

WCRP Perspective on Data Set Assessments



Assessment of Global Precipitation Products

A project of the World Climate Research Programme
Global Energy and Water Cycle Experiment
(GEWEX) Radiation Panel

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WCRP Core Projects

- **Climate and Cryosphere (CliC)** aims to improve understanding of the cryosphere and its interactions with the global climate system, and to enhance the ability to use parts of the cryosphere for detection of climate change.
- **Climate Variability Research Program (CLIVAR)** is the World Climate Research Programme (WCRP) project that addresses Climate Variability and Predictability, with a particular focus on the role of ocean-atmosphere interactions in climate.
- **Global Energy and Water Exchanges (GEWEX)** is to observe, understand and model the hydrological cycle and energy fluxes in the Earth's atmosphere and at the surface.
- **Stratospheric Processes And their Role in Climate (SPARC)** coordinates international efforts to bring knowledge of the stratosphere to bear on relevant issues in climate variability and prediction



SPARC Data Set Assessments

SPARC comprehensive peer-reviewed assessment reports include:

- [Trends in the Vertical Distribution of Ozone](#) (SPARC Report N°1, 1998);
- [Upper Tropospheric and Stratospheric Water Vapour](#) (SPARC Report N°2, 2000);
- [Intercomparison of Middle Atmosphere Climatologies](#) (SPARC Report N°3, 2002);
- [Stratospheric Aerosol Properties](#) (SPARC Report N°4, 2006);
- [Chemistry-Climate Model Validation](#) (SPARC Report N°5, 2010).

Work is currently underway in producing three additional reports:

- Second SPARC Water Vapor Assessment report (WAVAS-2);
- Report on stratospheric composition climatologies;
- Report on ozone profile assessments.



GDAP develops and reprocess **climate data records** of water and energy variables, complete with metadata and error bars.

Clouds – ISCCP (<http://climserv.ipsl.polytechnique.fr/gewexca/>)

Cloud Assessment completed 2012 (WCRP Report No. 23/2012)

Water Vapor – TBD

Assessment underway (third workshop in Sep 2013 at CSU)

Precipitation - GPCP

Sfc gauge obs (GPCC)

First Assessment completed 2008 (WCRP-128, WMO/TD-No. 1430)

Radiation – SRB (<http://eosweb.larc.nasa.gov/GEWEX-RFA/>)

Surface reference observations - BSRN

Radiation Assessment completed 2012 (WCRP Report No. 19/2012)

Aerosols – GACP over ocean; land is TBD

Aerosol Assessment underway

Turbulent Fluxes: SeaFlux and LandFlux

SeaFlux Assessment underway

LandFLux Assessment just starting

- Soil Moisture

A GDAP product is endorsed by GEWEX/GDAP to conform to a high standard of production and documentation. It consists of a blend of available satellite and in-situ observations and is periodically compared and assessed against other products in an open and transparent fashion. It is openly available to everyone without restrictions.



GEWEX Cloud Assessment Milestones

initiated in 2005 by GEWEX Radiation panel (GRP)

- 2005-2010:** **4 workshops :** *(2xMadison, New York, Berlin)*
- 2005: focus on longterm anomalies *(co-chairs: G. Campbell, B. Baum)*
 - 2006: focus on cloud amount *(co-chairs: B. Baum, C. Stubenrauch)*
 - 2008: first intercomparison of cloud property statistics
(co-chairs: C. Stubenrauch, S. Kinne)
 - 2010: first assessment using L3 monthly gridded cloud data and
revision of L2 -> L3 procedure
- 2009-2011:** **Preparation and quality check of common L3 data base**
monthly statistics (averages, variability, histograms) in netCDF format
- 2012:** **WCRP report**
(191 pages, submitted for review by GDAP in Apr, sent to WCRP in Sep)
- BAMS article** *(abstract accepted in June, article submitted in July)*
- revision of website**
- opening of database to public** *(after this meeting)*

Participating Datasets

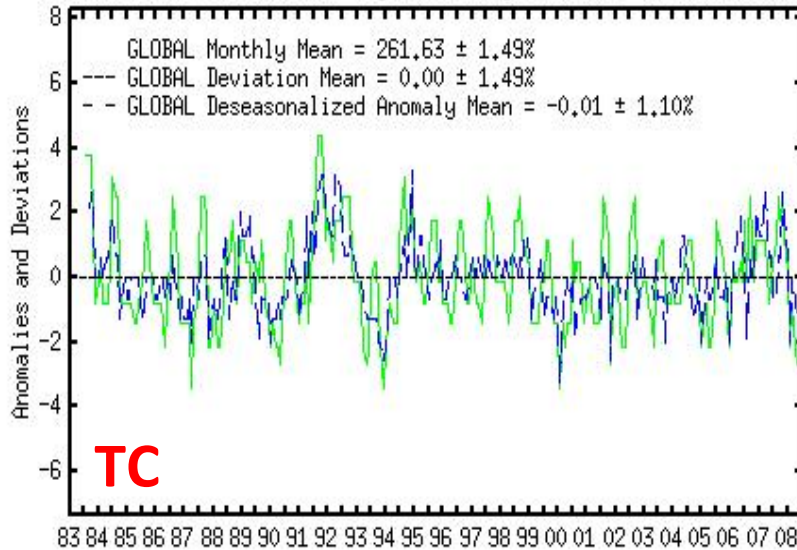
ISCCP <i>GEWEX cloud dataset</i>	<i>1984-2007</i>	<i>(Rossow and Schiffer 1999)</i>
MODIS-ScienceTeam	<i>2001-2009</i>	<i>(Menzel et al.2008; Platnick et al. 2003)</i>
MODIS-CERES	<i>2001-2009</i>	<i>(Minnis et al. 2011)</i>
TOVS Path-B	<i>1987-1994</i>	<i>(Stubenrauch et al. 1999, 2006; Rädcl et al. 2003)</i>
AIRS-LMD	<i>2003-2009</i>	<i>(Stubenrauch et al. 2010; Guignard et al. 2012)</i>
<i>relatively new retrieval versions:</i>		
PATMOS-x (AVHRR)	<i>1982-2009</i>	<i>(Heidinger et al., Walther et al. 2012)</i>
ATSR-GRAPE	<i>2003-2009</i>	<i>(Sayer et al. 2011)</i>
HIRS-NOAA	<i>1982-2008</i>	<i>(Wylie et al. 2005)</i>
<i>complementary cloud information:</i>		
CALIPSO-ScienceTeam	<i>2007-2008</i>	<i>(Winker et al. 2009)</i>
CALIPSO-GOCCP	<i>2007-2008</i>	<i>(Chepfer et al. 2010)</i>
MISR	<i>2001-2009</i>	<i>(DiGirolamo et al. 2010)</i>
POLDER	<i>2006-2008</i>	<i>(Parol et al. 2004; Ferlay et al. 2010)</i>

CALIBRATION EFFECTS

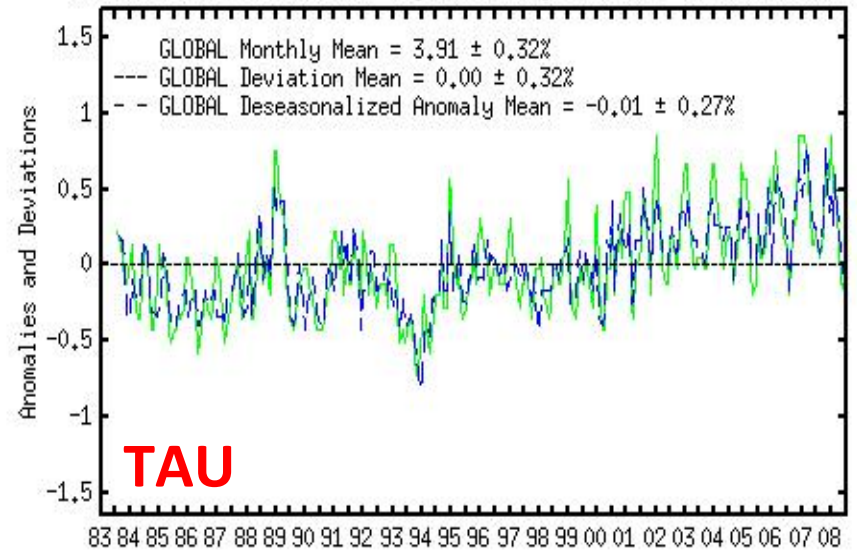
IR

VIS

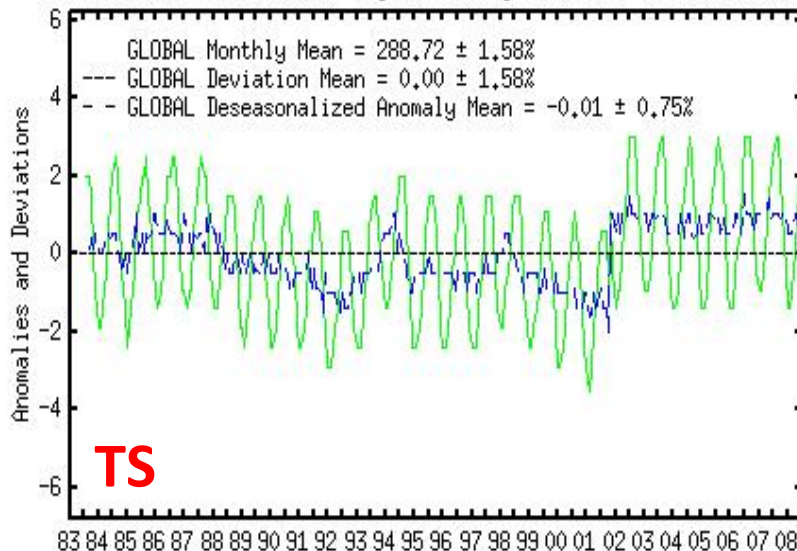
ISCCP-D2 (198307-200806) Cloud Top Temperature (K):
Deviations and Anomalies Of Region Monthly Mean From Total Period Mean



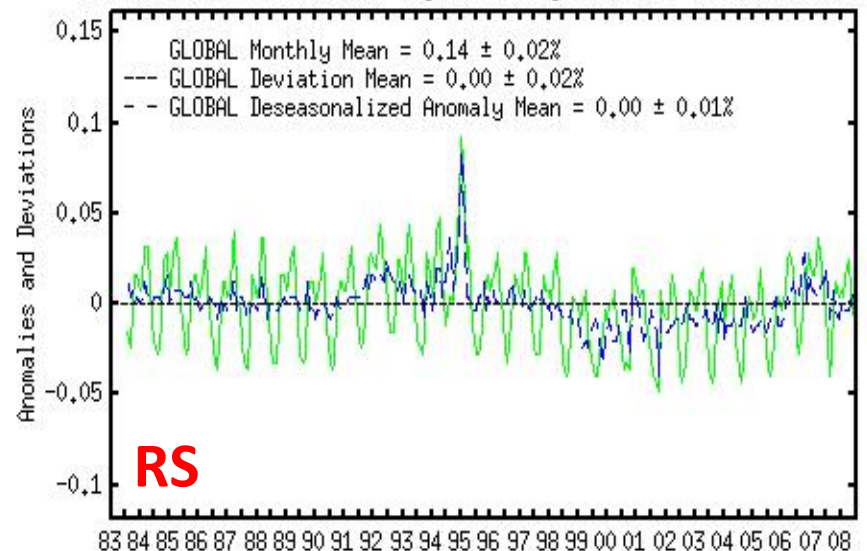
ISCCP-D2 (198307-200806) Cloud Optical Thickness:
Deviations and Anomalies Of Region Monthly Mean From Total Period Mean



ISCCP-D2 (198307-200806) Surface Temperature (K):
Deviations and Anomalies Of Region Monthly Mean From Total Period Mean



ISCCP-D2 (198307-200806) Surface Reflectance:
Deviations and Anomalies Of Region Monthly Mean From Total Period Mean



Water Vapor Assessment - GDAP basis for discussion

- T, q profiles are needed to study 3D atmosphere and to use it as input for ISCCP, SRB and Sfc. fluxes, but no single source was available.
- Major obstacles were:
 - Old GEWEX NVAP data set was based on a concept that merged several sources of satellite and in situ data without caring too much on instrument characterization or inter-calibration of satellites.
 - Operationally derived profile data sets, as used in ISCCP, were derived in real time and were not well inter-calibrated.
 - Early NWP based reanalysis data sets suffered from inadequate data assimilation techniques that prohibited the full use of satellite observations, e.g., most of the observations are only used over oceans and under clear sky conditions.
 - Recent new reanalysis have much improved data assimilation techniques but exhibit artificial trends
- Old sounders need background information in the retrieval to be competitive with models.
- New sounders (AIRS, IASI) appear to outperform NWP models.
- Many comparisons between NWP reanalysis, satellite products and radiosonde and GPS data exist in the literature but an organized product assessment has not been done.
- Instrument characterization and inter-calibration is critical but sometimes difficult.



Data Set Assessments

- Data set diversity can be confusing for users, and without the proper background information and understanding of the limitations of available data, there is a danger that these data may be incorrectly applied or misinterpreted;
- Users need to realise that it is often difficult to define a single best climate data source. Data sets are instead most often complementary in nature with varying strengths and weaknesses;
- Essential elements that define the usefulness of a data set are certainly its accuracy and error characterization, but data products can be evaluated too favourably by the developers themselves in order to encourage data usage;
- Assessments have benefits for both science and applications as well as product providers.

Benefits of Assessments

To Science and User Communities:

- Provide independent and transparent quality assurance for products;
- Endorse the use and the credibility of products to a broader community;
- Identify key limitations in products to stimulate improvements;
- Allow objective selections of appropriate data products.



Benefits of Assessments

To Product Providers:

- Provide background information on available products;
- Provide easy access to data in a common user friendly format;
- Establish reference data test-beds and tools for external evaluations.

Data Set Assessment: Experience

- It is the task of the assessments to conduct objective and independent evaluations and inter-comparisons. ***The basic goal is to point out differences and limitations and, if possible, to provide reasons for them.***
- It helps to involve the scientists that created the data so that sufficient background information on instruments, applied methods, and underlying assumptions and limitations can be more fully understood and conveyed to the user.
- Where product developers are involved, there is tendency to broaden the goal of the assessment from its original intent of informing the user community to one of using the assessment itself as a diagnostic to help investigators improve their respective products. The second objective clearly requires broad participation from the data producers. GDAP has found that ***these two objectives are, in fact, compatible with one another but should always be kept distinct in the assessment.***
- GDAP has also found that including Model and Reanalysis data sets in the comparisons is often useful in that it immediately incorporates needs of an eventual user community.

Data Set Assessment: Experience

- Assessment activities, like the products they assess, should not be viewed as static but rather as dynamic activities that may need to be repeated every 5-10 years depending upon the rate at which products are being added or modified within a given discipline.
- Even if the validation data, procedures and previously assessed data are archived for interim use by new product developers, comprehensive assessments are critical to move the field forward in a systematic way.

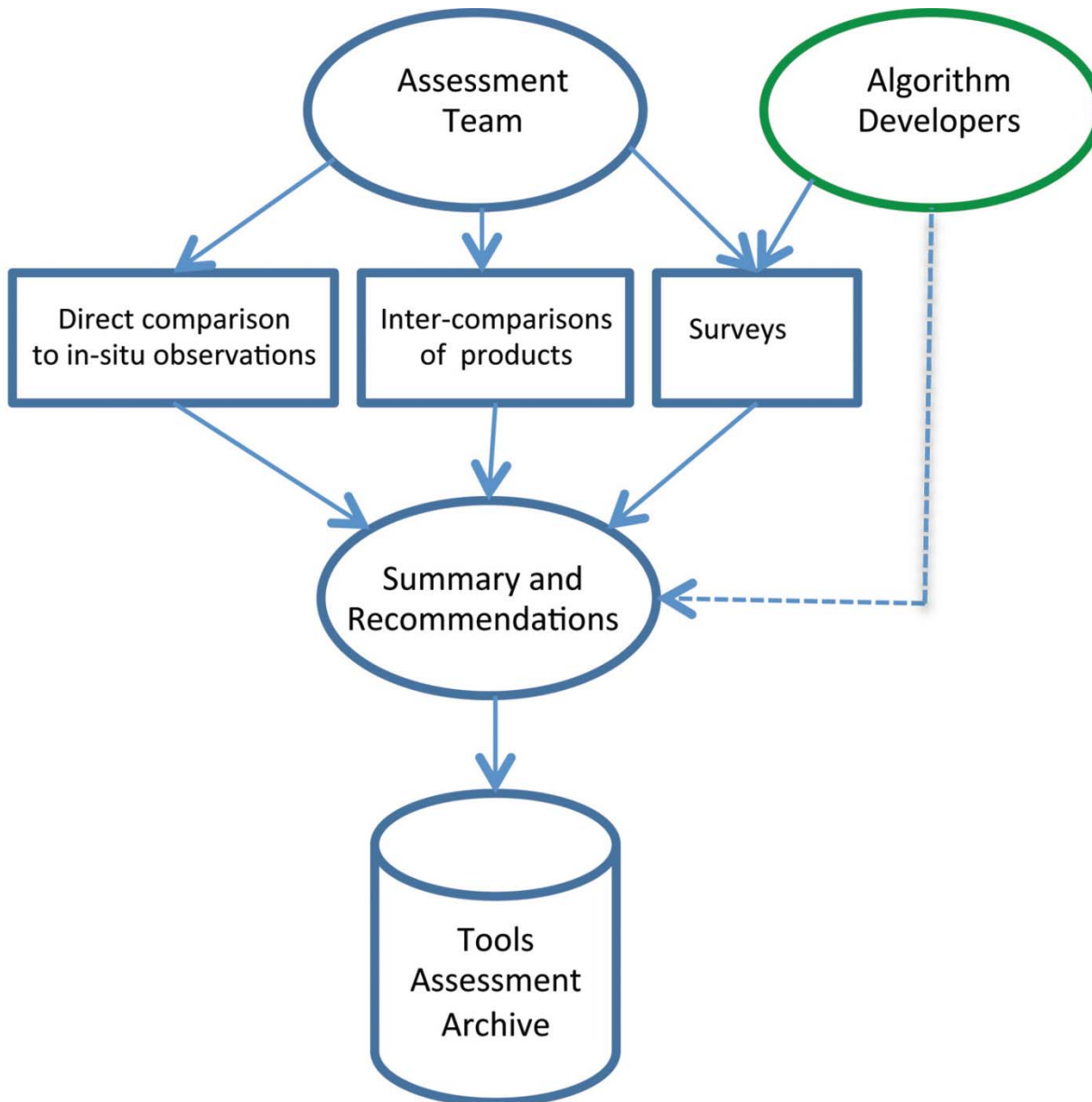
Towards a Blue Print for Data Set Assessments

- Assessment of geophysical products should cover the following elements:
 - A survey of available data, data sets and background information on these;
 - Detailed and complete documentation of all investigated data sets has to be a major element of any assessment;
 - Creation of simple systems for data access to the data products being assessed (via a common web-server in a user-friendly format) to encourage continuous exchange of data as well as to establish data references, tools and methods for future evaluations;
 - Inter-comparisons of different data sets (at different scales) facilitating a quantitative examination of strengths and limitations against reference data;
 - Recommendations for intended data uses / areas where data should not be used;
 - Provide easy access to the assessment report and all examined data-sets and methods.

Assessments Facts and Needs

- Assessments usually rely on voluntary efforts, which can take considerable time to finish and can collapse unless there is strong leadership.
- Thus assessments should include:
 - A dedicated, motivated, and respected person to lead the effort;
 - Complementary assessment team members with specialized knowledge;
 - Regular team meetings – open and closed workshops;
 - A centralized data depot for data sets created specifically for the assessment (e.g., validation data or common gridded products) that can be used to facilitate assessments by new products or new versions of existing products;
 - Seed funding for some centralized activities.

Key Elements of Assessment





Satellite Data Simulator Portal

<https://sites.google.com/site/satellitesimulators/>

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Multi-sensor simulator packages

- COSP: CFMIP Observation Simulator Package
 - CFMIP (<http://cfmip.metoffice.com/COSP.html>)
- CRTM: Community Radiative Transfer Model
 - NOAA (<http://www.star.nesdis.noaa.gov/smcd/spb/CRTM/>)
- ECSIM: EarthCARE Simulator
 - ESA (Voors et al, 2007)
- J-simulator: Joint Simulator for Satellite Sensors
 - JAXA/U Tokyo (<http://www22.atwiki.jp/j-simulator/pages/14.html>)
- RTTOV: Radiative Transfer Model for TOVS
 - UK MetOffice/ECMWF (Matricardi et al. 2004; Bauer et al., 2006)
- SDSU: Satellite Data Simulator Unit
 - Nagoya U (<http://precip.hyarc.nagoya-u.ac.jp/sdsu/>)
- Goddard SDSU
 - NASA GSFC
(http://atmospheres.gsfc.nasa.gov/cloud_modeling/sdsu.html)
- ISSARS: Instrument Simulator Suite for Atmos Remote Sensing
 - JPL (under development)

Possible Way Forward

- WCRP DAC shall further assess the practises used in WCRP (its not homogeneous in particular when it comes to the coupling with data set improvements);
- WDAC shall consult with all domains expertise and may publish best practises handbook (what Mark called the “blueprint”);
- Assessments might be initialised by the users rather than the producers of data sets;
- Domain/Topic specific competence bodies (e.g., GEWEX GDAP, CGMS working groups as ITWG, IPWG, GHRSSST, IOCCG, etc.) could organise the assessments, i.e., identify assessment leads/teams, guide the work and review the outcome as done in GEWEX GDAP;
- In WCRP the competence bodies have Steering Groups that they report to which report to the WCRP Joint Scientific Committee;
- The assessment teams shall undertake the assessments and report to the competence bodies that should have some representation in CEOS WGClimate;
- CEOS WGClimate to monitor the overall status of satellite (plus combined satellite/in situ) data set assessments;
- CEOS WGClimate to ensure assessment activities have resources, where appropriate through CEOS/CGMS member agencies
- GCOS and WCRP DAC to provide overall review of all assessments (in principal data set assessments should be done for in situ data records as well, e.g., the different radiosonde data records).