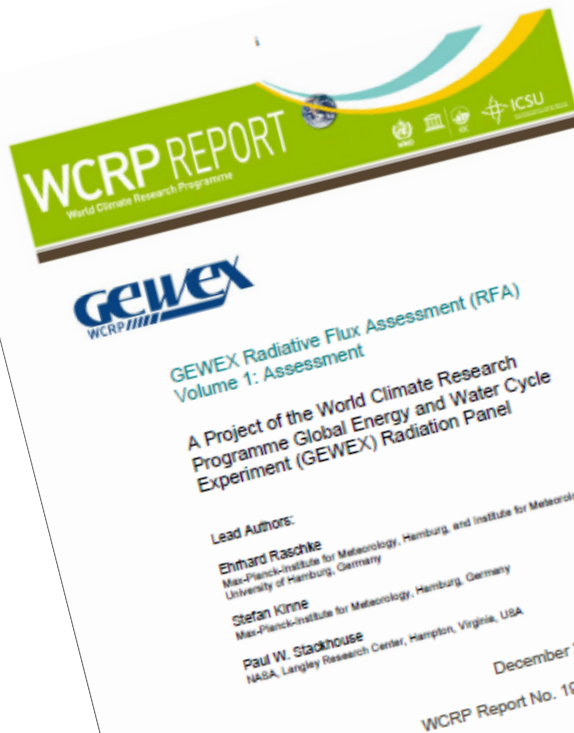


# GEWEX Perspective on Data Set Assessments



## 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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May 2008

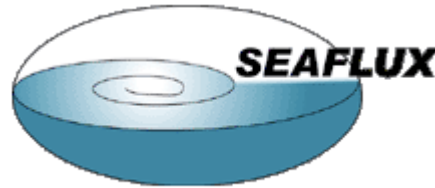
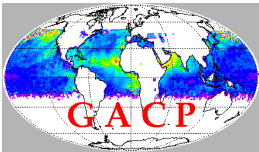
WCRP-128  
WMO/TD-No. 1430



Jörg Schulz (EUMETSAT)



# GEWEX Reference Products



Home : My Downloads : Advanced Search :



Validation  
BSRN

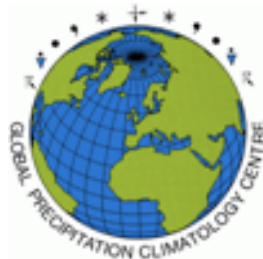
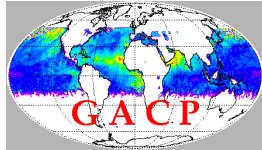
Validation  
Ships and Buoys

Validation  
Towers



# Value added by GDAP: GEWEX Integrated Products

Common Ancillary Data



+



Validation  
BSRN

Validation  
Ships and Buoys

Validation  
Towers



Common Output with uncertainty

# Data Set Assessments performed by GRP/GDAP

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

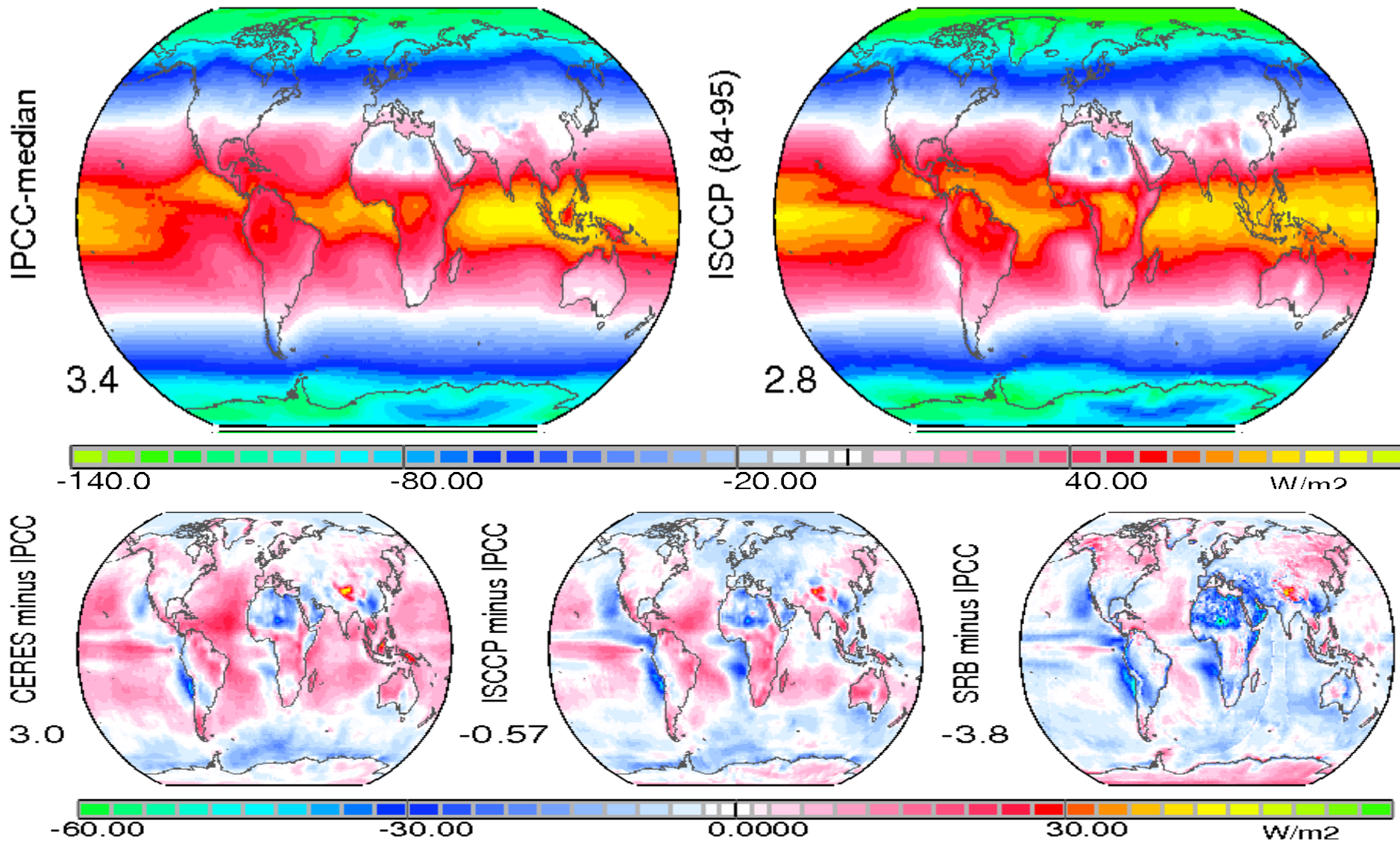
LandFLux Assessment just starting

- 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.*



# Annual averages of the net radiation at the TOA



Discrepancies between flux fields are caused by ancillary data and computational schemes (e.g.: treatment of clouds)

# Key Findings

- Available data sets of ISCCP, SRB and CERES do show differences but:
  - IPCC-4thAssessment model results show even larger diversity.
  - Uncertainties in various ancillary data and artifacts propagate to all products and perturb their interpretation (e.g.: cloud boundaries).
  - Estimates of CRE are uncertain due to ill-defined cloud and clear-sky atmosphere and surface properties
  - Coordinate joint assessment efforts in future with similar projects of aerosols and clouds (and also precipitation and evaporation).
  - Define and organize future assessments more precisely to shorten the process.

# 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** *(accepted in December 2012)*
  - revision of website**
  - opening of database to public**

# Participating Datasets

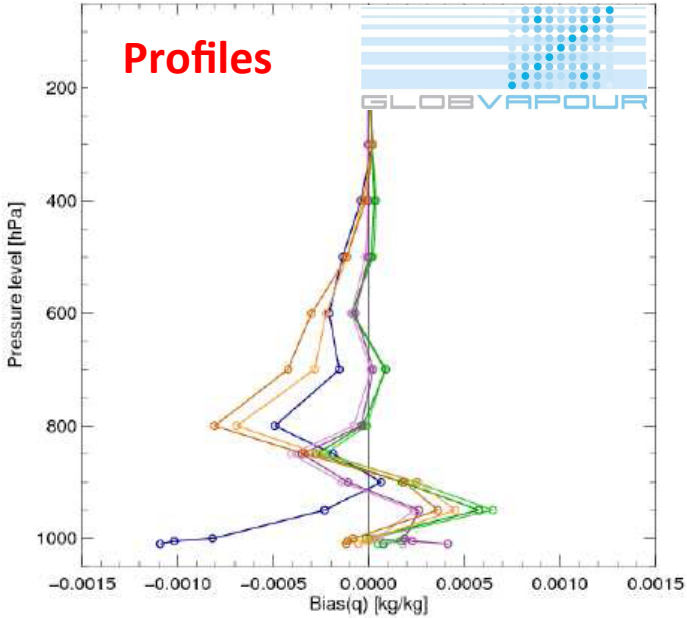
<b>ISCCP</b> <i>GEWEX cloud dataset</i>	<b>1984-2007</b>	<i>(Rossow and Schiffer 1999)</i>
<b>MODIS-ScienceTeam</b>	<b>2001-2009</b>	<i>(Menzel et al. 2008; Platnick et al. 2003)</i>
<b>MODIS-CERES</b>	<b>2001-2009</b>	<i>(Minnis et al. 2011)</i>
<b>TOVS Path-B</b>	<b>1987-1994</b>	<i>(Stubenrauch et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



# The New Water Vapor Assessment

- 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 is available.
- Many new sounders and reference radiosonde and GPS-based methods are now available that were not available 10 years ago.
- The GEWEX/ESA DUE GlobVapour workshop on long term water vapour data sets and their quality assessment was hosted by the European Space Agency ESRIIN centre in Frascati (Rome), Italy from March 8-10, 2011 created lots of interest.
- A second workshop hosted by DWD, Germany consolidated the assessment strategy and technical implementation.

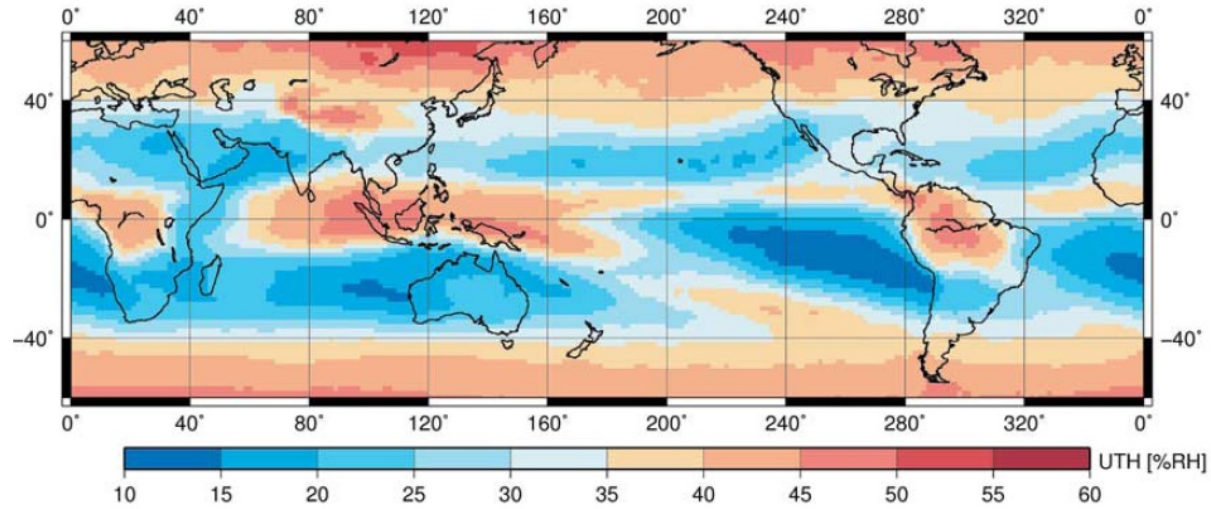
# Variables



*IASI inter-comparison  
(Stengel et al., 2012)*

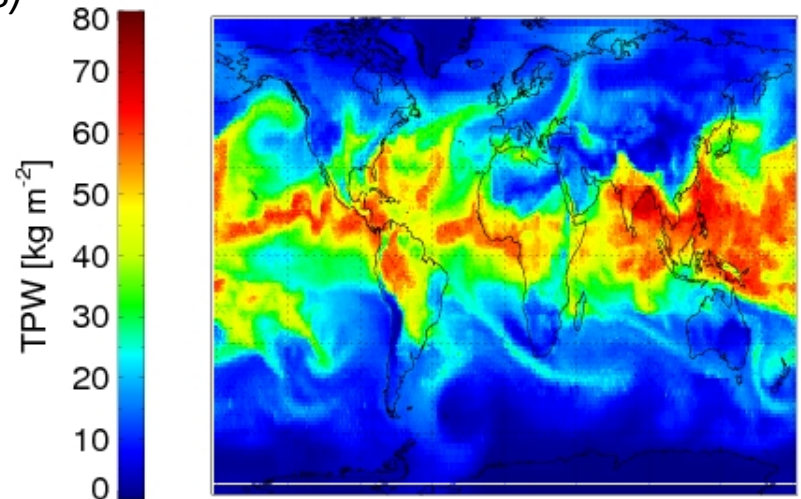
*ATOVS, Courcoux (2012)*

## Upper tropospheric humidity



*AMSU-B,  
Buehler et al. (2008)*

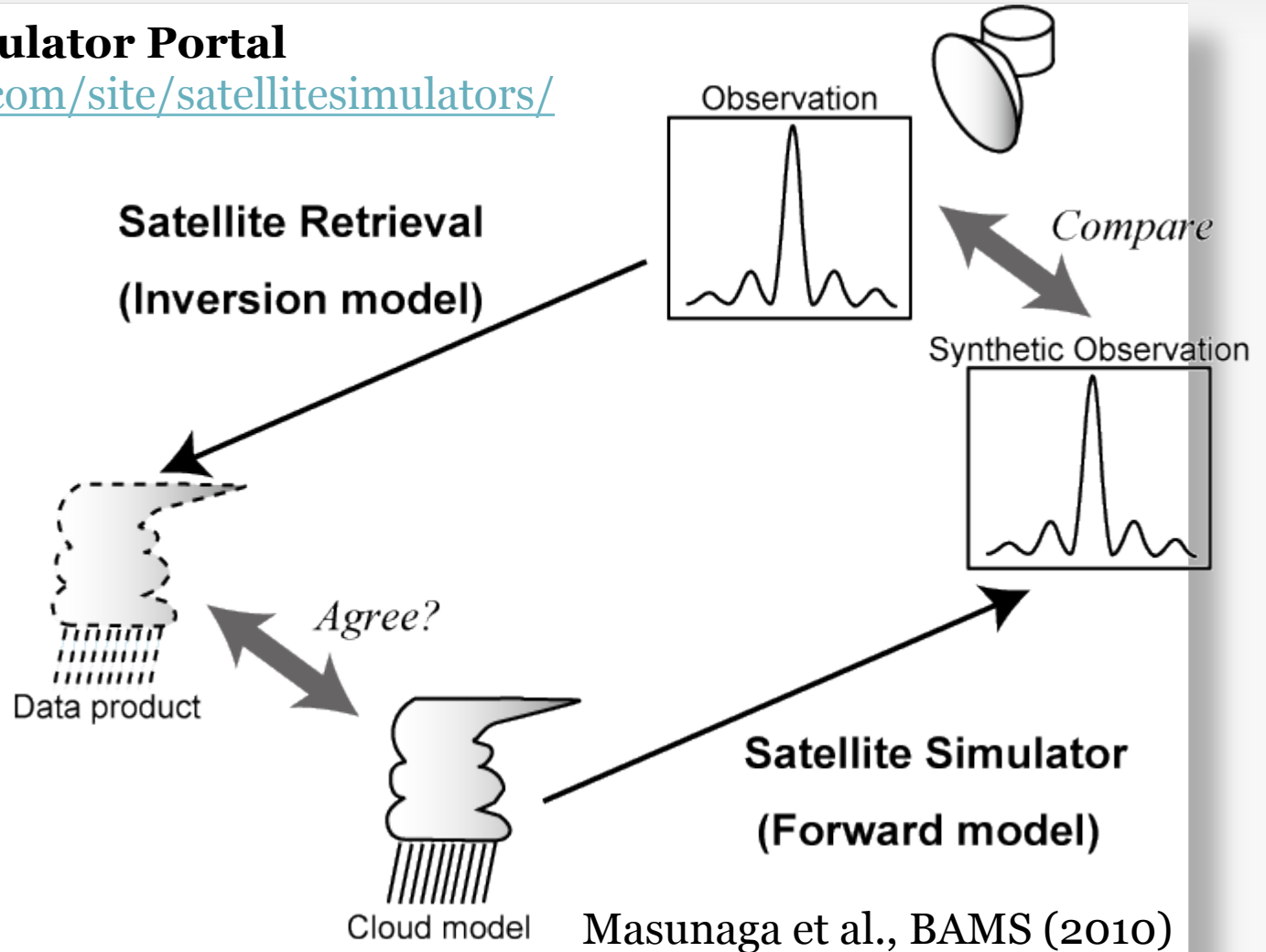
## Total column water vapour



# What is a satellite simulator?

## Satellite Data Simulator Portal

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

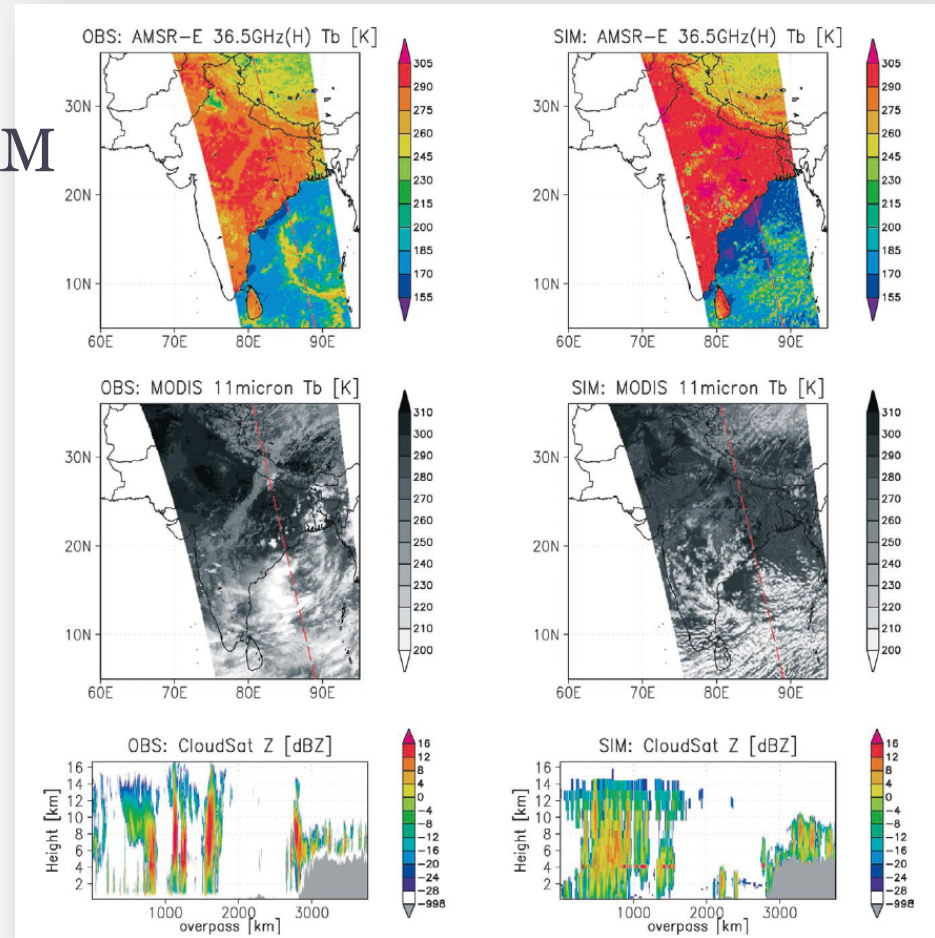


# An Example

## ► Applications

### ► Radiance-based GCM/CRM evaluation

- Instead of product-based.
- Makes it easier to track down the error sources.
- Requires some knowledge of radiative processes



Goddard SDSU applied to a WRF simulation from Masunaga et al., BAMS (2010)

# Multi-sensor simulator packages

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- ▶ **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://www2.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](http://atmospheres.gsfc.nasa.gov/cloud_modeling/sdsu.html))
- ▶ **ISSARS: Instrument Simulator Suite for Atmos Remote Sensing**
  - ▶ JPL (under development)

# 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.



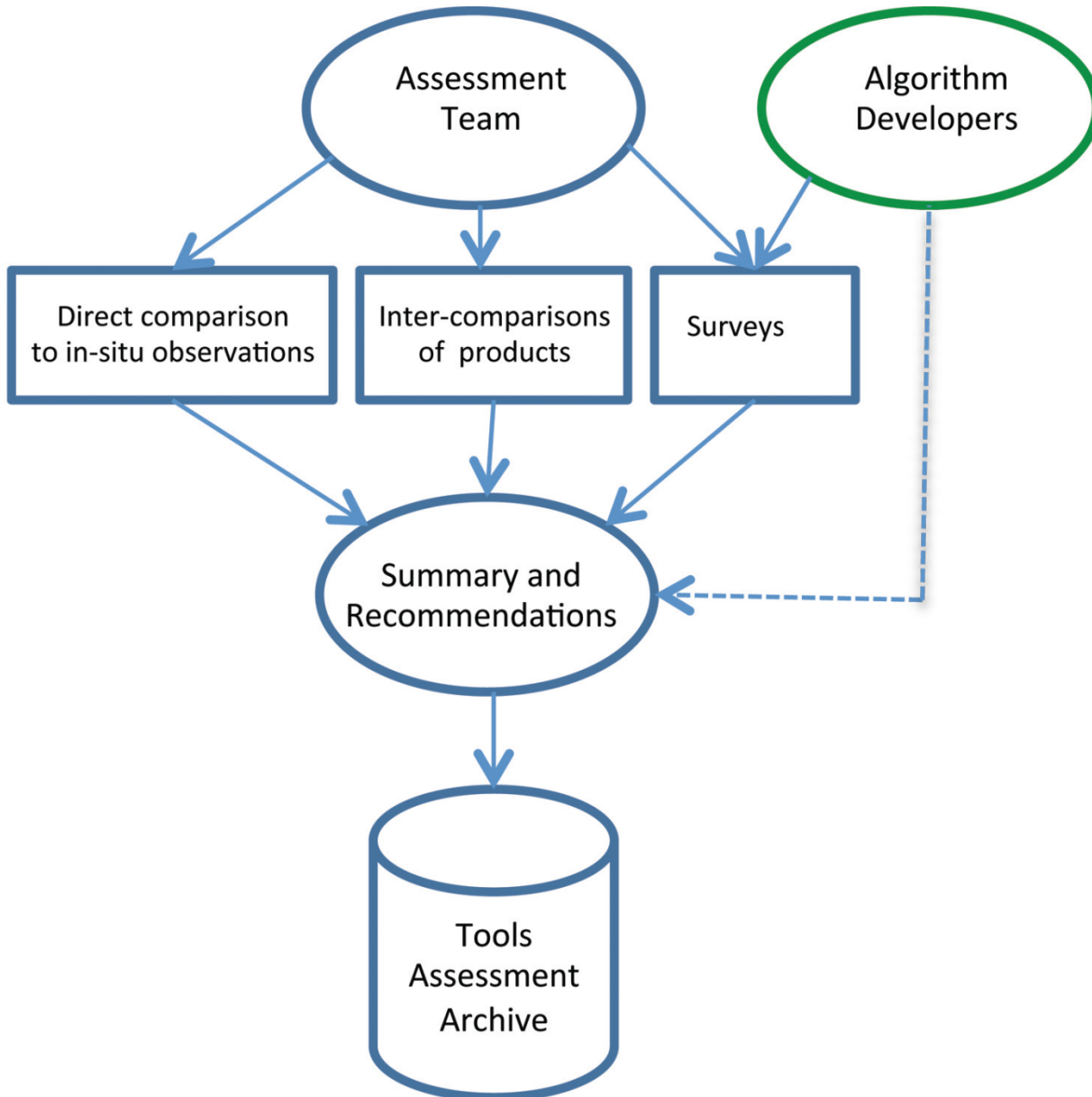
# Data Set Assessment: Experience

- 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.***

# Data Set Assessment: Experience

- GDAP has 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.
- 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.

# Key Elements of Assessment



# Key Elements of Data Set Assessments

- 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.

# 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) and may publish best practises handbook;
- 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, CEOS VCs , etc.) could organise the assessments, i.e., identify assessment leads/teams, guide the work and review the outcome as done in GEWEX GDAP;
- The assessment teams shall undertake the assessments and report to the competence bodies;
- Results of data set assessment might be distributed at all places where the data records appear, e.g., GOSIC, NCAR Climate Data Guide, reanalyses.org, GEO, etc.
- CEOS WGClimate to monitor the overall status of satellite (plus combined satellite/in situ) data set assessments;
- CEOS WGClimate help to ensure that assessment activities have resources, where appropriate through CEOS/CGMS member agencies;
- GCOS and WCRP DAC to provide overall review of all data set assessments (in principal data set assessments should be done for in situ data records as well, e.g., the different radiosonde data records).