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COMMISSION FOR BASIC SYSTEMS
OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS

EXPERT TEAM ON SATELLITE UTILIZATION AND PRODUCTS

ITEM: 7.2

SEVENTH SESSION

GENEVA, SWITZERLAND, 27-30 MAY 2013

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SATELLITE DATA FOR APPLICATIONS:

Climate / GFCS

(Submitted by the Secretariat)

Summary and Purpose of Document

This paper outlines case studies that could be used to demonstrate the direct or indirect value of satellite data for climate services, addressing the priority societal benefit areas of the Global Framework for Climate Services: food security, water, disaster risk reduction, health. Starting from the end user, these case studies are intended to validate, and inform, the end-to-end Architecture for Climate Monitoring from Space and its further development.

ACTION PROPOSED

The seventh session is invited to comment on this document, in particular to discuss the approach taken and the details of the case studies.

References: 1. Strategy Towards an Architecture for Climate Monitoring from Space: http://www.wmo.int/pages/prog/sat/documents/ARCH_strategy-climate-architecture-space.pdf

2. Climate ExChange (WMO 2012; Tudor Rose, 288pp.: http://www.wmo.int/pages/gfcs/casestudies_en.php)

DISCUSSION

1. Climate services and satellite observations

- The GFCS Implementation Plan (2012) [1] states that "a climate service is climate information prepared and delivered to meet user needs."

- Core elements of a climate service include:
  - Monitoring
  - Reanalyses
  - Attribution of phenomena & events, including extremes
  - Indicators / indices
  - Forecasts (predictions and projections)

- Downstream elements of climate services could be for instance:
  - Seasonal climate outlooks (3-6 months) over South East United States, to inform livestock and fruit farmers
  - Expected trend in annual rainfall over the next 3 decades in support of hydropower infrastructure decision-making in India
  - Assessment of whether the recent drought in the Greater Horn of Africa, by its length/severity has been a 1 in 10, 1 in 30, 1 in 50 years event (to inform building resilience against famine and manage risks).
  - Answer to: How will sea-ice parameters change along the North-East passage over the next 20 years in September?

The Implementation Plan for the Global Framework for Climate Services[2] and its Annex on Observations and Monitoring[3] recognize the Architecture for Climate Monitoring from Space and recognize that "The development of an architecture for sustained climate monitoring from space will bring the same structures and rigor to climate monitoring that are currently in place for weather monitoring and forecasting. The definition and implementation of the architecture will be based on requirements established by GCOS for the subset of ECVs that can be monitored from space. The architecture will be defined as an end-to-end system, involving the different stakeholders, including operational satellite operators and R&D space agencies, the Coordination Group for Meteorological Satellites (CGMS), the Committee on Earth Observation Satellites (CEOS), GCOS, WCRP, and GEO."

Noting the generic value chain when generating satellite-based datasets for climate applications (Fig. 1), a logical view on the Architecture for Climate Monitoring from Space was developed (Fig. 2 and Reference 1).

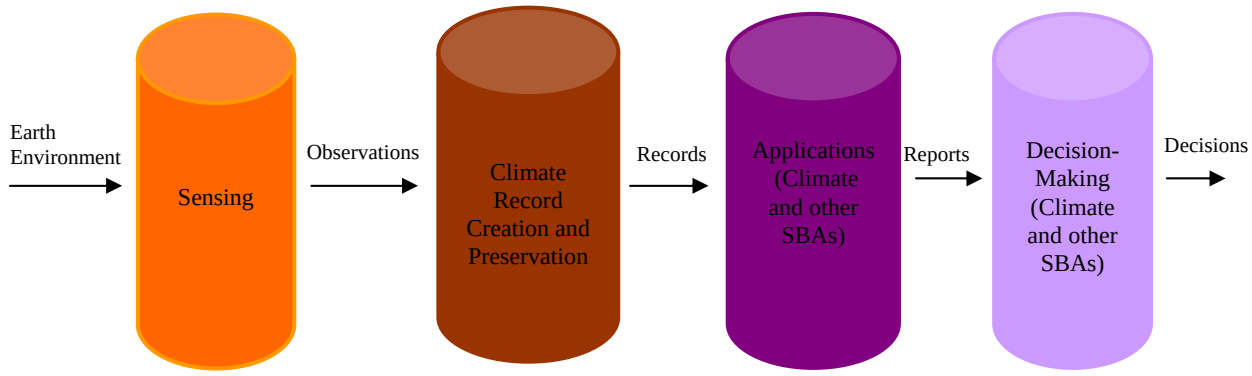

Figure 1: Schematic processing flow of remotely-sensed data for climate applications

1 http://www.wmo.int/pages/gfcs/documents/2012.09.07GFCSImplementationPlan_FinalOrder.pdf
2 http://www.wmo.int/pages/gfcs/documents/2012.09.07GFCSImplementationPlan_FinalOrder.pdf
3 http://www.wmo.int/pages/gfcs/office/documents/OBS-ANNEX-TO-GFCS-IMP-PLAN_en.pdf

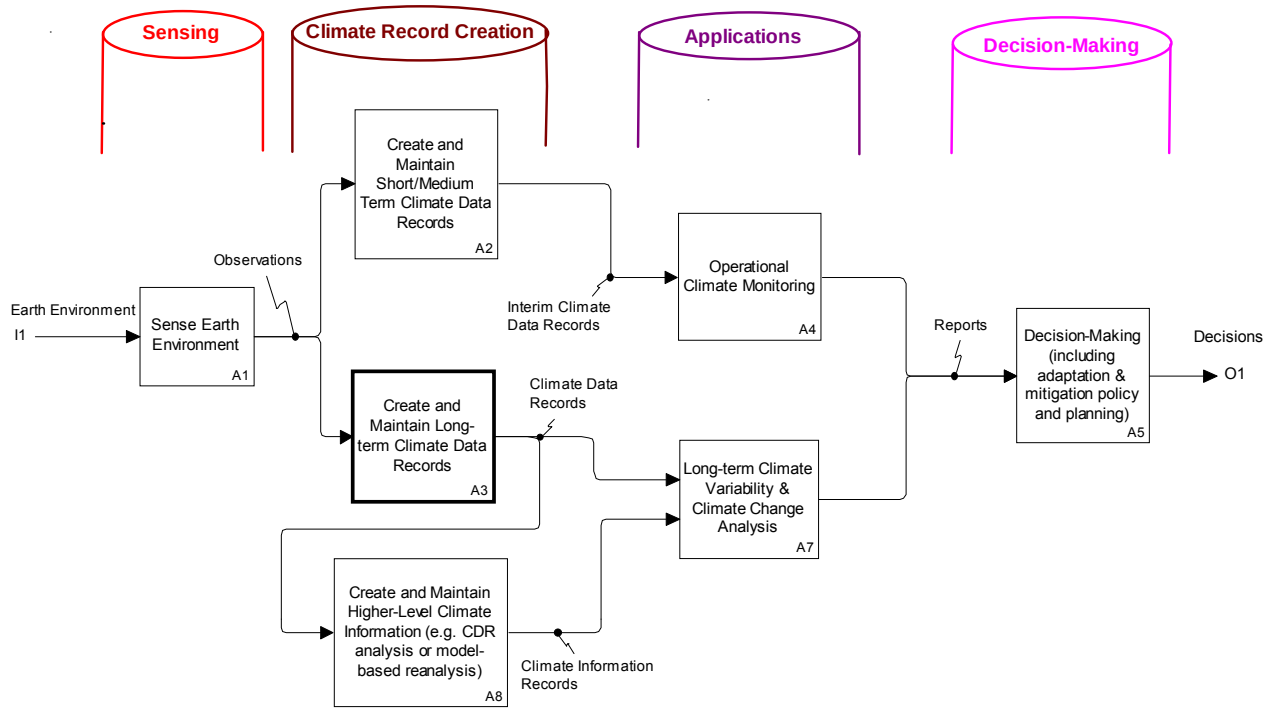

Figure 2: Logical view of the Architecture for Climate Monitoring from Space

2. Translating service requirements into satellite requirements

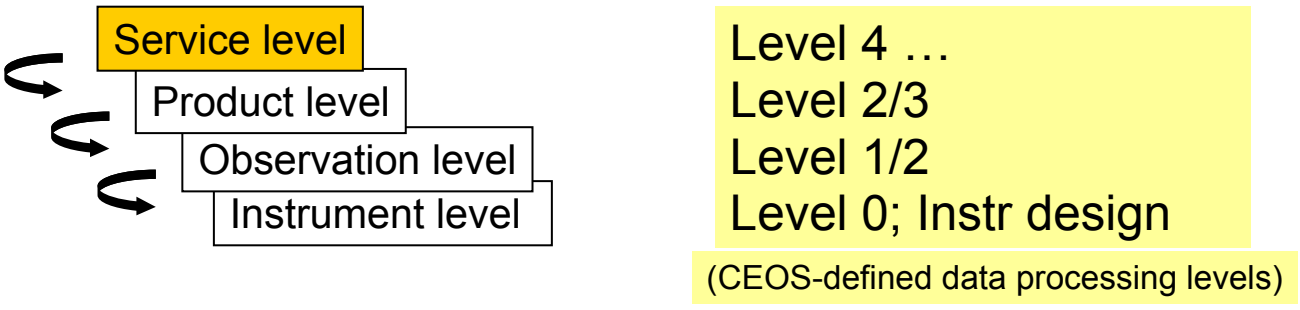

Figure 3: Service-level requirements need translation into product, observation and instrument level requirements

The WMO Rolling Review of Requirements process provides a solid basis for ensuring that observation requirements are met by instruments, thereby enabling the generation of products and services. For weather applications, where products and services are well established, the identification of observation requirements is well advanced, largely because the impact of observations on NWP is well quantified. Unlike for weather applications such systematic identification of needs is only in its infancy for climate services. Valuable groundwork has been laid through the definition of Essential Climate Variables (ECVs) under the auspices of the WMO co-sponsored Global Climate Observing System (GCOS)[4], and related requirements definitions for satellite datasets and products[5].

Statement: There is no systematic process in place to systematically capture GFCS-related

4 http://www.wmo.int/pages/prog/gcos/Publications/gcos-138.pdf (GCOS 2010 Implementation Plan)
5 http://www.wmo.int/pages/prog/gcos/Publications/gcos-154.pdf (2011 Satellite Supplement)

service requirements that can then be translated into product, observation and instrument requirements.

It should be noted that:

- The WMO Rolling Review of Requirements (RRR) process nominally encompasses observations and products up to level 2 ("technology-free")
- However some requirements (e.g., GCOS) are a mix of level 2 and level 3
- Capturing higher-level product requirements (e.g., "length of dry spell", "number of days with PM10 exposure above 50 µg/m3") would be a significant extension of the current RRR, which focuses now on observations.
- Capturing socio-economic data (e.g., population density; crop yield; value of infrastructure) is outside of the scope of the current RRR approach.

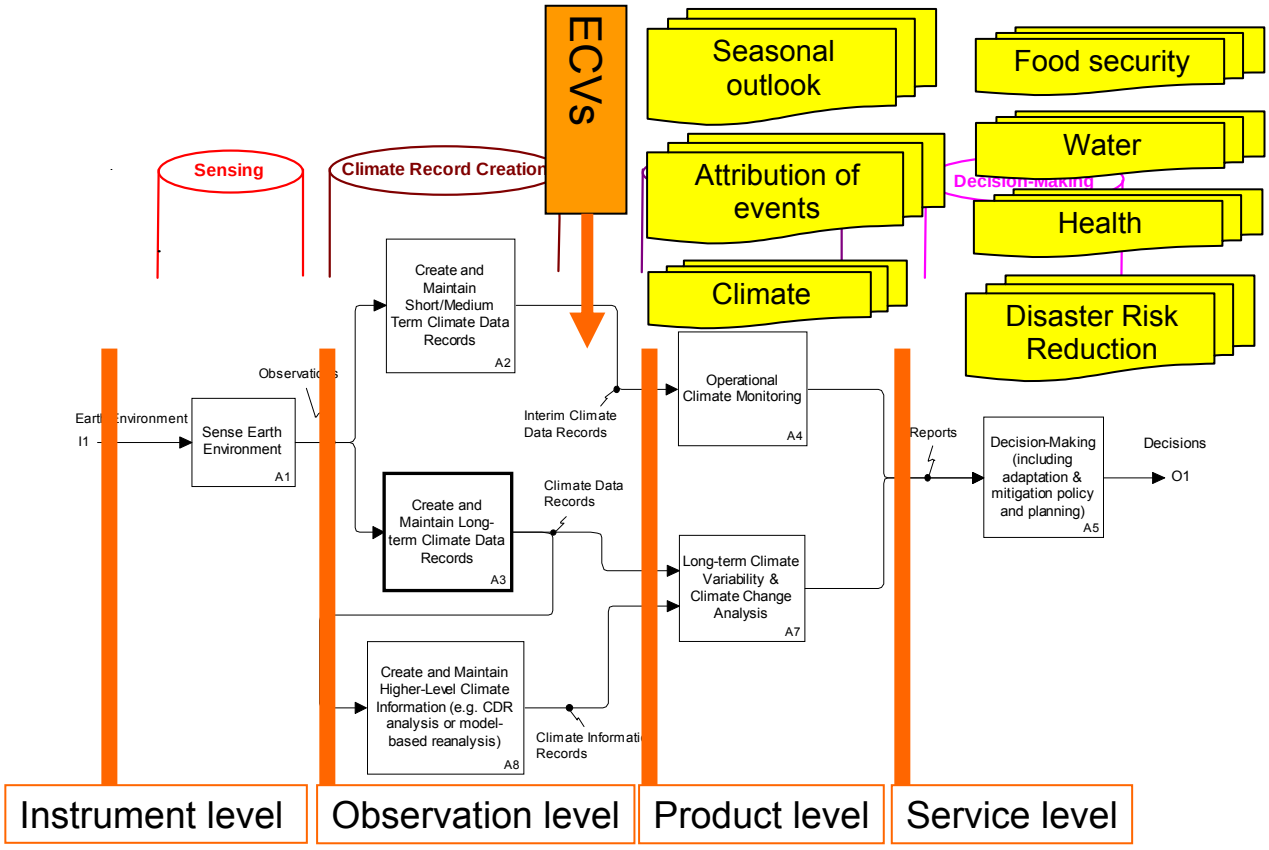

Figure 4: Logical View of Architecture, with different levels of processing

Case Studies in "Climate ExChange" (Reference 2)

In order to demonstrate the direct or indirect value of satellite data for climate services, a process is needed to:
- Systematically collect climate service requirements
- Translate these into product (and subsequently, observation, instrument) requirements.

Case studies addressing the priority societal benefit areas of the Global Framework for Climate

Services (food security, water, disaster risk reduction, health) should be identified, preferably two for each sector, one of them being typical for the developing world, and the other for the developed world. These case studies would be intended to validate and inform the end-to-end Architecture for Climate Monitoring from Space and its further development.

An initial analysis of the publication "Climate ExChange" (Reference 2) prepared and published to underpin the GFCS with more than 60 case studies related to climate services yielded the following results (Table 1):

Table 1: Initial set of case study candidates to demonstrate the value of the Architecture for Climate Monitoring from Space for the GFCS (Source: Reference 2)

GFCS Benefit Area	Title of case study (+Reference)	Country/ Region	Climate service identified	Major gaps	Satellite components (direct/indirect)	ECVs addressed	Com-ments
Agriculture	Helping the world's poorest farmers adapting to climate change (p28)	Australia, SE Asia, India, East Africa	Seasonal forecast		Contribution to seasonal forecasting	Precipitation	
Agriculture	Climate change impact on Indonesian fisheries (p72)	Indonesia	Indicators for fish abundance		SST and biophysical parameters	SST, chlorophyll-a, phytoplankton	
Water	Identifying local climate impacts on weather and water (p85)	USA	Drought prediction and assessment ; attribution; variability and change		Direct measurements; tornado occurrence; contribution to reanalysis	Temperature, wind, precipitation	
Health	Seasonal forecasting for Africa: water, health management and capacity building	West Africa	Seasonal forecasts; probability of epidemic outbreaks		Satellite-based precipitation estimates; river discharge patterns	Precipitation; River discharge	
Disaster Risk Reduction	The North American Drought Monitor	North America	Seasonal forecasts; drought index		Precipitation estimates; streamflow; snow mass; soil moisture; vegetation parameters all contributing to drought index; cross-comparison with in-situ data	Precipitation estimates; streamflow; snow mass; soil moisture; vegetation parameters	