WORLD METEOROLOGICAL ORGANIZATION

WMO SPACE PROGRAMME

SATELLITE REPORTS

STATUS OF THE AVAILABILITY AND USE OF SATELLITE DATA AND PRODUCTS BY WMO MEMBERS

2005

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EXECUTIVE SUMMARY

This document provides the results of an analysis of the responses to a questionnaire that was distributed in 2003 to WMO Members in order to assess the status of the availability and use of satellite data and products.

The Commission for Basic Systems (CBS) Open Programme Area Group on Integrated Observing Systems (OPAG-IOS) has the strategic goal to improve systematically the utilization of the capabilities of the space-based component of the Global Observing System (GOS) with emphasis on improving the utilization of satellite data and services in developing countries. This should be assisted by means of a recurring review and monitoring activity, based on information obtained from a dedicated biennial questionnaire.

Comments and recommendations based on the analysis of the responses are contained in Section 2. Section 3 provides background information related to the purpose of the questionnaire and the WMO Strategy to Improve Satellite System Utilization. Sections 4, 5 and 6 contain in-depth analyses of the responses for the different WMO Regions and in several different application areas. All data and supporting tables are contained in Annexes A and B.

1. BACKGROUND

1.1 WMO's Commission for Basic Systems (CBS) Open Programme Area Group on Integrated Observing Systems (OPAG-IOS) has the strategic goal to improve systematically the utilization of the space-based component of the Global Observing System's capabilities with emphasis on improving utilization of satellite data and services in developing countries.

1.2 One of the means to achieve this is through a critical review and monitoring process of the availability and use of satellite data. The review and monitoring process will be performed continuously by means of a dedicated questionnaire. The first questionnaire for this purpose was issued in 1996, a second edition in March 1999, a third in 2001 and the present fourth edition in 2003. While each edition has been somewhat different, they have become more concise. A preliminary evaluation of the questionnaire was performed by a sub-group of the OPAG-IOS Expert Team on Improving Satellite System Utilization and Products. Results and conclusions from the WMO Member responses to the questionnaire are presented in the document.

2. COMMENTS AND RECOMMENDATIONS

2.1 Participation in the 2003 edition of the questionnaire was about 35%. It was slightly more than in 1999 and slightly less than in 2001. It should be noted that the edition, which collected the most answers, was the first edition: in 1996, 46% of the Members returned the questionnaire. A high level of participation to the survey is the key for deducing from the answers a representative picture of the situation and constructive conclusions. It is also interesting to note that, in each region, more than half of the Members answered at least once to the questionnaire. It is, therefore, reasonable to seek 50% of participation level. Members should be made aware of the importance of returning the questionnaire for getting better support and services.

(1) **Recommendation:** Members should be encouraged to return a completed questionnaire in order to ensure a participation level of at least 50%. The importance of their participation and the benefits, which could result from a successful survey, should be pointed out to them;

(2) **Recommendation:** Members who returned only one edition of the questionnaire should be provided with support to address the possible problems they encounter.

2.2 The use of Internet for accessing satellite data has increased in all regions since 2001. During the same period, the use of GEO HR, GEO WEFAX, LEO HRPT, LEO APT and the MDD Systems have decreased.

Recommendation: WMO Regional Associations should be encouraged to establish Advanced Dissemination Methods (ADMs) that would be linked into an Integrated Global Data Dissemination Service (IGDDS). WMO Members should be encouraged to access satellite data and products via IGDDS when available.

2.3 Most Members reported using satellite data. In each region, the tendency was to use digital satellite data rather than analogue satellite data. This is true for data from both geostationary and polar satellites.

Recommendation: WMO Members should use digital satellite data rather than analogue in all operational applications.

2.4 Many Members process and exchange satellite data with other Members. In RA III both the processing of satellite data and the reception of processed satellite data from other Members were rather low.

Recommendation: RA III Members should keep each other informed of the products they process with regional coverage and consider sharing satellite data and products across the region when relevant, e.g., via an ADM.

2.5 Many Members extracted products derived from satellite data and, at the same time, received products elaborated in specialized centres. Since communication systems, such as Internet, ease the transmission of such products, it is disconcerting that the percentage of Members reporting a limitation in the capacity of communication systems was higher in 2003 than in the previous years.

Recommendation: Members should be provided with support for improving the capacity of their communication systems.

2.6 Less than half of the Members use satellite soundings and products. Fewer Members indicated processing satellite soundings. The Members who processed satellite soundings usually also extracted other derived products.

Recommendation: WMO Members should be informed of the benefits derived from the use of satellite soundings and products in all operational applications.

2.7 The extraction of other satellite-derived parameters was prevalent except in RA III and RA IV. The same observation holds for the extraction of level 3 and level 4 products from satellite-derived parameters.

Recommendation: RA III and RA IV should consider the benefits obtained from the extraction of other satellite-derived parameters.

2.8 Parameters related to cloud fields occupy the first five places of the most important parameters (considering all regions and all application areas). Precipitation rate was sixth and was also quoted as the most required but unavailable parameter. Hence, there was a need for assessing it with more accuracy and better resolution. Wind profiles and soil moisture were also quoted as most required but unavailable parameters, the latter for the first time.

Recommendation: Space agencies participating in the space-based component of the GOS should consider further efforts to improve the accuracy and resolution of precipitation rate, wind profiles and soil moisture derived products.

2.9 It is encouraging to see that significant efforts have been dedicated to training and continuing education. Adapted knowledge will be the key to making the best possible use of the research satellites that are now part of the space-based component of the Global Observing System (GOS), and of the new operational satellites that will be in orbit in the near future. In this regard, it is disconcerting that the limited knowledge on the use of equipment is a stronger limiting factor in 2003 than in 2001.

Recommendation Relevant training and education should continue in order to address both the limitations of knowledge already reported by Members and to anticipate the future needs linked to new technologies.

2.10 The average number of staff has increased in three regions (RA II, RA V, RA VI), has stayed almost stable in RA I and decreased in RA IV (for a technical reason) and RA III. The decrease in RA III was of concern, since the average number of staff was already quite low. In most regions, meteorologists form the largest category of staff working in satellite data reception and processing, but they tended to be less well represented in comparison to other staff categories.

Recommendation: Members should be encouraged to maintain sufficient staff resources for satellite activities and promote staff education in order to meet the future needs of developing technologies.

3. PARTICIPATION IN THE SURVEY

General Comments (Table 0.1)

- It is disappointing that 42% of WMO Members have not answered any edition of the questionnaire. Additionally, in each of the regions RA I, RA IV and RA V, more than half of WMO Members have not answered any edition of the questionnaire;
- Only 14% of all WMO Members have answered all editions of the questionnaire!
- Also noteworthy is that the first edition of the questionnaire was the most popular of all. 46% of the Members returned a completed questionnaire in 1996. Since then, the responses have stabilized at around 35% participation rate (33% in 1999, 37% in 2001, 35% in 2003). It is recommended that a more user-friendly version of the questionnaire be considered. For instance, proposing an electronic version (either online or on CD) could facilitate Members' task of collecting the information from the different services and managing the answers.

RA I 15% of the Members returned the questionnaire in 2003 and 52% returned one edition of the questionnaire since 1996. These percentages are the lowest for all regions. An effort to encourage the participation of Members of RA I should be made, especially in view of the decreasing participation since 1999.

RA II 38% of Members have answered this edition of the questionnaire and 71% of them have answered at least one edition since 1996.

RA III With 92% of the Members (11 out of 12) returning at least one edition since 1996, RA III has the highest score of all regions. As the participation rate had not been above half since 1999 (50% in 1999 and 2001, 42% in 2003), it was concluded that there is quite a variation of the Members answering each edition.

RA IV In 2001 the participation rate reached the level it had in 1996 (27%) and has increased since then to reach 36% in 2003. The percentage of Members having returned at least one questionnaire since 1996 is 55%. This tendency for an increase in the participation rate is very positive and should be encouraged. It is remarkable that RA IV is the only region in which the participation rate has not decreased since 1999.

RA V A third of the Members returned the questionnaire in 2003. 72% of the Members answered at least one edition of the questionnaire.

RA VI With 52% of the Members returning the questionnaire in 2003, RA VI remains the region responding the most to the survey, although the participation decreased slightly (56% of answers in 2001).

4. ACCESS TO SATELLITE DATA

General Tendencies

- Internet was used increasingly for accessing satellite data;
- The use of GEO HR, GEO WEFAX, LEO HRPT, LEO APT and that of the MDD System have all decreased since 2001;

- The access to analogue data has decreased while access to digital data has increased in each region and for both geostationary and polar satellites;
- Many WMO Members processed satellite data themselves. Exchange of processed data between Members was considerable;
- In RA III, the reception of processed satellite data from other countries and the self-processing were both very low;
- The average number of staff has increased in three regions (RA II, RA V, RA VI); has remained almost stable in RA I and decreased in RA IV (for a technical reason) and RA III. The decrease in RA III was of concern, since the average number of staff was already quite low;
- In most regions, meteorologists form the largest category of staff working in satellite data reception and processing, but they tended to be less well represented in comparison to other staff categories.

Technical Information

- WMO Members answering the questionnaire varied considerably from one edition to another. To allow comparisons, the tables in Annex B often include columns labelled TOTAL YEAR. Such a column includes the data collected from all editions of the questionnaire until and including that year;
- In each column, the percentage that usually follows a YEAR in the label indicates the proportion of answers for that YEAR with respect to the total number of NMHSs.

4.1 Data Access in each Region

General Tendencies

- In considering all data from all Members who responded at least once to the questionnaire (see the TOTAL YEAR columns), it is noted that, in each region, the tendency was for an increased use of Internet for accessing satellite data;
- In considering all regions and all broadcast systems, it is noted that only LEO HRPT in RA II showed a growing trend;
- In each region, access to analogue data has reduced;
- Most members were equipped with satellite data receiving facilities. The lack of information from members of RA IV (especially those in Central America) may be interpreted as poor access to satellite data in that region.

Data Access in RA I (Table 1.1.1)

- The use of WEFAX has decreased from 67% in 2001 to 25% in 2003;
- No Member reported using LEO APT, while LEO HRPT was still prevalent (about 63% of the Members);
- Internet was being used increasingly for accessing satellite data (38%). Some Members only access satellite data through Internet;
- Since the rate of participation by RA I in the survey was not very high, interpretation of the results should be made with prudence.

Data Access in RA II (Table 1.1.2)

- The use of LEO WEFAX has decreased from 79% in 2001 to 31% in 2003;

- The use of LEO APT and LEO HRPT remained stable with, respectively, about 22% and 63% of the answering NMHSs using these services;
- 46% of the Members reported using Internet to access satellite data - confirming the growing tendency;
- Two Members lost their GEO HR capability. Since they were in the field-of-view of METEOSAT, they may be planning a transition to MSG or ADM systems;
- One Member has acquired an HRPT capability for NOAA;
- Some Members received data from Quikscat and Aqua/Terra.

Data Access in RA III (Table 1.1.3)

- Access to satellite data from GEO HR and through Internet were the most reported means of access (each by 40% of the answering Members);
- Each of the other broadcast services (GEO WEFAX, LEO HRPT and LEO APT) was reported to be used by 20% of the answering Members;
- The slight decrease in the use of GEO HR data was due to a new entry relying only on analogue systems;
- Two Members reported recently receiving data through Internet;
- All Members of RA III have access to data from geostationary satellites (GEO HR, GEO WEFAX or Internet), 9 out of 12 have access to data from polar satellites (HRPT, APT or Internet) and 4 rely only on analogue systems.

Data Access in RA IV (Table 1.1.4)

- The use of Internet for accessing satellite data has progressed to the detriment of the usual direct broadcast services. 63% of the answering Members reported using Internet (against 22% in 2001);
- The analogue systems lost more users than the digital ones. First was GEO WEFAX (25% of the Members responding in 2003 reported using it, while there were 67% of them in 2001), then LEO APT (25% in 2003 against 33% in 2001);
- However, the use of digital direct broadcast systems followed the same decreasing tendency: from 33% to 13% for LEO HRPT and from 50% to 25% for GEO HR;
- The number of digital receiving systems was still very low, although one member reported an increase of one HR system for GOES.

Data Access in RA V (Table 1.1.5)

- The use of analogue systems (both WEFAX and APT) decreased strongly;
- Two-thirds of the answering Members indicated the use of Internet to access satellite data;
- One member reported a reduction in the availability in digital data. A few members expressed interest in other satellite data such as Quikscat, Aqua/Terra, Envisat, DMSP/SSMI;
- Polar satellites now have the same level of interest as those for GEO.

Data Access in RA VI (Table 1.1.6)

- Only 24% of the answering Members of RA VI reported using Internet to access satellite data; RA VI has the lowest score of all regions;

- Particular to this region was the use, by a third of the answering Members, of the ADM system on EUMETCast;
- Digital reception (about 60% of use for each of GEO HR and LEO HRPT) was favoured, compared to analogue reception, although GEO WEFAX and LEO APT were still used by 44% and 20% of the answering Members;
- RA VI has the largest number of HR stations;
- Although many analogue stations were closed, several WEFAX stations remained in operation;
- The use of data from Quikscat, Aqua/Terra, Envisat was growing.

4.2 Data Access by Broadcast Service

General Tendencies

- Since 2001, Internet was the only means for data access whose use has increased. Access to GEO HR, GEO WEFAX, LEO HRPT, LEO APT and the use of the MDD System have all decreased since 2001;
- Access to analogue data has diminished while digital data has increased. This applies equally as well for data from geostationary and polar satellites.

GEO HR (Table 1.2.1)

- There was a global decrease in access to GEO HR data. It was noticeable in each region, be it in comparison to the first survey (1996) or comparing all answers until 2001 (TOTAL 2001) to all answers until 2003 (TOTAL 2003);
- RA IV had the smallest access to data from GEO HR (25% in 2003 against 33% in 1996) and the largest was in RA VI (56% against 68%);
- The decrease in access to GEO HR data was due to the increased use of Internet and ADM satellite distribution system.

GEO WEFAX (Table 1.2.2)

- The access to WEFAX data has decreased in every region;
- In 2003, RA VI reported the biggest access (44% of the Members answering in this region) and RA III the least (20%).

LEO HRPT (Table 1.2.3)

- The general trend since 2001 was for a reduction in access to LEO HRPT data;
- From 1996 to 1999, every region increased its access to LEO HRPT data. Since 1999, there have been several evolutions;
  - The first evolution was found in RA I and RA II: from 1999 to 2001, access to LEO HRPT data continued to increase and has remained stable since then; The second one was found in RA III, RA IV and RA V: the access to LEO HRPT data has decrease since 1999;
  - The evolution in RA VI is rather particular: the access to LEO HRPT data reached a peak in 2001, well above all other regions and decreased since then to reach (with 60%) the fourth broadest access (after RA I, RA II and RA V);
- With four regions in which more than 60% of the answering members reported accessing LEO HRPT data, it can be concluded that this broadcast system was being well utilized;

- From 1996 to 2003, only one region registered a decrease (from 17% to 13%).

LEO APT (Table 1.2.4)

- The decrease in the use of LEO APT data started in 1999 for RA I and RA II and in 2001 for the other regions to reach a not so low level in 2003,
- RA IV was the region reporting the broadest access to LEO APT data (25% of the answering Members);
- None of the 8 answering Members of RA I reported accessing LEO APT data. Many NMHS preferred to access digital data from polar orbiting satellites.

MDD System (Table 1.2.5)

- All regions reported a decrease in the use of the MDD System;
- In 2003, three regions (RA III, RA IV and RA V) showed no use of the MDD System (Note that RA V is not covered by the MDD system).

Internet (Table 1.2.6)

- In all regions, there was an increase in the use of Internet for accessing satellite data since 2001. The 2001 edition of the questionnaire was the first one to seek information about the use of Internet;
- RA V and RA IV were the regions mainly accessing satellite data through Internet (respectively 67% and 65% of the answering Members).

Other Sources (Table 1.2.7)

- RA I reported discontinuation of the use of SADIS;
- RA V and VI reported an increased use of MODIS and QUIKSCAT data;
- The use of SSM/I and ENVISAT data was continuously growing.

4.3 Processing of Satellite Data

General Tendencies

- The percentage of Members processing satellite data themselves was not so high in most regions;
- Exchanges of processed data were common among Members. More than 70% of the Members reported making satellite data accessible to other countries. In each region other than RA III and RA VI, more than half of the Members reported receiving satellite data from other countries;
- Attention should be given to the situation in RA III, since both the reception from other countries and the processing of satellite data were reported by only 40% of the answering Members.

Own Processing (Table 1.3.1)

- In almost all regions the percentage of Members processing satellite data themselves was at least 50%. Only RA III had a somewhat lower percentage with 40%;
- It should be noted that in RA I, RA-III and RA-IV, this percentage has reduced since the last survey.

Reception from Other Countries (Table 1.3.2)

- A comparison was made with the results of 2001, since the 2001 edition was the first one to request this information;
- The global tendency was a regular increase in the reception of digital data and products from other countries, the digital exchanges being made easier by new technologies, such as faster lines, Internet and ADM;
- In 2003, all members from RA V reported receiving data from other countries.

Processing of TOVS/ATOVS Data (Table 1.3.3)

- The general tendency was for a reduction in the processing of TOVS/ATOVS data;
- The reduction in RA II and RA VI was possibly associated with the availability of TOVS/ATOVS data (profiles and radiances) from other sources (such as EARS for EUMETSAT countries);
- In 2003, RA V was the region in which the percentage of Members processing TOVS/ATOVS data was the highest (50%).

Distribution to Other Users

- In every region, the percentage of Members, which reported making satellite data and products accessible to others, was above 70%.

4.4 Staff involved in Satellite Data Reception and Processing

General Tendencies (Tables 1.4.1 & 1.4.2)

- The average number of staff (all professional categories) has increased significantly in RA II, RA V and RA VI. The increase in RA I is rather slight;
- RA III and RA IV reported a decrease. This decrease represented a potential problem for RA III, since the average number of staff reported in 2001 was very low already (12.8 in 2001 to 10 in 2003). Despite this decrease being due to a large NMHS not answering in 2003, RA IV remained, with an average of 32.7, the region employing the most staff in satellite data reception and processing;
- The greatest increase in the average number of operators was found in RA IV (+1.8), of technicians in RA II (+3.2) and of meteorologists in RA VI (+2.9);
- In all regions except RA II, meteorologists formed the largest category of staff working in satellite data reception and processing. In RA II, technicians were more numerous compared to other staff categories;
- In RA II and RA III (and RA IV for a technical reason), the number of meteorologists slightly decreased;
- The total number of staff (all RAs included) was estimated to be about 3,500 persons.

Particularities of RA I (Table 1.4.3)

- Most members have 1-2 operators, 1-2 technicians and 3-5 meteorologists;
- While the number of operators and technicians was stable, there was a slight increase in the number of meteorologists to an average of 4 persons.

Particularities of RA II (Table 1.4.4)

- Most members have 1-2 operators, 1-2 technicians and 1-3 meteorologists;
- A few members have more than 10 persons in each category;
- The significant increase in the average number of technicians (from 3.8 to 7) was due to the corresponding increase for one Member;
- The proportion between staff categories has changed to the benefit of technicians while operators and meteorologists were less represented this year;
- The average number of operators decreased exactly half a point. The total staff number in this region was estimated between 500 and 550, representing an increase of about 15%.

Particularities of RA III (Table 1.4.5)

- Most members have 1-2 operators, 1-2 technicians and 3-6 meteorologists;
- The proportion between staff categories has changed to the benefit of technicians, while operators and meteorologists were less represented this year;
- The total staff number in this region was estimated to be about 120, representing a reduction of about 20%;
- On the positive side, it can be seen that the staff distribution was nearly homogenous within the region and that the number of meteorologists remained high, except for one member.

Particularities of RA IV (Table 1.4.6)

- Most members have 0-2 operators, 1-2 technicians and 6-8 meteorologists;
- The proportion between staff categories has changed to the benefit of operators and technicians while the number of meteorologists decreased slightly;
- One member with a large NMHS did not answer in 2003, but had answered in 2001. Without taking into account the answer from this member, the number of meteorologists would have been of 4 in 2001 and 6 in 2003, and thus would have represented an increase;
- The total staff number in this region was estimated to be 720 including the answer from the member with a large NMHS and to 250 not including its answer.

Particularities of RA V (Table 1.4.7)

- Most members have 0-2 operators, 0-2 technicians and 6-8 meteorologists;
- The proportion between staff categories has changed to the benefit of operators and technicians while the number of meteorologists decreased slightly;
- In the three staff categories, the average numbers were increasing;
- The total staff number was estimated to be about 205 persons, representing an increase of about 20%.

Particularities of RA VI (Table 1.4.8)

- Most members have 0-2 operators, 1-3 technicians and 2-5 meteorologists, although a few members have many more staff;
- The global increase of staff number was more significant for meteorologists that for operators and technicians;

- Including the numbers from a member with very large NMHS, the total staff number for the region was estimated to be 1200 (the largest for all RAs). This represented an increase of about 20% compared to 2001. It would be reduced to 500 staff members if the answer from the large contributor had not been included.

5. SATELLITE DATA AND PRODUCTS

General Tendencies

- Most Members reported using satellite data. Digital satellite data were used more than analogue satellite data;
- The extraction of products derived from satellite data was very prevalent. At the same time, many Members received satellite products prepared in specialized, their transmission being now easier due to powerful communication systems such as Internet;
- Some Members indicated they extracted products from digital satellite data, but were not processing these data anymore;
- Few Members (less than half of them) declared using satellite soundings and products. As expected, even fewer Members declared processing satellite soundings. The processing of satellite soundings was often correlated to the extraction of products derived from satellite soundings;
- The extraction of other satellite-derived parameters was prevalent except in RA III and RA IV. The same observation holds for the extraction of level 3 and level 4 products from satellite-derived parameters;
- Parameters related to cloud fields occupy the first five places of the most important parameters (considering all regions and all application areas). Precipitation rate was sixth and was also quoted as the most required but unavailable parameter. Hence, there is a need for assessing it with more accuracy and better resolution. Wind profiles and soil moisture were also quoted as most required but unavailable parameters, the latter for the first time;
- There was an overall decrease in the limitation factors in the use of satellite data and products. The situation had worsened only in the capacity of communication systems and in the knowledge in the use of equipment.

Technical Information

- Some questions on satellite data and products were not introduced before 1999 (respectively 2001) into the questionnaire. However, it was possible, for some questions asked in 2003, to deduce tendencies for the years prior to 1999 (respectively 2001) from different questions that were asked in those years. The implied information was used to complete the tables, especially for the TOTAL YEAR columns. More specific information will be given below on a case by case basis;
- It should be recalled that each column TOTAL YEAR includes the replies to all editions of the questionnaire until and including that year;
- In each column, the percentage that follows a YEAR in the label indicates the proportion of answers for that YEAR with respect to the total number of NMHSs.

5.1 Use of Satellite Data and Products

General Tendencies

- In 2003, most Members reported using satellite data, at least for qualitative use based on image interpretation. Except for RA I and RA II, all regions used digital

satellite data rather than analogue satellite data. Taking into consideration the results from all questionnaires until 2001 and 2003 respectively (TOTAL 2001 and TOTAL 2003 columns), it can be seen that the transition from analogue to digital was confirmed in RA IV, RA V and RA VI, but not in RA I, RA II, RA III;

- Less than 50% of the Members answering the questionnaire in 2003 utilized satellite soundings and products. One reason may be that only a few members operate their own NWP models, which are the typical applications of soundings. However, in view of the usefulness of soundings for monitoring the stability of the atmosphere with Nowcasting purposes, specific training in the use of satellite soundings should be envisaged within education and training programmes(for instance using MSG);
- The increased capabilities of communication systems such as Internet enhanced the transmission to the NMHS of satellite products created in specialized centres. Furthermore, the operational use of satellites was no longer confined to GEO and LEO satellites: specific and specialized data and products from research and development satellites were more and more being used, for instance, for sea state and environmental monitoring.

Technical Information

- Some questions were not introduced before 2001 into the questionnaire. For the previous editions, it was sometimes possible to infer information from other questions. In that case, the information was used in the tables under the columns 1996 and TOTAL YEAR;
- It should be recalled that a column TOTAL YEAR includes the replies to all editions of the questionnaire until and including that year;
- In each column, the percentage that follows a YEAR in the label indicates the proportion of answers for that YEAR with respect to the total number of NMHSs.

Image Interpretation from Analogue Data (Table 2.1.1)

- In each RA, 50% or more of the Members continued to use satellite image data;
- The qualitative use of analogue data has been regularly decreasing in RA IV and RA V since 1999. This decrease was balanced by the increased use of Internet for accessing satellite data (cf. Table 1.1.4 for RA IV and Table 1.1.5 for RA V).

Image Interpretation from Digital Data (Table 2.1.2)

- The slight reduction in the qualitative use of digital data in RA I was due to the fact that Members not responding in 2001 did not use digital data in 2003;
- There was also a slight reduction of the use of digital data in RA II. Two Members from the RA II declared to not use digital data any more;
- The strong increase in RA V was linked to the increased use of Internet for acquiring satellite data;
- The qualitative use of digital data has grown steadily in RA II and RA III over the years.

Use of Satellite Soundings (Table 2.1.3)

- The use of satellite soundings has decreased in all regions since 2001 and disappeared in RA I;
- Although some Members, answering for the first time, reported using no satellite soundings, the steady decrease was certainly related to the wider availability of

satellite derived products (see also Table 2.1.4) that do not need the use of satellite soundings as stand-alone information;

- Thus, proper training in the use of satellite soundings must be maintained.

Use of Satellite Sounding Products (Table 2.1.4)

- The use of satellite soundings product has been slightly decreasing over the years in RA II and RA V. RA V, however, remained the region relying the most on satellite sounding products;
- In RA III, RA IV and RA VI, the use of satellite sounding products has increased between 1999 and 2001 and decreased since then;
- The big increase in RA I can be attributed to responses from three users who had not before returned the questionnaire.

Qualitative Use of Satellite Products from other Sources (Table 2.1.5)

- Apart from slight reductions in two regions (RA I and RA VI), the qualitative use of satellite products from other sources has increased in the last two years;
- It should be noted that all Members from RA V answering in 2003 reported using satellite products from other sources;
- Data exchanged also included those from research satellites such as AQUA/TERRA and QUIKSCAT;
- There was an overall tendency to exchange satellite data and products through Internet. This allowed Members to access to information for a wider range of satellites, regardless of the individual capabilities of receiving and processing data.

5.2 Extraction of Products from Digital Satellite Data

General Tendencies

- The extraction of products from digital satellite data was very prevalent among Members, although some of them reported that they no longer process digital satellite data;
- The processing of satellite soundings remained globally stable and was often correlated to the extraction of products derived from satellite soundings. RA I makes an exception to this tendency, as half of its Members reported extracting products derived from satellite soundings (cf. Table 2.2.3), while none of them declared processing satellite soundings (cf. Table 2.2.2);
- In RA I, RA II, RA V and RA VI, the proportion of Members extracting other satellite-derived parameters was either high or increasing. The extraction of level 3 and level 4 products from satellite-derived parameters was increasing in all but one of these regions. RA II showed a slight decrease in the extraction of level 3 and level 4 products. Of concern was the situation in RA III and RA IV, because the percentage of extraction of other satellite-derived parameters was very low and no Member in these regions reported extracting level 3 and level 4 products from satellite-derived parameters.

Technical Information

- **Same as in §5.1**

Extraction of Products Derived from Digital Satellite Data (Table 2.2.1)

- The results in two regions (RA I and RA III) indicate an increasing tendency since 1999. Apart from them, only RA V saw an increase in the last two years;
- The three other regions (RA II, RA IV, RA VI) developed the extraction of products from digital data in the period from 1999 to 2001 and have reduced it since then;
- In RA II, this reduction results from the abandonment of the extraction of products derived from digital satellite data by two Members in 2003;
- RA VI was the region where extraction of meteorological products by processing of digital satellite data was the most common (76% of the Members).

Processing of Satellite Soundings (Table 2.2.2)

- Processing of satellite soundings and processing of TOVS/ATOVS data were not always correlated, e.g., in RA III and RA V (compare with Table 1.3.3). The reason could be that some Members process TOVS data but extract neither full soundings nor post-processed products derived from them;
- A strange phenomenon was noted in RA III: until 2001 (see TOTAL 2001), 20% of the Members reported processing both TOVS data and satellite soundings. In 2003, 20% of the Members report processing TOVS data, whereas none of them reported processing satellite soundings;
- Apart from the larger decrease in RA III, the processing of satellite soundings remained globally stable.

Extraction of Products Derived from Satellite Soundings (Table 2.2.3)

- Not surprisingly, most Members who extracted products derived from satellite soundings also processed satellite soundings themselves (cf. Table 2.2.2);
- The significant increase in RA I of the extraction of products derived from satellite soundings was correlated to the significant increase in the use of these products in this region (cf. Table 2.1.4);
- RA V reported high use and extraction of such products;
- No Members from RA III reported extracting processed products from satellite soundings.

Extraction of other Satellite-Derived Parameters (Table 2.2.4)

- For this question, it was not possible to draw results from similar questions in the 1996 edition;
- The extraction of other satellite-derived parameters has increased in all regions, except in RA IV. The reduction in the percentage in RA IV was not due to Members stopping the extraction of such parameters, but to Members responding for the first time to not extracting such parameters.

Extraction of Level 3 & 4 Products from Satellite-Derived Parameters (Table 2.2.5)

- For this question, it was not possible to draw results from similar questions in editions prior to 2001;

- In RA I, RA V and RA VI, the percentage of Members declaring extracting of such products has increased since 2001. In RA II, RA III and RA IV, it has decreased;
- RA V is the region mostly extracting such products (50% of the Members).

5.3 Important Parameters

General Tendencies (Tables 2.3.1 a&b)

- Parameters related to cloud fields were rated of first importance, overall and for many application areas (in the order: cloud imagery, cloud cover, cloud top temperature, cloud type, cloud top height);
- Precipitation rate was sixth (all regions considered) of the most important parameters and first for the most required but unavailable parameters. Hence, there was a need for assessing precipitation rate with more accuracy and better resolution;
- Wind profiles was second in the list of the most required but unavailable parameters. This indicated a need for the development of operational wind profiling systems in space;
- Soil moisture appeared for the first time among the most required but unavailable parameters (third). This reflected the growing interest in the water cycle;
- The atmospheric instability index was quoted as most required but unavailable parameter for Nowcasting & VSRF and Synoptic Analysis.

Technical Information

- Tables 2.3.0 a&b provide the row results. For each parameter and each application area, the given number was the number of times the parameter has been quoted as an important parameter for the corresponding application area;
- In the tables presenting, for each year, the six most important parameters (Tables labelled 2.3.Na for various N), the percentage assigned to a given parameter corresponds to the number of times this parameter has been quoted with respect to the number of returned questionnaires;
- Comparisons with data before 2001 were difficult, because the list of parameters published in the editions of 1999 and 1996 was not the same as that published in 2001 and 2003. For some application areas, it was however possible to use this different list of parameters and show results for 1996 and 1999.

Nowcasting and VSRF (Tables 2.3.2 a&b)

- Parameters related to cloud fields were considered to be the most important for Nowcasting and VSRF. They represented 68% of the quoted parameters and occupied the five first positions of importance;
- The top six parameters were almost the same in 2003 as in 2001. However, in 2001, they covered 93% of the most important parameters, whereas they now cover only 73%. This reflected the fact that more parameters were now used for Nowcasting and VSRF;
- It was noteworthy that the precipitation rate has lost a position in the order of importance, but gained one in the list of important but not available parameters to reach the top of the list. In this list, it was followed by the atmospheric instability index (in the first place in 2001) and the cloud water profile (replacing the cloud base height).

Synoptic Analysis (Tables 2.3.3 a&b)

- The five most important parameters for Synoptic Analysis were related to cloud fields (66% of quotation). This was also the case in 2001, although the order of the parameters has changed. In the sixth position, sea surface temperature has replaced the temperature profile;
- The top six parameters represented in 2003 69% of the most important parameters, whereas in 2001, they represented 85%. This is attributed to the fact that in 2003 a larger diversity of parameters were used for synoptic analysis;
- As for Nowcasting and VSRF, the precipitation rate has become the most required and not available parameter, replacing the atmospheric instability index that occupied this position in 2001. Wind profiles replaced cloud base height in the third position.

Global & Regional NWP (Tables 2.3.4 a&b)

- The most important information used for NWP was the vertical structure of the atmosphere (temperature and wind) and the air-sea interactions (sea surface temperature and wind over sea surface);
- Land surface temperature appeared for the first time in the top six most useful parameters and in the list of the most required but not available parameters (top position). In accordance with the growing importance of surface parameters, cloud top temperature disappeared from the top six most useful parameters for the first time in all editions of the survey;
- Specific humidity profile reappeared in the top six list.

Aeronautical Meteorology (Tables 2.3.5 a&b)

- Aeronautical meteorology is based on methods from Nowcasting & VSRF and Synoptic Analysis and thus the most important parameters for aeronautical meteorology were related to cloud fields (62% of quotation), except for volcanic ash;
- Among the most required but unavailable parameters, only one was common for Aeronautical Meteorology and for Synoptic Analysis, wind profile. Cloud base height and the height of tropopause were the other two most required but unavailable parameters.

Marine Meteorology (Tables 2.3.6 a&b)

- Sea surface temperature and cloud imagery occupied, as in 2001, the first two position of the top six parameters. Sea-ice cover moved from the seventh to the fourth position;
- Significant wave height and wave period/direction have moved from the last two positions of the six most important parameters to the first two positions of the most required but not available parameters;
- This application area indicated a need for improved use of data from satellite equipped with sensors such as ERS, TOPEX-POSEIDON, QUIKSCAT and the future JASON-2.

Agricultural Meteorology (Tables 2.3.7 a&b)

- Land surface temperature and NDVI were still very much utilized, but have been joined at the top of the list of the most important parameters by cloud cover and cloud imagery;

- Vegetation features continued to be the most required but not available parameters (in the order: soil moisture, vegetation type, land surface temperature).

Hydrology (Tables 2.3.8 a&b)

- It was satisfying to see that precipitation rate, which was rated as the most important parameters for hydrological applications, had become more available (this parameter lost a position in the list of most required but unavailable parameters);
- Snow cover moved down to the fifth position of most important parameters, but entered the top three of the most required but unavailable parameters;
- Soil moisture moved up a place to reach the top of the most required but unavailable parameters, reflecting the growing interest in the water cycle;
- More parameters (four instead of two in the last edition) related to cloud fields appeared this year in the top six parameters (in the order: cloud imagery, cloud cover, cloud top temperature and cloud type parameters).

Atmospheric Chemistry (Tables 2.3.9 a&b)

- Three of the most important parameters for atmospheric chemistry were related to the ozone field and the content in aerosol. The other three most important parameters (trace gases, apparent thermal inertia and cloud imagery) were new in the top six list;
- It should be noted that the three most required but not available parameters (ozone profile, aerosol total column, trace gases) all appeared in the list of most important parameters. This indicated a need for improvement.

Climatology/Global Change (Tables 2.3.10 a&b)

- Cloud field (cover and type) and surface temperature (sea and land) were still considered as very important parameters for climatology and global change;
- It was satisfying to see that precipitation rate moved from most required but not available parameter (in 2001) to most important parameter in 2003;
- Sea level was still a required but not available parameter, while land surface temperature was at the same time required but not available and considered as most important (need for improvement).

Environmental and Disaster Monitoring (Tables 2.3.11 a&b)

- Fire monitoring was at the top of the list for the most important parameters since 1999 and, at the same time, the most required but not available parameters since 2001. This confirmed the importance of monitoring fire and of consolidating such monitoring from satellites;
- Cloud field parameters were more numerous this year among the most important parameters, while precipitation rate and volcanic ash maintained their position;
- Aerosol total column and wind profile appeared for the first time among the most required but not available parameters.

Research Applications (Tables 2.3.12 a&b)

- From the parameters reported as the most important for research applications, it can be concluded that research activities focused mainly on clouds, precipitations and sea-air interactions;

- Soil moisture appeared as most required but not available parameters and reflected the research interest for water cycle;
- The accuracy quality of data for precipitation rate and temperature profile should be improved, because these two parameters were quoted as both most important and most required but not available.

Public Weather Services (Tables 2.3.13 a&b)

- Public Weather Services activities being mainly related to general weather forecasting, the most important parameters were naturally related to cloud fields (cloud imagery, cover, type and top temperature), precipitations and extreme events (including fires);
- The most required but not available parameters were all related to precipitation monitoring (precipitation rate, rain profile, precipitation index). This is an area that needs improvement for future development.

5.3 Limiting Factors in the Use of Satellite Data and Products

General Tendencies (Table 2.4.0)

- All areas considered, the global tendency was an improvement, i.e., a reduction of the number of reported limitations. Deteriorations at the global level appeared only in the capacity of communication systems and in the knowledge in the use of equipment.

Technical Information

- Each table in Annex B presents the results on the limitations reported in a given area. For each year, the row YEAR provides, for each region, the number of Members that have reported a limitation in the given area during that year. A row "Percentage (YEAR)" provides, for each region, the previous number divided by the number of Members of that region having answered the questionnaire that YEAR (cf. Table 0.1).

Limitation in the Receiving Equipment (Table 2.4.1)

- Three out of four answering Members from RA I and RA IV reported a lack of receiving equipment. The proportion was not as high in the last survey, especially in RA I;
- A possible explanation for the situation in RA I was that, while MSG-1 was already in orbit, the NMHSs of RA I had not yet real-time access to MSG data. This situation will hopefully change with the PUMA (Preparation for the Use of MSG in Africa) Project. The PUMA project is supported by the European Commission in collaboration with EUMETSAT and WMO and aims at promoting the access of African countries to MSG data;
- The overall average percentage of members reporting lack of receiving equipment has remained stable (at 42%) since 2001. The implementation of the Advanced Dissemination Methods (ADM) and the WMO Information System (WIS) may help improve the situation.

Limitation in the Maintenance Know-how or Services (Table 2.4.2)

- The proportion of Members reporting a limitation in maintenance know-how or services has decreased since 2001 (from 35% to 29%);

- Two regions have seen a significant diminution of the reported limitation (RA II from 36% to 23% and RA VI from 26% to 12%). RA V also saw a diminution from 57% to 50%;
- Of concern was the significant increase in the reported limitation in RA I (from 33% to 50%), in RA III (from 67% to 80%) and in RA IV (from 17% to 25%).

Limitation in Data Dissemination (Table 2.4.3)

- The decrease in the limitation of data dissemination in RA VI compensated the increase in other regions, with the result that at the global level, the situation remained stable;
- The situation in RA I may improve with the implementation of the PUMA project;
- The largest increase in reported limitations in data dissemination was found in RA V (from 14% to 33%).

Limitation in the Availability of Required Data and Products (Table 2.4.4)

- The overall trend was for better availability of the required data and products (diminution of the reported limitations from 39% to 35%);
- Differences between the percentages in 2001 and 2003 were in general quite significant. Only RA V and RA VI reported an increased limitation in the availability of required data and products. The global tendency was for improvement;
- The improving trend should not hide the fact that a third of the Members did report a limitation in the availability of required data and products. The development of ADM could contribute to improving the situation.

Limitation in Communication System Capacity (Table 2.4.5)

- The percentage of Members that reported a limitation in the capacity of communication systems has increased from 32% in 2001 to 39% in 2003. This remained a concern, due to the expected increase in the volume of satellite data and products with the new satellite systems. The availability of appropriate communication system capacities will be a key element for an efficient utilization of satellite data and products;
- Only RA II and RA IV saw an improvement of the capacity of communication systems;
- The level of limitation reported in RA I, RA III, RA V and RA VI has increased since 2001. It was especially noteworthy in RA III (80% of the Members reporting limitations).

Limitation in the Knowledge in the Use of Equipment (Table 2.4.6)

- Lack of knowledge in the use of equipment has been reported more often by Members (from 25% in 2001 to 30% in 2003);
- All regions, except RA VI (22% to 12%), reported an increased lack of knowledge in the use of equipment, RA III reporting the largest increase (33% to 80%).

Lack of Knowledge in the Use of Satellite Data and Products (Table 2.4.7)

- Lack of knowledge on satellite data and products was not reported as strongly in 2003 as it was in 2001 (reduction from 33% to 30%). This tendency was due to RA II, RA V and RA VI. The situation in RA IV remained stable and, in RA II, was slightly worse;

- In RA III, however, the situation has deteriorated (from 0% in 2001 to 60% in 2003 of Members reporting limitations). Therefore, special efforts should be made for training in RA III. Other regions shall however not be neglected, as continuous training remains key to adapt to new technologies.

Lack of Knowledge in Programming Techniques (Table 2.4.8)

- The percentage of Members that reported a lack of knowledge in programming techniques has decreased (from 45% to 39%);
- Only RA VI reported an increase (15% to 23%);
- One way to achieve the programming requirements of each individual NMHS could be to develop network or consortia in which NMHSs could share knowledge, experience, responsibilities and benefits. EUMETSAT's network Satellite Application Facilities (SAFs) could serve as an example.

Limitation in Availability of Application Software and Methods (Table 2.4.9)

- The overall situation has improved, since the total percentage of Members reporting a limitation in the availability of software and methods has decreased from 65% to 56%;
- This overall decrease was due to an improvement concentrated in three regions. Three other regions still suffer from limitation in availability of application software and methods;
- In RA III all Members reported a limitation and, in RA I, 88% of the members did so.

Limitation in the Impact for the Intended Application (Table 2.4.10)

- There was an overall slight improvement (from 28% to 26%) in the impact for the intended application;
- RA II reported the largest improvement (from 36% to 23%) and RA I the largest deterioration (from 22% to 38%). Differences were smaller for the other regions, with a slight improvement in RA IV and RA VI and a slight depreciation in RA III and RA V.

6. TRAINING IN SATELLITE METEOROLOGY

General Comments

- It is very positive to see that significant efforts have been made dedicated towards training and continuing education;
- It is important to stress that efforts towards training and education should continue to be made. The results in Section 5 highlight the importance of good knowledge of satellite data and products;
- Relevant training and education should continue to be conducted, because adapted knowledge will be the key in making the best possible use of the research satellites that are now part of the space-based component of the Global Observing System (GOS)and of the new operational satellites that will be in orbit in the near future.

General Tendencies

- The number of staff trained at Regional Meteorological Training Centres (RMTCs) has decreased considerably since 2001;
- The number of staff trained at university or in industry has also decreased considerably since 2001. RA III is the only region reporting an increase;

- Training by distant learning - Computer Aided Learning (CAL) and the Virtual Laboratory (VL) - has slightly decreased since 2001. RA IV reports the largest decrease;
- Internal training has increased both with respect to the reported training activities and to the staff reported to have been trained. Internal training stays the most commonly used means of training. Both of these observations are very positive. However, none of the 8 NMHSs from RA I which answered the questionnaire reported internal training activities. They may be waiting for the implementation of the PUMA project, part of which includes training activities;
- Bilateral training activities have decreased by about half.

Technical Information

- 69 questionnaires were returned in 2001 and 66 in 2003. The average numbers below are the quotients of absolute numbers to the number of returned questionnaires. For example, the average number of reported training activities is the reported number of training activities divided by the number of questionnaires returned the same year. Thus average numbers can be considered as a global WMO average;
- Except in [§4.4.3], the numbers reported in a given year (e.g., 2003) concern activities held in the previous year (in this ex. 2002). In [§4.4.3], we consider training activities foreseen for the year in question and the following one (e.g., 2003 and 2004);
- A comparison has been made with the results for 2001.

6.1 Methods of Training

Training at the RMTCs (Tables 3.1.1- 3.1.3)

- Although the average number of reported training activities organized at the RMTCs is quite stable (0.36 in 2001 to 0.35 in 2003), the number of staff members reported to have been trained at the RMTCs has considerably decreased (in average from 2.9 to 0.65 persons per responding NMHS);
- The overall decrease of trained staff members (from 200 to 45) is mainly due to the corresponding decrease in RA VI (from 154 to 3) especially in the area of satellite image interpretation (93 to 2). However, since RA VI does not have an RMTC, it is possible that the 154 staff members reported to have been trained in 2001 may well have been at institutions other than RMTCs. In this respect, it is interesting to remark that the overall number of trained staff members did not diminish as much (considering all training methods) in 2001; it was 561 in 2001 and it was now 543 in 2003.

Training at WMO (Tables 3.1.4 and 3.1.5)

- The average number of reported training activities occurring at WMO has increased from 0.19 to 0.24, whereas the number of staff members reported to have been trained at WMO remains rather stable (average of 0.32 in 2003 against 0.30 in 2001).

Training at University/Industry (Tables 3.1.6- 3.1.8)

- There was a slight decrease in the number of reported training activities taking place at a university or in industry (from 0.38 to 0.35 in average), but the decrease in the

number of staff members reported to have been trained was much larger (from 2.41 to 0.9 in average);

- RA III was the only region in which the number of trained staff members had increased and, together with RA VI, the only one in which the number of reported training activities had increased; It should be noted that RA I and RA IV reported no training in 2003, while, in 2001, they had reported respectively 0.67 and 1.34 trained staff members per answering NMHS. RA I may be waiting for the implementation of the Preparation for Use of Meteosat Second Generation in Africa (PUMA).

Training by Distant Learning (Tables 3.1.9. and 3.1.10)

- Many NMHSs reported training staff through distant learning, including by Computer Aided Learning (CAL) and through the Virtual Laboratory (VL), to be decreasing slightly. The average number of reported training activities decreased from 0.17 in 2001 to 0.14 in 2003. Correspondingly, the average number of staff members to be trained decreased from 0.67 in 2001 to 0.43 in 2003;
- The largest decrease was found in RA IV: from 0.50 to 0.13 for the average number of training activities and from 0.86 to 0.13 for the average number of trained staff members.

Internal Training (Table 3.1.11- 3.1.13)

- Internal training remained increasingly popular. An average of 0.59 of internal training activities was reported (against 0.45 in 2001) and an average of 9.52 staff members were trained in 2002 (against 8.93 in 2000). These high numbers are very positive;
- RA I reported no internal training in 2003 and 2001. Hopefully, the implementation of the PUMA project will change this situation, especially with the future availability to NMHSs of RA I of image data from the new generation Meteosat (MSG) delivered through EUMETCast;
- The highest absolute number of trained staff members was found in RA VI, but in proportion to the number of returned questionnaires in the region, the highest result was found in RA V with 28 average number of trained staff members against 15 in RA VI.

Bilateral Training (Tables 3.1.14- 3.1.16)

- No NMHS in RA I and RA III has ever reported bilateral training. No NMHS in RA IV and RA V reported bilateral training in response to the questionnaire. Only RA II and RA VI reported bilateral training, but with a decrease from 2 to 1.53 in RA II and from 5.3 to 3.54 in RA VI of average number of trained staff members;
- It should be noted that there was an increase in the average number of staff members having been trained in satellite image interpretation (from 0.77 in 2001 to 1.15 in 2003).

6.2 Training in each Region

Training in RA I (Table 3.2.1 & 3.2.2)

- 5 out of 6 training activities reported by the NMHSs took place at an RMTC (4 in satellite image interpretation and one in software development). One distant learning activity was reported in satellite image interpretation;
- The number of staff members reported to have been trained must be exactly one per training activity, as the numbers are exactly the same;

- In 2001, 5 training activities were reported for a total of 31 staff members. Members of RA I may be waiting for the implementation of the PUMA project, which will include training activities.

Training in RA II (Table 3.2.3 & 3.2.4)

- A total of 18 training activities were reported: 6 took place at a university or in industry (for a total of 16 staff members), 4 in internal (for 64 staff members), 4 at an RMTC (for a total of 19 staff members), 2 in bilateral training (20 staff members) and 2 at WMO (6 staff members). Among these 18 reported training activities, 8 were in satellite image interpretation (for a total of 56 staff members), 7 in the physical basis for remote sensing (29 staff members), 1 in the use of equipment (35 staff members) and 2 in other areas (5 staff members);
- In 2001, 28 training activities were reported for a total of 537 staff members (against 125 in 2003). The average number of training activities is 0.41 in 2001 against 0.27 in 2003. 7.78 staff members per answering NMHS were reported to have been trained in 2001 and only 1.89 in 2003. This large reduction is partly due to the fact that an NMHS which reported many training activities in 2001 did not answer the questionnaire in 2003;
- No distance learning was reported by any of the members of this region.

Training in RA III (Table 3.2.5 & 3.2.6)

- An increased number of training activities was reported in 2003 (an average of 0.14 per answering NMHS against 0.06 in 2001). The average number of trained staff, however, diminished from 0.43 per NMHS answering in 2001 to 0.33 in 2003;
- Compared to 2001, more staff were trained in 2003 in equipment maintenance and operation, whereas less staff were trained in physical basis for remote sensing and in satellite image interpretation;
- There is no reported training organized in bilateral relation.

Training in RA IV (Table 3.2.7 & 3.2.8)

- More training activities were reported in 2003 (an average of 0.26 per answering NMHS against 0.17 in 2001). The average number of staff members reported to be trained diminished (0.67 in 2003 per answering NMHS against 0.72 in 2001);
- Training in physical basis for remote sensing and in satellite image interpretation reduced slightly from 34 trained staff members in 2001 to 31 in 2003;
- No bilateral training was organized in this region, neither training at university nor in the industry.

Training in RA V (Table 3.2.9 & 3.2.10)

- There is a net increase in the reported training in this region, which is mainly due to a large number of NMHSs answering the questionnaire in 2003 but not in 2001. The average number of reported training activities grew from 0.19 in 2001 to 0.30 in 2003 and the average number of trained staff members per answering NMHS from 0.29 in 2001 to 2.85 in 2003;
- Training is mostly organized in physical basis for remote sensing and in satellite image interpretation (80% of the training activities and 94% of the trained staff);
- Most training was internally organized (45% of the training activities and 91% of the trained staff). No training was organized with a partner member.

Training in RA VI (Table 3.2.11 & 3.2.12)

- Although the average number of training activities per answering NMHS decreased from 0.90 in 2001 to 0.76 in 2001, the average number of staff members reported to have been trained remained rather stable (8.13 in 2001 to 8.23 in 2003);
- The main two areas of training are physical basis for remote sensing and satellite image interpretation (representing together 68% of the reported training activities and 82% of the trained staff);
- All training methods were used. Internal training was used the most (38% of the training activities and 72% of the trained staff). In second position, 24% of the training activities took place at a university or industry and that 17% of the trained staff were trained by bilateral arrangement.

6.3 Total and Planned Training

Total Training (all regions) (Tables 3.3.1- 3.3.3)

- The average number of trained staff members per answering NMHS decreased from 17.81 in 2001 to 14.06 in 2003, although the average number of reported training activities remained stable (1.86 in 2001 to 1.80 in 2003).

Planned Training (Tables 3.3.4- 3.3.5)

- In 2001, the number of staff members foreseen to be trained in 2002-2003 was 1695. The number of staff members reported in 2003 to have been trained in 2002 was 928, which was more than half the number foreseen for two years!
- The number of staff members planned to be trained in 2003-2004 was 1227, whereas in 2001, the number of staff members planned to be trained in 2001-2002 was 1695. This reduction does not necessarily mean that training was being considered less important. It may well mean that NMHSs were starting to better estimate their needs in training;
- Satellite image interpretation remained the most popular training area, also as to the foreseen training with more than half of foreseen training activities. Physical basis for remote sensing was the second most foreseen training area;
- Class 1 and Class 2 meteorological technicians were the categories of staff most foreseen for training.

ANNEX A

LIST OF TABLES

PARTICIPATION TO THE SURVEY

1. ACCESS TO SATELLITE DATA

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1.2 Data Access by Broadcast Service

1.3 Processing of Satellite Data

1.4 Staff Involved in Satellite Data Reception and Processing

2. SATELLITE DATA AND PRODUCTS

2.1 Use of Satellite Data

2.2 Extraction of Products from Digital Satellite Data

2.3 Application Areas and Important Parameters

2.4 Limiting Factors in the Use of Satellite Data and Products

3 TRAINING IN SATELLITE METEOROLOGY

3.1 Methods of Training

3.2 Training in each Region

3.3 Total and Planed Training

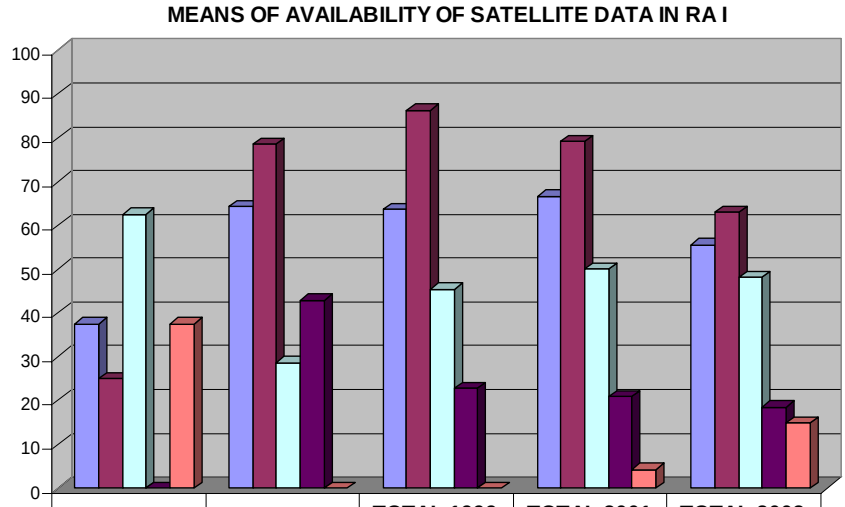
ANNEX B

TABLES

Table 1
Number of returned questionnaires

		2003	%	2001	%	1999	%	1996	%	ALL	%	LAST TWO	%	LAST PLUS ONE	%	AT LEAST TWO	%	AT LEAST ONE	%
RA I	52	8	15	9	17	15	29	14	27	2	4	3	6	5	10	13	25	27	52
RA II	34	13	38	14	41	14	41	19	56	5	15	9	26	12	35	19	56	24	71
RA III	12	5	42	6	50	6	50	7	58	2	17	2	17	4	33	7	58	11	92
RA IV	22	8	36	6	27	2	9	6	27	0	0	4	18	5	23	7	32	12	55
RA V	18	6	33	7	39	2	11	8	44	1	6	5	28	6	33	7	39	13	72
RA VI	48	25	52	27	56	22	46	31	65	10	21	18	38	23	48	34	71	41	85
Total	**186**	**65**	**35**	**69**	**37**	**61**	**33**	**85**	**46**	**20**	**11**	**41**	**22**	**55**	**30**	**87**	**47**	**128**	**69**

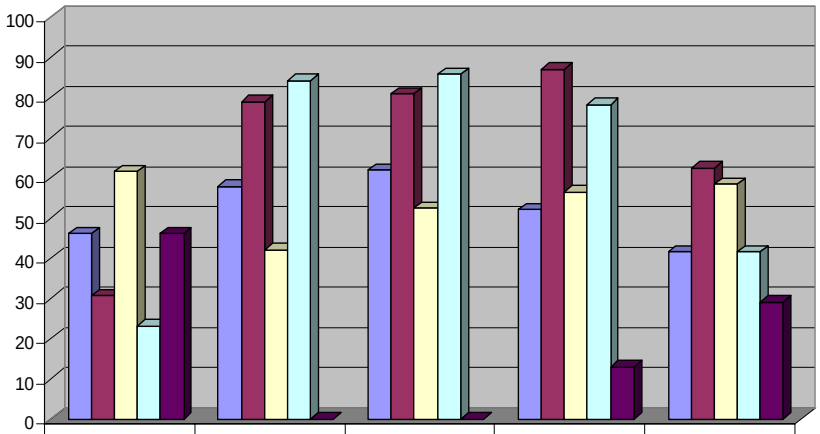
Table 1.1.1



	2003 (15%)	1996 (27%)	TOTAL 1999 (42%)	TOTAL 2001 (46%)	TOTAL 2003 (52%)
GEO HR	38	64	64	67	56
GEO WEFAX	25	79	86	79	63
LEO HRPT	63	29	45	50	48
LEO APT	0	43	23	21	19
INTERNET	38	0	0	4	15

Table1.1.2

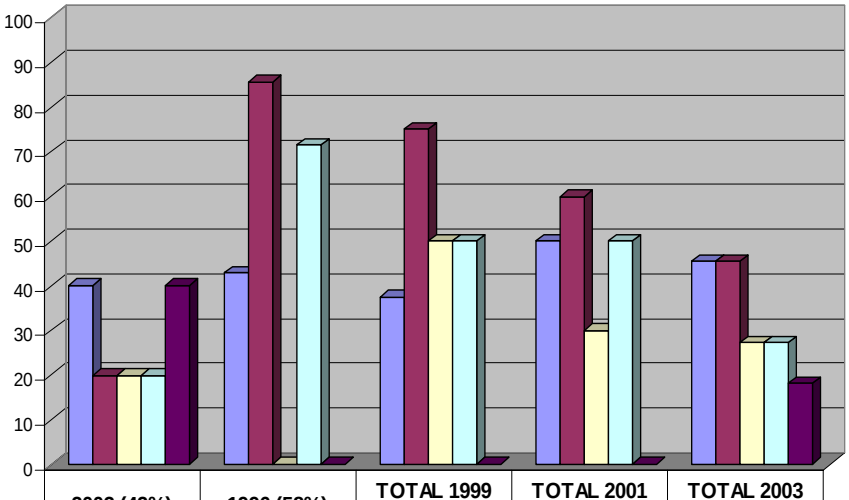
MEANS OF AVAILABILITY OF SATELLITE DATA IN RA II



	2003 (38%)	1996 (56%)	TOTAL 1999 (62%)	TOTAL 2001 (68%)	TOTAL 2003 (71%)
GEO HR	46	58	62	52	42
GEO WEFAX	31	79	81	87	63
LEO HRPT	62	42	52	57	58
LEO APT	23	84	86	78	42
INTERNET	46	0	0	13	29

Table1.1.3

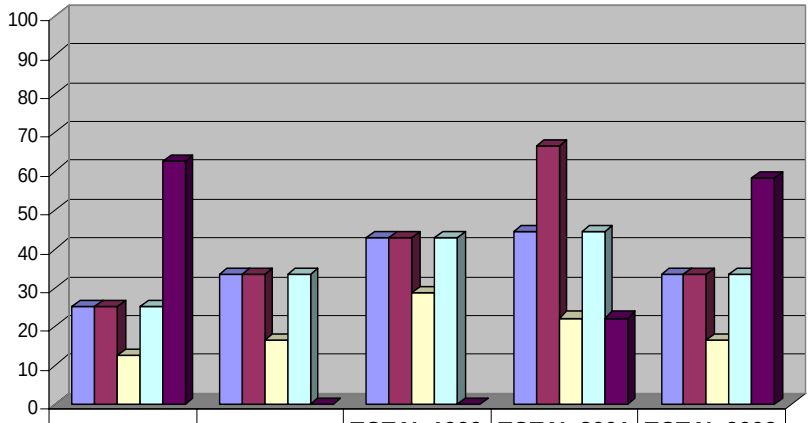
MEANS OF AVAILABILITY OF SATELLITE DATA IN RA III



	2003 (42%)	1996 (58%)	TOTAL 1999 (67%)	TOTAL 2001 (83%)	TOTAL 2003 (92%)
GEO HR	40	43	38	50	45
GEO WEFAX	20	86	75	60	45
LEO HRPT	20	0	50	30	27
LEO APT	20	71	50	50	27
INTERNET	40	0	0	0	18

Table 1.1.4

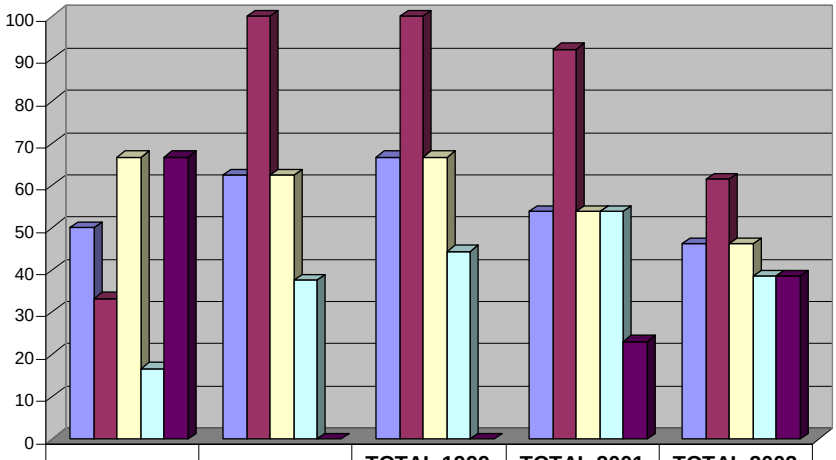
MEANS OF AVAILABILITY OF SATELLITE DATA IN RA IV



	2003 (36%)	1996 (27%)	TOTAL 1999 (32%)	TOTAL 2001 (41%)	TOTAL 2003 (55%)
GEO HR	25	33	43	44	33
GEO WEFAX	25	33	43	67	33
LEO HRPT	13	17	29	22	17
LEO APT	25	33	43	44	33
INTERNET	63	0	0	22	58

Table 1.1.5

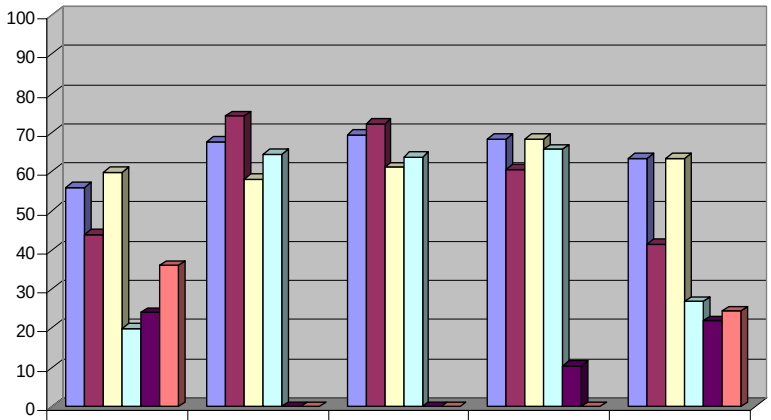
MEANS OF AVAILABILITY OF SATELLITE DATA IN RA V



	2003 (33%)	1996 (44%)	TOTAL 1999 (50%)	TOTAL 2001 (72%)	TOTAL 2003 (72%)
GEO HR	50	63	67	54	46
GEO WEFAX	33	100	100	92	62
LEO HRPT	67	63	67	54	46
LEO APT	17	38	44	54	38
INTERNET	67	0	0	23	38

Table 1.1.6

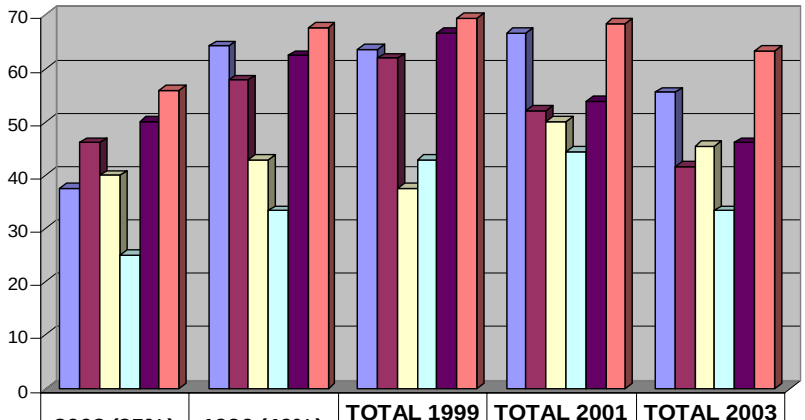
MEANS OF AVAILABILITY OF SATELLITE DATA IN RA VI



	2003(52%)	1996 (65%)	TOTAL1999 (75%)	TOTAL 2001 (79%)	TOTAL2003 (85%)
GEO HR	56	68	69	68	63
GEO WEFAX	44	74	72	61	41
LEO HRPT	60	58	61	68	63
LEO APT	20	65	64	66	27
INTERNET	24	0	0	11	22
ADM	36	0	0	0	24

Table 1.2.1

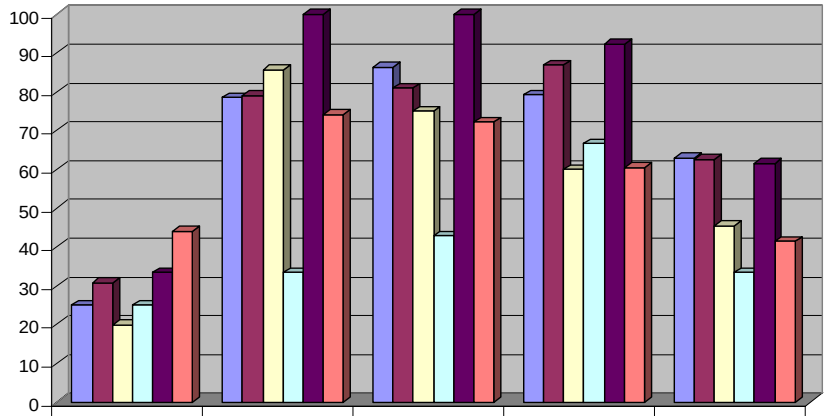
AVAILABILITY (%) OF GEO HR DATA



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	38	64	64	67	56
RA II	46	58	62	52	42
RA III	40	43	38	50	45
RA IV	25	33	43	44	33
RA V	50	63	67	54	46
RA VI	56	68	69	68	63

Table 1.2.2

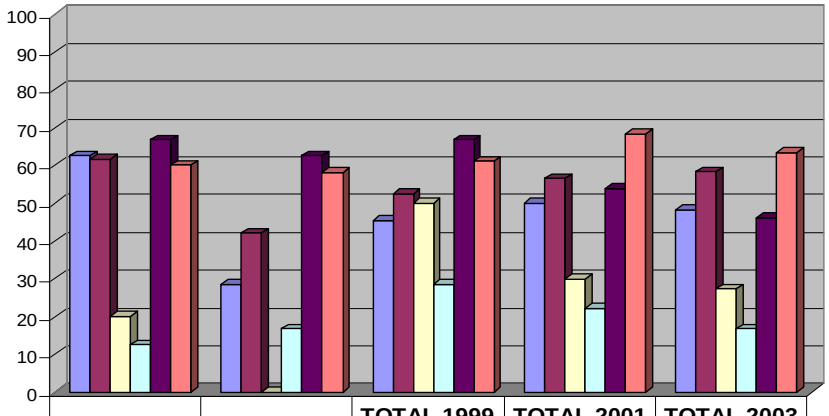
AVAILABILITY (%) OF GEO WEFAX DATA



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	25	79	86	79	63
RA II	31	79	81	87	63
RA III	20	86	75	60	45
RA IV	25	33	43	67	33
RA V	33	100	100	92	62
RA VI	44	74	72	61	41

Table 1.2.3

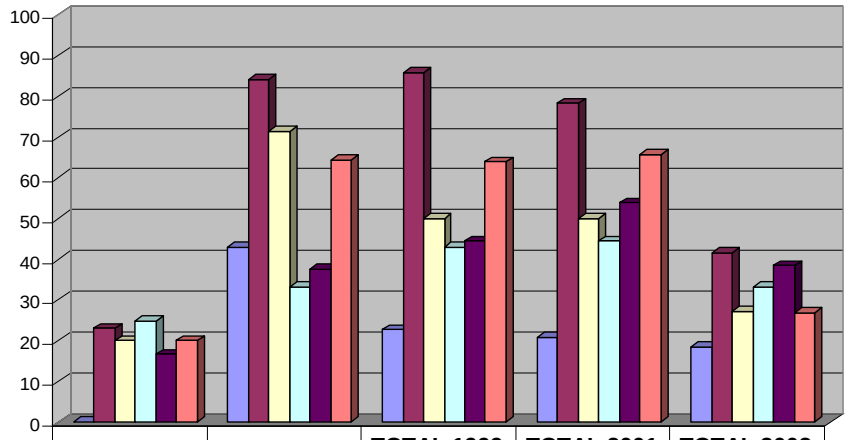
AVAILABILITY (%) OF LEO HRPT



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	63	29	45	50	48
RA II	62	42	52	57	58
RA III	20	0	50	30	27
RA IV	13	17	29	22	17
RA V	67	63	67	54	46
RA VI	60	58	61	68	63

Table 1.2.4

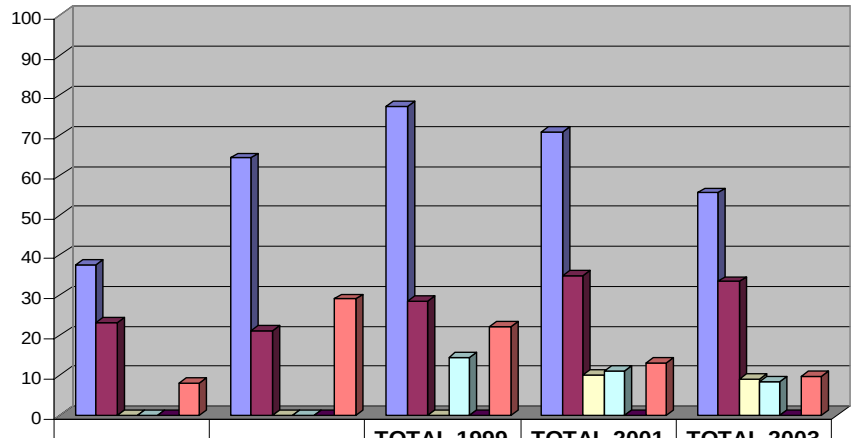
AVAILABILITY (%) OF LEO APT



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	0	43	23	21	19
RA II	23	84	86	78	42
RA III	20	71	50	50	27
RA IV	25	33	43	44	33
RA V	17	38	44	54	38
RA VI	20	65	64	66	27

Table 1.2.5

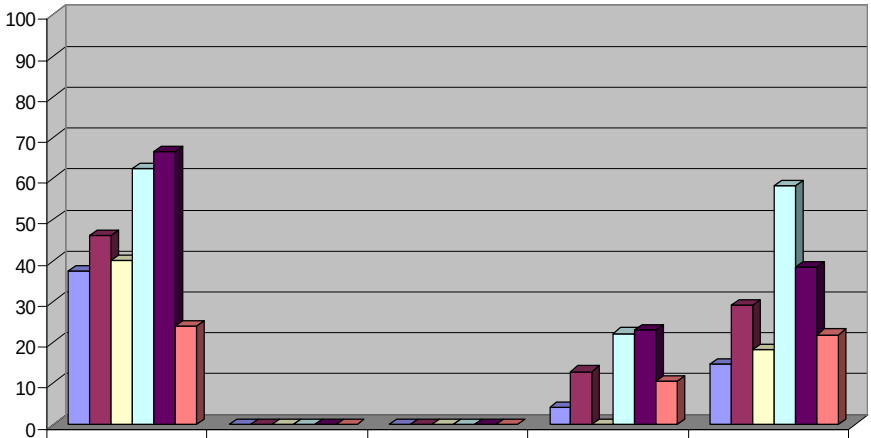
AVAILABILITY (%) OF MDD SYSTEMS



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	38	64	77	71	56
RA II	23	21	29	35	33
RA III	0	0	0	10	9
RA IV	0	0	14	11	8
RA V	0	0	0	0	0
RA VI	8	29	22	13	10

Table 1.2.6

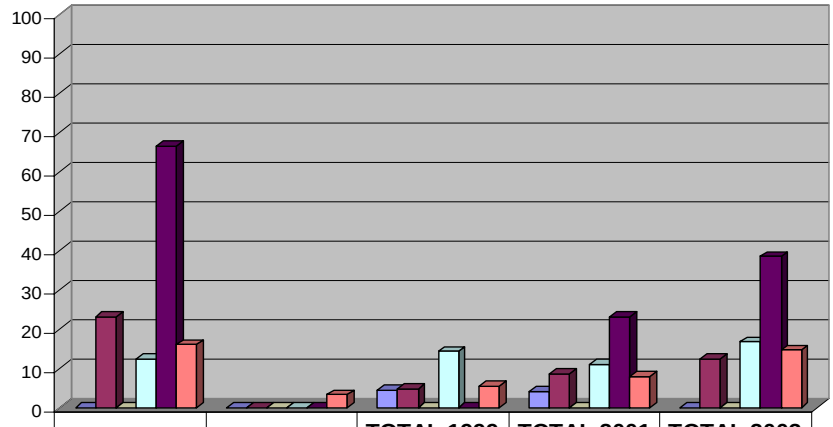
USE OF INTERNET CONNECTION FOR ACCESSING SATELLITE DATA



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	38	0	0	4	15
RA II	46	0	0	13	29
RA III	40	0	0	0	18
RA IV	63	0	0	22	58
RA V	67	0	0	23	38
RA VI	24	0	0	11	22

Table 1.2.7

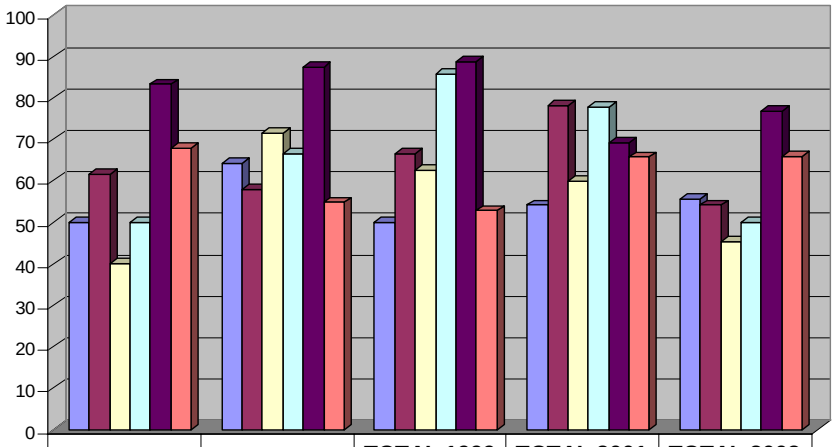
USE (%) OF DATA FROM OTHER SOURCES (SADIS, DMSP, QUICKSCAT, ERS....)



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	0	0	5	4	0
RA II	23	0	5	9	13
RA III	0	0	0	0	0
RA IV	13	0	14	11	17
RA V	67	0	0	23	38
RA VI	16	3	6	8	15

Table 1.3.1

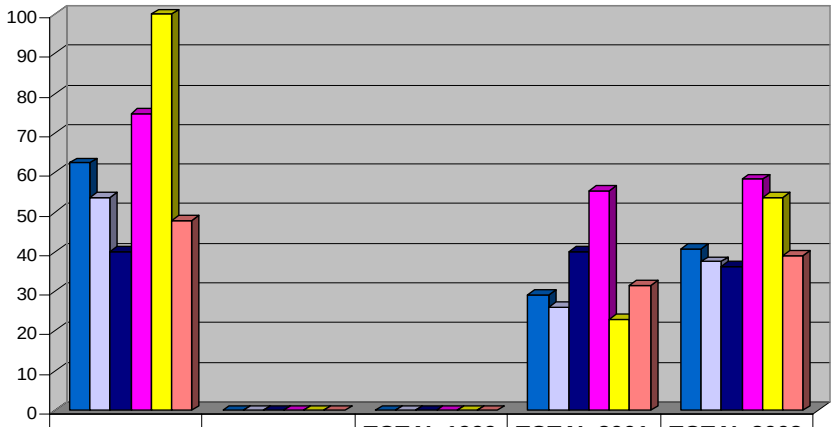
OWN PROCESSING



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	50	64	50	54	56
RA II	62	58	67	78	54
RA III	40	71	63	60	45
RA IV	50	67	86	78	50
RA V	83	88	89	69	77
RA VI	68	55	53	66	66

Table 1.3.2

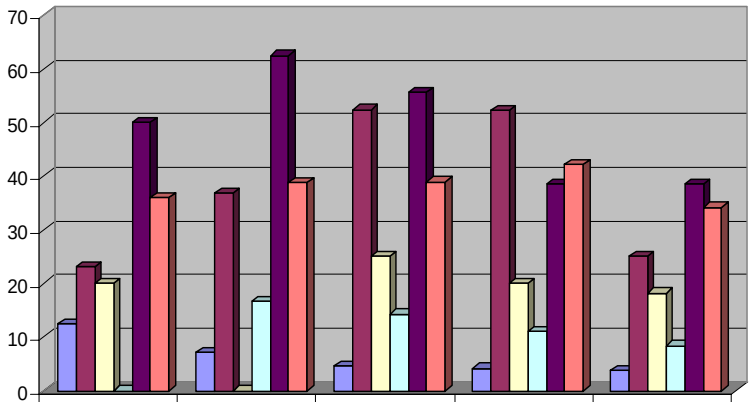
RECEPTION FROM OTHER COUNTRIES



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	63	0	0	29	41
RA II	54	0	0	26	38
RA III	40	0	0	40	36
RA IV	75	0	0	56	58
RA V	100	0	0	23	54
RA VI	48	0	0	32	39

Table 1.3.3

TOVS PROCESSING



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	13	7	5	4	4
RA II	23	37	52	52	25
RA III	20	0	25	20	18
RA IV	0	17	14	11	8
RA V	50	63	56	38	38
RA VI	36	39	39	42	34

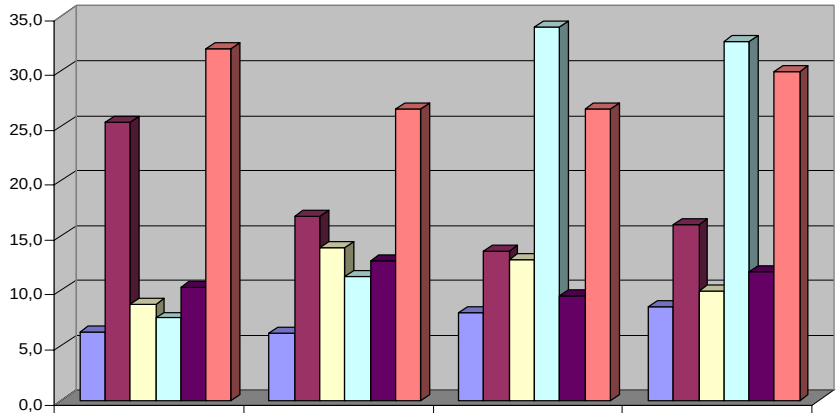
Table 1.4.1

Distribution of staff involved in satellite data reception and processing for each WMO region

	RA I				RA II				RA III				RA IV				RA V				RA VI			
STAFF	**1996**	**total 1999**	**total 2001**	**total 2003**	**1996**	**total 1999**	**total 2001**	**total 2003**	**1996**	**total 1999**	**total 2001**	**total 2003**	**1996**	**total 1999**	**total 2001**	**total 2003**	**1996**	**total 1999**	**total 2001**	**total 2003**	**1996**	**total 1999**	**total 2001**	**total 2003**
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
OPS																								
0	71	50	33	38	37	29	30	25	57	38	20	27	67	71	78	50	75	78	62	38	32	39	45	44
1	21	23	29	31	26	29	26	29	14	25	30	27	17	0	0	25	13	0	15	15	32	33	29	27
3	7	14	17	12	11	14	17	13	14	13	20	18	17	29	11	8	0	0	15	23	19	17	18	20
6	0	5	8	8	11	0	4	17	0	0	0	0	0	0	11	0	0	11	0	8	0	6	5	5
9	0	9	4	4	0	0	4	4	14	13	20	18	0	0	0	0	0	0	0	8	6	0	0	0
12	0	0	4	4	0	0	9	8	0	13	10	9	0	0	0	17	13	11	8	8	3	3	0	2
15	0	0	4	4	11	19	9	4	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
>75	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	2
	100	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**13**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
TECHS																								
0	29	45	29	31	42	24	26	33	43	38	50	36	83	57	67	33	25	22	46	38	32	31	29	24
1	50	32	42	38	21	33	43	33	43	38	30	36	0	0	0	25	38	44	31	31	26	39	47	44
3	7	18	25	31	16	29	22	21	0	13	20	27	0	14	22	25	0	0	8	8	32	22	16	22
6	0	5	0	0	5	5	0	0	0	0	0	0	17	14	11	0	13	11	8	15	3	3	0	2
9	14	0	4	0	0	0	4	8	14	13	0	0	0	14	0	8	25	22	8	8	0	0	3	2
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	16	10	4	0	0	0	0	0	0	0	0	8	0	0	0	0	3	3	3	2
>75	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	2
	100	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
METS																								
0	36	32	33	31	37	38	22	25	0	13	10	9	33	29	33	8	13	0	0	8	16	19	18	12
1	21	23	13	19	16	14	26	21	14	13	10	9	0	0	0	17	38	0	31	8	19	28	29	27
3	14	23	21	27	16	14	13	21	71	50	40	36	17	0	11	17	25	11	0	8	26	25	16	27
6	0	9	13	12	11	19	17	13	0	0	20	27	17	29	33	25	13	0	8	15	16	6	16	5
9	7	9	13	4	16	5	9	8	14	0	0	9	33	29	11	17	0	0	8	8	3	3	3	5
12	0	0	4	4	0	5	4	4	0	0	0	0	0	0	0	0	0	0	0	0	3	6	5	5
15	21	5	4	4	0	5	9	8	0	25	20	9	0	14	0	8	13	11	8	0	13	11	11	17
>75	0	0	0	0	5	0	0	0	0	0	0	0	0	0	11	8	0	0	0	0	3	3	3	2
	100	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
OPS	8	32	38	36	43	54	36	27	25	28	34	30	16	13	4	9	18	19	19	26	33	30	29	27
TECHS	21	23	19	19	24	22	28	44	21	16	8	14	16	27	5	11	38	30	21	22	20	21	20	19
METS	71	45	44	45	33	24	36	29	54	56	59	56	69	61	92	80	44	51	60	53	48	49	50	54
	100	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 1.4.2

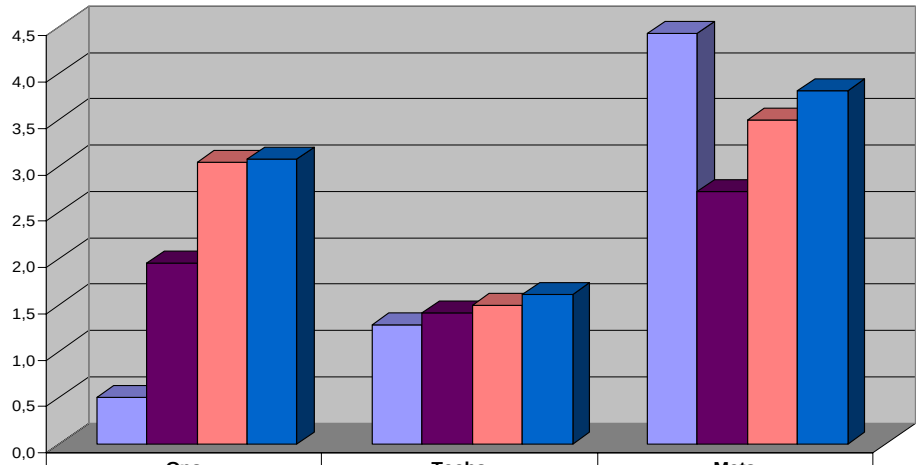
Total staff involved in satellites



	1996	total 1999	total 2001	total 2003
RA I	6,2	6,1	8,0	8,5
RA II	25,3	16,8	13,6	16,0
RA III	8,7	13,9	12,8	10,0
RA IV	7,5	11,3	34,0	32,7
RA V	10,3	12,7	9,5	11,7
RA VI	32,1	26,6	26,6	30,0

Table 1.4.3

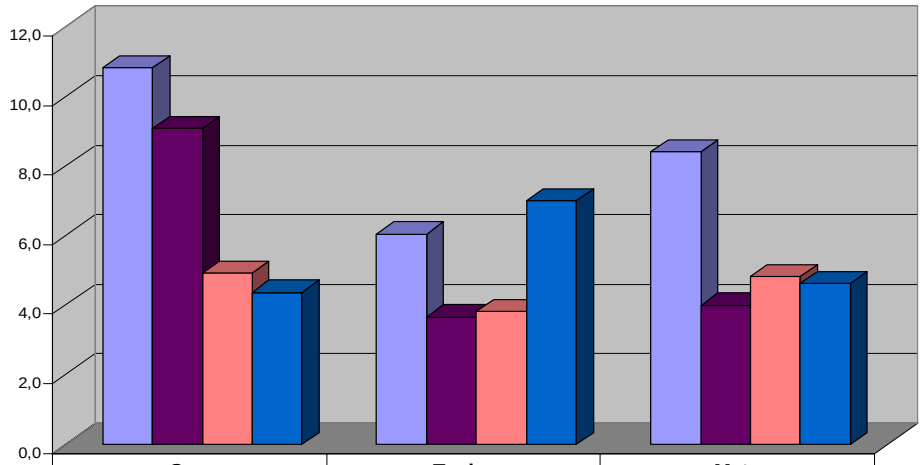
RA I - Average persons



	Ops	Techs	Mets
1996	0,5	1,3	4,4
Total 1999	2,0	1,4	2,7
Total 2001	3,0	1,5	3,5
Total 2003	3,1	1,6	3,8

Table 1.4.4

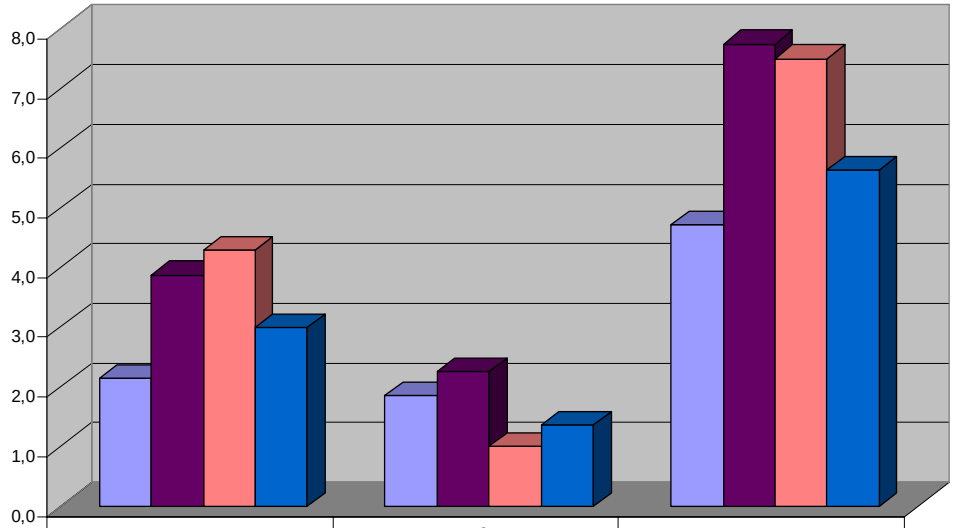
RA II - Average persons



	Ops	Techs	Mets
1996	10,8	6,1	8,4
Total 1999	9,1	3,7	4,0
Total 2001	4,9	3,8	4,8
Total 2003	4,4	7,0	4,6

Table 1.4.5

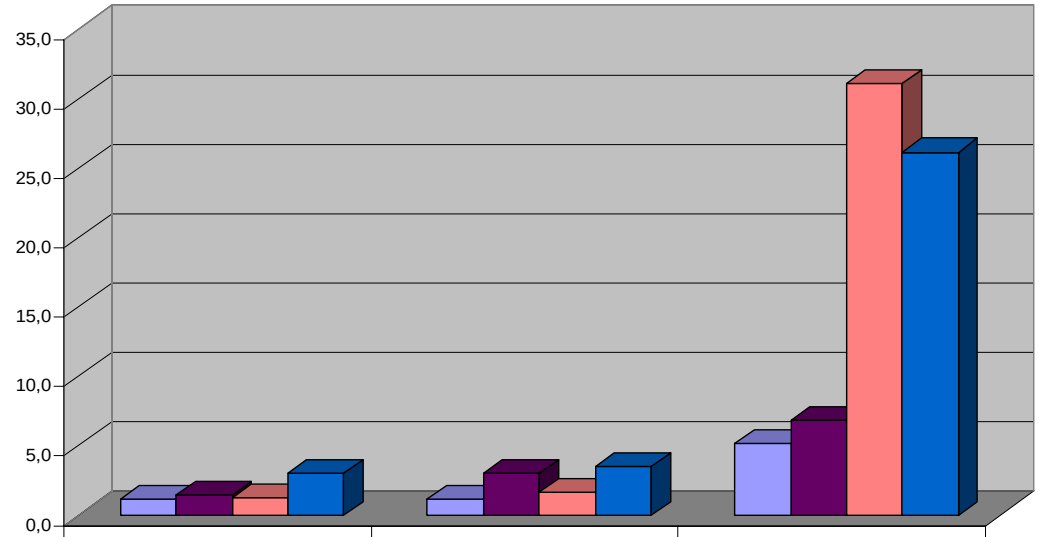
RA III - Average persons



	Ops	Techs	Mets
1996	2,1	1,9	4,7
Total 1999	3,9	2,3	7,8
Total 2001	4,3	1,0	7,5
Total 2003	3,0	1,4	5,6

Table 1.4.6

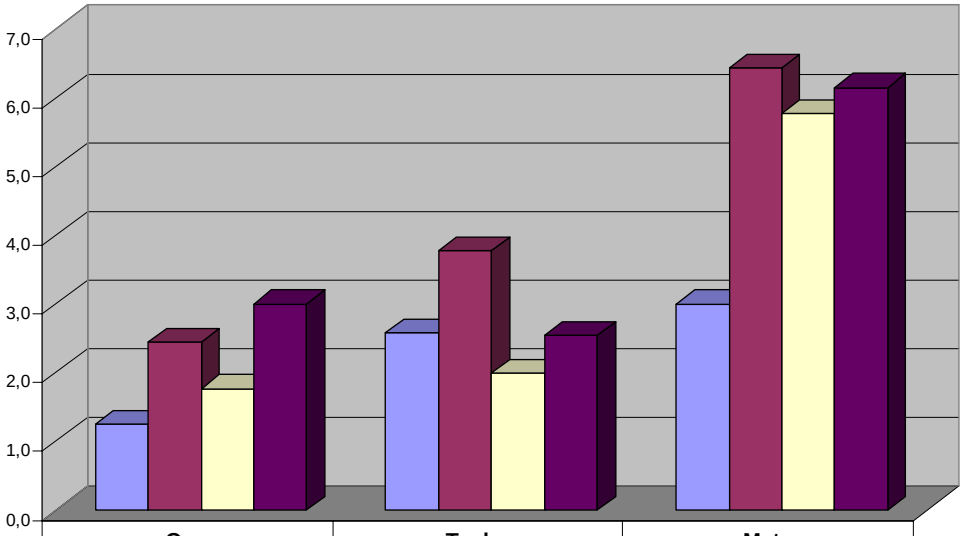
RA IV - Average persons



	Ops	Techs	Mets
1996	1,2	1,2	5,2
Total 1999	1,4	3,0	6,9
Total 2001	1,2	1,7	31,1
Total 2003	3,0	3,5	26,2

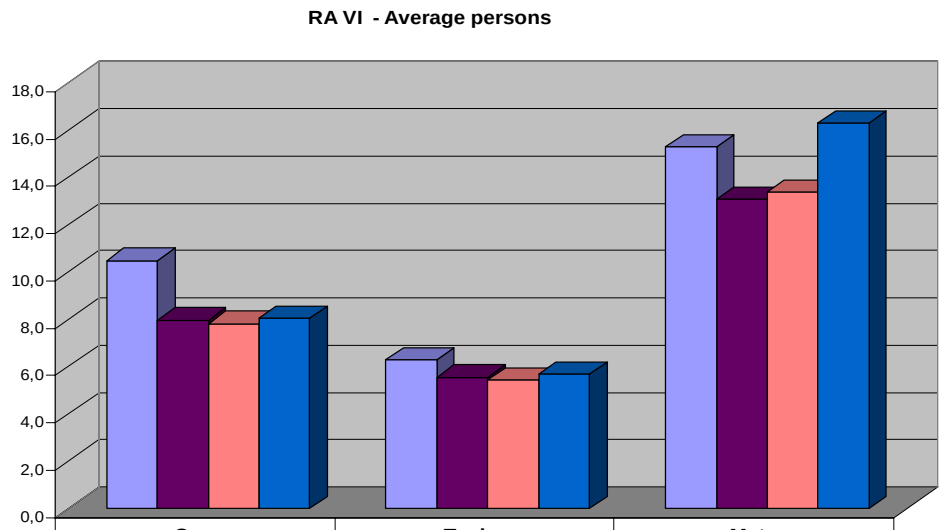
Table 1.4.7

RA V - Average persons



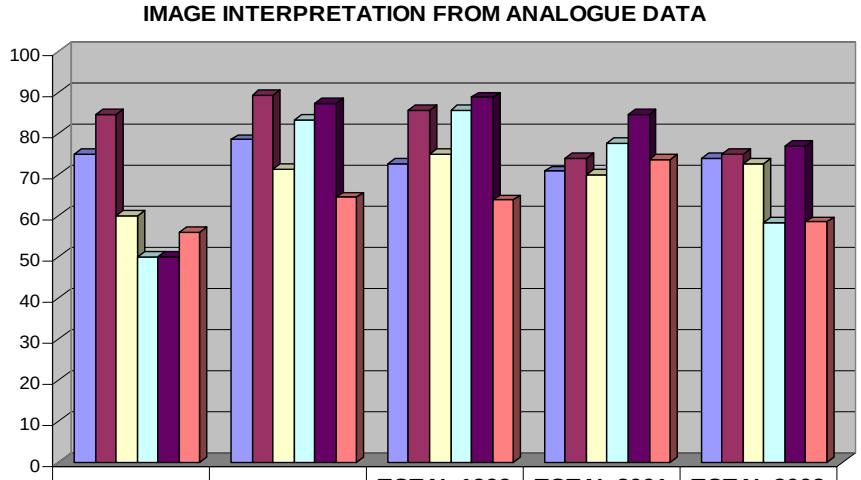
	Ops	Techs	Mets
1996	1,3	2,6	3,0
Total 1999	2,4	3,8	6,4
Total 2001	1,8	2,0	5,8
Total 2003	3,0	2,5	6,2

Table 1.4.8



	Ops	Techs	Mets
1996	10,5	6,3	15,3
Total 1999	8,0	5,6	13,1
Total 2001	7,8	5,4	13,4
Total 2003	8,0	5,7	16,3

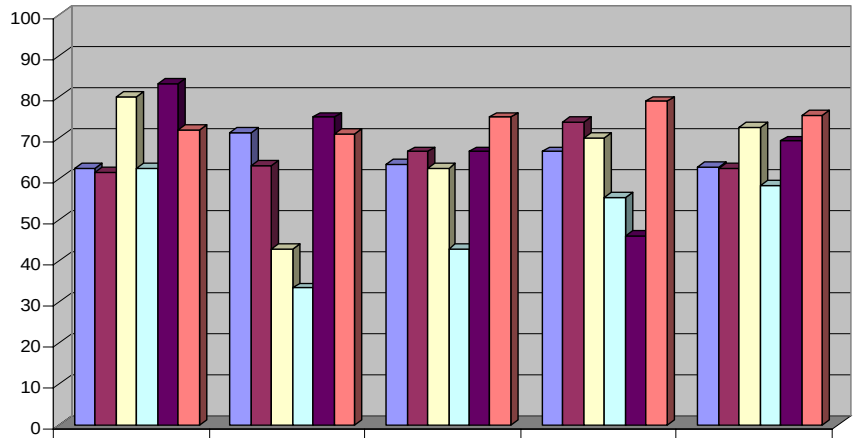
Table 2.1.1



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	75	79	73	71	74
RA II	85	89	86	74	75
RA III	60	71	75	70	73
RA IV	50	83	86	78	58
RA V	50	88	89	85	77
RA VI	56	65	64	74	59

Table 2.1.2

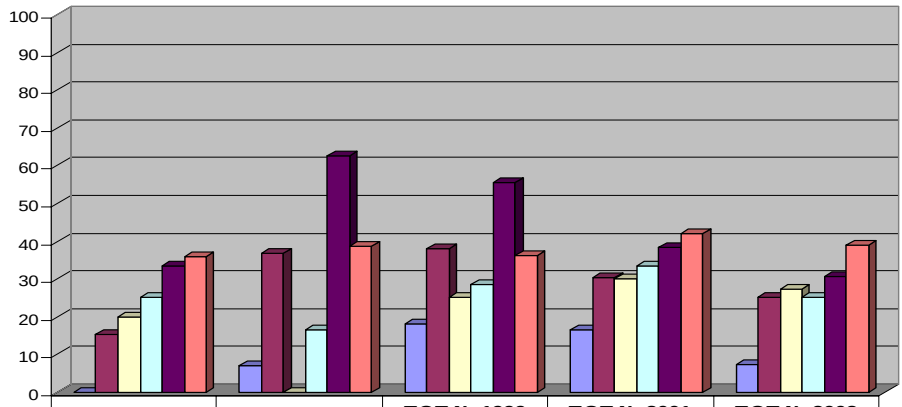
IMAGE INTERPRETATION FROM DIGITAL DATA



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	63	71	64	67	63
RA II	62	63	67	74	63
RA III	80	43	63	70	73
RA IV	63	33	43	56	58
RA V	83	75	67	46	69
RA VI	72	71	75	79	76

Table 2.1.3

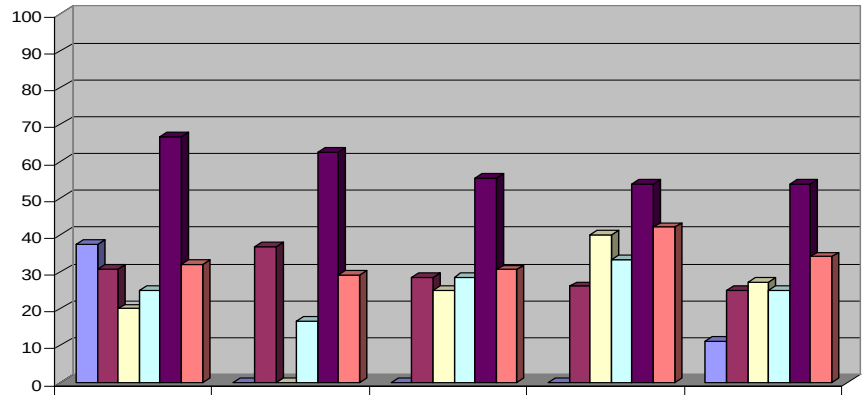
SATELLITE SOUNDINGS



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	0	7	18	17	7
RA II	15	37	38	30	25
RA III	20	0	25	30	27
RA IV	25	17	29	33	25
RA V	33	63	56	38	31
RA VI	36	39	36	42	39

Table 2.1.4

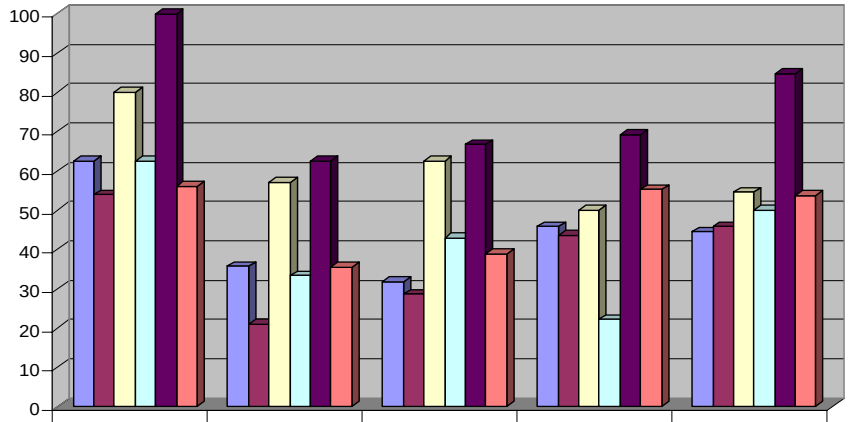
SATELLITE SOUNDING PRODUCTS



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	38	0	0	0	11
RA II	31	37	29	26	25
RA III	20	0	25	40	27
RA IV	25	17	29	33	25
RA V	67	63	56	54	54
RA VI	32	29	31	42	34

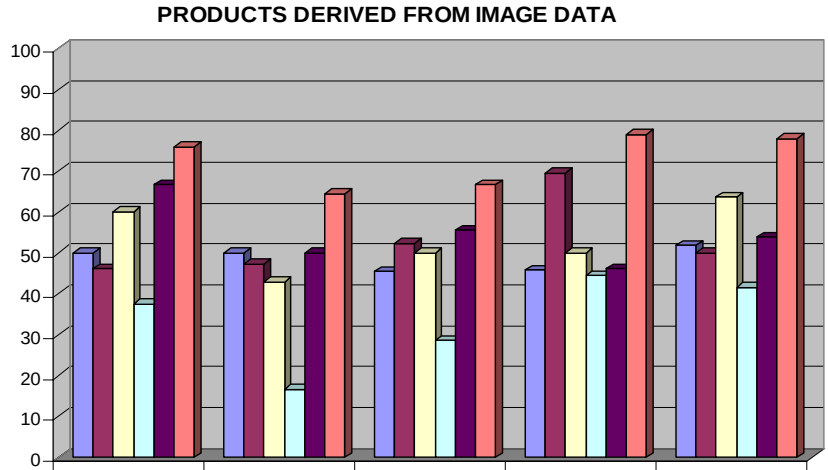
Table 2.1.5

QUALITATIVE USE OF SATELLITE PRODUCTS FROM OTHER SOURCES



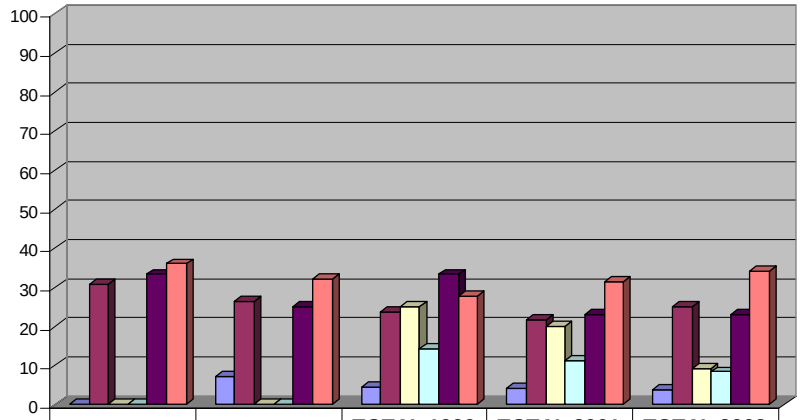
	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	63	36	32	46	44
RA II	54	21	29	43	46
RA III	80	57	63	50	55
RA IV	63	33	43	22	50
RA V	100	63	67	69	85
RA VI	56	35	39	55	54

Table 2.2.1
Countries (%) extracting satellite derived products from digital data



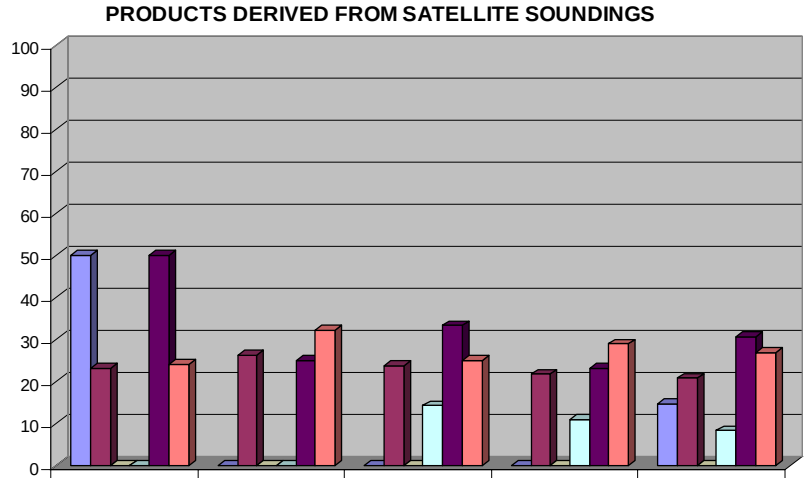
	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	50	50	45	46	52
RA II	46	47	52	70	50
RA III	60	43	50	50	64
RA IV	38	17	29	44	42
RA V	67	50	56	46	54
RA VI	76	65	67	79	78

Table 2.2.2
Countries (%) processing satellite soundings



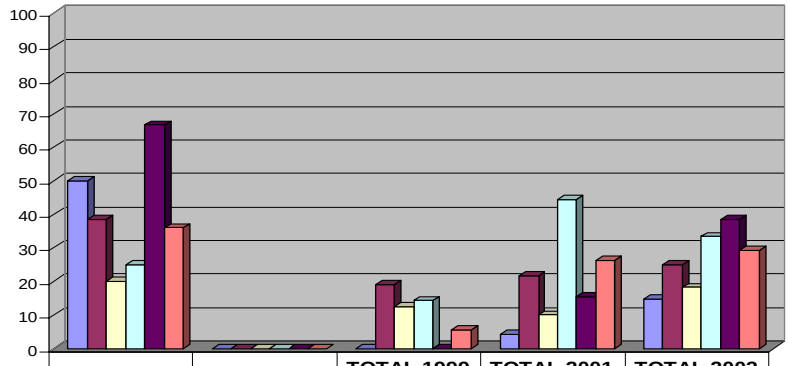
	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	0	7	5	4	4
RA II	31	26	24	22	25
RA III	0	0	25	20	9
RA IV	0	0	14	11	8
RA V	33	25	33	23	23
RA VI	36	32	28	32	34

Table 2.2.3
Countries (%) extracting processed products from satellite soundings



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	50	0	0	0	15
RA II	23	26	24	22	21
RA III	0	0	0	0	0
RA IV	0	0	14	11	8
RA V	50	25	33	23	31
RA VI	24	32	25	29	27

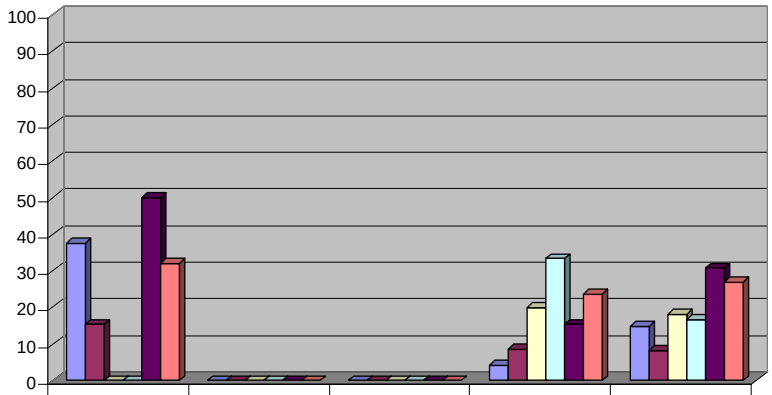
Table 2.2.4
Countries (%) extracting other satellite derived parameters



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	50	0	0	4	15
RA II	38	0	19	22	25
RA III	20	0	13	10	18
RA IV	25	0	14	44	33
RA V	67	0	0	15	38
RA VI	36	0	6	26	29

Table 2.2.5
Countries (%) extracting level 3 & 4 products from satellite derived parameters

LEVEL 3 (MAPPED) & LEVEL 4 (MODEL OUTPUT) PRODUCTS FROM SATELLITE DERIVED PARAMETERS



	2003 (35%)	1996 (46%)	TOTAL 1999 (55%)	TOTAL 2001 (63%)	TOTAL 2003 (69%)
RA I	38	0	0	4	15
RA II	15	0	0	9	8
RA III	0	0	0	20	18
RA IV	0	0	0	33	17
RA V	50	0	0	15	31
RA VI	32	0	0	24	27

Table 2.3.0a
Most frequently used parameters (for each application area)

Parameters name	NOW VSRF	Syn	NWP	Aero Met	Marine Met	Agri Met	Hydr.	Atm. Chem	Clim. Gl.Ch	Envir. Dis.	Res.	PWS	**Total**
Aerosol total column	1		1					4	1	2	1		10
Apparent Thermal Inertia			1					1			1		3
Atmospheric Instability Index	10	6	1	5	1	3	2			4	3	2	37
Cloud base height	4	4		11	1	1				2	1	1	25
Cloud cover	34	35	4	23	9	12	11		15	10	10	26	189
Cloud ice total column	1	1	1	2							1	1	7
Cloud imagery	45	45	1	31	16	12	13	1	5	12	10	34	225
Cloud top height	22	21	2	19	2	3	4		3	3	3	7	89
Cloud top temperature	36	30	1	20	6	6	10		5	5	8	8	135
Cloud type	27	23		28	10	7	8		8	4	5	14	134
Cloud water profile	4	3	2	2	1	4	5		3	3	5	3	35
Cloud water total column	5	3	1	2		2	3		3	1	2	2	24
Fires	1	1		2		5	1			16	1	8	35
Height of tropopause	2	4	1	4					1				12
Icebergs					3					1			4
Land cover	1	1			1	7	4		3	1	2	1	21
Land surface features	1		1			4	3	1	2	2	2	1	17
Land surface temperature	2	4	5	3	1	12	2		6	1	2	5	43
Leaf Area Index (LAI)	1					6					1		8
Long-wave surf. Emissivity						1			1		2		4
LW outgoing rad. TOA		1	1			1		1	6		3		13
Norm. Diff. Veg. Index (NDVI)						10			4	3	3		20
Ocean currents					4				1			1	6
Ozone Profile			1					6	3	3	1		14
Ozone total column								8	4	1			13
Precipitation index	4	3	1	4	2	5	7		4	5	4	5	44
Precipitation rate	11	8	1	4	4	9	14	1	8	9	6	9	84
Rain Profile	2	1		1		2	3		1	3	4	4	21
Salinity					2		2				1		5
Sea-ice cover		1	3		11				1				16
Sea-ice surface temperature					3				1	1	1		6
Sea Level					7		2		4				13
Sea surface temperature	6	10	11	2	20	2	2		11	2	6	3	75
SW outgoing rad. TOA		1				1		1	3		2		8
Short-wave irradiance at surf.			1			1	2	1	6	1	1		13
Significant wave height	1			1	8					1			11
Snow cover		2	4			3	10		2	5	2	5	33
Snow melting conditions							4			1	1		6
Soil moisture			2			6	3		1	1	2	2	17
Specific humidity profile	2	2	11		1	3		1	1	1	3	1	26
Specific humidity total column	1	2	1				1		1			1	7
Temperature profile	5	9	13	4		2	1	1	5	1	6	3	50
Trace gases								7	2	1	2		12
Tropopause temperature		2						1			1		4
Vegetation type						5	1		1	2	3	1	13
Wave period/direction		2		1	6				1				10
Wind profile	5	6	8	11	1	1	1	1	3	3	3	4	47
Wind speed over sea surface	1	2	2	2	10				1	3	1	4	26
Wind vector over sea surface	3	5	8	3	15				1	1	2	4	42
Volcanic ash	1			13		1		1	1	8		3	28
Others		1		1						1			3

Table 2.3.0b
Most required but not available parameters (for each application area)

Parameters name	NOW VSRF	Syn	NWP	Aero Met	Marine Met	Agri Met	Hydr.	Atm. Chem	Clim. Gl.Ch	Envir. Dis.	Res.	PWS	**Total**
Aerosol total column	1			2				7		8	2	1	21
Apparent Thermal Inertia	2	1		1			1					1	6
Atmospheric Instability Index	16	14		7					1	1	3	3	45
Cloud base height	9	3	1	15	1				1		1	1	32
Cloud cover		1	1								1	1	4
Cloud ice total column	2	1		5							1		9
Cloud imagery		1											1
Cloud top height	4	5		5									14
Cloud top temperature	2	2		1							1		6
Cloud type	5	6									1	1	13
Cloud water profile	11	7	4	3		1	1				2	1	30
Cloud water total column	11	9	2	3	1	1	5			1		2	35
Fires					1	1		1		9		2	14
Height of tropopause	2	2		9				1	1		1		16
Icebergs					1								1
Land cover			1			5	2	1	4	1		1	15
Land surface features			3			2	4		3	2		3	17
Land surface temperature	5	1	5			7	2		6		1		27
Leaf Area Index (LAI)			1			7	2				1		11
Long-wave surf. Emissivity			1			2	1		4	1			9
LW outgoing rad. TOA						3			2		3		8
Norm. Diff. Veg. Index (NDVI)						6	2		4	1		1	14
Ocean currents					8				1		1	1	11
Ozone Profile	1	1	2					8	4	3	2		21
Ozone total column	1	1						4	6	2	1		15
Precipitation index	5	7	1				3		1	1		4	22
Precipitation rate	17	15	2	4	1	6	10		1	2	4	7	69
Rain Profile	5	5					6		1	2	1	6	26
Salinity					4		2		2		1	1	10
Sea-ice cover					2								2
Sea-ice surface temperature				1	1			1					3
Sea Level				1	6			1	5	3	1	2	19
Sea surface temperature		4	2		6				2	1	2	2	19
SW outgoing rad. TOA		1				1			1		2		5
Short-wave irradiance at surf.						1		2		1	1		5
Significant wave height		1		1	14		1			1		3	21
Snow cover			5				8		1		1		15
Snow melting conditions						1	8		1	2	3	1	16
Soil moisture			5	1		14	16		3	4	5	1	49
Specific humidity profile	6	6	3	3			2		1	1	1		23
Specific humidity total column		2	1	1		1							5
Temperature profile	10	6	4	9			1				4	2	36
Trace gases			1		1			7	4	3	2	2	20
Tropopause temperature		1		3				1		1			6
Vegetation type			2			9	1	1	1	3	2	1	20
Wave period/direction					15					1	1	2	19
Wind profile	11	12	5	12	3	1		2		5	2	4	57
Wind speed over sea surface	2	2	1	1	7	1				2			16
Wind vector over sea surface	1	1	2	1	8					1			14
Volcanic ash	1	1		4	1			2	1	4			14
Others			1	2	1	1	1		1	1		1	9

Table 2.3.1a
Important parameters – Overview (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Cloud imagery	13	Cloud imagery	20	Cloud imagery	13	N/A	0
2	Cloud cover	11	Cloud cover	15	Cloud cover	8	N/A	0
3	Cloud top temperature	8	Cloud top temperature	12	Cloud type	7	N/A	0
4	Cloud type	8	Cloud type	9	Cloud top temperature	6	N/A	0
5	Cloud top height	5	Sea surface temperature	5	Cloud top height	5	N/A	0
6	Precipitation rate	5	Precipitation rate	5	Precipitation rate	4	N/A	0
	Total	49	Total	66	Total	43		0
Most required parameters								
1	Precipitation rate		Precipitation rate		Land surface features		N/A	
2	Wind profile		Wind profile		Sea level		N/A	
3	Soil moisture		Atm. instability index		Land cover		N/A	

Table 2.3.1b
Important parameters – Overview (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Cloud imagery	Cloud imagery	Cloud imagery	Prec. rate	Prec. rate	Cloud imagery
Cloud cover	Cloud cover	Cloud top temp.	Cloud imagery	Cloud imagery	Cloud cover
Cloud top temp.	Cloud top temp.	Cloud cover	Cloud cover	Cloud cover	Cloud type
Cloud type	Cloud type	S.S.T.	Cloud top height	Cloud type	Cloud top height
S.S.T.	Cloud top height	Cloud type	Cloud top temp.	Cloud top temp.	Cloud top temp.
Prec. rate	Cloud water prof.	Cloud top height	Cloud type	S.S.T.	Prec. rate
Most required but not available					
Cloud water tot col	Prec. rate	Wind profile	Prec. rate	Soil moisture	Cloud base height
Cloud water prof.	Rain Profile	Prec. Index	Land surf. feature	Wind profile	Prec. rate
Atm. Instab. Index	Atm. Instab. Index	Atm. Instab. Index	Prec. Index	Prec. rate	L.S.T.

Table 2.3.2a
Nowcasting and VSRF – Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Cloud imagery	19	Cloud imagery	25	Cloud imagery	9	Cloud imagery	18
2	Cloud top temperature	15	Cloud top temperature	22	Cloud top temperature	8	Cloud type	10
3	Cloud cover	14	Cloud type	19	Cloud top height	8	Cloud cover	10
4	Cloud type	11	Cloud cover	18	Cloud cover	6	Cloud top height	9
5	Cloud top height	9	Precipitation rate	6	Cloud type	6	Cloud top temperature	7
6	Precipitation rate	5	Cloud base height	4	Land surface temperature	4	Sea surface temperature	7
	Total	73	Total	94	Total	41	Total	61
Most required but not available								
1	Precipitation rate		Atmospheric instability index		Precipitation rate		Atmospheric instability rate	
2	Atmospheric Instability Index		Precipitation rate		Temperature profile		Precipitation rate	
3	Cloud water profile		Cloud base height		Specific humidity profile		Cloud water profile	

Table 2.3.2b
Nowcasting & VSRF – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Cloud imagery	Cloud imagery	Cloud top height	Cloud imagery	Cloud imagery	Cloud imagery
Atm. Instab. Index	Cloud top temp.	Cloud top temp.	Cloud cover	Cloud type	Cloud top temp.
Cloud cover	Cloud cover	Cloud cover	Cloud type	Cloud cover	Cloud cover
Cloud top temp.	Cloud top height	Cloud type	Cloud top temp.	Cloud top temp.	Cloud type
		Cloud imagery	Cloud top height	Temp. Profile	Cloud top height
		S.S.T.	Cloud wat. tot. col.	Wind Profile	
Most required but not available					
Cloud water prof.	Atm. Instab. Index	Atm. Instab. Index	Atm. Instab. Index	Cloud wat. tot. col.	Prec.rate
	Prec.rate	Cloud wat. tot. col.	Cloud type	Wind Profile	Cloud base heig.
	Temp. Profile	Temp. Profile	Cloud water prof.	Cloud water prof.	Atm. Instab. Index

Table 2.3.3a
Synoptic Analysis– Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Cloud imagery	19	Cloud imagery	26	N/A	0	N/A	0
2	Cloud cover	15	Cloud cover	18	N/A	0	N/A	0
3	Cloud top temperature	13	Cloud type	17	N/A	0	N/A	0
4	Cloud type	10	Cloud top temperature	16	N/A	0	N/A	0
5	Cloud top height	9	Cloud base height	4	N/A	0	N/A	0
6	Sea surface temperature	4	Temperature profile	4	N/A	0	N/A	0
	Total	69	Total	85	Total	0	Total	0
Most required but not available								
1	Precipitation rate		Atmospheric instability index		N/A		N/A	
2	Atmospheric Instability Index		Precipitation rate		N/A		N/A	
3	Wind profile		Cloud base height		N/A		N/A	

Table 2.3.3b
Synoptic Analysis – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Cloud imagery	Cloud imagery	Cloud cover	Cloud imagery	Cloud cover	Cloud imagery
Cloud cover	Cloud cover	Cloud top temp.	Temp. Profile	Cloud imagery	Cloud cover
Cloud top temp.	Cloud top temp.	Cloud imagery	Cloud top height	Cloud top temp.	Cloud top height
	Cloud type	Temp. Profile	Cloud top temp.	S.S.T.	Cloud type
	Cloud top height	Cloud top height		Cloud type	Cloud top temp.
	Land sur. temp.	Cloud type			
Most required but not available					
	Atm. Instab. Index	Atm. Instab. Index	Speci.hum.prof.	Prec. rate	Cloud top height
	Cloud wat. tot. col.	Cloud type		Wind Profile	Cloud base heig.
		Prec. index		Atm. Instab. Index	Height of tropo.

Table 2.3.4a
Assimilation in Global & Regional NWP– Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Temperature profile	14	Temperature profile	22	Cloud imagery	9	Sea surface temperature	11
2	Sea surface temperature	12	Wind profile	18	Cloud top temperature	8	Cloud top temperature	10
3	Specific humidity profile	12	Sea surface temperature	18	Cloud top height	7	Ozone total column	8
4	Wind profile	9	Wind vector over sea surface	8	Cloud cover	5	Ozone profile	8
5	Wind vector over sea surface	9	Cloud top temperature	7	Cloud type	5	Temperature profile	7
6	Land surface temperature	6	Cloud imagery	5	Temperature profile	5	Specific humidity profile	7
	Total	62	Total	78	Total	40	Total	51
Most required but not available								
1	Land surface temperature		Wind profile		Cloud cover		Wind profile	
2	Soil moisture		Wind vector over sea surface		Ozone profile		Cloud water profile	
3	Wind profile		Cloud water profile		Land cover		Wind speed over sea surface	

Table 2.3.4b
Assimilation in Global & Regional NWP – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
L.S.T.	S.S.T.	S.S.T.	Temp. Profile	Wind Profile	Speci.hum.prof.
Wind Profile	Temp. Profile	Temp. Profile		Wind vector s.s.	Snow cover
	Wind vector s.s.	Wind Profile			Sea-Ice cover
	Cloud cover				Wind vector s.s.
	Speci.hum.prof.				
Most required but not available					
	Cloud water prof.	Temp. Profile		Land surface feat.	L.S.T.
	Snow cover				Soil moisture
	Speci.hum.prof.				

Table 2.3.5a
Aeronautical Meteorology - Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Cloud imagery	16	Cloud imagery	19	Cloud imagery	13	Cloud imagery	24
2	Cloud type	14	Cloud cover	17	Cloud top temperature	10	Cloud top temperature	12
3	Cloud cover	12	Cloud type	16	Cloud top height	10	Ozone total column	10
4	Cloud top temperature	10	Cloud top temperature	14	Cloud cover	8	Ozone profile	11
5	Cloud top height	10	Cloud top height	12	Cloud type	7	Temperature profile	8
6	Volcanic ash	7	Cloud base height	6	Temperature profile	7	Specific humidity profile	5
	Total	67	Total	84	Total	55	Total	70

Most required but not available				
1	Cloud base height	Cloud base height	Height of tropopause	Wind profile
2	Wind profile	Wind profile	Cloud top temperature	Atmospheric instability index
3	Height of tropopause	Atmospheric instability index	Precipitation rate	Land surface temperature

Table 2.3.5b
Aeronautical Meteorology – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Cloud type	Cloud cover	Cloud imagery	Cloud imagery	Cloud cover	Cloud imagery
Cloud imagery	Cloud imagery	Cloud cover	Cloud cover	Cloud type	Cloud type
Cloud base height	Cloud top temp.	Cloud top temp.	Cloud top height	Volcanic ash	Cloud top height
Cloud cover	Cloud type	Cloud type	Cloud top temp.	Cloud imagery	Cloud cover
Cloud top temp.	Cloud top height			Cloud top temp.	Wind profile
Cloud top height	Cloud base height				
Most required but not available					
Cloud water prof.	Cloud base height.	Cloud imagery	Cloud ice to. col.	Prep. rate	Cloud base height
Cloud water to col.	Height of tropo.		Temp. Profile		Cloud top height
	Temp. Profile				Wind Profile

Table 2.3.6a
Marine Meteorology - Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Sea surface temperature	14	Sea surface temperature	18	sea surface temperature	10	Cloud imagery	17
2	Cloud imagery	11	Cloud imagery	14	Cloud imagery	9	Sea surface temperature	14
3	Wind vector over sea surface	10	Wind vector over sea surface	13	Wind speed over sea surface	7	Cloud type	14
4	Sea-ice cover	8	Cloud cover	12	Wind vector over sea surface	7	Cloud cover	13
5	Cloud type	7	Significant wave height	9	Ocean currents	6	Wind speed over sea surface	8
6	Wind speed over sea surface	7	Wave period/direction	8	Significant wave height	6	Wind vector over sea surface	7
	Total	57	Total	74	Total	45	Total	73

Most required but not available				
1	Wave period/direction	Significant wave height	Cloud cover	Wind speed over sea surface
2	Significant wave height	Wind vector over sea surface	Cloud top height	Wind vector over sea surface
3	Ocean currents	Ocean currents	Cloud top temperature	Significant wave height

Table 2.3.6b
Marine Meteorology – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Wind vector s.s.	Cloud imagery	Cloud imagery	Sea level	S.S.T	Cloud imagery
S.S.T.	Cloud type	Cloud top temp.	Sig. wave height	Sea-ice cover	Wind speed s.s.
	S.S.T.	Icebergs	Wind vector s.s.	Wind vector s.s.	Wave period/direc
	Cloud cover	S.S.T.	S.S.T	Wind speed s.s.	Cloud cover
	Wind vector s.s.	Sig. wave height			sea-ice surf em.
Most required but not available					
Wave period/direc	Sig. wave height	Wave perio /direc	Wave period/direc	Sig. wave height	Salinity
	Wave period/direc	Wind speed s.s.	Wind speed s.s.		
			Wind vector s.s.		

Table 2.3.7a
Agricultural Meteorology - Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Cloud cover		NDVI	20	NDVI	8	Cloud imagery	20
2	Cloud imagery		Land surface temperature	16	Precipitation index	7	Land surface features	18
3	Land surface temperature		Cloud cover	13	Land surface temperature	6	Soil moisture	13
4	NDVI	7	Cloud imagery	10	Cloud imagery	5	Cloud type	11
5	Precipitation rate	7	Soil moisture	8	Fire	5	Cloud cover	10
6	Cloud type	5	Vegetation type	7	Cloud top temperature	4	NDVI	5
	Total	45	Total	74	Total	36	Total	77
Most required but not available								
1	Soil moisture		Soil moisture		Vegetation type		Precipitation rate	
2	Vegetation type		Vegetation type		Precipitation rate		Soil moisture	
3	Land surface temperature		Lead area index		Cloud top temperature		Cloud cover	

Table 2.3.7b
Agricultural Meteorology – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
N.D.V.I.	L.S.T.	L.A.I.	Cloud imagery	Fires	L.S.T.
Land surf. feature		Land cover	Cloud cover		Veg. type
Prec. Index		Cloud top temp.	N.D.V.I.		Cloud cover
Prec. rate		Soil moisture	Cloud top height		Snow cover
Soil moisture			Cloud type		
			Prec. rate		
Most required but not available					
L.A.I.	Soil moisture		Veg. type	Soil moisture	Prec. rate
LW out rad TOA	Veg. type		L.S.T.	L.A.I.	Land cover
			Soil moisture	N.D.V.I.	Snow melt. con.

Table 2.3.8a
Hydrology - Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Precipitation rate	12	Snow cover	15	NDVI	8	Cloud imagery	20
2	Cloud imagery	11	Precipitation rate	13	Precipitation index	7	Land surface features	18
3	Cloud cover	9	Cloud imagery	13	Land surface temperature	6	Soil moisture	13
4	Cloud top temperature	9	Land cover	10	Cloud imagery	5	Cloud type	11
5	Snow cover	8	Cloud type	10	Fires	5	Cloud cover	10
6	Cloud type	7	Snow melting conditions	8	Cloud top temperature	4	NDVI	5
	Total	56	Total	69	Total	34	Total	77
Most required but not available								
1	Soil moisture		Precipitation rate		Snow cover		Land surface temperature	
2	Precipitation rate		Soil moisture		Cloud base height		Soil moisture	
3	Snow cover		Precipitation index		Cloud water total column		Snow cover	

Table 2.3.8b
Hydrology – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Cloud cover	Cloud imagery	Cloud type	Cloud imagery	Prec. rate	Snow cover
Cloud top temp.	Cloud cover	Cloud imagery	Cloud cover		Prec. rate
Cloud imagery	Cloud top temp.	Cloud wat profile	Cloud top height		Snow melt con.
Cloud type	Cloud type	Land cover	Cloud top temp.		
Prec. Rate	Prec. Index	Snow cover	Prec. Index		
Most required but not available					
Cloud wat tot col.	Prec. rate	Snow cover	Prec. rate	Soil moisture	L.A.I.
Land surf feature	Rain Profile	Snow melt.con.	Prec. Index		
			Soil moisture		

Table 2.3.9a
Atmospheric Chemistry - Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Ozone total column	22	Ozone total column	35	N/A	0	N/A	0
2	Trace gases	19	Ozone profile	28	N/A	0	N/A	0
3	Ozone Profile	16	Aerosol total column	21	N/A	0	N/A	0
4	Aerosol total column	11	Temperature profile	7	N/A	0	N/A	0
5	Apparent Thermal Inertia	3	Fires	7	N/A	0	N/A	0
6	Cloud imagery	3		0	N/A	0	N/A	0
	Total	73	Total	98	Total	0	Total	0
Most required but not available								
1	Ozone Profile		Aerosol total column		N/A		N/A	
2	Aerosol total column		Trace gases		N/A		N/A	
3	Trace gases		Ozone profile		N/A		N/A	

Table 2.3.9b
Atmospheric chemistry – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Aerosol tot col.	Cloud imagery	Volcanic ash		Aerosol tot col.	Ozone tot col.
LW out rad TOA				Ozone profile	Ozone profile
Prec. Rate				Ozone tot col.	Trace gases
SW irrad. surf.				Trace gases	Aerosol tot col.
Most required but not available					
Trace gases	Aerosol tot col.	Ozone profile	Aerosol tot col.		Ozone profile
	Ozone tot col.	Ozone tot col.			Trace gases
					Volcanic ash

Table 2.3.10a
Climatology/Global Change - Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Cloud cover	11	Cloud cover	18	Sea surface temperature	7	Cloud type	8
2	Sea surface temperature	8	Long-wave outgoing rad. TOA	14	Long-wave outgoing rad. TOA	4	Cloud top temperature	6
3	Cloud type	6	Sea surface temperature	12	Cloud top height	4	Cloud top height	6
4	Precipitation rate	6	Cloud imagery	12	Cloud imagery	4	Cloud cover	6
5	Land surface temperature	5	Land surface temperature	8	Precipitation index	4	Sea surface temperature	6
6	Long-wave outgoing rad. TOA	5	Temperature profile	6	Temperature profile	4	NDVI	5
	Total	41	Total	70	Total	27	Total	37
Most required but not available								
1	Land surface temperature		Precipitation rate		Cloud cover		Land surface temperature	
2	Ozone total column		Sea level		Cloud base height		Soil moisture	
3	Sea Level		Long-wave outgoing rad. TOA		Snow cover		Long-wave outgoing rad. TOA	

Table 2.3.10b
Climatology/Global change – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
S.S.T.	Cloud cover	Cloud cover	Prec. Rate	Cloud cover	Cloud cover
Ozone profile	Cloud top temp.	Cloud type	L.S.T.	Cloud type	SW irrad. surf.
Temp. profile	L.S.T.	Sea Level		N.D.V.I	LW out rad TOA
	LW out rad TOA	S.S.T			S.S.T.
					SW out rad TOA
Most required but not available					
Land cover	L.S.T.		Land cover		L.S.T.
	Ozone. Tot col.		L.S.T.		LW surf. emiss.
	Soil moisture				

Table 2.3.11a
Environmental/Disaster Monitoring - Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Fires	13	Fires	24	Fires	8	Soil moisture	13
2	Cloud imagery	10	Cloud imagery	24	Ozone total column	5	Cloud imagery	12
3	Cloud cover	8	Cloud top temperature	16	Ozone profile	5	Land surface features	12
4	Precipitation rate	7	Precipitation rate	14	Land surface temperature	5	NDVI	8
5	Volcanic ash	6	Land cover	12	Sea surface temperature	5	Ozone profile	7
6	Cloud top temperature	4	Volcanic ash	6	NDVI	4	Ozone total column	7
	Total	48	Total	96	Total	32	Total	59
Most required but not available								
1	Fires		Fires		Ozone total column		Snow cover	
2	Aerosol total column		Volcanic ash		Atmospheric instability index		Land cover	
3	Wind profile		Precipitation rate		Vegetation type		Vegetation type	

Table 2.3.11b
Environmental/Disaster monitoring – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Prec. Rate	Cloud imagery	Fires	Fires	Fires	Fires
Veg. Type	Cloud cover	Snow cover	Cloud cover	Prec. Index	Prec. rate
	Cloud top temp.	Volcanic ash	Cloud imagery	Prec. rate	Snow cover
	Cloud water prof.			Wind speed s.s.	N.D.V.I.
	Volcanic ash			Volcanic ash	Land surf feature
Most required but not available					
Fires	Aerosol tot col.	Fires		Wind profile	Soil moisture
	Fires	Aerosol tot col.			
		Wind profile			

Table 2.3.12a
Research applications - Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Cloud cover	8	Sea surface temperature	16	N/A	0	N/A	0
2	Cloud imagery	8	Cloud imagery	14	N/A	0	N/A	0
3	Cloud top temperature	7	Cloud top temperature	14	N/A	0	N/A	0
4	Precipitation rate	5	Cloud cover	10	N/A	0	N/A	0
5	Sea surface temperature	5	Precipitation rate	8	N/A	0	N/A	0
6	Temperature profile	5	Long-wave outgoing rad. TOA	8	N/A	0	N/A	0
	Total	39	Total	70	Total:	0	Total:	0
Most required but not available								
1	Soil moisture		Precipitation rate		N/A		N/A	
2	Precipitation rate		Temperature profile		N/A		N/A	
3	Temperature profile		Ozone profile		N/A		N/A	

Table 2.3.12b
Research applications – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Cloud water prof.	Cloud cover	Cloud water prof.	Cloud top temp.	Cloud imagery	Cloud type
S.S.T	Cloud imagery	Rain prof.	Prec. rate	Cloud top temp.	Cloud cover
	Cloud top temp.		S.S.T	LW out rad TOA	Temp. profile
	Prec. rate			Prec. rate	
				Temp. profile	
				Wind profile	
Most required but not available					
LW out rad TOA	Aerosol tot col.		S.S.T.		Soil moisture
	Prec. rate		Temp. profile		Temp. profile
			Veg. type		

Table 2.3.13a
Public Weather Services - Important parameters (per Year, all Regions)

Most frequently used								
	2003	**%**	**2001**	**%**	**1999**	**%**	**1996**	**%**
1	Cloud imagery	21	Cloud imagery	33	Cloud imagery	13	N/A	0
2	Cloud cover	16	Cloud cover	20	Cloud cover	8	N/A	0
3	Cloud type	9	Cloud top temperature	13	Cloud type	7	N/A	0
4	Precipitation rate	6	Precipitation rate	11	Cloud top temperature	6	N/A	0
5	Cloud top temperature	5	Land surface temperature	11	Cloud top height	5	N/A	0
6	Fires	5	Land surface features	2	Precipitation rate	4	N/A	0
	Total	61	Total	90	Total	43		0
Most required but not available								
1	Precipitation rate		Precipitation rate		Land surface features		N/A	
2	Rain Profile		Temperature profile		Sea level		N/A	
3	Precipitation index		Ozone profile		Land cover		N/A	

Table 2.3.13b
Public Weather Services – Important parameters (in 2003, per Region)

Most frequently used					
RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**
Cloud cover	Cloud imagery	Cloud cover	Cloud cover	Cloud imagery	Cloud imagery
Cloud imagery	Cloud cover	Cloud imagery	Cloud imagery	Prec. Rate	Cloud cover
Cloud type	Cloud top temp.	Cloud top height		Cloud cover	Cloud type
Wind speed s.s.	Cloud type				Snow cover
	Cloud water prof.				Fires
	L.S.T.				
Most required but not available					
	Rain profile				Prec. rate

Table 2.4.0
Limiting factors and trend

	Number of reports 2001	2003	Percentages 2001	2003	trend
Lack of receiving equipment	29	28	42	**42**	**stability**
Lack of maintenance know-how	24	19	35	**29**	**improvement**
Required data not disseminated	20	19	29	**29**	**stability**
Required data not available	27	23	39	**35**	improvement
Communication system capacity limitations	22	26	32	**39**	deterioration
Lack of knowledge in use of equipment	17	20	25	**30**	deterioration
Lack of knowledge in use of satellite data & products	23	20	33	**30**	**improvement**
Lack of knowledge in programming techniques	31	26	45	**39**	**improvement**
Limitations in availability of application software & methods	45	37	65	**56**	**improvement**
Limited impact for the intended application	19	17	28	**26**	**Improvement**
total res. average	257	235	37,	**35.6**	**improvement**

Table 2.4.1
Lack of receiving equipment

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**6**	**4**	**2**	**6**	**2**	**8**	**28**
2001	4	6	2	4	3	10	29
1999	6	7	3	-	-	7	23
Percentages (2003):	**75**	**31**	**40**	**75**	**33**	**31**	**42**
Percentages (2001):	44	43	33	67	43	37	42
Percentages (1999):	35	50	50	-	-	32	35

Table 2.4.2
Deficiencies in the maintenance know-how and/or services

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**4**	**3**	**4**	**2**	**3**	**3**	**19**
2001	3	5	4	1	4	7	24
1999	5	-	-	2	-	2	9
Percentages (2003):	**50**	**23**	**80**	**25**	**50**	**12**	**29**
Percentages (2001):	33	36	67	17	57	26	35
Percentages (1999):	24	-	-	100	-	10	14

Table 2.4.3
Deficiencies in data dissemination

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**4**	**4**	**2**	**2**	**2**	**5**	**19**
2001	4	4	2	1	1	8	20
1999 (excluding problems with receiving equipment)	11 (5)	9 (2)	4 (1)	1 (1)	- -	10 (3)	35 (12)
Percentages (2003):	**50**	**31**	**40**	**25**	**33**	**19**	**29**
Percentages (2001):	44	29	33	17	14	30	29
Percentages (1999):	64	64	67	50	-	45	54

Table 2.4.4
Deficiencies in the availability of required data and products

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**3**	**5**	**1**	**2**	**2**	**10**	**23**
2001	4	9	3	2	1	8	27
Percentages (2003):	**38**	**38**	**20**	**25**	**33**	**38**	**35**
Percentages (2001):	44	64	50	33	14	30	39

Table 2.4.5
Limitation in communication system capacity

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**5**	**3**	**4**	**4**	**2**	**8**	**26**
2001	3	7	1	4	1	6	22
1999	5	2	2	1	-	2	12
Percentages (2003):	**63**	**23**	**80**	**50**	**33**	**31**	**39**
Percentages (2001)	33	50	17	67	14	22	32
Percentages (1999)	29	14	33	50	-	10	18

Table 2.4.6
Lack of knowledge in use of equipment

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**4**	**4**	**4**	**3**	**2**	**3**	**20**
2001	3	3	2	2	1	6	17
Percentages (2003):	**50**	**31**	**80**	**38**	**33**	**12**	**30**
Percentages (2001):	33	21	33	33	14	22	25

Table 2.4.7
Lack of knowledge in use of satellite data and products

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**4**	**4**	**3**	**4**	**1**	**4**	**20**
2001	3	8	0	3	2	7	23
1999	5	4	1	2	1	4	17
Percentages (2003):	**50**	**31**	**60**	**50**	**17**	**15**	**30**
Percentages (2001):	33	57	0	50	29	26	33
Percentages (1999):	29	29	17	100	25	18	26

Table 2.4.8
Lack of knowledge in programming techniques

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**5**	**5**	**3**	**4**	**3**	**6**	**26**
2001	7	7	4	5	4	4	31
1999	11	6	1	1	1	4	24
Percentages (2003):	**63**	**38**	**60**	**50**	**50**	**23**	**39**
Percentages (2001):	78	50	67	83	57	15	45
Percentages (1999):	65	43	17	50	25	18	37

Table 2.4.9
Limitations in availability of application software and methods

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**7**	**7**	**5**	**4**	**4**	**10**	**37**
2001	7	10	4	5	4	15	45
1999	13	4	3	1	2	5	28
Percentages (2003):	**88**	**54**	**100**	**50**	**67**	**38**	**56**
Percentages (2001):	78	71	67	83	57	56	65
Percentages (1999):	76	29	50	50	50	23	43

Table 2.4.10
Limitations in the impact for the intended application

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
2003	**3**	**3**	**1**	**2**	**2**	**6**	**17**
2001	2	5	1	2	2	7	19
1999	5	5	0	1	1	4	16
Percentages (2003):	**38**	**23**	**20**	**25**	**33**	**23**	**26**
Percentages (2001):	22	36	17	33	29	26	28
Percentages (1999):	29	36	0	50	25	18	25

Table 3.1.1
Training at RMTCs in the fundamentals of remote sensing

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**-**	**1**	**-**	**1**	**1**	**1**	**4**
No. of reported training activities (2001)	2	1	-	-	-	3	6
Average (2003)	**0**	**8**	**0**	**13**	**17**	**4**	**0.06**
Average (2001)	22	7	-	-	-	11	0.09
No. of trained staff members (2003)	**-**	**2**	**-**	**2**	**1**	**1**	**6**
No. of trained staff members (2001)	11	1	-	-	-	13	25

Table 3.1.2
Training at RMTCs in satellite image interpretation

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**4**	**2**	**-**	**3**	**1**	**2**	**12**
No. of reported training activities (2001)	3	2	1	1	-	5	12
Average (2003)	**50**	**15**	**0**	**38**	**17**	**8**	**0.18**
Average (2001)	33	14	17	17	-	19	0.17
No. of trained staff members (2003)	**4**	**15**	**-**	**6**	**2**	**2**	**29**
No. of trained staff members (2001)	12	11	7	1	-	93	124

Table 3.1.3
Training at RMTCs (all training areas)

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**5**	**4**	**1**	**8**	**2**	**3**	**23**
No. of reported training activities (2001)	6	4	1	1	1	12	25
No. of trained staff members (2003)	**5**	**19**	**1**	**14**	**3**	**3**	**45**
No. of trained staff members (2001)	24	13	7	1	1	154	200

Table 3.1.4
Training at WMO in satellite image interpretation

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**1**	**2**	**1**	**3**	**4**	**11**
No. of reported training activities (2001)	1	2	1	1	2	2	9
Average (2003)	**0**	**8**	**40**	**13**	**50**	**15**	**0.17**
Average (2001)	11	14	17	17	29	7	0.13
No. of trained staff members (2003)	**0**	**1**	**2**	**1**	**3**	**5**	**12**
No. of trained staff members (2001)	1	4	1	2	2	6	16

Table 3.1.5
Training at WMO (all training areas)

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**2**	**3**	**1**	**5**	**5**	**16**
No. of reported training activities (2001)	1	4	2	1	3	2	13
No. of trained staff members (2003)	**0**	**6**	**3**	**1**	**5**	**7**	**22**
No. of trained staff members (2001)	1	6	3	2	3	3	21

Table 3.1.6
Training at university / industry in physical basis of remote sensing

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**3**	**1**	**0**	**1**	**3**	**8**
No. of reported training activities (2001)	1	2	0	1	1	6	11
Average (2003)	**0**	**23**	**20**	**0**	**17**	**12**	**0.18**
Average (2001)	11	14	0	17	14	22	0.16
No. of trained staff members (2003)	**0**	**6**	**3**	**0**	**2**	**3**	**14**
No. of trained staff members (2001)	5	21	0	2	1	59	88

Table 3.1.7
Training at university / industry in satellite image interpretation

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**2**	**1**	**0**	**0**	**3**	**6**
No. of reported training activities (2001)	0	3	0	1	3	2	9
Average (2003)	**0**	**15**	**20**	**0**	**0**	**12**	**0.09**
Average (2001)	0	21	0	17	43	7	0.13
No. of trained staff members (2003)	**0**	**7**	**1**	**0**	**0**	**9**	**17**
No. of trained staff members (2001)	0	33	0	2	4	5	44

Table 3.1.8
Training at university / industry (all training areas)

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**6**	**3**	**0**	**2**	**12**	**23**
No. of reported training activities (2001)	2	6	0	3	4	11	26
No. of trained staff members (2003)	**0**	**16**	**14**	**0**	**3**	**29**	**62**
No. of trained staff members (2001)	6	79	0	8	5	68	166

Table 3.1.9
Training by distant learning in satellite image interpretation

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**1**	**0**	**1**	**1**	**2**	**4**	**9**
No. of reported training activities (2001)	0	1	0	1	0	3	5
Average (2003)	**13**	**0**	**20**	**13**	**33**	**15**	**0.14**
Average (2001)	0	7	0	17	0	11	0.07
No. of trained staff members (2003)	**1**	**0**	**1**	**1**	**6**	**21**	**30**
No. of trained staff members (2001)	0	2	0	3	0	15	20

Table 3.1.10
Training by distant learning (incl. CAL and VL) (all training areas)

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**1**	**0**	**1**	**1**	**2**	**4**	**9**
No. of reported training activities (2001)	**0**	**1**	**0**	**3**	**0**	**8**	**12**
Average (2003)	**13**	**0**	**20**	**13**	**33**	**15**	**0.14**
Average (2001)	0	7	0	50	0	30	0.17
No. of trained staff members (2003)	**1**	**0**	**1**	**1**	**6**	**21**	**30**
No. of trained staff members (2001)	**0**	**2**	**0**	**7**	**0**	**37**	**46**

Table 3.1.11
Internal training in the physical basis of remote sensing

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**1**	**0**	**1**	**3**	**4**	**9**
No. of reported training activities (2001)	0	3	0	1	1	3	8
Average (2003)	**0**	**8**	**0**	**13**	**50**	**15**	0.14
Average (2001)	0	21	0	17	14	11	0.12
No. of trained staff members (2003)	**0**	**6**	**0**	**10**	**61**	**169**	**246**
No. of trained staff members (2001)	0	150	0	8	3	26	187

Table 3.1.12
Internal training in satellite image interpretation

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**2**	**1**	**2**	**3**	**7**	**15**
No. of reported training activities (2001)	0	3	1	1	1	7	13
Average (2003)	**0**	**15**	**20**	**25**	**50**	**27**	**0.23**
Average (2001)	0	21	17	17	14	26	0.19
No. of trained staff members (2003)	**0**	**23**	**3**	**11**	**99**	**151**	**287**
No. of trained staff members (2001)	0	210	20	12	3	110	355

Table 3.1.13
Internal training (all training areas)

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**4**	**1**	**6**	**3**	**19**	**39**
No. of reported training activities (2001)	0	9	1	2	2	17	31
Average (2003)	**0**	**31**	**20**	**75**	**50**	**73**	**0.59**
Average (2001)	0	64	17	33	29	63	0.45
No. of trained staff members (2003)	**0**	**64**	**3**	**28**	**171**	**391**	**657**
No. of trained staff members (2001)	0	409	20	20	6	161	616

Table 3.1.14
Bilateral training in the physical basis of remote sensing

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**1**	**0**	**0**	**0**	**1**	**2**
No. of reported training activities (2001)	0	1	0	1	0	2	4
Average (2003)	**0**	**8**	**0**	**0**	**0**	**4**	**0.03**
Average (2001)	0	7	0	17	0	7	0.06
No. of trained staff members (2003)	**0**	**10**	**0**	**0**	**0**	**15**	**25**
No. of trained staff members (2001)	0	1	0	2	0	45	48

Table 3.1.15
Bilateral training in satellite image interpretation

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**1**	**0**	**0**	**0**	**4**	**5**
No. of reported training activities (2001)	0	2	0	1	0	6	9
Average (2003)	**0**	**8**	**0**	**0**	**0**	**15**	**0.08**
Average (2001)	0	14	0	17	0	22	0.13
No. of trained staff members (2003)	**0**	**10**	**0**	**0**	**0**	**66**	**76**
No. of trained staff members (2001)	0	2	0	2	0	49	53

Table 3.1.16
Bilateral training (all training areas)

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
No. of reported training activities (2003)	**0**	**2**	**0**	**0**	**0**	**7**	**9**
No. of reported training activities (2001)	0	4	0	2	3	12	21
Average (2003)	**0**	**15**	**0**	**0**	**0**	**27**	**0.14**
Average (2001)	0	29	0	33	43	44	0.30
No. of trained staff members (2003)	**0**	**20**	**0**	**0**	**0**	**92**	**112**
No. of trained staff members (2001)	0	28	0	4	5	143	180

Table 3.2.1
RA I -Number of reported training activities

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	0	0	0	0	0
Software development	1	0	0	0	0	0	0
Physical basis for remote sensing:	0	0	0	0	0	0	0
Satellite image interpretation:	4	0	0	1	0	0	5
Other	0	0	0	0	0	0	0
Total	5	0	0	0	0	0	5

Table 3.2.2
RA I - Number of trained staff members

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	0	0	0	0	0
Software development	1	0	0	0	0	0	1
Physical basis for remote sensing:	0	0	0	0	0	0	0
Satellite image interpretation:	4	0	0	1	0	0	5
Other	0	0	0	0	0	0	0
Total	5	0	0	1	0	0	6

Table 3.2.3
RA II - Number of reported training activities

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	0	0	1	0	1
Software development	0	0	0	0	0	0	0
Physical basis for remote sensing:	1	1	3	0	1	1	7
Satellite image interpretation:	2	1	2	0	2	1	8
Other	1	0	1	0	0	0	2
Total	4	2	6	0	4	2	18

Table 3.2.4
RA II - Number of trained staff members

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	0	0	35	0	35
Software development	0	0	0	0	0	0	0
Physical basis for remote sensing:	2	5	6	0	6	10	29
Satellite image interpretation:	15	1	7	0	23	10	56
Other	2	0	3	0	0	0	5
Total	19	6	16	0	64	20	125

Table 3.2.5
RA III - Number of reported training activities

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	1	0	0	0	1
Software development	0	0	0	0	0	0	0
Physical basis for remote sensing:	0	0	1	0	0	0	1
Satellite image interpretation	0	2	1	1	1	0	5
Other	1	1	0	0	0	0	2
Total	1	3	3	1	1	0	9

Table 3.2.6
RA III - Number of trained staff members

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	10	0	0	0	10
Software development	0	0	0	0	0	0	0
Physical basis for remote sensing:	0	0	3	0	0	0	3
Satellite image interpretation:	0	2	1	1	3	0	7
Other	1	1	0	0	0	0	2
Total	1	3	14	1	3	0	22

Table 3.2.7
RA IV - Number of reported training activities

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	2	0	0	0	1	0	3
Software development	2	0	0	0	2	0	4
Physical basis for remote sensing:	1	0	0	1	1	0	3
Satellite image interpretation:	3	1	0	1	2	0	7
Other	0	0	0	0	0	0	0
Total	8	1	0	2	6	0	17

Table 3.2.8
RA IV - Number of trained staff members

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	3	0	0	0	3	0	6
Software development	3	0	0	0	4	0	7
Physical basis for remote sensing:	2	0	0	0	10	0	12
Satellite image interpretation:	6	1	0	1	11	0	19
Other	0	0	0	0	0	0	0
Total	14	1	0	1	28	0	44

Table 3.2.9
RA V - Number of reported training activities

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	1	0	2	0	3
Software development	0	0	0	0	1	0	1
Physical basis for remote sensing:	1	2	1	0	3	0	7
Satellite image interpretation:	1	3	0	2	3	0	9
Other	0	0	0	0	0	0	0
Total	2	5	2	2	9	0	20

Table 3.2.10
RA V - Number of trained staff members

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	1	0	10	0	11
Software development	0	0	0	0	1	0	1
Physical basis for remote sensing:	1	2	2	0	61	0	66
Satellite image interpretation:	2	3	0	6	99	0	110
Other	0	0	0	0	0	0	0
Total	3	5	3	6	171	0	188

Table 3.2.11
RA VI - Number of reported training activities

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	2	0	3	1	6
Software development	0	0	4	0	4	0	8
Physical basis for remote sensing:	1	1	3	0	4	1	10
Satellite image interpretation:	2	4	3	4	7	4	24
Other	0	0	0	0	1	1	2
Total	3	5	12	4	19	7	50

Table 3.2.12
RA VI - Number of trained staff members

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	0	0	7	0	22	8	37
Software development	0	0	10	0	9	0	19
Physical basis for remote sensing	1	2	3	0	169	15	190
Satellite image interpretation:	2	5	9	21	151	66	254
Other	0	0	0	0	40	3	43
Total	3	7	29	21	391	92	543

Table 3.3.1
Number of reported training activities (all regions)

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	2	0	4	0	7	1	14
Software development	3	0	4	0	7	0	14
Physical basis for remote sensing:	4	4	8	0	9	2	27
Satellite image interpretation:	12	11	6	9	15	5	58
Other	2	1	1	0	1	1	6
Total	23	16	23	9	39	9	119

Table 3.3.2
Number of trained staff members (all regions)

	RMTC	WMO	Univ./Ind	Distant	Internal	Bilateral	Total
Equipment	3	0	18	0	70	8	99
Software development	4	0	10	0	14	0	28
Physical basis for remote sensing:	6	9	14	0	246	25	300
Satellite image interpretation:	29	12	17	30	287	76	451
Other	3	1	3	0	40	3	50
Total	45	22	62	30	657	112	928

Table 3.3.3
Total Training

	RA I	**RA II**	**RA III**	**RA IV**	**RA V**	**RA VI**	Total
No. of reported training activities (2003)	**6**	**18**	**9**	**16**	**20**	**50**	**119**
No. of reported training activities (2001)	9	28	4	12	13	62	128
No. of trained staff members (2003)	**6**	**125**	**22**	**44**	**188**	**543**	**928**
No. of trained staff members (2001)	31	537	30	50	20	561	1,229

Table 3.3.4
Staff to be trained in 2003-2004

	Class 1	Class 2	Class 3	Hydrology	Environment	Total
Equipment	30	52	19	6	8	115
Software development	35	35	10	11	3	94
Physical basis for remote sensing:	141	79	17	10	4	251
Satellite image interpretation:	313	125	31	27	3	499
Other	137	90	40	0	1	268
Total	656	381	117	54	19	1227

Table 3.3.5
Staff to be trained in 2001-2002 (as reported in 2001)

	Class 1	Class 2	Class 3	Hydrology	Environment	Total
Equipment	42	39	36	0	30	147
Software development	82	42	16	4	24	168
Physical basis for remote sensing:	168	175	8	12	7	370
Satellite image interpretation:	429	414	24	28	40	935
Other	58	8	5	4	0	75
Total	779	678	89	48	101	1695

ANNEX C

QUESTIONNAIRE 2003

QUESTIONNAIRE ON THE USE OF SATELLITE DATA AND PRODUCTS

COVER NOTE

For a few moments please give this questionnaire your individual attention. Answering the questionnaire may directly benefit your NMHS in the area of satellite data and satellite meteorology. It could help to provide better services, i.e., it could improve aid programmes, education & training activities, research and development of products; and it could give guidance to satellite operators.

Name of NMHS: _____

_____

Country: _____

WMO Region: _____

List of staff and services answering this questionnaire:

_____

_____

Overview

1. Does your NMHS routinely obtain satellite data from any source?

   Yes No

2. Do you have plans to routinely obtain satellite data for use in your NHMS in the next two years?

   Yes No

If you checked "No" in question 2, comment in question 3 below and then only respond to the questions of Sections 3 to 6.

3. Why are you not interested in routinely using satellite data?

   _____

   _____

   _____

SECTION 1 - ACCESS TO DATA AT THE NMHS

Please complete Table 1 to indicate: satellite name; number of receiving stations (if any); reception frequency (enter the code in Table 2); and broadcast service (enter the code in Table 3).

Table 1

Sat Code	Satellite name	No. of receiving stations	Frequency (use code in Table X)	Broadcast service (use code in Table 3)	Sat Type
1.	Meteosat-5				Operational meteorological satellites
2.	Meteosat-7				
3.	GOES-E				
4.	GOES-W				
5.	GMS				
6.	FY-2				
7.	GOMS				
8.	NOAA-……(specify)				
9.	METEOR…..(specify)				
10.	FY-1				
11.	ERS-2				R/D & other environmental satellites
12.	DMSP SSMI				
13.	Quikscat				
14.	INSAT				
15.	Others (specify)				
16.					

Table 2

Code	Frequency
1.	15 min
2.	30 min
3.	Hourly
4.	3-hourly
5.	6-hourly
6.	12-hourly
7.	Daily
8.	Other
9.	
10.	
11.	

Table 3

Code	Broadcast service
1.	APT
2.	LRPT
3.	HRPT
4.	WEFAX
5.	LRIT
6.	HR (geo)
7.	MDD
8.	Internet
9.	GTS
10.	Other
11.	

ACCESS TO AND PROCESSING OF SATELLITE DATA

Do you process digital data by yourself?	Yes	No
Do you receive digital data and products from other countries?	Yes	No
Do you process TOVS/ATOVS data?	Yes	No
Are satellite derived data and products made available to the meteorological offices and/or to other users?	Yes	No

How many persons are involved in satellite data reception and processing as one of their primary duties at the NMHS?

Table 4

Professional category	Number
Operators	
Technicians and programmers	
Meteorologists and scientists	

Section 2 - SATELLITE DATA AND PRODUCTS

Do you use satellite data at the NMHS for the following? (multiple answers allowed)

Image interpretation (qualitative use) from analogue data	Yes	No
Image interpretation (qualitative use) from digital data	Yes	No
Satellite soundings	Yes	No
Satellite sounding products	Yes	No
Qualitative use of satellite products from other sources	Yes	No

Do you extract products from digital satellite data at the NMHS? (multiple answers allowed)

Products derived from image data	Yes	No
Satellite soundings	Yes	No
Products derived from satellite soundings	Yes	No
Other satellite-derived parameters	Yes	No
Level 3 (mapped) & 4 (model output) products from satellite-derived parameters	Yes	No

APPLICATION AREAS AND IMPORTANT PARAMETERS

Please complete the following table to indicate the application areas and related important geophysical parameters.

Table 5

	Application area	**Using the application area code from Table 10 , list the most frequently used (up to six) and the most required but not available parameters (up to three) relevant to the duties of your NMHS**								
		Top six						**Three most required but not available**		
		Mandatory			**Useful**					
Methods	Nowcasting & VSRF									
	Synoptic Met.									
	Assimilation in Global and Regional NWP									
Applications / Services	Aeronautical meteorology									
	Marine meteorology									
	Agricultural meteorology									
	Hydrology									
	Atmospheric chemistry									
	Climatology/Climate change									
	Environmental/Disaster Monitoring									
	Research applications									
	Public Weather Services (PWS)									

SECTION 3 -LIMITING FACTORS IN THE USE SATELLITE DATA AND PRODUCTS

Complete Table 6 by checking if the factor limits your access to satellite data or products

Table 6

Limiting Factors	
Lack of receiving equipment	
Lack of maintenance know-how and/or services	
Required data is not disseminated	
Data and products required not available	
Communication system capacity limitation	
Lack of knowledge on use of equipment	
Other (please specify)	

Complete Table 7 by checking those factor(s) that limit your utilization of satellite data and products.

Table 7

Limiting Factors	
Lack of knowledge in use of satellite data & products	
Lack of knowledge in programming techniques	
Limitation in availability of application software & methods	
Limited impact for the intended application	
Others (specify)	

Section 4 - EDUCATION AND TRAINING IN SATELLITE METEOROLOGY

Indicate how many staff members have been on training courses of the listed skills in satellite meteorology last year, and what institution provided the courses. Indicate the number of staff members, separate for each professional category listed, you intend to train during this year and the following one.

Table 8

	Number of staff trained last year						Staff members to be trained during the next 2 years				
	RMTC	WMO (other than RMTC)	University / Industry	Distant learning incl. CAL / Virtual Lab	Internal	Bilateral	Meteorologist (Class 1)	Meteorological Technician (Class 2)	Meteorological Technician (Class 3)	Hydrologist	Others (Environment)
Equipment operation & maintenance											
Software development											
Physical basis for remote sensing											
Satellite image interpretation											
Other											

Table 9

Type /name of the course	Duration	Frequency	Language	Method of training (local teachers, through MTC, CAL …)	Develop proper learning material	Open to external students

Section 5: RESEARCH AND DEVELOPMENT

Are there research programmes in satellite data application running at the NMHS? (please specify each item)

Design of payload for satellites: _____

_____

Design of acquisition and processing facilities: _____

Development of methods of data processing: _____

Development of satellite derived products: _____

Assessment of quality and impact of satellite data: _____

Use of satellite data in research projects: _____

Are there training courses in satellite meteorology organised by your Service?

Section 6 - QUESTIONNAIRE

Do you have any suggestions on how we could improve this questionnaire?

_____

_____

Table 10

Application Code	Parameters	Application Code	Parameters
1	Aerosol total column	31	Sea-ice surface temperature
2	Apparent Thermal Inertia	32	Sea Level
3	Atmospheric Instability Index	33	Sea surface temperature
4	Cloud base height	34	Short-wave outgoing rad. TOA
5	Cloud cover	35	Short-wave irradiance at surf.
6	Cloud ice total column	36	Significant wave height
7	Cloud imagery	37	Snow cover
8	Cloud top height	38	Snow melting conditions
9	Cloud Top Temperature	39	Soil moisture
10	Cloud type	40	Specific humidity profile
11	Cloud water profile	41	Specific humidity total column
12	Cloud water total column	42	Temperature Profile
13	Fires	43	Trace gases
14	Height of tropopause	44	Tropopause temperature
15	Icebergs	45	Vegetation Type
16	Land cover	46	Wave period/direction
17	Land surface features	47	Wind profile
18	Land surface temperature	48	Wind speed over sea surface
19	Leaf Area Index (LAI)	49	Wind vector over sea surface
20	Long-wave surf. emissivity	50	Volcanic ash
21	Long-wave outgoing rad. TOA	51	Others (specify):
22	Norm. Diff. Veg. Index (NDVI)	52	
23	Ocean currents	53	
24	Ozone profile	54	
25	Ozone total column	55	
26	Precipitation index	56	
27	Precipitation rate	57	
28	Rain profile	58	
29	Salinity	59	
30	Sea-ice cover	60	

GENERAL COMMENTS

Section 1: _____

Section 2: _____

_____

Section 3: _____

_____

Section 4: _____

Section 5: _____

Section 6: _____

_____

Other: _____

_____