GDAP Report

Rémy Roca, Chair
Tristan L'Ecuyer, Vice Chair
Jörg Schulz, Ex- Chair
Matthew McCabe, Ex-Vice Chair
Credits to all GDAP members, data project and assessment leads and reviewers

GEWEX

Content

- GDAP Objectives
- GEWEX Data Products
- GEWEX Data Quality Assessments
- GEWEX Ground-Based Observations
- GDAP New Activities
- GDAP contributions to GEWEX Science Questions
- GEWEX links to other WCRP or ex WCRP activities

- Membership
- Issues for the SSG

GDAP Objectives

- Data records
  - Guide production and analysis of global data sets with respect to GEWEX questions, e.g., energy and water budget closure;
  - Use new data sources in the data sets, e.g. GPM
  - Tailor data sets to needs of GCs, e.g., water availability, extremes and PROES activities and directly participate/interact with GCs and PROESs;
  - Evaluation of climate models – obs4mips connect;
- In situ networks
  - Guidance of surface networks such as BSRN and GPCC needed for assessments
  - Evaluation of satellite products
  - Evaluation and tuning of models
- Data quality assessments
  - To assure quality and knowledge about data sets including suitability for applications;
  - To improve uncertainty estimation for data records
  - Assess adequacy of observing system - Interact with CEOS/CGMS WG Climate

GEWEX Data Products and Integration of them

ISCCP (Bill Rossow and NOAA NCEI)

Aerocom MAC (Stefan Kinne)

SRB (Paul Stackhouse)

GPCP (Bob Adler et al.)

SEAFLUX (Carol Anne Clayson)

LandFlux (Matt Mc Cabe, Carlos Jimenez)

Soil Moisture (Wouter Dorigo)

GEWEX Merged and Integrated Product (Paula Brown and Chris Kummerow)

ISCCP Production @ NCEI

NCEI Goals:

To develop the expertise and capabilities to produce, understand, and operationally maintain the International Satellite Cloud Climatology Project (ISCCP) H-Series Climate Data Record.

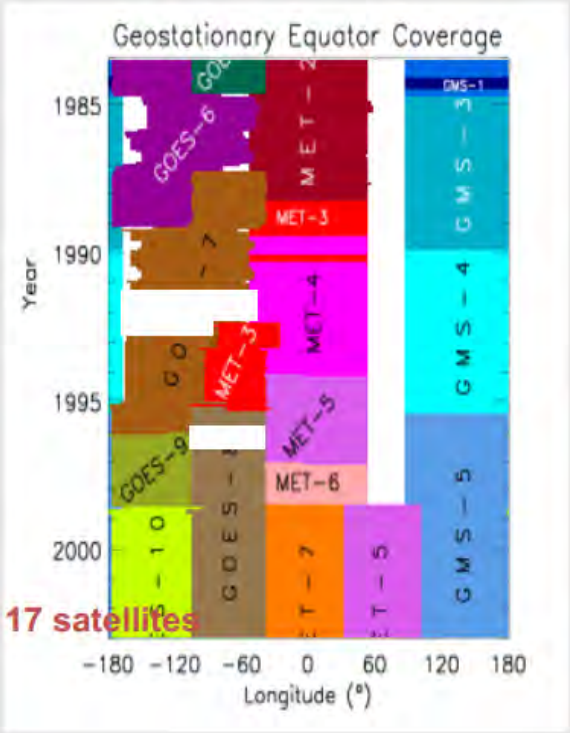
Additional Goals to sufficiently maintain the product and expand user base

- Understand end-user needs for ISCCP Cloud Products to shore up stakeholder involvement and feedback
- Engage SPC partners to acquire QC'd geostationary data
- Drive and support analysis of climate indicators using ISCCP data products

Why is NCEI Producing ISCCP H-Series?

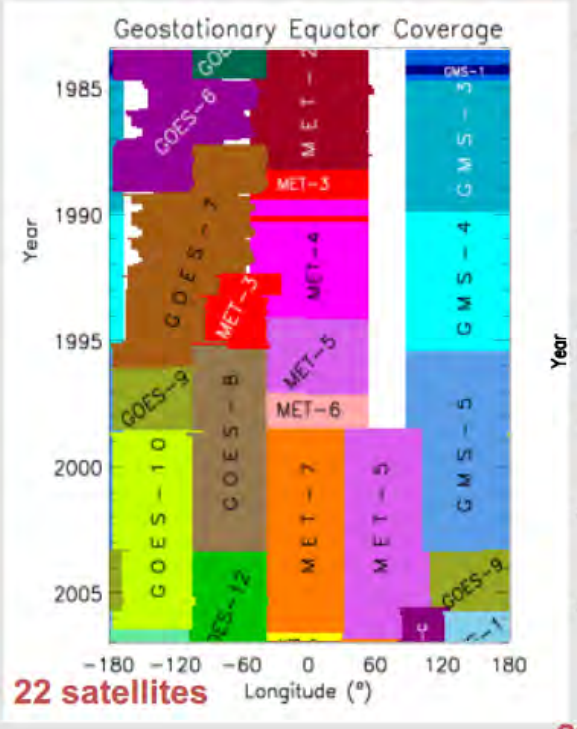
ISCCP B1 data (10 km, 3 hr) was stored without stewardship for 15 years at NCDC. We began stewarding it in 2003, putting together 9 formats, 7 navigation, and multiple calibrations into a single accessible FCDR

B1 Status - 2003



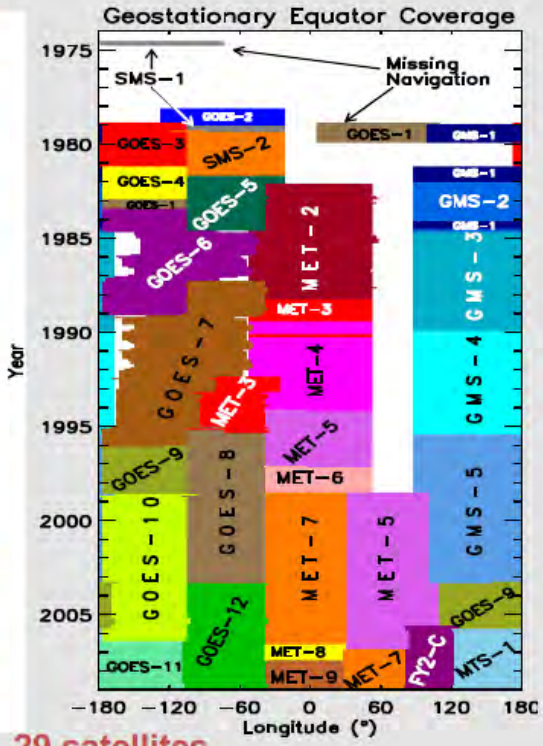
17 satellites

B1 Status - 2006



22 satellites

B1 Status - 2008



29 satellites

NEW ISCCP PRODUCTS (1982-2016)

- HXS (like DX): 10 km, 3 hr, by satellite
- HXG (new, like global DX): 10 km, 3hr, global
- HGS (new, like DS): 100 km, 3 hr, by satellite
- HGG (like D1): 100 km, 3 hr, global
- HGH (like D2): 100 km, monthly mean diurnal
- HGM (like D2): 100 km, monthly

- Ancillary: NNHIRS: 100 km, 3 hr, global
- Ancillary: OZONE, SNOWICE: 100 km, daily
- Ancillary: AEROSOL: 100 km, monthly
- Fixed Ancillary: TOPO (10 km), SURFACETYPE (25 km)

D-Version to H-Version Changes

Radiance Calibrations: (1) Anchor for VIS calibration extended to combined results for NOAA-9 and NOAA-18, spanning most of the time record. (2) Overall IR calibration adjusted for small gain error in AVHRR calibrations compared to MODIS. (3) Geostationary normalization procedure changed to use all the radiance data rather than a small number of special samples

Cloud Detection Algorithm: (1) Added new radiance space contrast test inside regions with land-water mixtures (2) Updated surface type categories for algorithm tests to improve tests in rough topography (3) Revised daytime cloud detection over snow and ice by eliminating 3.7 μm tests. Improved polar cloud detection (4) summertime by reducing VIS detection thresholds over snow and ice and (5) wintertime by changing marginally cloudy to clear and marginally clear to cloudy

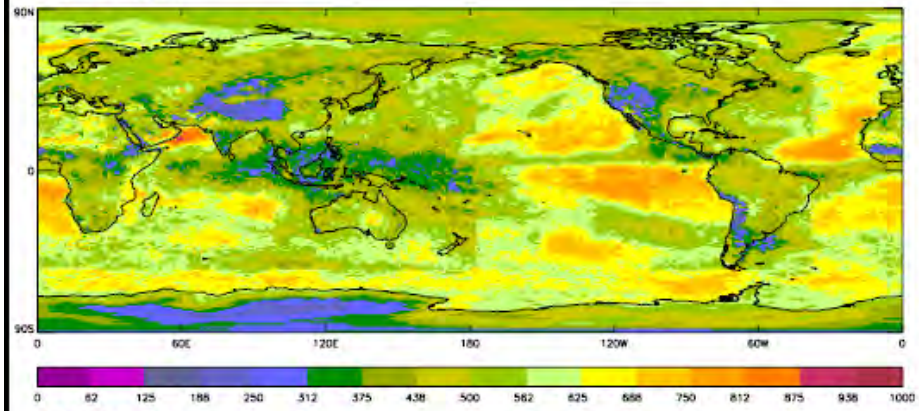
Gridded Product Contents: (1) Spatial sampling changed from 30 km to 10 km. (2) Revised the COUNTS-to-physical conversion tables to remove special values for underflow and overflow. (3) Increased uncertainty estimate information. (4) Filling of missing observations is performed in the global, 3-hr product instead of in the monthly product.

VIS and IR Radiance Models:(1) Replaced ocean VIS reflectance model with more accurate version with explicit glint treatment. (2) Calculated instrument-specific ozone absorption coefficients. (3) Added water vapor above 300 mb level in atmospheric ancillary data. (4) Added treatment of stratospheric and tropospheric aerosol scattering and absorption. (5) Improved surface temperature retrieval by accounting for variations of surface IR emissivity by surface type. (6) Introduced more explicit atmospheric and cloud vertical structures for retrievals

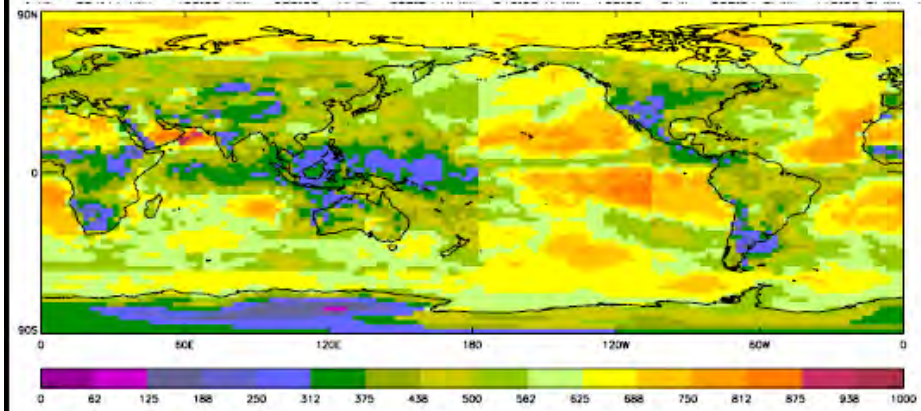
Comparison of ISCCP HGM and D2 Products

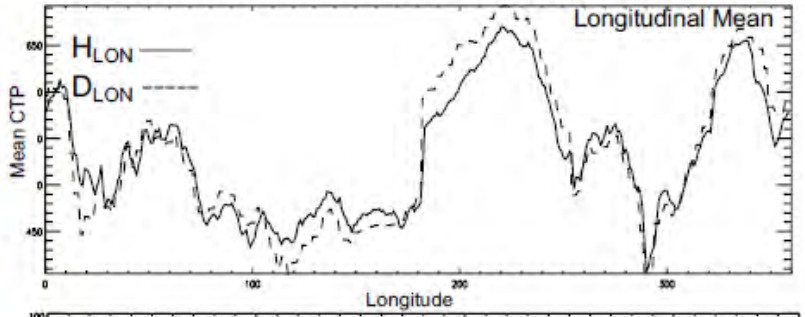
May 2009 HGM – D2 Comparison Plots Mean Cloud Top Pressure

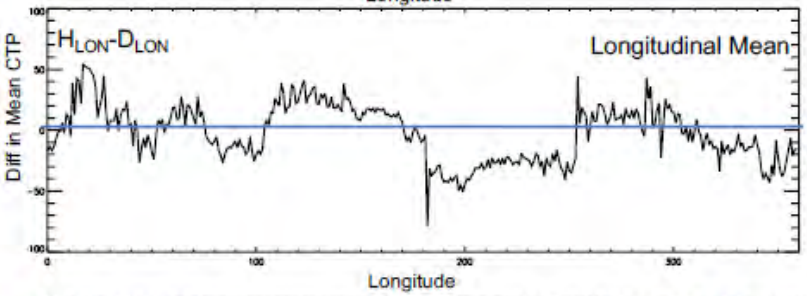
H-Series

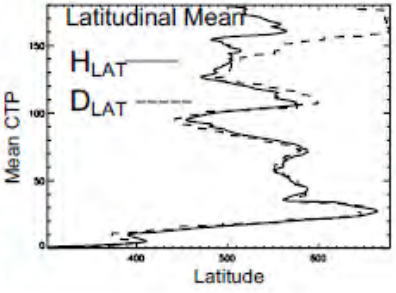


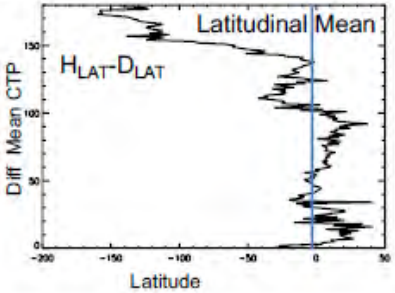
D-Series











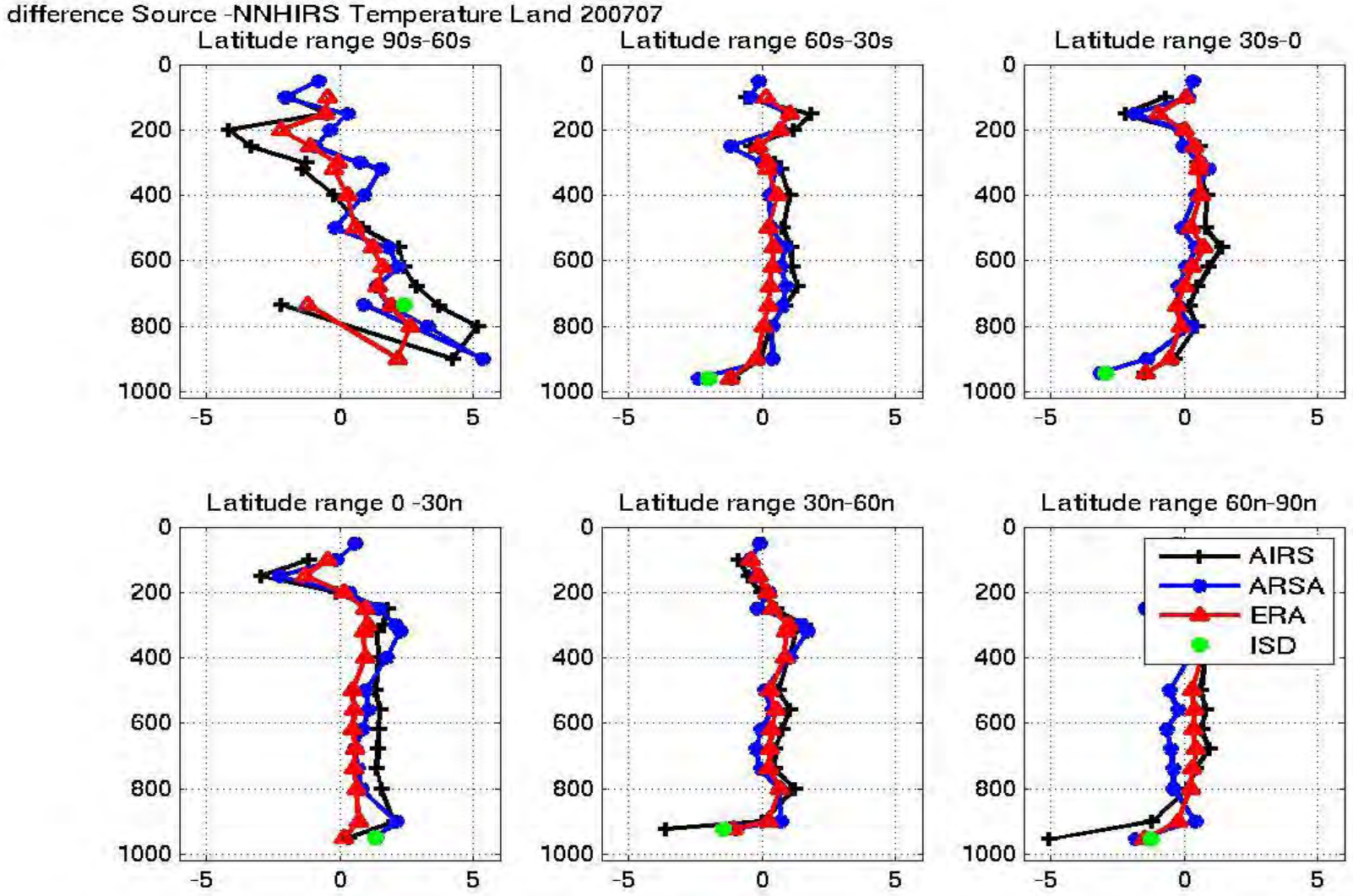
NNHIRS INTERPOLATIONS/ ADJUSTMENTS

- Filters at 1 and 99% -- cloud contamination
- RH low and high constraints (low in winter poles)

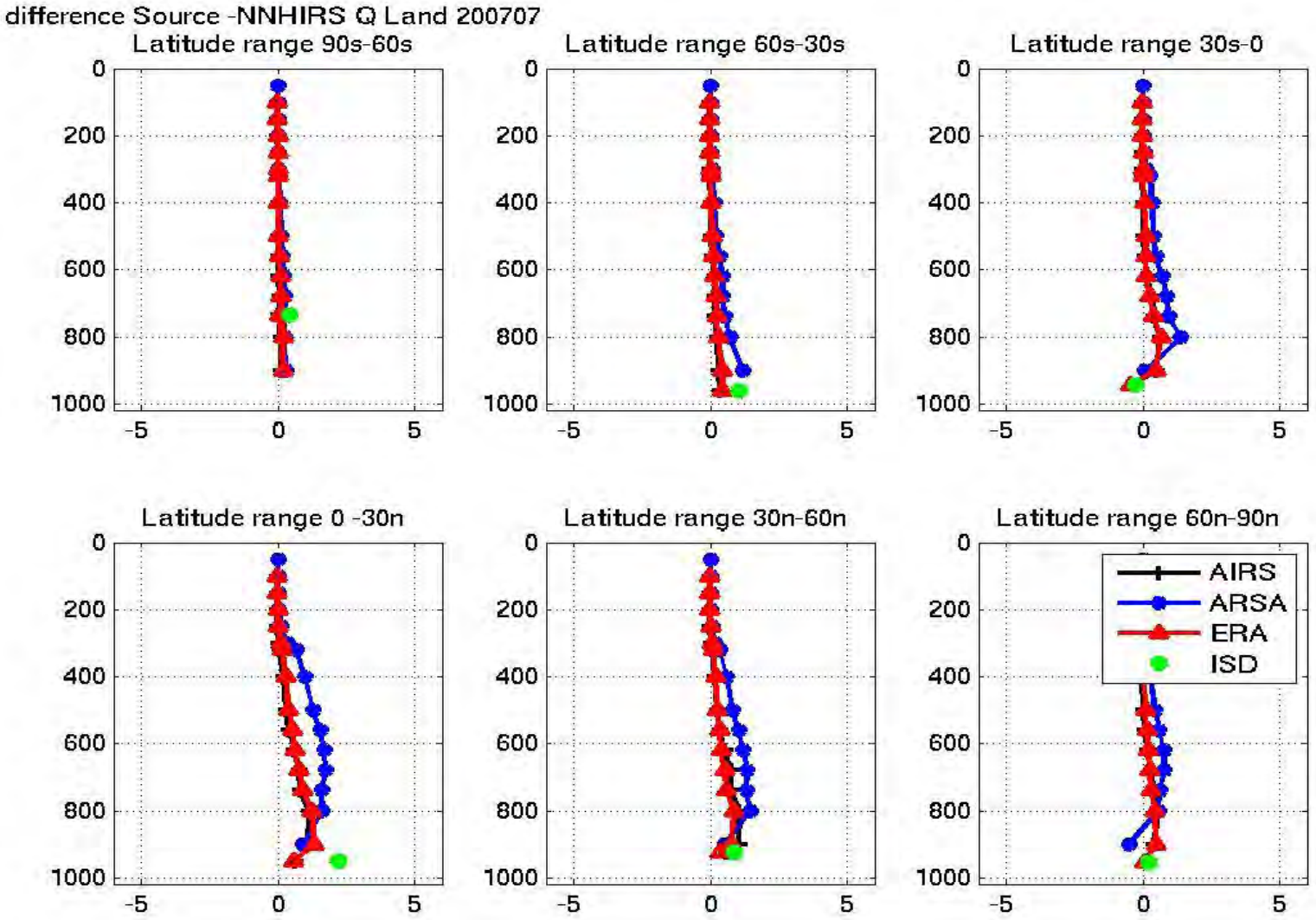
- Ocean daily mean Q, Land daily minimum Q
- Ocean linear time interpolation
- Land diurnal model interpolation

- Ocean QA adjusted by SeaFlux climatology
- Land TA adjusted by ISD climatlogy

NNHIRS PROFILE COMPARISONS

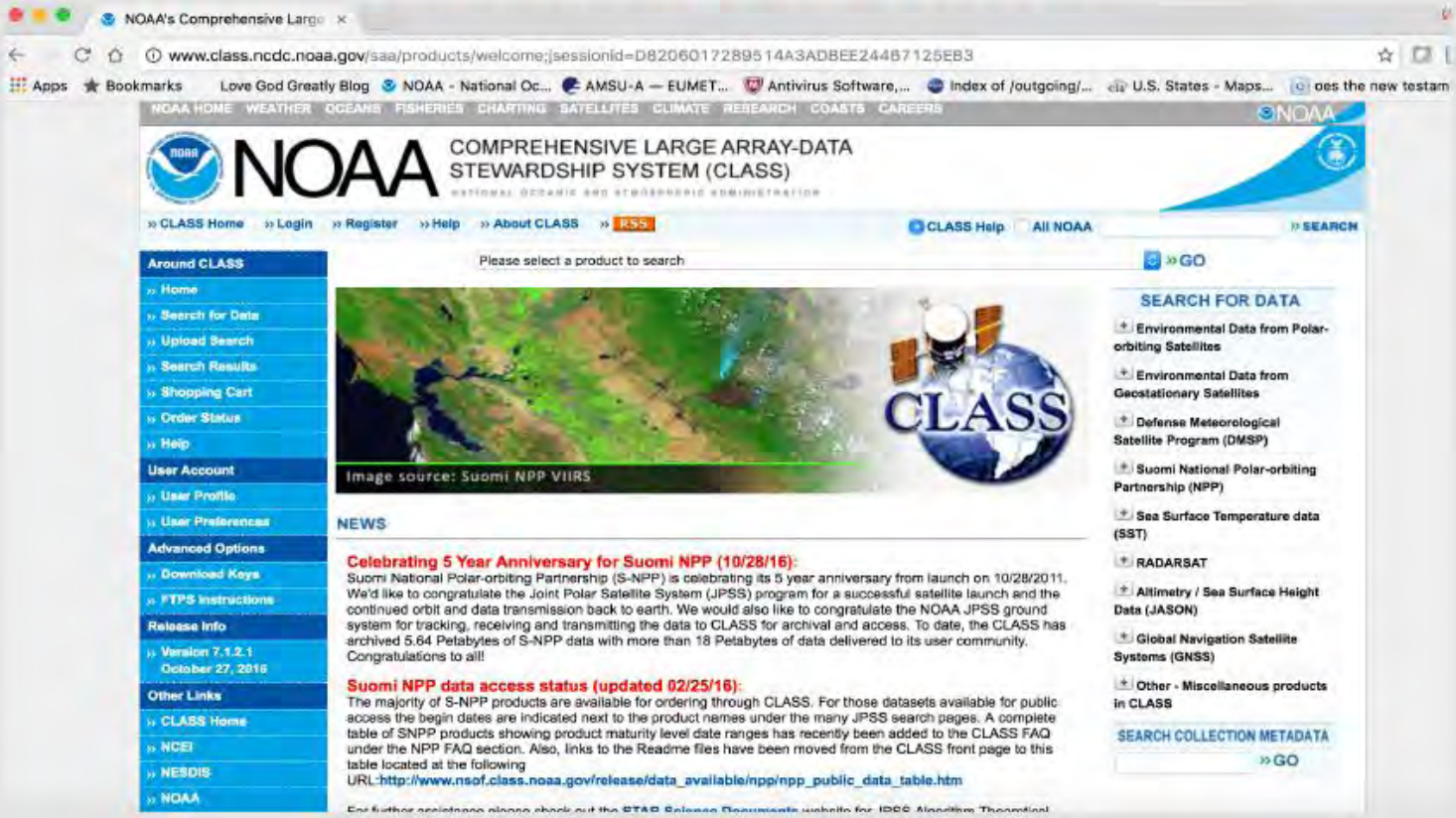


NNHIRS PROFILE COMPARISONS



Transparent Access to ISCCP

- Archived in CLASS with HDSS-Archive System (HAS) access 1983/07 and 2009/12 by 1/31/17 and extended period by 6/30/17.



ISCCP Production @ NCEI

NCEI ISCCP H-Series Phase Schedule:

- **Phase I** – Reproduce ISCCP D-Series record for July 1983-Dec. 2009 (aka Base Period)
  - Ported code to run at NCEI (Code package includes B1U and GAC QC code, Production Code, Calibration Code, and Ancillary Data Production Code)
  - QC'd base period GAC and B1U data
  - Wrapping up CDR documentation package
  - Currently producing and archiving data (~1 decade approved and completed)

  Expected Completion: **Mid-Late Jan. 2017**

- **Phase II** – Extend the time series to include data from January 1982 through June 2015 (i.e., thru Himawari-7)

  Expected Completion: **Mid-Late June 2017**

- **Phase III** –Introduce Himawari-8 and GOES-R data into ISCCP H-Series processing stream for build up into operational production. Current update frequency is planned to be completed on a quarterly basis.

  Expected Completion: **Mid-Late Dec. 2017**

*Note: Original release is v01r00

MACv2

an AeroCom product

Stefan Kinne, *MPI-Meteorology*

AeroCom

- an (basically) unfunded initiative
  - collaborative spirit – no competition
- founded by common interests to advance understanding of model complexity
  - common experiments / (input) emission data
- linking data and simulation groups
  - annual meetings … now with AeroSAT branch
- open access data archive visualization
  - http://aerocom.met.no/Welcome.html (talk to Jan)
- advance (climate) science understanding
  - contributing to IPCC

based on community spirit

- data and modeling exchange (annual reunions)
- understanding of needs and limitations
- developing relationships / friendships
- sharing and helping (rather than competing)

- PARIS 2003

  where it started

2004

… over the years the participation kept growing

2015

Max-Planck Aerosol Climatology

ftp ftp-projects.zmaw.de/aerocom/climatology/MACv2_2017

- 1x1 deg global, monthly, aerosol opt. properties
- capturing today's average properties for
  - column amount ('attenuation') AOD
  - column absorption ('composition') AAOD
  - particle 'size' information FMF, Angstrom

– how? …. combine!

- quality statistics from sun-photometer data
- completeness from bottom-up modeling

relying on OBSERVATIONS of AERONET and MAN plus background from modeling

(no direct use of satellite data)

AerChemMIP AeroSAT CCMI AeroCom

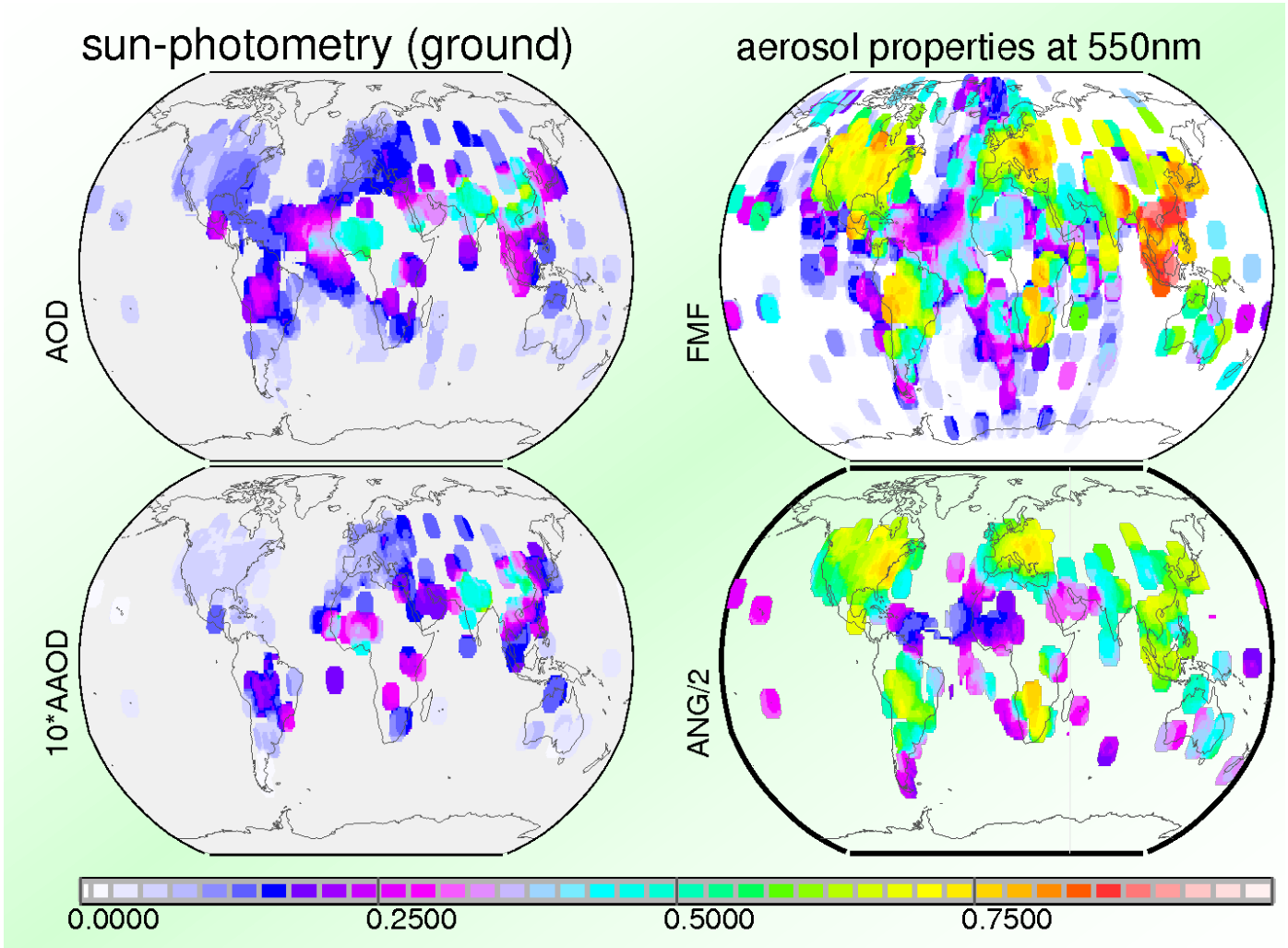
why MAC ?

… climate studies require aerosol rad. properties

- simulations from global modeling
  - accuracy suffers from input and complexity
  - time-consuming
- prescription by a climatology (e.g. MAC)
  - direct link to observations
  - fast (and simple to implement)

while the climatology can be a nice option in many applications … the reliance on context from global modeling underlines to importance on advancements in detailed aerosol modeling

use observations if you can



AOD

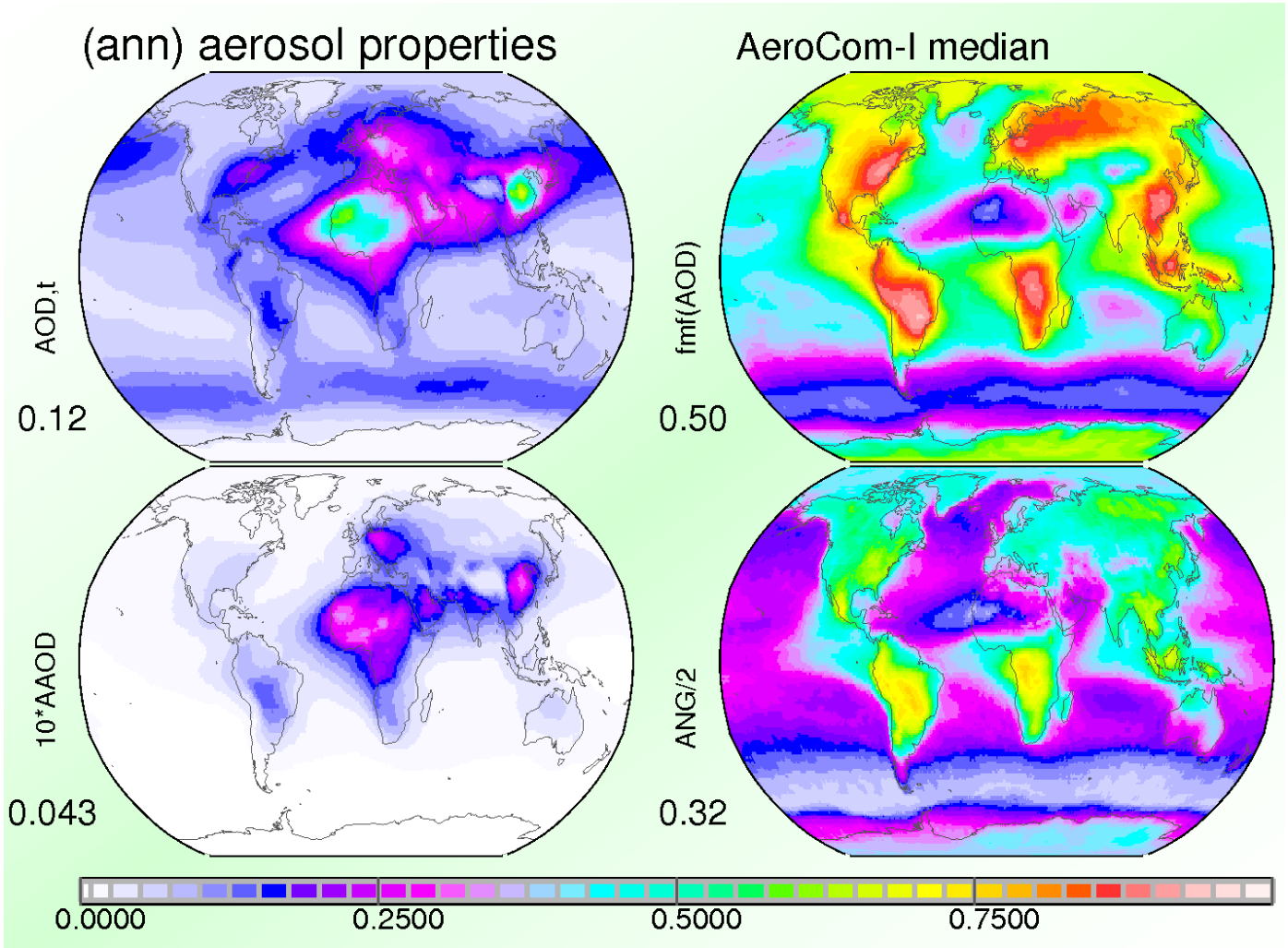
AAOD
(10 times)

FMF

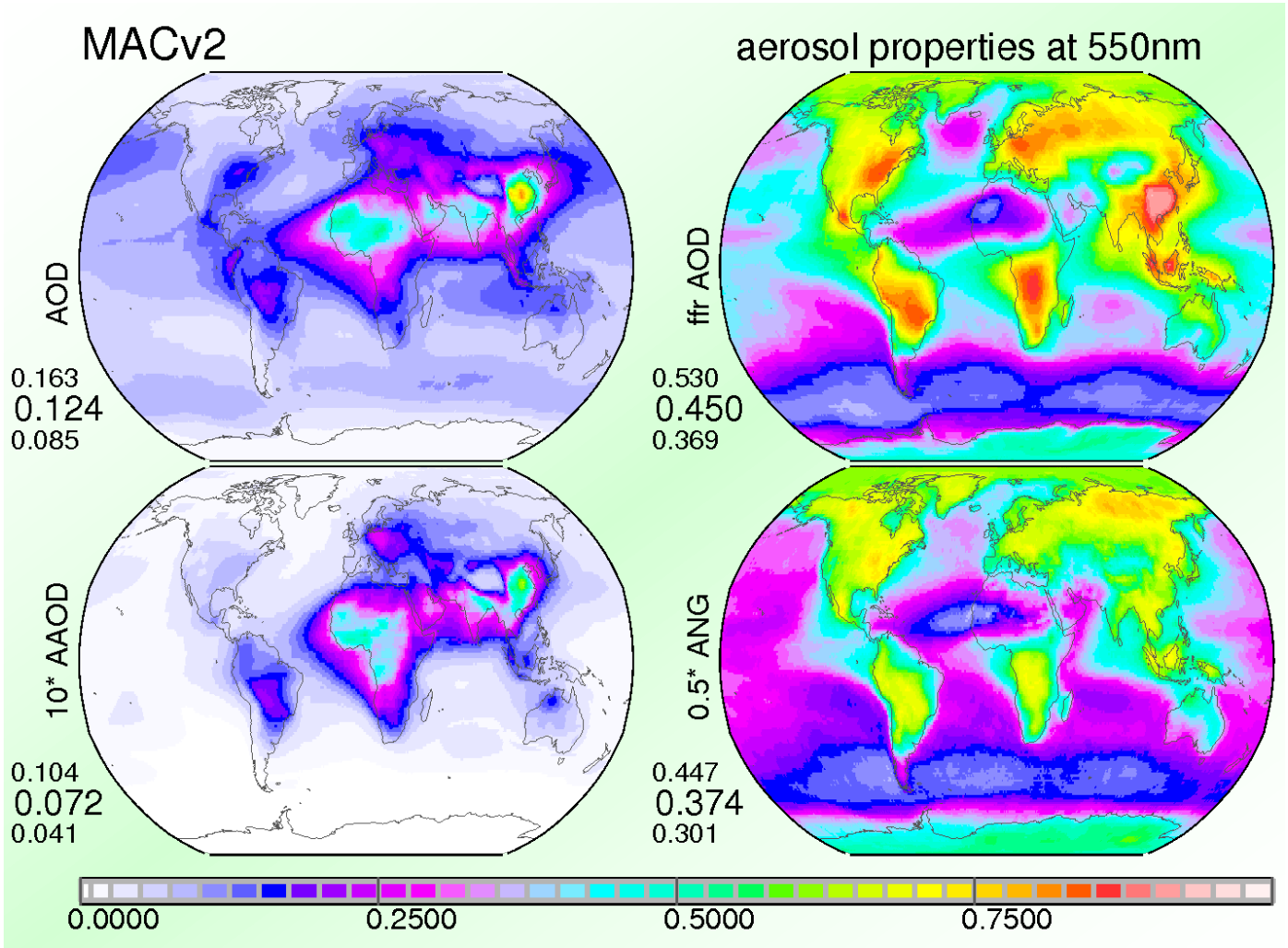
ANG
(div by 2)

annual
means

complete modeling



extended with model context → MACv2



AOD

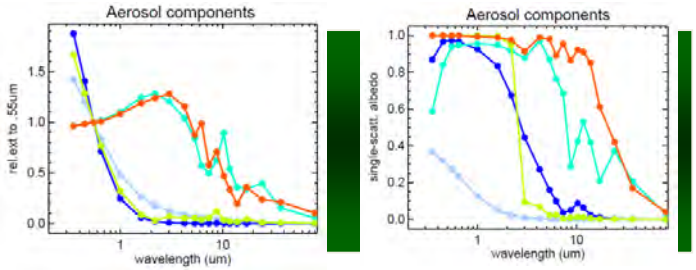
AAOD
(10 times)

FMF

ANG
(div by 2)

annual
means

AOD by components



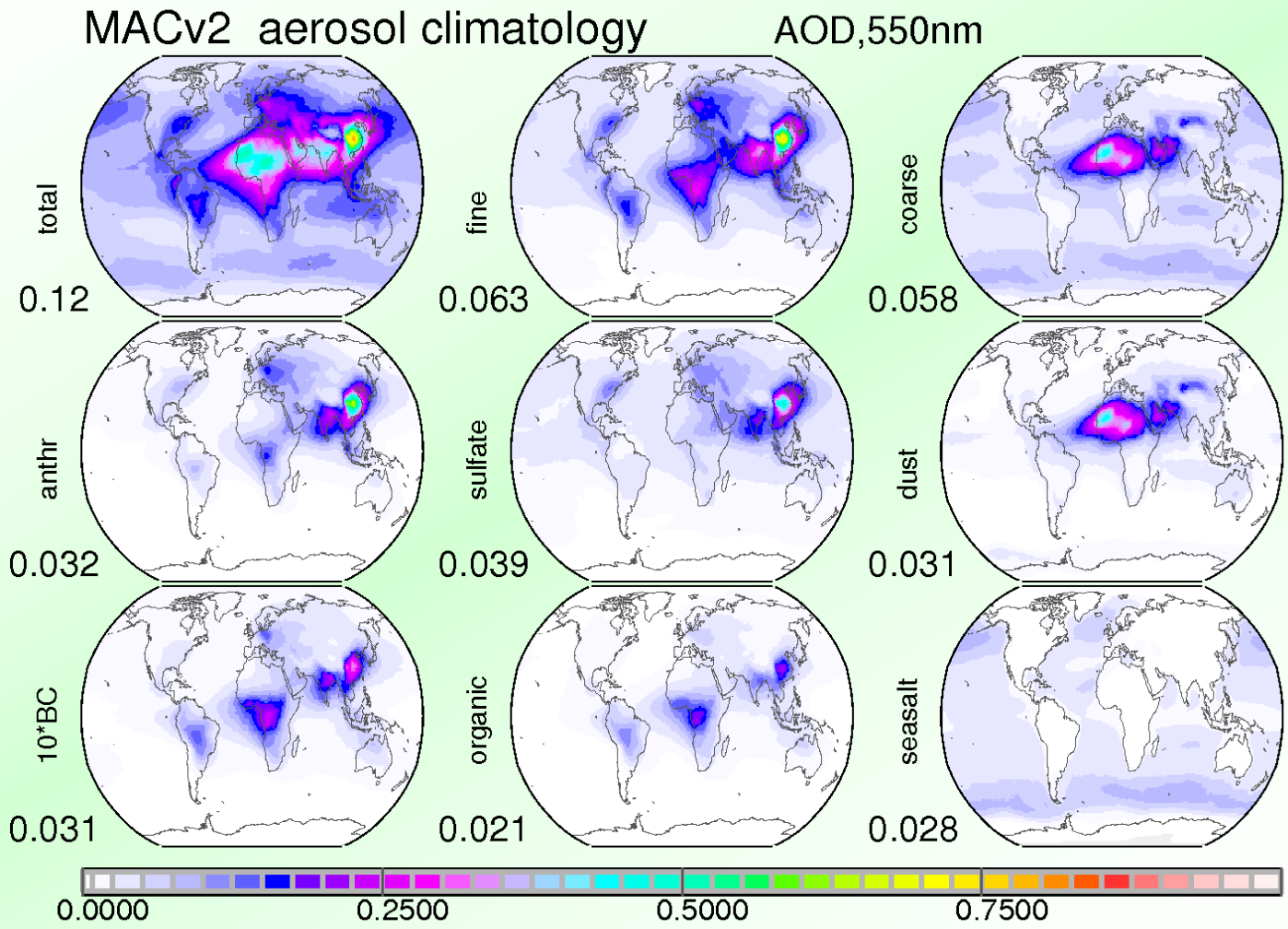
BC
black carb

OC
org. carb

SU
sulfate

DU
dust

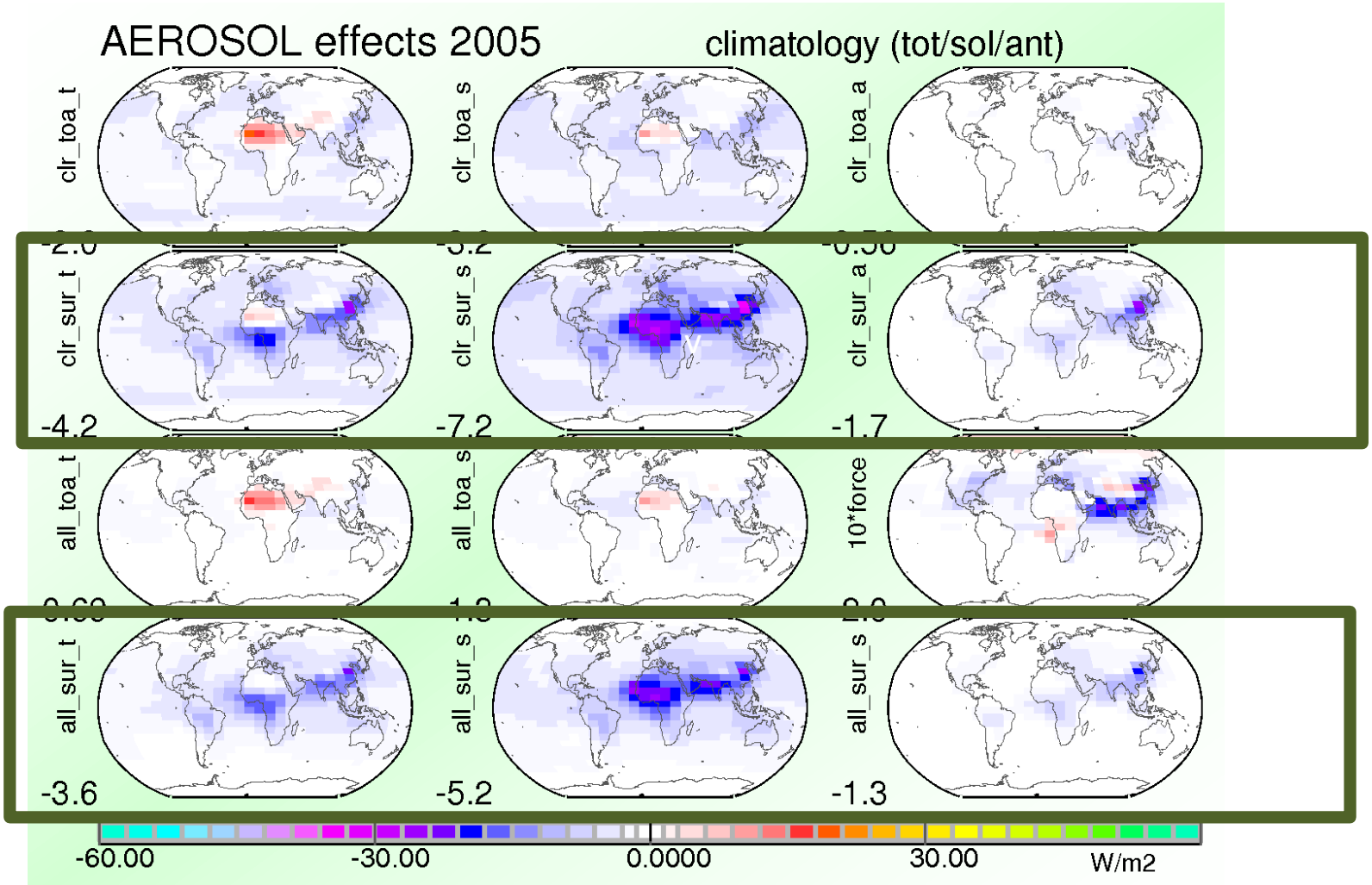
SS
seasalt



at surface direct effect most important

clr-sky 2005

all-sky 2005



SRB Web Site and Data Sources

http://gewex-srb.larc.nasa.gov

1. **Atmospheric Science Data Center (main archive):**

   http://eosweb.larc.nasa.gov/project/srb/srb_table

2. **My NASA Data Live Access Server**

   http://mynasadata.larc.nasa.gov

3. **NCDC THREDDS Server**

   http://www.ncdc.noaa.gov/oa/rsad/netcdf-access/index.php?name=srb

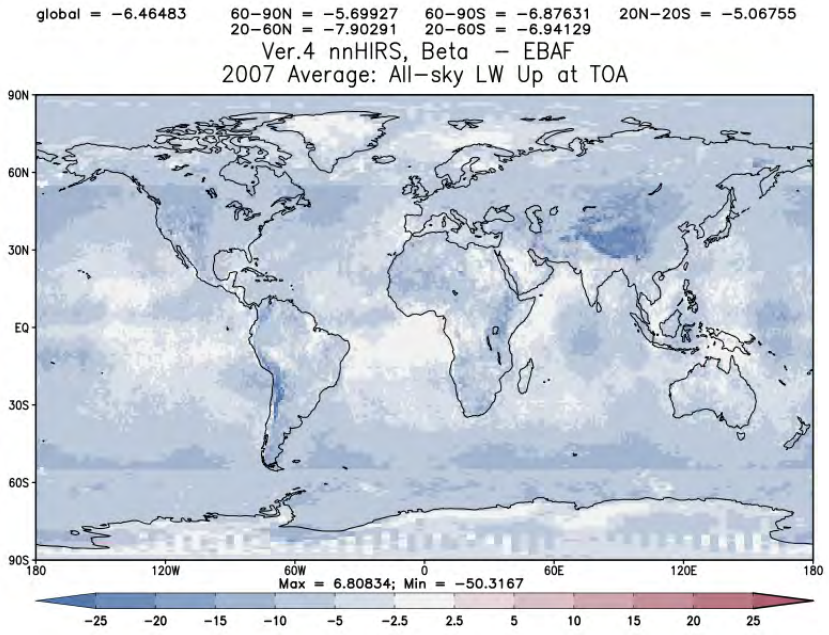
SRB Release 3 Data Products

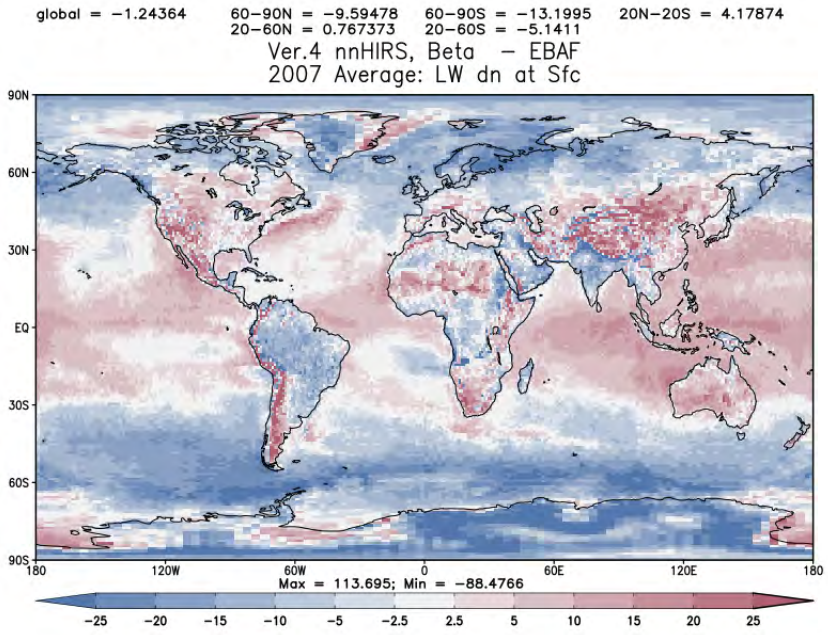
(Spatial Resolution: 1° x 1°; 7/83 – 12/07)

Data Types	Model Name	Temporal Resolution	Parameters
SW	GEWEX SW (Pinker/Laszlo) (v3.0)	3-hourly, Monthly Averaged 3-hourly, Daily and Monthly Averaged (UTC and local sun time)	All-sky: Surface down, up, PAR down; TOA Down, Up
			Clear-Sky: Surface Down, Up; TOA Up
	LPSA (Staylor/ Gupta) (v3.0)	Daily, Monthly	All-sky: Surface Down, Net, and Albedo
			Clear-sky: Surface Down
LW	GEWEX LW (Fu/Liou/ Stackhouse) (v3.1)	3-hourly, Monthly Averaged 3-hourly, Daily and Monthly Averaged	All-sky and clear-sky: TOA up; Surface Up and Down
	LPLA (Gupta) (v3.0)	3-hourly, Monthly Averaged 3-hourly, Daily and Monthly Averaged	All-sky Surface Downward, Net; Cloud Radiative Forcing
Input Property	CLDPROPS	3-Hourly	Surface emissivity, skin temperature, atmospheric profile; cloud phase, fraction, optical depth and LWC

Note: The LPSA and LPLA algorithms are also used in CERES Surface-Only

Annual Averaged Differences of new LW compared to CERES





GEWEX SRB: Summary Status

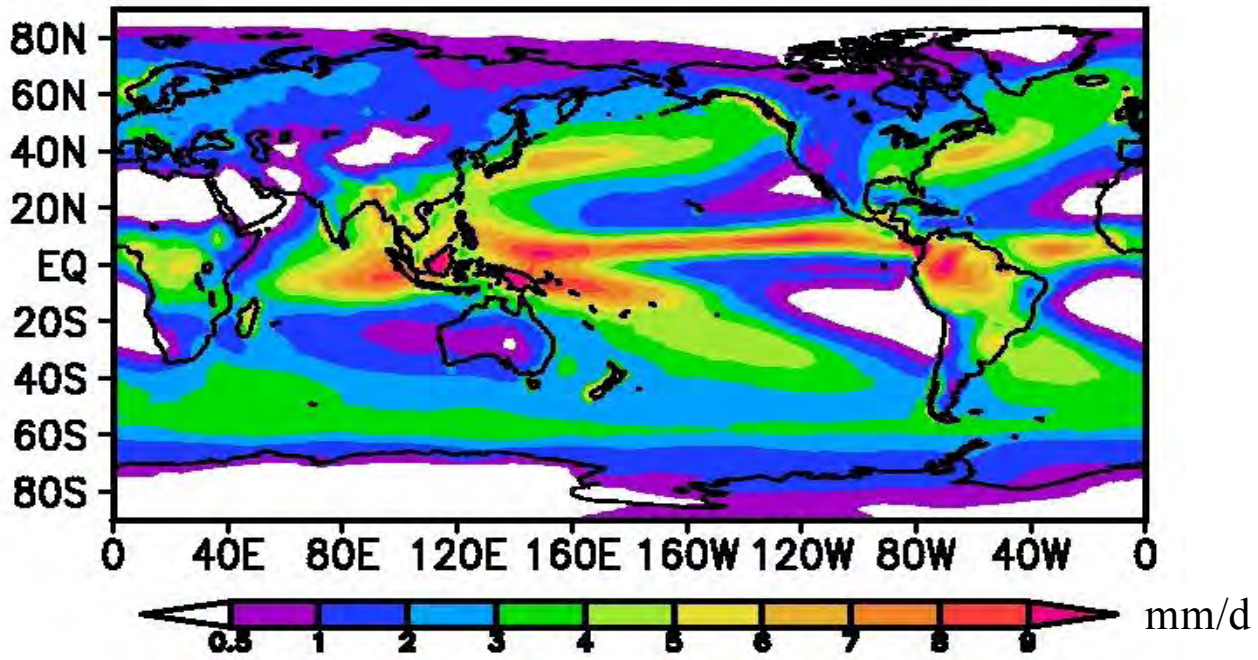
- GEWEX SRB Rel 4-IP:
  - New inputs from ISCCP nnHIRS and HXS processed were assessed and new algorithms processed for 1°x1°
    - versions delivered for SRB Rel 4-IP Beta
  - Analysis shows improved SW fluxes relative to BSRN and ocean buoy measurements and also new inputs and algorithms relative
    - Ocean fluxes reduced; land fluxes increased
    - TOA reflectance reduced
  - Analysis shows LW not improved
    - nnHIRS appears too moist over tropical oceans leading to biases relative to surface measurements and CERES EBAF v2.8/SYN1Deg
    - HXS cloud rendering testing/assessment ongoing; homogenization with new microphysics

Summary and Conclusions

- Next Steps:
  - Will reprocess both SW and LW fluxes with Version 1 HXS at 1° x 1°; will reprocess 2005-2009 with revised calibration tables and cloud properties
    - Will be assessing changes to cloud production
  - Redeliver at 1x1 time periods needed; considering not reprocessing 30 years at 1x1 => proposal: 5 years each decade
  - Progress of conversion to ½° x ½° nearly completed
    - Using full equal area sampling and data production grid
    - Will provide data provides at the ½° x ½° equal angle

Global Precipitation Climatology Project (GPCP)

Robert Adler
U. of Maryland



GPCP is an often-used analysis based on satellite and gauge data (1979-near present).

No TRMM, GPM or Cloudsat data are in the current GPCP.

Adler et al., 2003 J. Hydromet

Huffman et al., 2009 GRL

GPCP Global Precipitation Products

Version 2.3

NASA, NOAA, DWD, UMD, GMU, others

- Monthly, 2.5° Merged Analysis (1979-present)
  Adler et al. (2003), J. Hydromet.

  Huffman et al. (2009) GRL

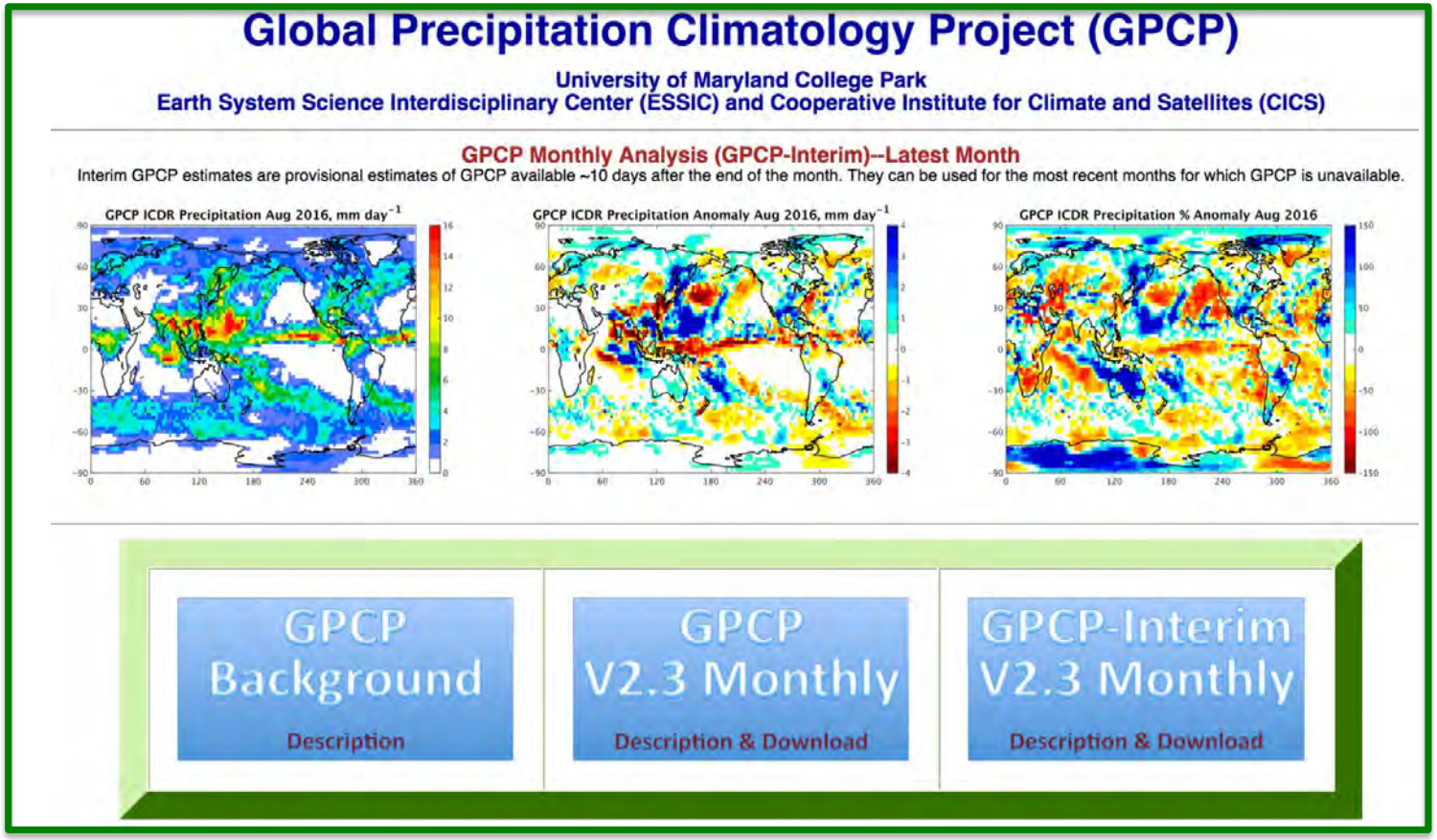
- Pentad, 2.5° Merged Analysis (1979-present)
  Xie et al. (2003) J. Climate

- Daily, 1° Merged Analysis (1997-present)
  Huffman et al. (2001) J. Hydromet.

[although produced using different data sets and algorithms, products are integrated,i.e. they add up]

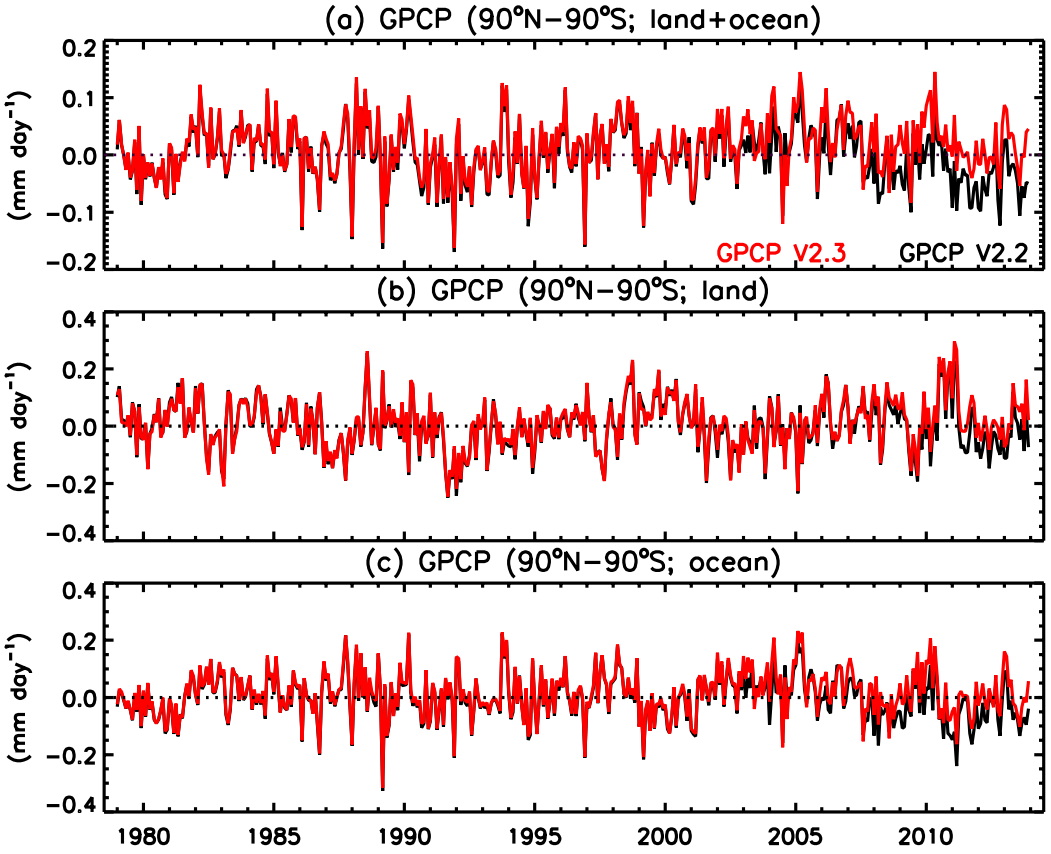
normally produced ~ 3 months after observation time

Web Address for Current GPCP products: GPCP.umd.edu



- **New GPCP Monthly (V2.3) being produced at UMD for NOAA's Climate Data Record (CDR) program**
- **Final analysis available a few months after time; Interim CDR (ICDR) available ~10 days after end of month for real-time climate analysis**
- **V2.3 Daily and Pentad products under development**

GPCP New V2.3 vs. V2.2



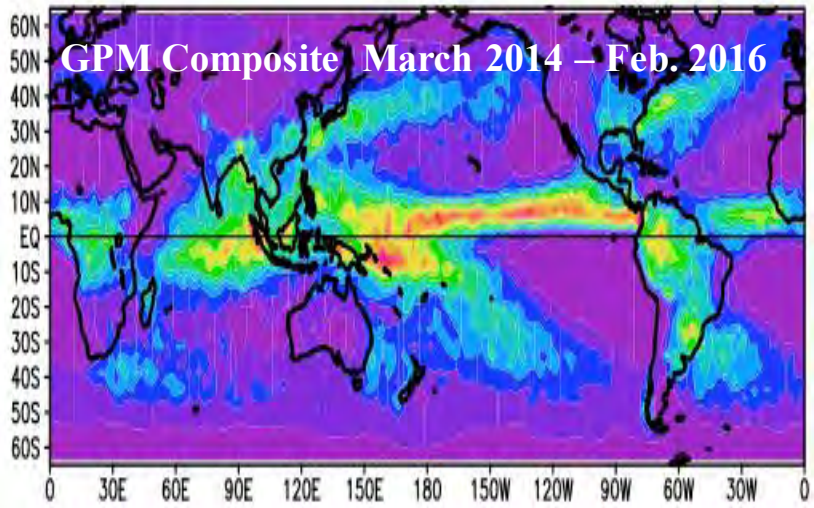
Land + Ocean

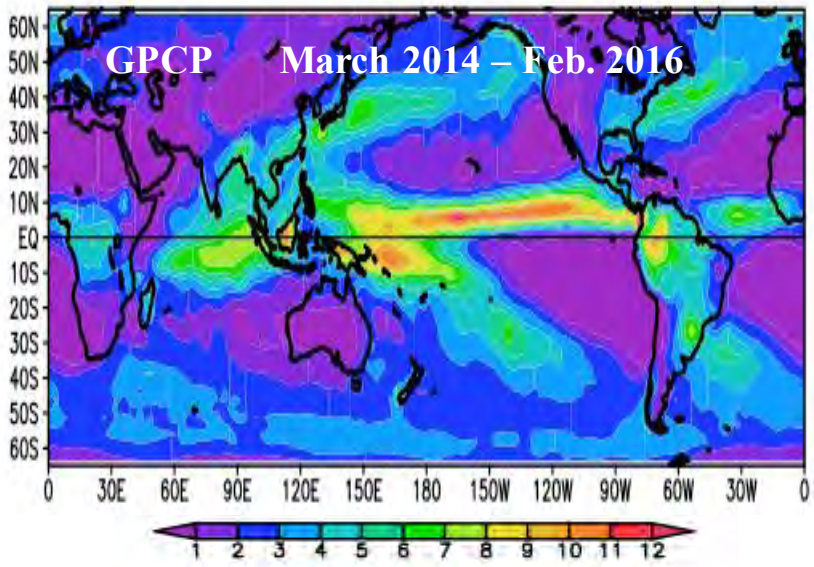
Land

Ocean

- Differences due to cross-calibration errors (SSMI to SSMIS and TOVS to AIRS) over ocean and use of new GPCC "Full" gauge analysis
- Biggest difference after 2009 (~ 1.8% over ocean)
- Regionally biggest difference 40-60N over ocean

GPM Two-Year Precipitation





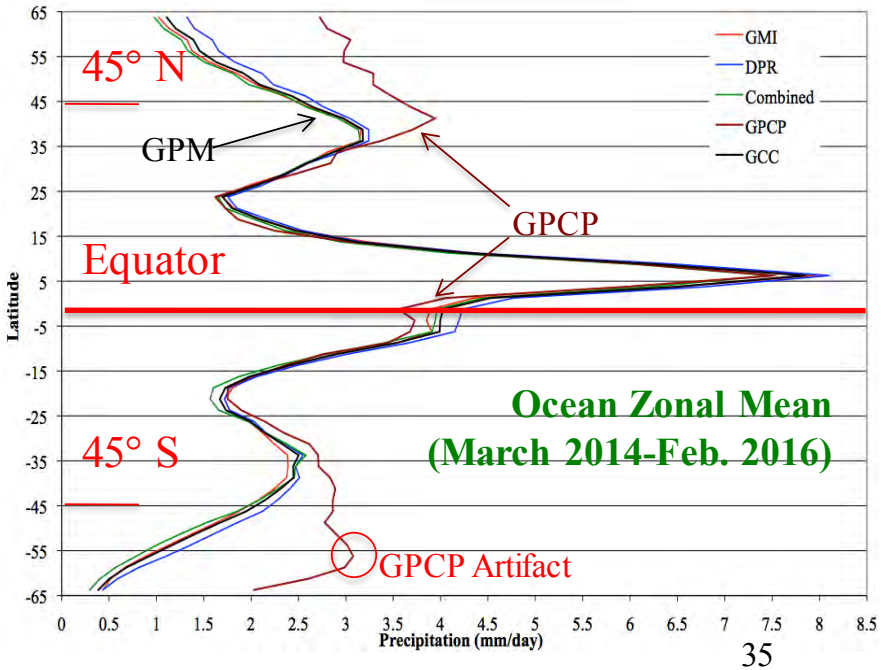
Ocean

Version 4 of GPM Products

GPM

mm/d	PMW	Radar	Comb	GPCP
25N-25S	3.50	3.63	3.37	3.33
65N-65S	2.70	2.83	2.63	3.07

- *GPM lower in extra-tropics*



Ocean Zonal Mean (March 2014-Feb. 2016)

GPCP Status

- Version 2.3 monthly and daily was in routine production with products typically produced about 2-3 months after end of month. ICDR Monthly was being produced within 10 days of end of month.
- AIRS precipitation processing affected by end of AMSU in September 2016, resulting in GPCP production stoppage—last month is August 2016.
- We are beginning to examine using AIRS-only precipitation estimates instead of AIRS/AMSU. First indications are small differences. Cross-calibrations of AIRS-only to AIRS-AMSU estimates possible. Estimate to go back to routine production—May 2017.
- NOAA/NCEI momentarily ready to make GPCP Monthly (V2.3) an official CDR with archive there (data would also be available from UMD). Daily and Pentad products are in process toward same status—in about a year.
- Article prepared for GEWEX Newsletter re. V2.3, changes from V2.2

- Version 3 GPCP work proceeding (George Huffman is PI)

GPCP Version 3

(being developed under NASA support; PI: Huffman)

New GPCP Version 3 will have:

* Monthly--0.5° resolution, GPROF microwave algorithm applied to SSMI, SSMIS data as satellite calibrator (1979-present) Other components (e.g., gauge) similar to current (V2) procedure.

* Daily—0.5° resolution (1998-present). Pentad for whole 1979-present period. Daily possible back to ~1983 using PERSIANN (IR-based).

* 3-hr—0.25° (1998-present) to match with ISCCP and SRB products (using GPM IMERG)

IMERG is GPM multi-satellite analysis

Overview on SeaFlux

Carol Anne Clayson, WHOI

With Brent Roberts, MSFC

And Jeremiah Brown, Principal Scientific Computing

5th GDAP Meeting

29 November – 1 December 2016

Washington, DC

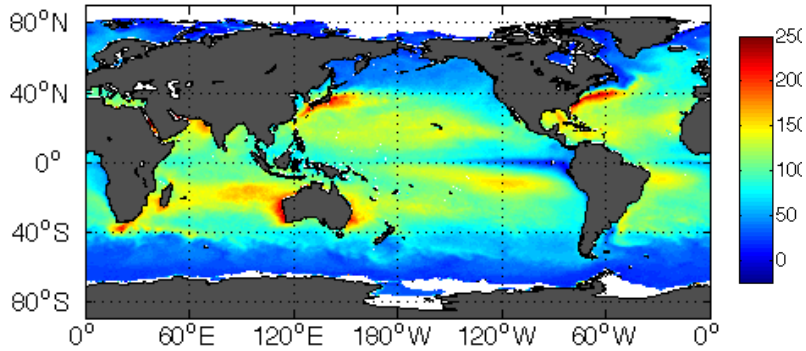
SeaFlux

- International project under the auspices of the GEWEX Data and Assessments Panel: *to improve our understanding and determination of ocean surface turbulent fluxes*
- Our main questions:
  - What is feasible in terms of resolution and length-of-time series for satellite data?
  - Can we produce a high resolution dataset using satellites that is better than conventional climatology and NWP products?
  - What are the best methods for creating this dataset?
  - How do the different datasets perform under varying applications?
- Elements of the project include:
  - Evaluation of global flux products
  - Providing library of flux datasets and in situ data sets for easy comparisons by researchers
  - Production of a high-resolution (1^o, 3 hourly) turbulent flux dataset

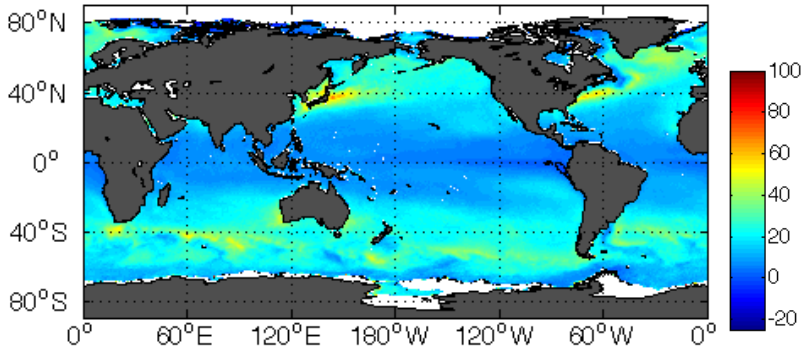
SeaFlux CDR version 2

- Near-surface air temperature, humidity, and winds
  - Based on Roberts et al. (2010) neural net technique
    - CLW content used to remove rain-contamination (except for F08)
    - F10 – F18, pixels segregated by clear/cloudy sky
    - One neural net for F08, two for all others (total)
  - SSM/I and SSMIS from CSU FCDR
- SST
  - Pre-dawn based on Reynolds OISST
  - Diurnal correction
  - Uses SRB, CERES, FLASHFlux for radiation, HOAPS, GPCP for precipitation
- Land mask from NOAA GSHHG, ice mask from AVHRR ice fraction, ISCCP ice shelf
- Uses neural net version of COARE
- Gap-filling methodology -- use of MERRA2 variability – 3 hour
- Available from 1988 through mid-2016

1999 Latent Heat Flux



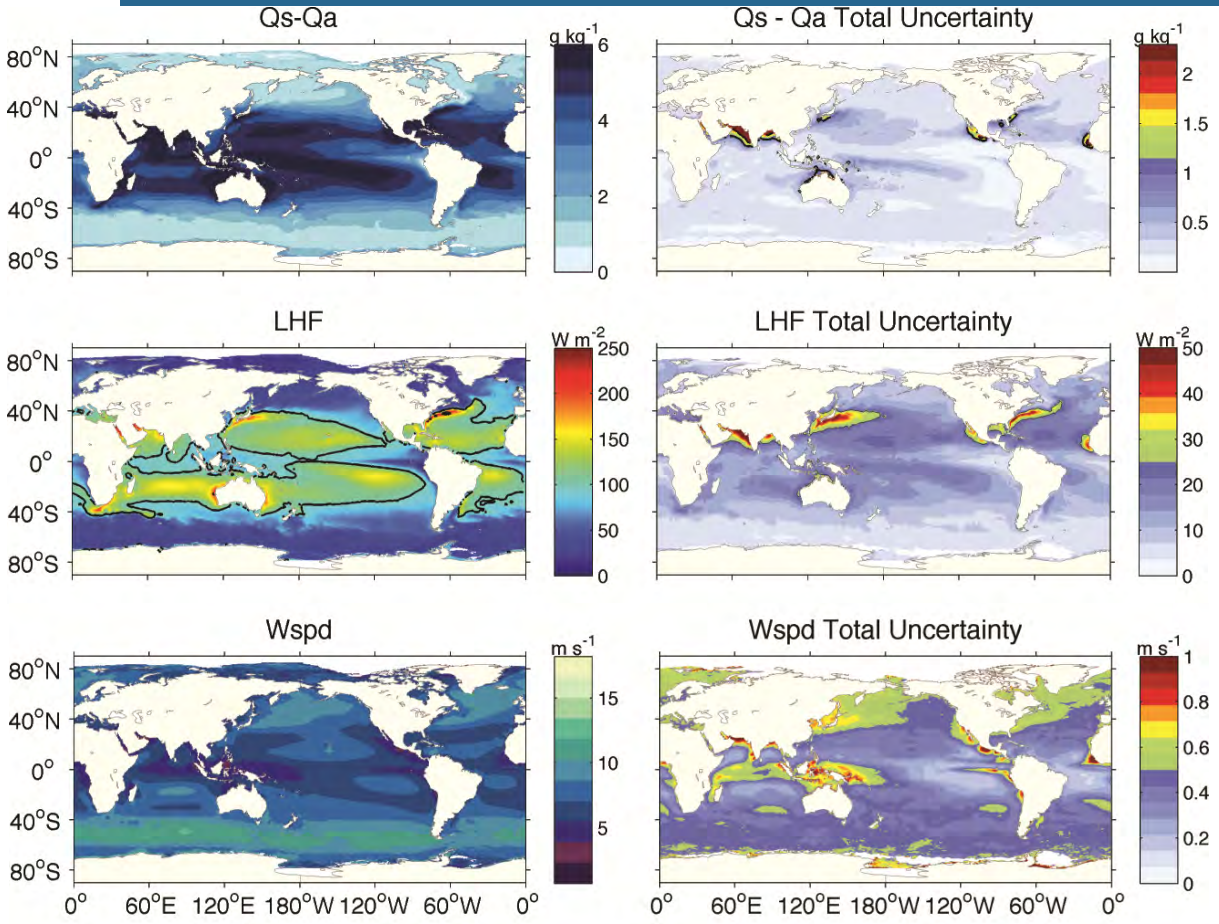
1999 Sensible Heat Flux



Global Energy and Water Cycle Experiment GEWEX WCRP

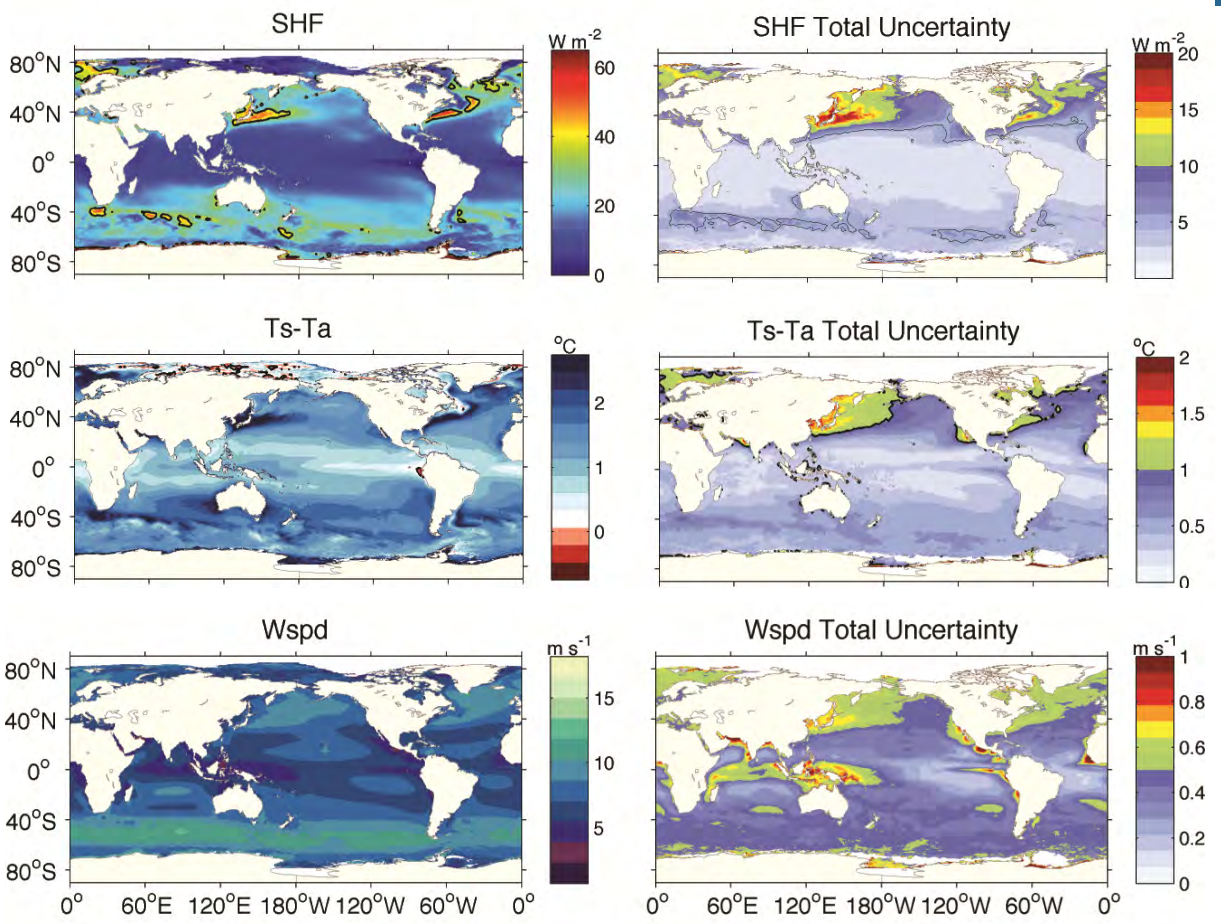
SEAFLUX

Uncertainty estimates of 10-year means



Variable	Global uncertainty
LHF (W m^{-2})	8.2 (9%)
SHF (W m^{-2})	4.2 (24%)
Windspeed (m s^{-1})	0.39 (5.2%)
Qa (g kg^{-1})	0.45 (4.0%)
SST (^{o}C)	0.12 (< 1%)
Ta (^{o}C)	0.35 (2%)
Ts - Ta (^{o}C)	0.44 (33%)
Qs - Qa (g kg^{-1})	0.27 (8.2%)

Uncertainty estimates of 10-year means



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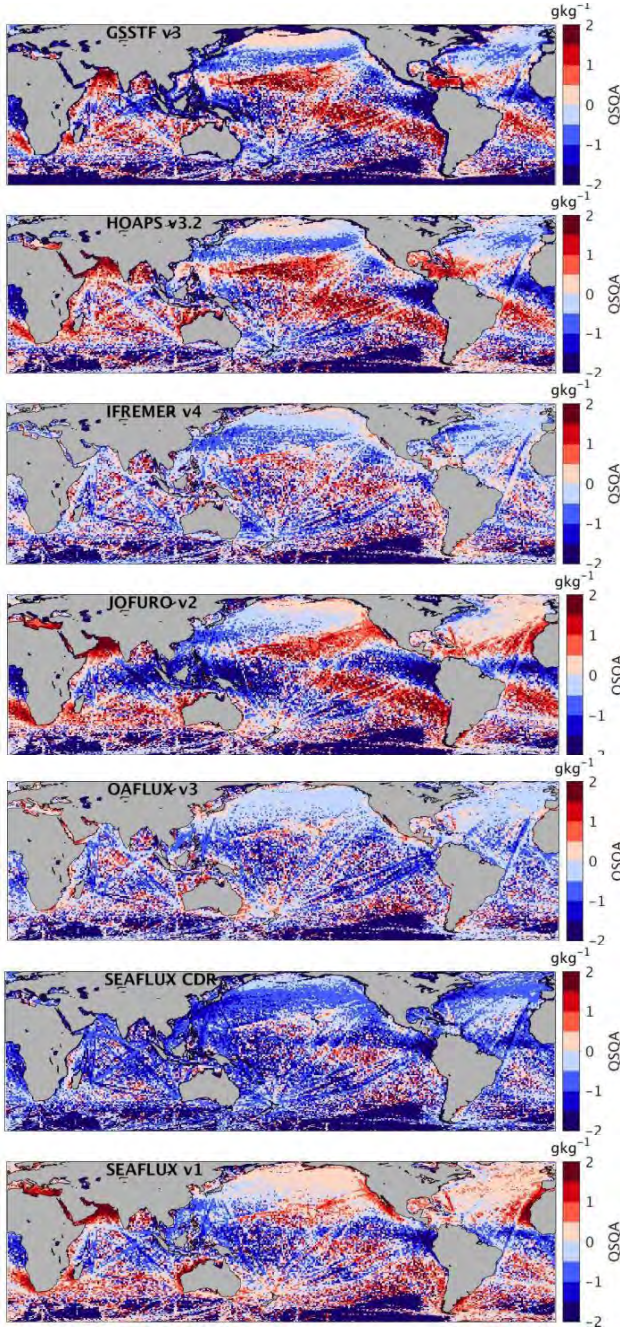
Regional biases (Qs-Qa)

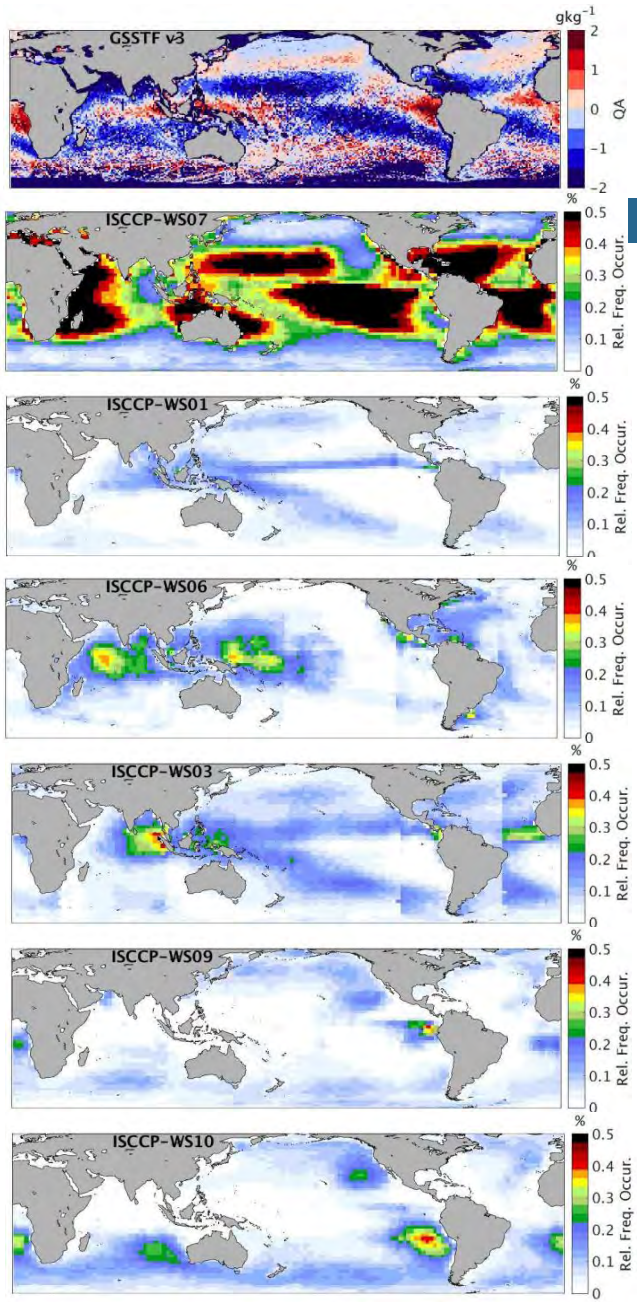
- Different products show strong regional patterns of biases compared to IVAD
- QSQA biases are driven primarily by differences in Qa retrievals rather than SST
- GSSTF v3, HOAPS v2, and JOFURO v2 all show a similar large scale pattern of biases, with strong regional signatures over the subtropical trade wind regimes and West Pacific STCZ
- IFREMER v4 and SeaFlux-V1 show muted regional signature, but they are still evident



Retrieval biases and weather states

- The structure in the retrieval (Qa, top) biases appear to be co-aligned with patterns of cloud weather states (defined by ISCCP cloud-top histograms)

- The largest biases in several of the Qa retrievals are aligned best with Global WS 7 (Tselioudis et al. 2012) – mostly clear, with thin boundary layer clouds



Final thoughts

There are multiple challenges at present for the development of accurate, precise, and consistent climate data records of turbulent latent and sensible heat fluxes.

- Large conditional/regional biases affect current remote sensing based estimates of near-surface air temperature and humidity, particularly under different cloud regimes
- Changes in the passive microwave observing system can generate anomalous variability in estimated turbulent fluxes:
- New advances are being made to address the development of climate-quality turbulent fluxes from remote sensing, including:
  1. Data Fusion
  2. New sensor development
  3. New approaches to handling cloud impacts on microwave TBs
  4. Improved sampling and analysis/blending techniques

جامعة الملك عبدالله
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King Abdullah University of
Science and Technology

Development and evaluation of global terrestrial fluxes

Matthew McCabe, Carlos Jimenez, Eric Wood, Amanda Siemann, Ali Ershadi, Diego Miralles
+ many other data contributors

Background: The LandFlux Project

Developing long-term terrestrial surface fluxes

GEWEX Data and Assessments Panel (GDAP) tasked with:

"*developing global, long-term, observationally based products of key water and energy cycle components*"

But there are considerable challenges in doing this:

- **Fluxes cannot** be monitored directly (needs to be inferred)
- **No** obvious best methodology
- **No** clear understanding of product quality (benchmarking)

esa European Space Agency

ESA funded WACMOS-ET project covered the period 2005-2007, focusing on ESA satellites

UNIVERSITEIT GENT

Estellus

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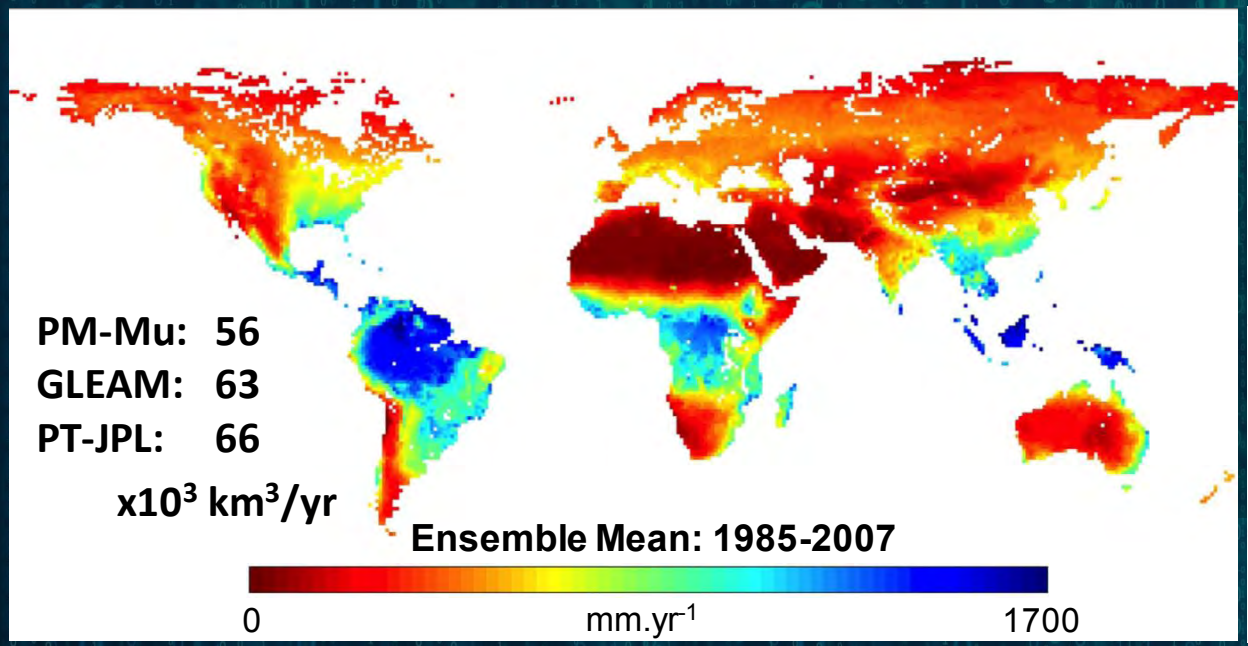
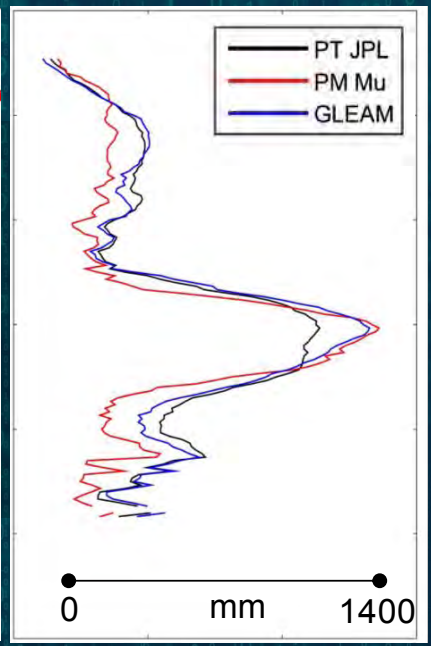
Background: Global Flux Products

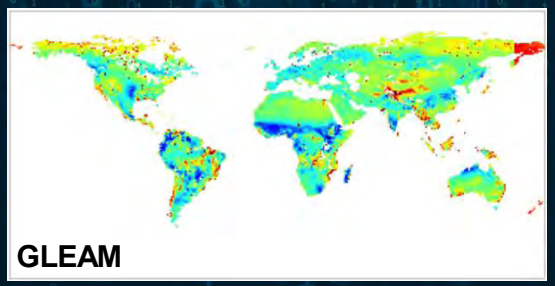
Specifications: conform to GDAP Guidelines

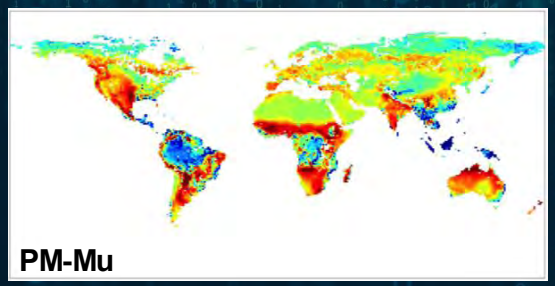
- 4 process-based models (GLEAM, PT-JPL, PM-Mu, SEBS)
- Long term product (LandFlux: 1984-2007) + WACMOS-ET (2005-07)
- 1° spatial resolution over all continents (but not ice surfaces**)
- 3-hourly temporal resolution (new for all models)
- Model forcing derived from a range of data-sources
  - **No clear choice** for "best" forcing data needs
  - Meteorology based largely on a Princeton dataset
  - Aimed for consistency with other GEWEX products

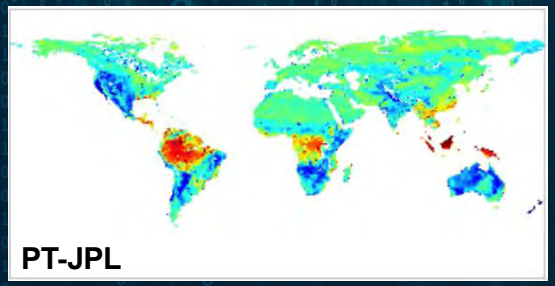
Global LandFlux Simulations











Model Mean - Ensemble Mean: 1985-2007

-300 0 300

Assessing Tower-to-Grid Scale Runs

- P-P plots at towers
- 1 to 99th percentiles with 25th, 50th, 75th

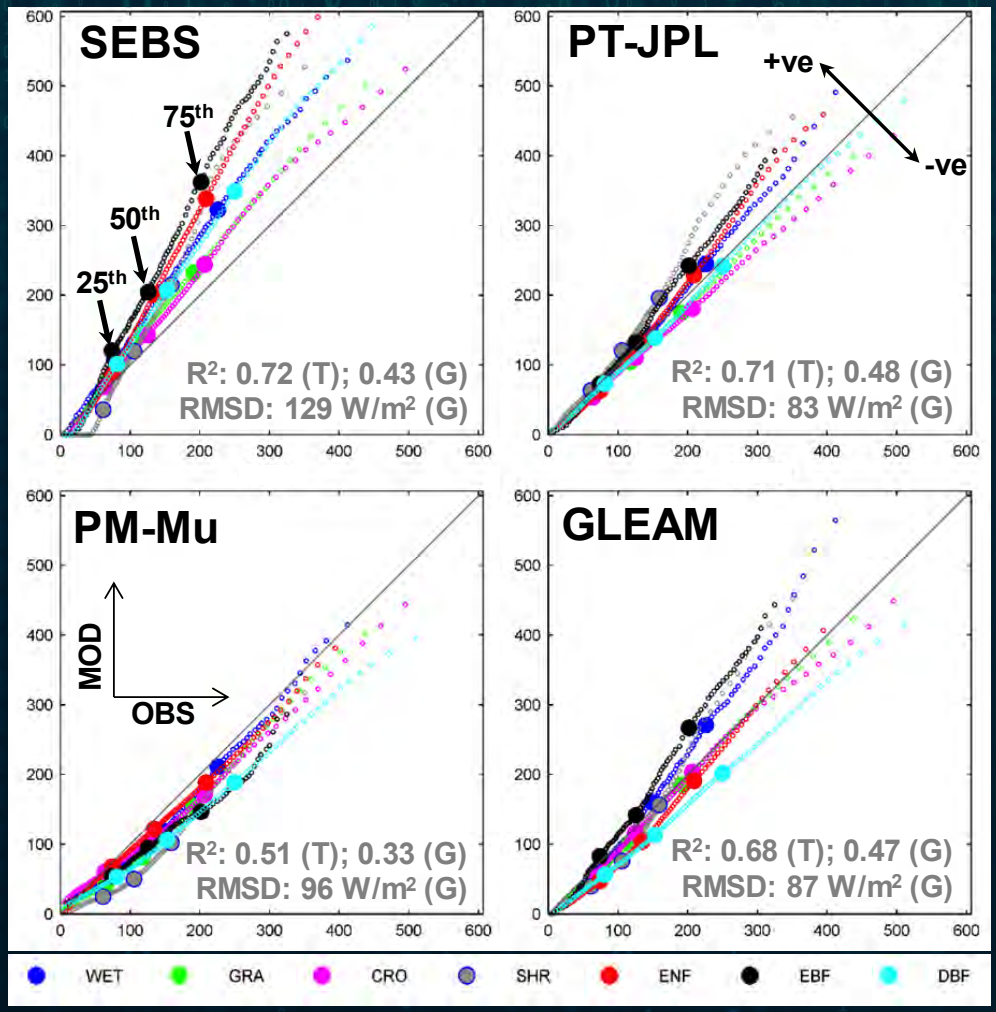
SEBS: over-predicts

PT-JPL: good response

PM-Mu: under-predict

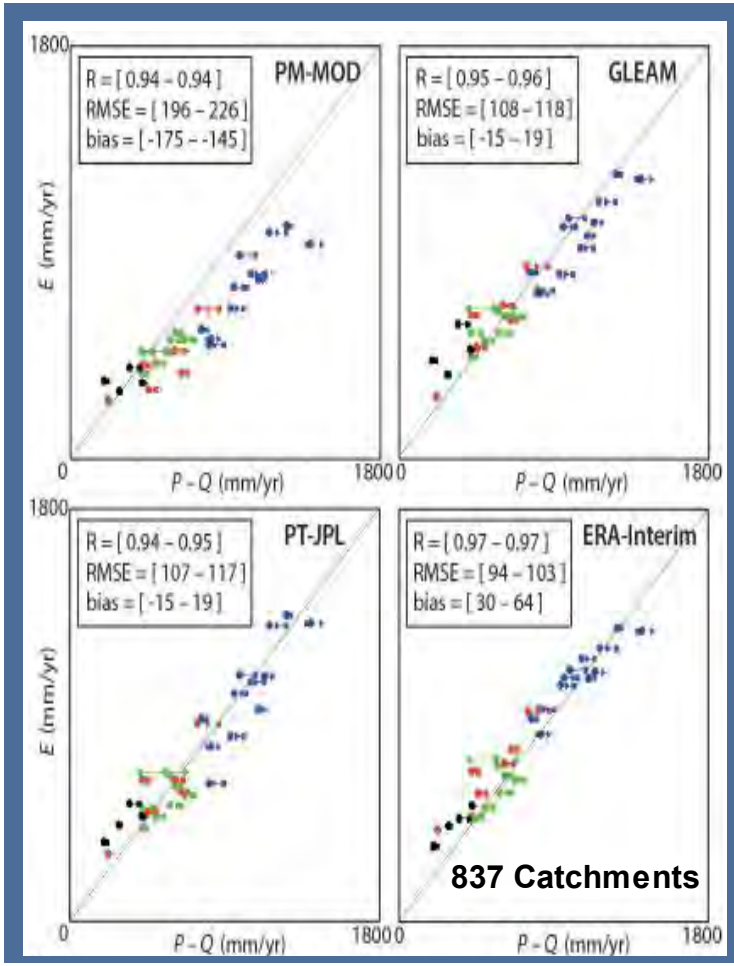
GLEAM: similar to JPL

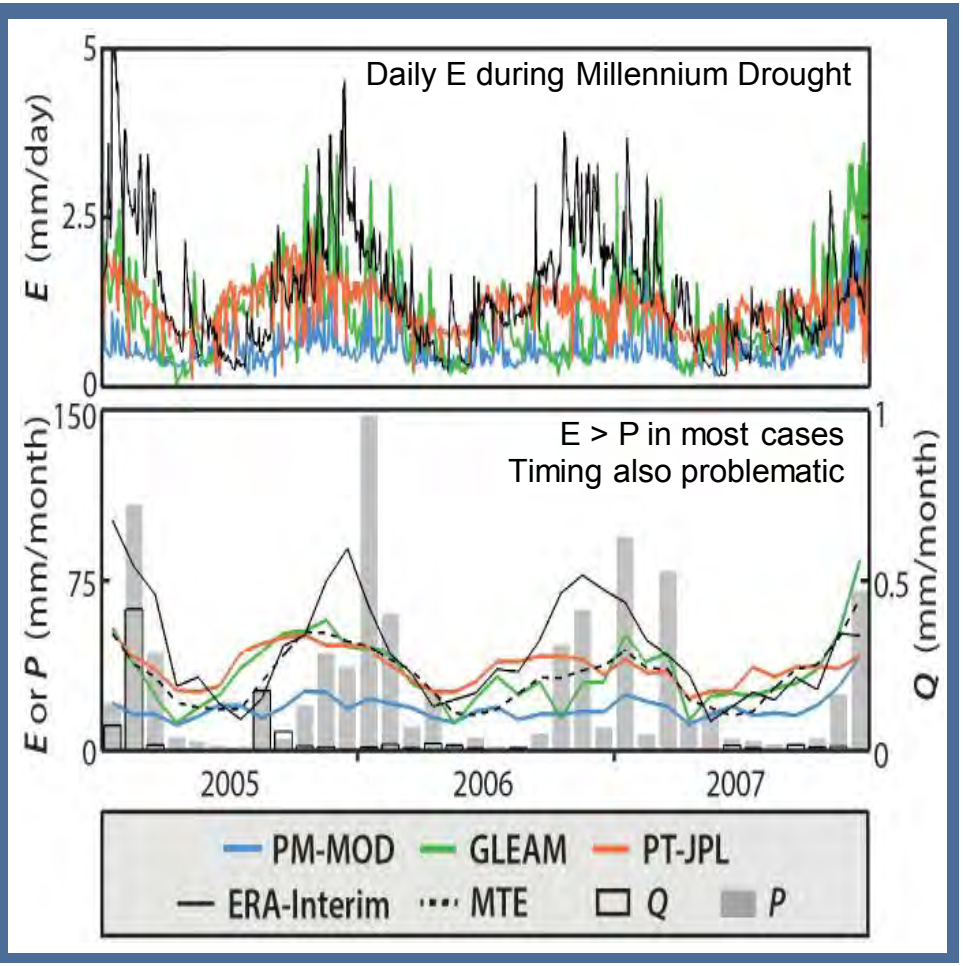
Grid-based runs degrade performance relative to towers



Assessing Water Budget Closure

Examining product response beyond the tower scale



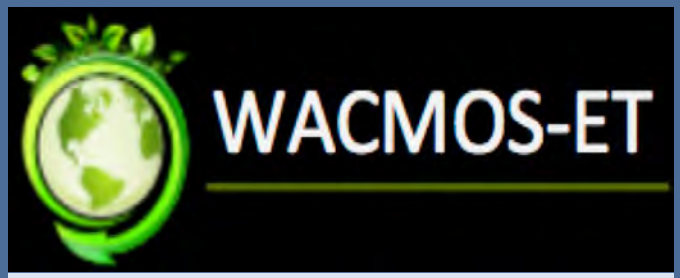


Project Summary and Overview

Development of global flux products

- Forcing data (consistency) is a constraint on model accuracy (H & LE)
- Considerable variability: no model works everywhere, or all the time
- Spatial and temporal resolution miss key processes (i.e. agriculture)
- Global averages are *somewhat* useful – need products that are fit for purpose (scales of relevance) and evaluated at those levels

http://hydrology.kaust.edu.sa/Landflux



http://wacmoset.estellus.eu

GEWEX Merged Product and GEWEX Integrated Product

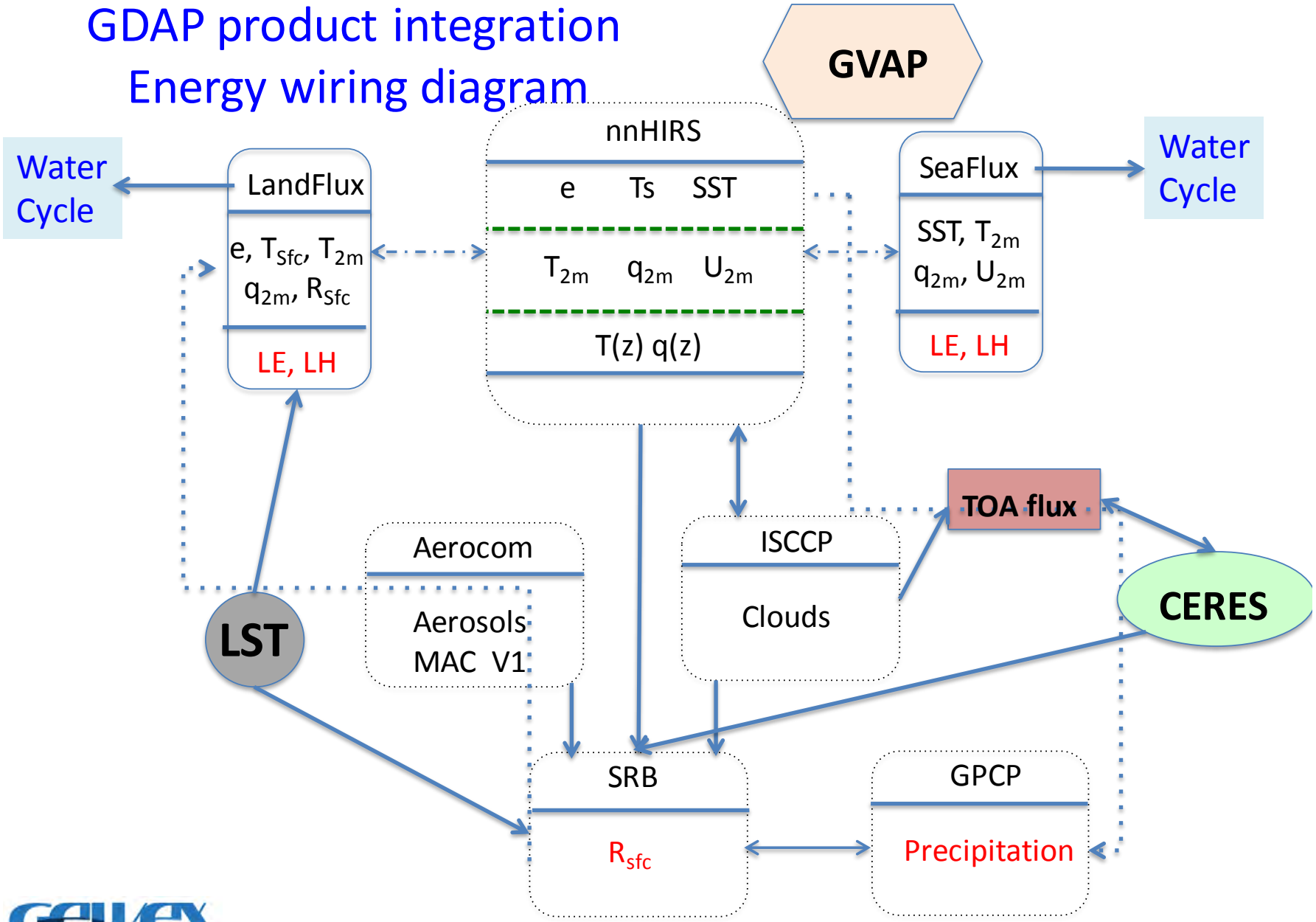
Paula Brown and Chris Kummerow

Products

The GEWEX Merged products puts these into a common file with common grids. The GEWEX Integrated product ensures full physical consistency between inputs. They both contain:

* Global Precipitation Climatology Project (GPCP)
* Int'l Satellite Cloud Climatology Project (ISCCP)
* Surface Radiation Budget (SRB)
* Sea Flux
* Land Flux (currently 3 potential products for LH)

GDAP product integration
Energy wiring diagram



ERA-5 and MERRA-2

* 3-D Water vapour/vapor?
* 3-D Wind speed and direction?
* Water vapor transport – across grid interfaces?
* Heat transport – across grid interfaces?

To Do

* Finalize list of inputs. 11/30
* Isolate parent file (common stuff) from ISCCP 11/30
* Regrid all products to 1°, 3-hourly equal-area grid 3/17
* Work on a flow chart showing interdependencies among products. Discussed briefly in Xiamen. 3/17
* Select variables for "user" merged dataset 11/30

  First guess: Time, grid #, sfc_type, TOA:SWup, TOA:LWup, SFC:SWdown, Sfc:LWdown, Sfc:SWup, Sfc:LWup, cloud optical thickness, aerosol optical depth, LH, SH, Precip.
* Write out a year of products & verify with providers 6/17
* Stage and write a GEWEX newsletter article. 9/17

GEWEX Data Quality Assessments

Clouds (Claudia Stubenrauch, Andrew Heidinger)

Water Vapor (Marc Schröder, Lei Shi)

Aerosol (Jeff Reid, Stefan Kinne, et al.)

Precipitation (Hiro Masunaga, Chris Kummerow)

Soil Moisture (Wouter Dorigo)

Update of
GEWEX Cloud Assessment Data base

Claudia Stubenrauch

Laboratoire de Météorologie Dynamique, IPSL, France

GDAP meeting, 29 Nov – 1 Dec 2016, Washington, USA

Datasets & Teams

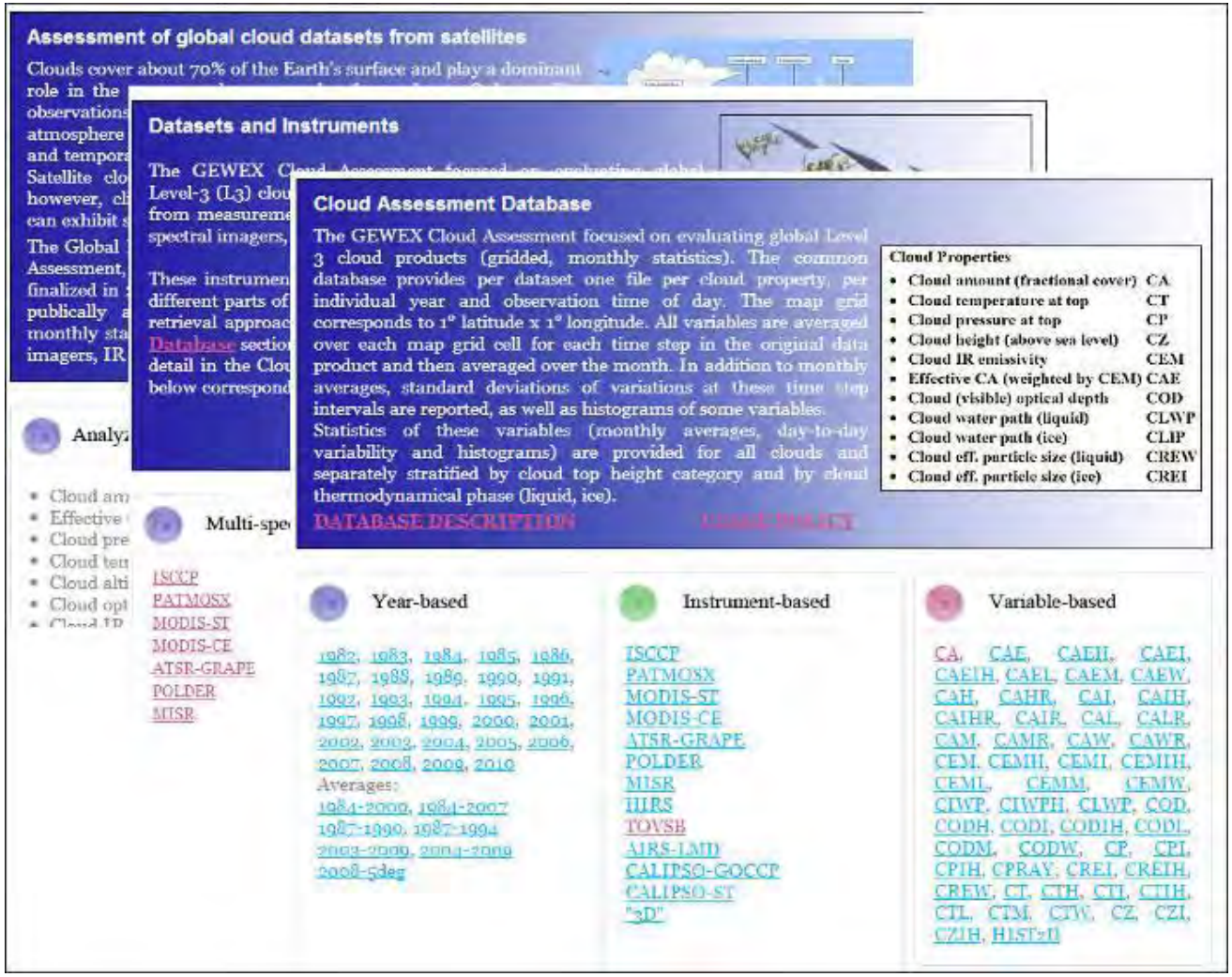
★ **updated data base:** improved versions + new data sets, -2016

global gridded L3 data (1° lat x 1° long) : monthly averages, variability, Probability Density Functions

ISCCP *GEWEX cloud dataset*	***1984-2007***	*(Rossow and Schiffer 1999)*
MODIS-ScienceTeam	***2001-2009***	*(Menzel et al.2008; Platnick et al. 2003)*
★ **MODIS-CERES**	***2001-2009***	*(Minnis et al. 2011)*
★ **TOVS Path-B -> HIRS-CM SAF**	***1987-1994***	*(Stubenrauch et al. 1999, 2006) ->CM SAF*
★ **AIRS-LMD**	***2003-2009***	*(Stubenrauch et al. 2010) -> AERIS*
★ **HIRS-NOAA**	***1982-2008***	*(Wylie et al. 2005)*
★ **PATMOS-x** (*AVHRR*)	***1982-2009***	*(Heidinger et al. 2012, Walther et al. 2012)*
★ **ATSR-GRAPE** -> **AATSR-Cloud_cci**	***2003-2009***	*(Sayer et al. 2011) -> ESA Cloud-cci*
★ **CALIPSO-ScienceTeam**	***2007-2008***	*(Winker et al. 2009)*
★ **CALIPSO-GOCCP**	***2007-2008***	*(Chepfer et al. 2010)*
★ **MISR**	***2001-2009***	*(DiGirolamo et al. 2010)*
POLDER	***2006-2008***	*(Parol et al. 2004; Ferlay et al. 2010)*
★ **IASI-LMD**	***2008-2016***	*French Data Centre AERIS*
★ **PATMOS-MODIS**		*NOAA*
★ **CLARA-CM SAF** (*AVHRR*)		*EUMETSAT Climate Monitoring, DWD*
★ **AVHRR-Cloud_cci**		*ESA, DWD*

GEWEX Cloud Assessment Web-site

A. Feofilov, LMD

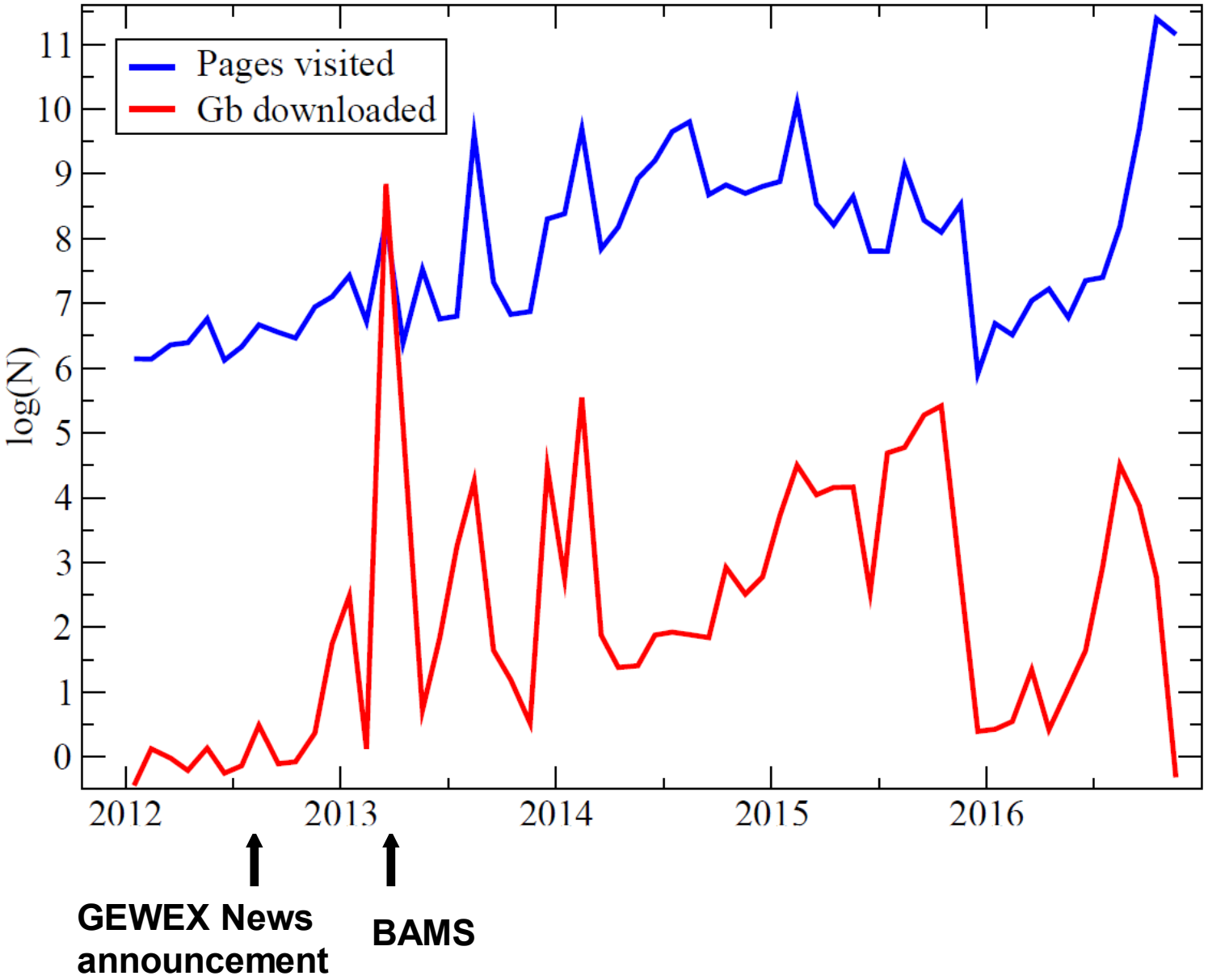


- **General sections:** description, meetings, publications, etc
- **"Datasets" :** provides individual descriptions
- **"Database" :** contains links to zipped netCDF files, grouped per variable, instrument and year, ftp-accessed.

http://climserv.ipsl.polytechnique.fr/gewexca

61

Statistics of Access to Web-site



Potential New Cloud Assessment and Link to CGMS ICWG

Andrew Heidinger
NOAA/NESDIS @CIMSS

Mike Foster and Andi Walther
Madison, Wisconsin USA

Thanks to Martin Stengel (ICWG Climate Topical Group Lead), Claudia Stubenrauch (Chair of GEWEX Cloud Assessment) and Stefan Kinne

ICWG Biennial workshop

The 1st biennial workshop of the ICWG, or ICWG-1, was held in Lille, France from 17 to 20 May 2016, with ~85 attendees. The workshop covered a wide range of topics concerning cloud parameter retrievals, its applications and related issues.

Key issues of the ICWG-1 are:

- *Cloud Modelling*
- *Cloud Parameter Retrievals from Combined Sensors*
- *Aggregation Methods for Climate Applications*
- *Assessment of Cloud Parameter Retrievals and their Uncertainty Estimates [LINK WITH IWWG]*
- *Cloud Parameters in Weather and Climate Applications*

ICWG-1

17-20 May 2016, Lille, France, Europe

Organized by Université de Lille 1 - Sciences & Technologies, France

Financially supported by EUMETSAT

Website: http://www.icare.univ-lille1.fr/crew/index.php/Welcome_ICWG.

GEWEX Cloud Assessment Discussion at IWCG

- The Climate Product Topical Group discussed the value of the GEWEX Cloud Assessment as an archive for level3 cloud climatologies in a shared format. To this end six of the participants present agreed to either add or extend their data holdings in the GEWEX archive (climserv.ipsl.polytechnique.fr/gewexca/):

SATCorps	**PATMOS-x**	**CLARA-A2**
HIRS CMSAF	**Cloud_CCI**	**CALIPSO**

- **Questions raised regarding the current GEWEX format included whether**:
  - The current level3 spatial resolution (1°x1°) would be sufficient for current and future model needs (perhaps add 0.5°x0.5° when possible)
  - We need to add or change included variables (CDNC, radiative properties)
  - Given the increase in AVHRR- and HIRS-derived records a method for satellite drift should be included;
  - Averaging standards should be developed to account for visible saturation for optical retrievals
  - Uncertainty estimates should be integrated into the averaging process.

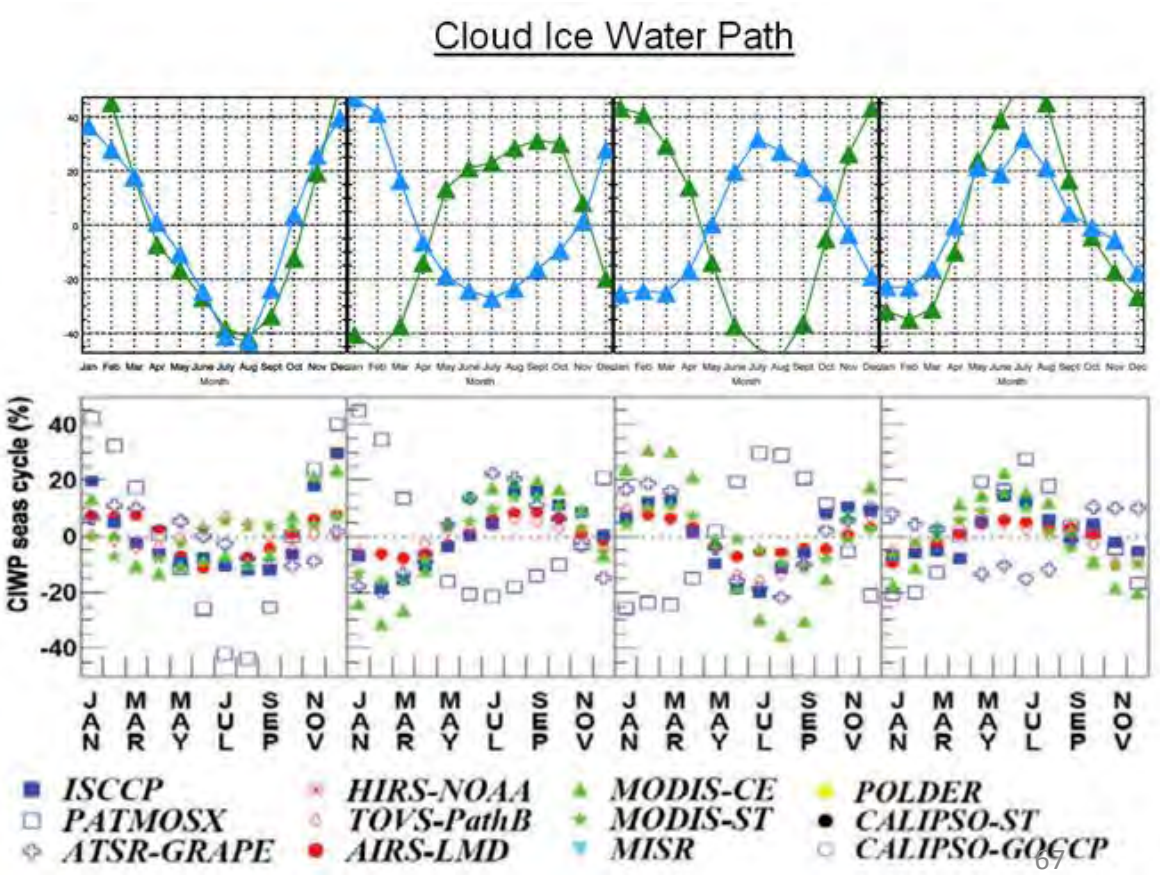
- **Recommendation to ICWG and GEWEX DAP**
  - The Climate Product Topical Group expressed interest in extending and expanding GEWEX Cloud Assessment activities in the ICWG framework.

ICWG climate topical group could serve as a platform for studying areas identified as weaknesses or outstanding questions that apply to all or many of the GEWEX CA cloud climate records

GEWEX Cloud Assessment Improvements

- Many of the GEWEX data sets are improving.
- Work continues to improve their stability.
- For example, EUMETSAT CM SAF CLARA-A2 is much more stable than CLARA-A1.
- PATMOS-x will fix its error in IWP in the GEWEX CA library where the annual cycle was off.
- In summary, the GEWEX CA data is getting better over time.
- GEWEX CA report has helped identify many issues that have been

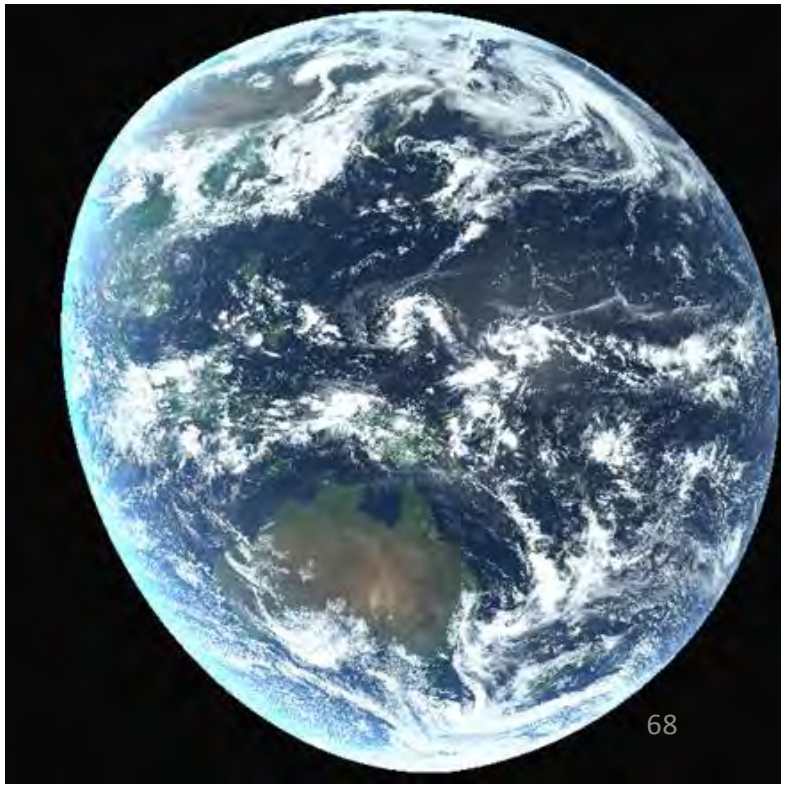
Example of improvement in the GEWEX CA (PATMOS-x IWP) The error was in generation of the averages,, not the algorithm



New Geostationary Imagers

- We are in period where the geo constellation is being updated and unified.
- MODIS-like spatial and spectral information
- Temporal sampling is 10 minutes for full disk and it will be synchronized (imho).
- Common channels in 1980 were 0.65 & 11 micron
- New common channels (AHI, ABI, AMI, FY-4, MTG): 0.45, 0.65, 0.86, 1.6, 3.75, 6.2, 7.2, 8.5, 11, 12, 13.3 micron
- Except for MTG, all of the imagers made by ITT - perhaps leads to commonality in calibration and navigation quality.

True Color at 10 minutes from AHI



Thoughts on New Cloud Assessment

- We have established there is broad interest in extending and improving the GEWEX CA Library.

- ICWG is still defining what to do?
  a. Redo the first assessment (new products, new resolution)
  b. Spawn off focused assessments (i.e. cloud water path)
  c. Apply the GEWEX CA library to some interesting questions using uniform analysis.
     - k-means cluster analysis is possible with this data
     - Library is applicable to some of the grand challenge questions
  d. Something entirely different (Obs4Mips, ISCCP-centric ?)

- GDAP may help in this definition;
- ICWG has willingness to report to GDAP

The GEWEX water vapor assessment (G-VAP)

Marc Schröder, Maarit Lockhoff, Kathrin Graw, Lei Shi

Thanks goes to

Thomas August, Ralf Bennartz, Bojan Bojkov, Eva Borbas, Xavier Calbet, Heather Cronk, Frank Fell, John Forsythe, Antonia Gambacorta, Kathrin Graw, Ben Ho, Heidrun Höschen, Julian Kinzel, Robert Kursinski, Anthony Reale, Remy Roca, Noelle Scott, Jörg Schulz, Tim Trent, Thomas Vonder Haar, Andi Walther

Status of G-VAP

- The major purpose of GEWEX water vapor assessment (G-VAP) is to quantify the state of the art in water vapour products being constructed for climate applications;
- Support the selection process of suitable water vapour products by the GEWEX Data and Assessments Panel (GDAP) for its production of globally consistent water and energy cycle products.
- Further details, in particular the assessment plan with a description of the scope and the Science Questions and an overview of available water vapour records, are available on the G-VAP webpage, http://gewex-vap.org.
- Assessment report is finalised and under review by GDAP,
- Report contains recommendations to international bodies, space agencies and individual PIs producing water vapour data records;
- G-VAP group plans continuation of the assessment work which was endorsed by last GDAP;
- EUMETSAT is continuing its funding of the central data base, workshops and presentations at GDAP meetings.

Recommendation

- CGMS, Space Agencies: Improve upon current satellite profiling capabilities with goals of providing high precision and long term stability, with sufficient vertical resolution, complete, unbiased global sampling and independency of models (sections 4.3.2.3 and 6.2).
- CGMS, Space Agencies: Dedicated validation archive for all water vapour sensors, also including ship based RS (sections 4.1, 6.4).
- CGMS, WMO, GRUAN: Aim at the sustained generation and development of a stable, bias corrected multi-station radiosonde archive including reprocessing of historical data (section 6.4).
- CGMS, WMO: Achieve consistency among reference observing systems and sustain corresponding services (section 6.3).
- WMO, GCOS: Oppose and balance user, scientific and product requirements with focus on climate analysis.
- Space Agencies: Need for continental high quality satellite data records.
- Space Agencies: Need for inter-calibrated radiance/brightness temperature data records and homogeneously reprocessed instantaneous satellite data records (sections 4.2.2, 4.3, 4.4).
- Space Agencies, GEWEX: Provide water vapour transport product in order to analyse atmospheric dynamics and to evaluate the constancy of relative humidity.
- Space Agencies, PIs: Develop and provide PDF based climatology of satellite-based radio-occultation data (section 6.2).
- Space Agencies, PIs: Provide averaging kernels, a priori state vectors and associated error covariance matrices together with the release of profile products (section 2.5).
- Space Agencies, PIs: Provide uncertainty information and assess uncertainty as function of total amounts and other dependent parameters (sections 3.2, 4.3.1.4, 6.4).

www.gewex-vap.org

→ Data Records

- **Satellite and reanalysis data records**
- **Operational satellite data**
- **Ground-based/in-situ data records**

TECHNIQUE	DATASET	PARAMETERS	TEMPORAL COVERAGE	SPATIAL COVERAGE	TEMPORAL RESOLUTION	SPATIAL RESOLUTION	MORE INFORMATION
(A)ATSR	AIRWAVE	TCWV	08/1991-03/2012	global	monthly	0.25°	Castelli et al., 2015
AATSR, HIRS, SSM/I, GNSS	NVAP-M Climate	TCWV, WV	01/1988-12/2009	global	daily, monthly	1.0°	DFS
AIRS, AMSU, HSB	NASA	TCWV, WV, T	09/2002-present	global	daily, monthly	1°, 12 levels	WEB
AIRS, AMSU-A, CPR, MODIS	WVCC	WV, T	07/2006-11/2012	global	daily-weekly	45 km	WEB
AMSR-E	REMSS	TCWV	06/2002-09/2011	global ocean	monthly	0.25°	WEB Hilburn and Wentz, 2008
AMSR-E	JAXA	TCWV	06/2002-10/2011	global ocean	monthly	0.25°	WEB
AMSU-B	U Miami	UTH	01/1999-12/2014	global, 60°N-60°S	monthly	1.5°	Chung et al., 2013
AMSU-B	LTU	UTH	01/1999-05/2008	global, 60°N-60°S	monthly	2.5°	WEB

With support from F. Fell

Last Workshops

Place: EUMETSAT HQ, Darmstadt, Germany
Date: 22+23 September 2016
Summary: available at http://www.gewex-vap.org

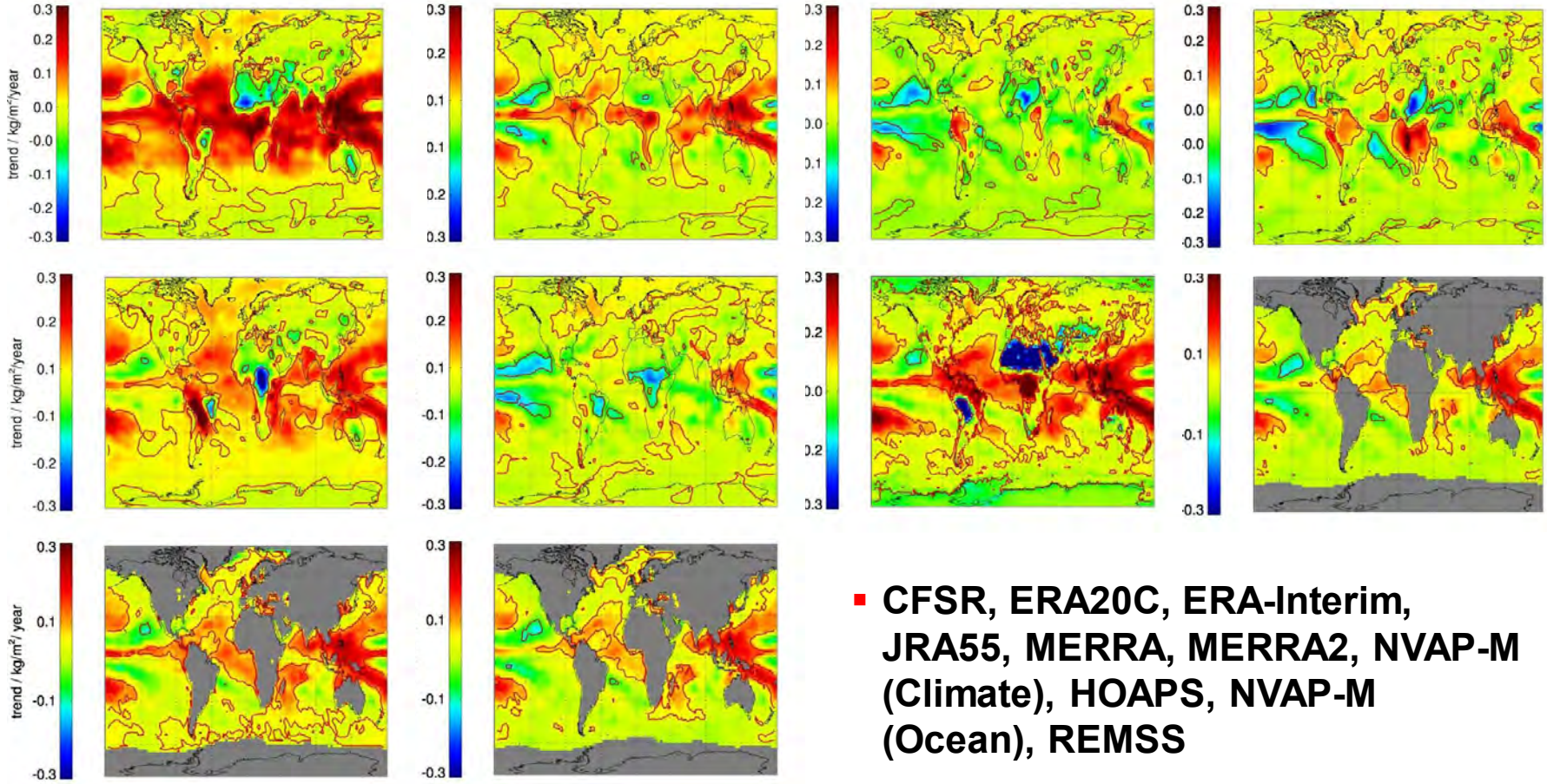
~25 participants from various nations and institutions.

All presentations are available online.

Publications related to G-VAP
(subset)

- **Courcoux, N. and Schröder, M.:** The CM SAF ATOVS data record: overview of methodology and evaluation of total column water and profiles of tropospheric humidity, Earth Syst. Sci. Data, 7, 397-414, doi:10.5194/essd-7-397-2015, 2015.
- **Kinzel, J., K. Fennig, M. Schröder, A. Andersson, K. Bumke, and R. Hollmann, 2016**: Decomposition of Random Errors Inherent to HOAPS-3.2 Near-Surface Humidity Estimates Using Multiple Triple Collocation Analysis. Accepted by JAOT.
- **Mieruch, S., M. Schröder, S. Noel, and J. Schulz, 2014:** Comparison of decadal global water vapor changes derived from independent satellite time series. *J. Geophys. Res. Atmos*., 119, doi:10.1002/2014JD021588.
- **Schröder, M., M. Jonas, R. Lindau, J. Schulz, and K. Fennig, 2013**: The CM SAF SSM/I-based total column water vapour climate data record: methods and evaluation against re-analyses and satellite. *Atmos. Meas. Tech.*, 6, 765–775, doi:10.5194/amt-6-765-2013.
- **Schröder, M., R. Roca, L. Picon, A. Kniffka, and H. Brogniez, 2014:** Climatology of free tropospheric humidity: extension into the SEVIRI era, evaluation and exemplary analysis. Atmos. Chem. Phys., 14, 11129-11148, doi:10.5194/acp-14-11129-2014.
- **Shi, L., C. J. Schreck III, and V. O. John:** HIRS channel 12 brightness temperature dataset and its correlations with major climate indices, *Atmos. Chem. Phys.*, 13, 6907-6920, doi:10.5194/acp-13-6907-2013, 2013.
- **Schröder, M., M. Lockhoff, J. Forsythe, H. Cronk, T. Vonder Haar, R. Bennartz**, 2016: The GEWEX water vapor assessment: Results from intercomparison, trend and homogeneity analysis of total column water vapour. J. Applied Meteor. Clim., 1633-1649, 55 (7), doi: /10.1175/JAMC-D-15-0304.1.
- **Trent, T., M. Schröder, J. Remedios,** 2016**:** Assessment of AIRS tropospheric humidity profiles with characterised radiosonde soundings within the GEWEX water vapor assessment. Submitted to JGR*.

Trend estimates



Updated from Schröder et al. (2016)

- **CFSR, ERA20C, ERA-Interim, JRA55, MERRA, MERRA2, NVAP-M (Climate), HOAPS, NVAP-M (Ocean), REMSS**
- **Mostly statistically significantly different, e.g. on global ocean scale.**

Regression, Time-to-detect

	Trend kg/m^2/decade	Regression % / K	TTD* years
CFSR	1.21 ± 0.16	24.9 ± 0.5	33
ERA-Interim	-0.11 ± 0.09	2.9 ± 0.5	22
ERA20C	0.37 ± 0.06	10.0 ± 0.2	18
HOAPS	0.25 ± 0.07	7.2 ± 0.3	18
JRA55	0.03 ± 0.06	2.6 ± 0.4	17
MERRA	0.75 ± 0.09	15.8 ± 0.3	22
MERRA2	0.04 ± 0.06	4.4 ± 0.3	17
nnHIRS	-1.51 ± 0.17	14.2 ± 1.3	35
NVAP-M Climate	0.68 ± 0.20	8.4 ± 0.7	37
NVAP-M Ocean	0.52 ± 0.07	10.1 ± 0.3	18
REMSS	0.34 ± 0.06	7.6 ± 0.3	17

- **Trend and regression values for previous slide.**
- **Largely no match with theory.**
- **Large diversity in TTD (function of noise and autcorrelation).**
- **Extremes values dominated by noise.**

AOT (AEROSOL) assessment

AOT – Aerosol Optical Thickness

Sundar Christopher
Richard Ferrare
Paul Ginoux
Stefan Kinne
Jeffrey Reid
Paul Stackhouse
Charles Ichoku

Hal Maring

The Assessment

- A Critical Review of the Efficacy of Commonly Used Aerosol Optical Thickness Retrievals
  - literature assessment
  - report to the Radiation Committee of GEWEX
    - commissioned by NASA Radiation Sci. Prog.
  - draft: July 20, 2015
  - assessment Panel:
    - Jeffrey S. Reid (editor), Sundar A. Christopher, Richard A. Ferrare, Paul A. Ginoux, Stefan Kinne, Gregory G. Leptoukh, W. Stackhouse
  - oversight:
    - Hal B. Maring, Charles M. Ichoku

the reports content

- level 3 1x1 monthly gridded AOD products
  - averaged, without or without objective error
  - these data-sets are numerous and available
  - Nature of the Problem: Fundamentals of Satellite Based Aerosol Products / Applications
  - Overview of Assessed Satellite Products
  - Evaluation of Product Evaluation, Verification and Intercomparion Studies
  - Satellite and model relationships
  - Aerosol Optical Thickness Trends

the status

- the good news
  - a BIG report exists (+ 80 pages of references)
- the bad news
  - little has happened during the last year (the latest version still has a July 2015 date)
  - … as Jeff (assuming overall responsibility) wanted to include new items (on the SE Asia hot-spot, MODIS, MISR)… he was side-tracked
- the way out ?
  - support and encourage Jeff …

– still relevant? new things happened since !

new developments

- AeroSAT
  - internally ongoing assessments !
  - uncertainty
  - air quality ?
  - new satellites
  - retrieval model issues
  - longterm records
  - vs modeling
  - new challenges

AeroSAT topics … at Beijing 2016

- characterizing retrieval uncertainty
  - pixel uncertainty required in assimilations
- challenges for contributions to air quality ass.
  - column properties vs near surface needs
- constraining aerosol type
  - since arbitrary … just for administrators ?
- long-term data record
  - are records accurate/long enough for trends?

Summary

- the GEWEX report is a great resources
  - but mainly for older, circulated data-sets
  - but too large for quick answers to users
  - Ex GDAP chair agreedto work on people to publish the report

- the aerosol retrieval community now meets regularly to share ideas / interact with users
  - but multi-sensor capabilities are avoided

- for climate records
  - applying the same successful retrievals (e.g. dark target, tanre ocean) to different sensors

GDAP Precipitation Assessment

HIRO MASUNAGA AND CHRIS KUMMEROW

GDAP Precipitation Assessment Plan

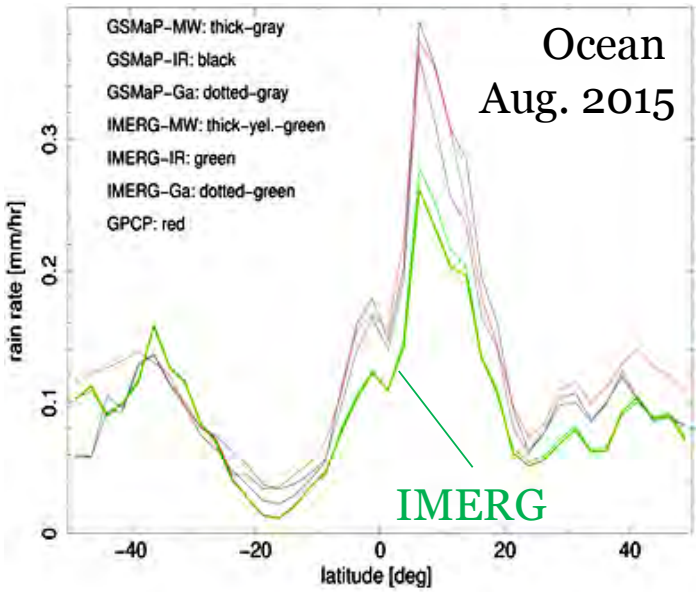
- Need for a new precipitation assessment
  - Increasing availability of precipitation products
  - Recent satellite programs such as GPM
- Lessons learned from previous assessments
  - Past GRP/GDAP Assessment Reports, while thorough and detailed, took nearly a decade to complete.
  - It is desired, however, to address the urgent needs of broad science community in a timely manner.
- Strategies for timely delivery of assessment reports
  - **1)** *Publish a series of concise interim reports.*
  - **2)** *Identify the foci of assessment in advance.*

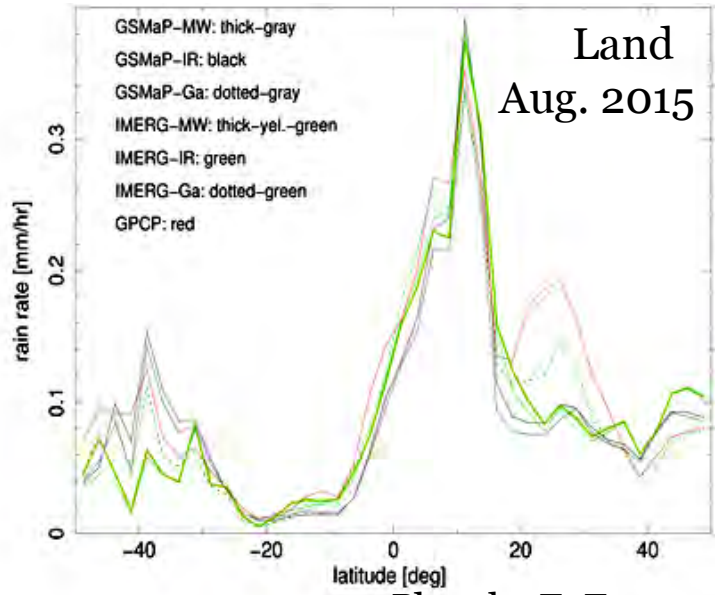
Assessment foci

- The list of prioritized foci for the assessment
  - **1) *Global and Regional Climatology (long-term mean and trend)***
  - **2)** *Time series analysis in the context of different modes of climate variability*
  - ***3) Extremes***
  - **4)** *Frozen precipitation*
  - **5)** *Structural Errors*

Global multi-satellite datasets

- Zonal mean rainfall (August 2015)
  - Global mutli-satellite data products are compared as a starting point, since they are among the most widely used.
    - GPCP, IMERG (MW, IR, & Ga), and GSMaP (MW, IR, & Ga)

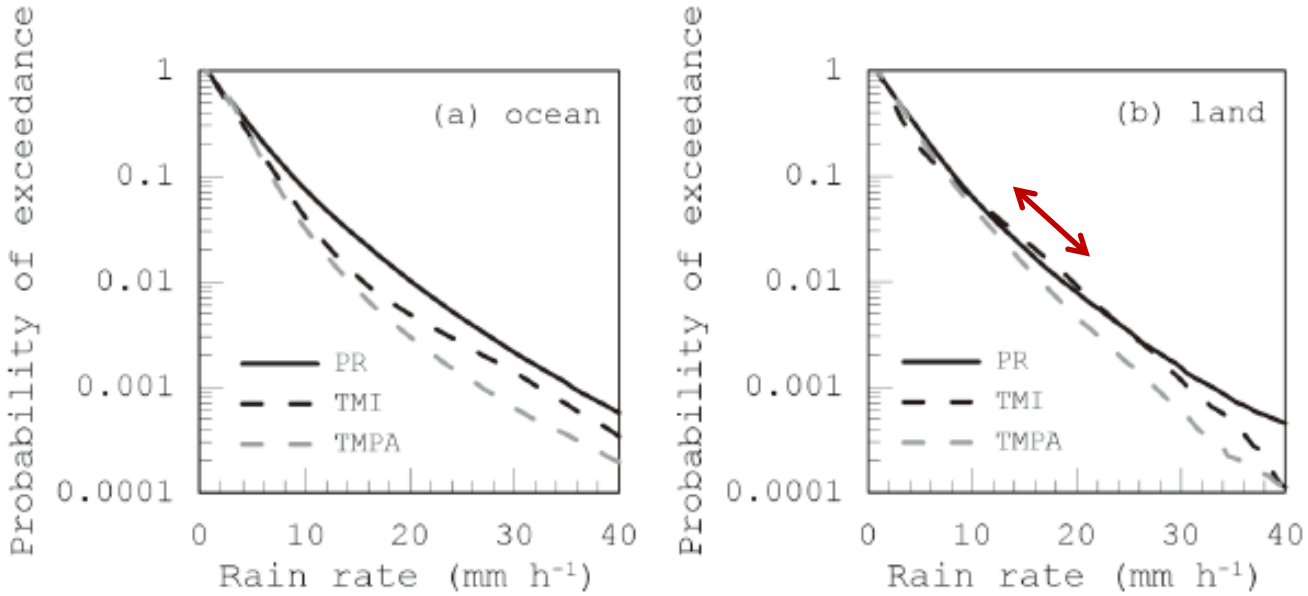




Plots by F. Furuzawa

TRMM rains over maritime continents

- PDF of PR, TMI, and TMPA rains



PR best captures extreme rainfall events over ocean.

TMI beats PR for a range of 10-20 mm/h over land.

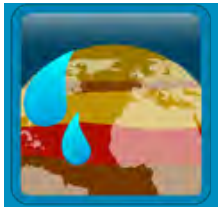
Sekaranom and Masunaga (submitted to JAMC)

Summary

- Intercomparison of global multi-satellite products
  - Pilot study with IMERG and GSMaP
    - MW products agree reasonably between IMERG and GSMaP.
    - When combined with IR, the discrepancy is vastly expanded.
    - And gets worse when calibrated with gauges.
- Extreme rainfall from the three TRMM products
  - PR>TMI for light and extreme rains, while TMI<PR for moderately heavy rain over land.
    - The empirical PCT-rain relation is even trickier than one might think.

Outstanding issues

- Review findings with product developers
- Test for temporal homogeneity of data sets
- Find some independent in-situ data for absolute reference to anchor results.
- Continue publishing results
- GDAP commented that the assessment shall be more inclusive by taking more data sets and producers into the process also to benefit from momentum from the CGMS IPWG. A workshop may also be worthwhile to make the assessment better known among the data producers.



Towards Soin Moisture assessment

- To achieve general consensus Wouter Dorigo initiated the ISSI International Team “Adding value to soil moisture information for climate studies”
  - First meeting in November 2014
  - Second meeting in November 2015
- Group planned to draft a **validation whitebook** with a selected group scientists (2015) which will be discussed and iterated with the soil moisture community at large next year (e.g SMAP cal/val + SM workshop in Feb. 2016);
- The consented whitebook toserve as the **official guideline for a soil moisture assessment activity has not been finalised and no review by GDAP was performed;**
- Assessment start uncertain.

esa

Ground-based observations

BSRN (Chuck Long)

ISMN (Wouter Dorigo)

GPCC (Andreas Becker, Udo Schneider)

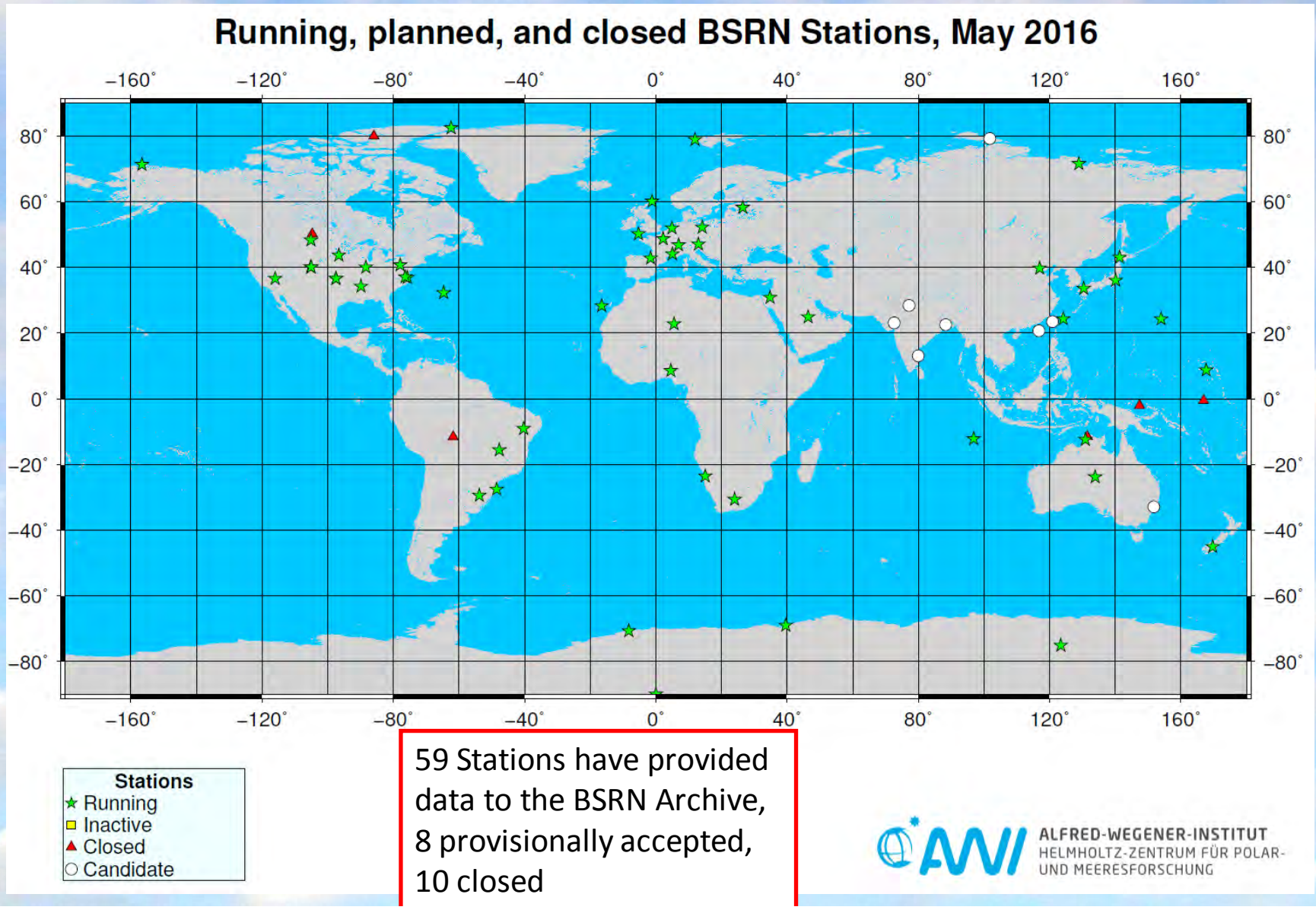
ARM (Jim Mather)

BSRN Scientific Review and Workshop

- 14th BSRN Scientific Review Workshop
  - 26-29 April 2016 in Canberra, Australia
  - Hosted by Australian BoM
  - Host Nicole Hyett

https://www.wcrp-climate.org/WCRP_Reports/2016/WCRP_Report_17_2016_14th_BSRN_Meeting_Report.pdf

Current Stations: 2016



State of the WRMC (Sept 2016): 9011 station-months available

Baseline Surface Radiation Network

[BSRN homepage] - [Staff | Stations | Parameter | Methods] - [**LR0100** | LR0300 | LR0500 | LR1000 | LR1100 | LR1200 | LR1300 | LR3010 | LR3030 | LR3300 | All | latest datasets]

Click on a number shows a list of all datasets for selected year and station.

Station	Short name	Station scientist currently in charge	pre BSRN	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2014	2015	All
Alert	ALE	Christopher Cox (christopher.j.cox@noaa.gov)														5	12	12	12					X
Alice Springs	ASP	Bruce Forgan (B.Forgan@bom.gov.au)					12	12	12	12	12	12	11	12	12	12	12	12						X
Barrow	BAR	David Longenecker (David.U.Longenecker@noaa.gov)		12	12	12	12	12	12	12	12	12	12	12	12	12								X
Bermuda	BER	David Longenecker (David.U.Longenecker@noaa.gov)		12	12	12	12	12	12	12	12	12	12	12	10							2			X
Billings	BIL	Charles Long (chuck.long@noaa.gov)			4	12	12	12	12	12	12	12	11								12	4			X
Bondville	BON	John Augustine (John.A.Augustine@noaa.gov)					12	12	12	12	12	12													X
Boulder, SURFRAD	BOS	John Augustine (John.A.Augustine@noaa.gov)					5	12	12	12										12	6				X
Boulder	BOU	David Longenecker (David.U.Longenecker@noaa.gov)		12	12	12	12	12	12									12	12	12	12	12	12	7	X
Brasilia	BRB	Enio Bueno Pereira (eniobp@cptec.inpe.br)																8	10	4	12	12	12	1	X
Cabauw	CAB	Wouter Knap (knap@knmi.nl)															11	12	12	12	12	12	12	8	X
Camborne	CAM	Jonathan Tamlyn (jonathan.tamlyn@metoffice.gov.uk)												12	12	12	12	12	12	12	1			7	X
Carpentras	CAR	Thierry Duprat (thierry.duprat@meteo.fr)										12	12	12	12	12	12	12	12	12	12	12	12	6	X
Chesapeake Light	CLH	Fred M. Denn (Frederick.M.Denn@nasa.gov)										8	12	11	12	12	12	12	12	12	12	12	12	8	X
Cener	CNR	Xabier Olano (xolano@cener.com)																			6	12	12	7	X
Cocos Island	COC	Bruce Forgan (B.Forgan@bom.gov.au)														3	10	8	12	12	12	12	12	3	X
De Aar	DAA	Lucky Ntsangwane (lucky.ntsan										7	6	12	11	12	1								X
Darwin	DAR	Charles Long (chuck.lo												10	12	12	12	12	12	12	12	12	12	1	X
Desert Rock	DRA	John Augustin								10	12	12	12	12	12	12	12	12	12	12	6				X
Concordia Station	DOM	Vito																12	12	12	12	2			X
Darwin Met Office	DWN																			12	12	12	12	9	12	3	X
Eureka																			4	12	12	12	12				X
Southern Great Pl		noaa.gov)				12	7	12	12	12	12	12	12	12	12	12	12	12	12	12	11	12	12	4			X
Florianop		emc.ufsc.br)				6	12	12	10	12	12	9	12	12	12	12	12								4	12	6	X
Fort Peck		ustine (John.A.Augustine@noaa.gov)					12	12	12	12	12	12	12	12	12	12	12	12	12	12	6						X
Fukuoka		asao Omori (rrc-jma@met.kishou.go.jpp)																				9	12	12	12	12	7	X
Goodwin Cree		John Augustine (John.A.Augustine@noaa.gov)					12	12	12	12	12	12	12	12	12	12	12	12	12	12	6						X
Gobabeb	GOB	Roland Vogt (roland.vogt@unibas.ch)																					8	12	12	8	X
Neumayer Station	GVN	Gert König-Langlo (Gert.Koenig-Langlo@awi.de)	121	9	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	1	X
Lauder	LAU	Bruce Forgan (B.Forgan@bom.gov.au)																									
Lerwick	LER	Jonathan Tamlyn (jonathan.tamlyn@metoffice.gov.uk)											12	12	12	12	11	11	12	5				12	8	X
Lindenberg	LIN	Klaus Behrens (Klaus.Behrens@dwd.de)				3	12	12	12	12	12	12	12	12	12	12	12	12	4							X
Langley Research Center	LRC	Fred M. Denn (Frederick.M.Denn@nasa.gov)																						1	8	X
Momote	MAN	Charles Long (chuck.long@noaa.gov)						3	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	10			X
Minamitorishima	MNM	Masao Omori (rrc-jma@met.kishou.go.jp)																				9	12	12	12	7	X
Nauru Island	NAU	Charles Long (chuck.long@noaa.gov)								2	12	12	12	12	12	12	12	12	12	12	12	12	12	9			X
Ny-Ålesund	NYA	Marion Maturilli (Marion.Maturilli@awi.de)		5	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12			X

> 750 years of radiation measurements

Total of 23 stations measure complete up and down radiation budget

Scientific Impact

Web of Science™ | InCites™ | Journal Citation Reports® | Essential Science Indicators℠ | EndNote™ | Sign In | Help | English

WEB OF SCIENCE™ — THOMSON REUTERS

Search | My Tools | Search History | Marked List

Citation Report: 128

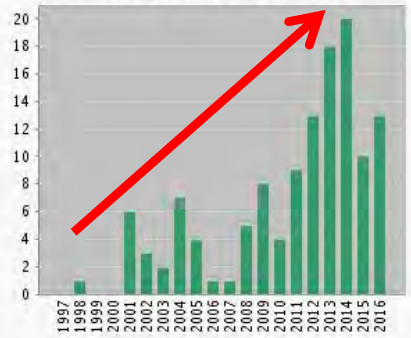
(from All Databases)

You searched for: TOPIC: (BSRN) ...More

This report reflects citations to source items indexed within All Databases.

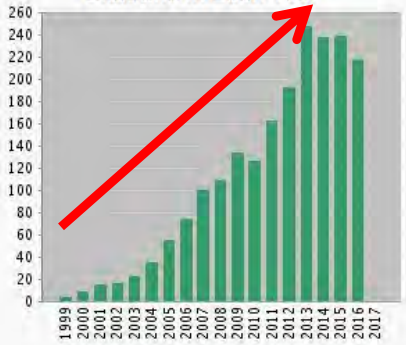
Cited over 1800 times without self-citations
In over 1400 articles
Producing an h-index of 21…
And climbing!

Published Items in Each Year



The latest 20 years are displayed.
View a graph with all years.

Citations in Each Year



The latest 20 years are displayed.

Results found:	128
Sum of the Times Cited [?] :	[illegible]
Sum of Times Cited without self-citations [?] :	1853
Citing Articles [?] :	[illegible]
Citing Articles without self-citations [?] :	1444
Average Citations per Item [?] :	[illegible]
h-index [?] :	21

Sort by: Times Cited -- highest to lowest

Page 1 of 13

BSRN Working Groups (Active)

- Infrared Working Group (Julian Gröbner)
- Spectral Working Group (Kathy Lantz)
- Broadband Shortwave Working Group (Allison McComiskey)
- Cold Climate Issues Working Group (Chris Cox)
- Uncertainties Working Group (Nicole Hyett ~ Interim Ian Dollery)
- Long-Term Data Sets Working Group (Martial Haeffelin)
- Archive Working (Gert König-Langlo)

Intercomparison of Infrared Radiation References campaign

- Proposed for fall 2017, ARM SGP site
  - Has multitude of observation resources
- PMOD IRISs, NREL ACP, WISG-referenced
- Trying to resurrect original ASR, but doubtful
- Coordinate with Radiation Scales Task Team for WMO/CIMO
  - Investigate traceability of above plus PMOD and NREL Black Body reference units

IRIS: Infrared Integrated Sphere Radiometer (PMOD/WRC)
ACP: Absolute Cavity Pyrgeometer (NREL)
WISG: World Infrared Standard Group
ASR: Absolute Sky-scanning Radiometer

BSRN Archive

- Denoted as the World Radiation Monitoring Center
- Since 2008 operated by the Alfred Wegener Institute for Polar and Marine Research (AWI), Germany
  - Under the direction of Dr. Gert Koenig-Langlo who is retiring this coming June
- Happy to report that AWI director Karin Lochte agreed to continue support
- WRMC data curator Dr. Amelie Driemel is the designated successor

Summary

- **BSRN includes 59 stations with contributed data**
  - **> 750 station-years of observations**
  - **Dispersed from 90^{O} S through 82^{O} N**
- **8 new sites have been provisionally approved**
- **Increasing recognition, use, and scientific impact**

Chuck.long@noaa.gov; http://bsrn.awi.de

The International Soil Moisture Network (ISMN)

A centralized data hosting facility, a „network of networks“, endorsed by GEWEX (thanks Peter!) and sponsored by ESA EOP SMOS.

http://ismn.geo.tuwien.ac.at/

The International Soil Moisture Network (ISMN)
Data Availability

- A centralized data hosting facility, a „network of networks“, endorsed by GEWEX (thanks Peter!) and sponsored by ESA EOP SMOS.
- **Currently available at the ISMN:**
  - **49 networks** (42 meeting last year))
  - **~ 2050 Stations** (1600 last year)
  - ~ 8000 soil moisture datasets (6500 last year)
  - historical datasets
    (**since 1952**)
  - operational datasets with
    near-real time update
  - **Additional variables**:
    - Soil temperature
    - Air temperature
    - Precipitation
    - Snow depth
    - Snow water equivalent
    - „Static“ variables (soil texture, saturation point,..)

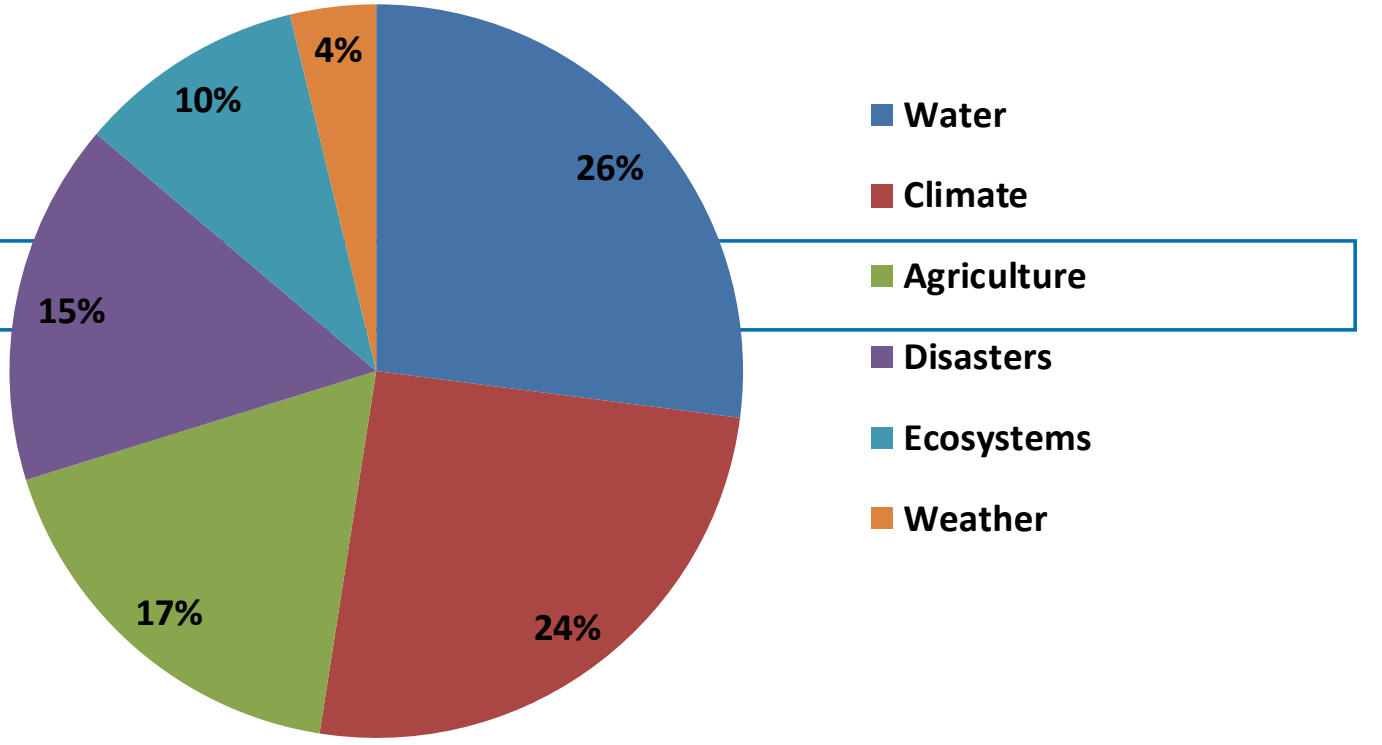
http://ismn.geo.tuwien.ac.at/

TU WIEN GEO

esa International Soil Moisture Network

Data Usage

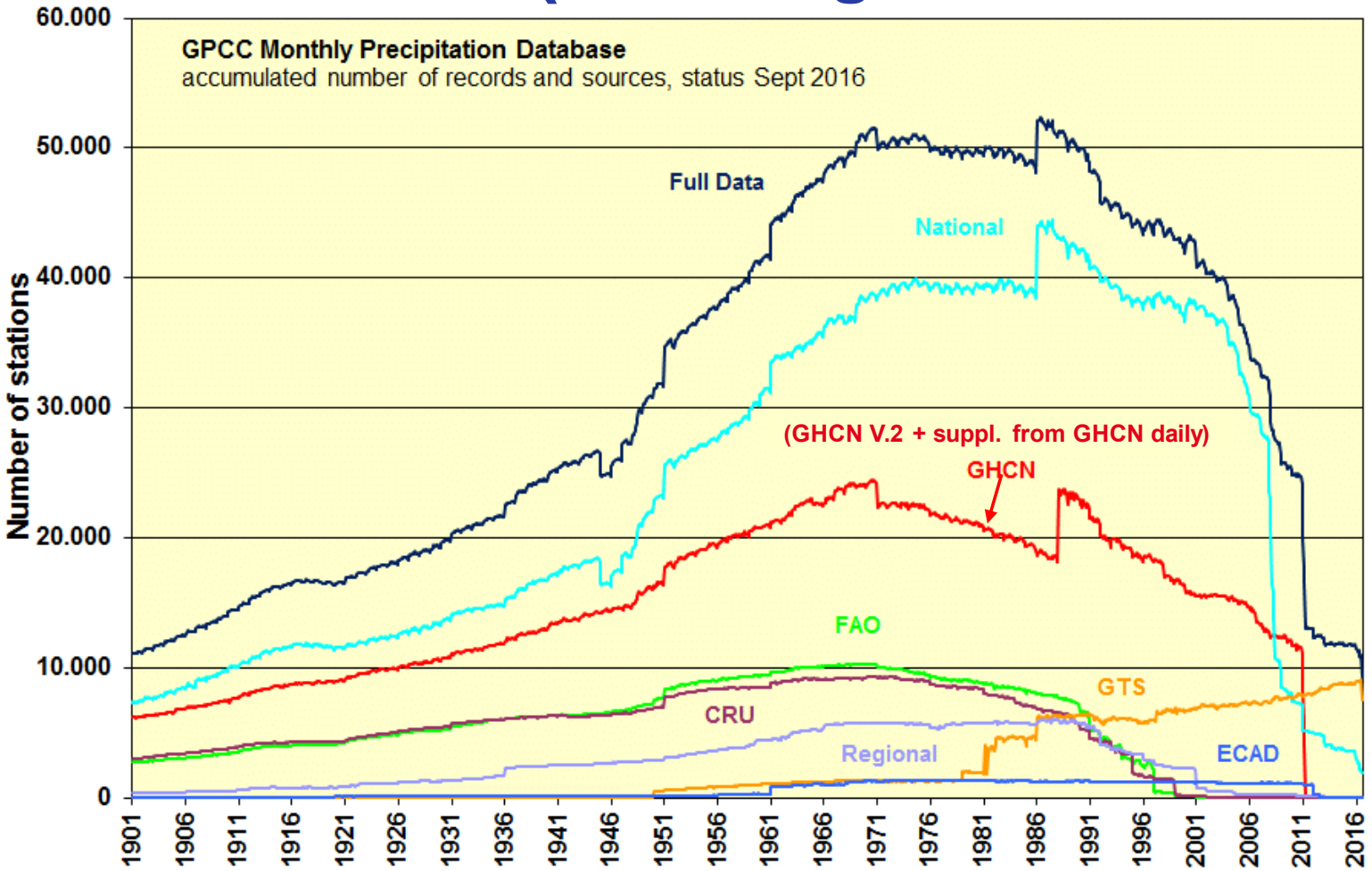
- use of data as indicated by users at subscription



GPCC background

- **GPCC was established at the beginning of 1989 at Deutscher Wetterdienst (DWD) on invitation by WMO; now in operation for more than 27 years**
- **GPCC's main task is the archiving and the analysis of precipitation on the basis of in-situ data for the land-surface**
- **It is GPCP's component for the analysis of the in-situ measurements**
- **GPCC is contributing to GEWEX (GHP and GDAP) and GCOS**

GPCC data base (according to data sources)



GTS includes SYNOP-based GPCC and CPC data and CLIMAT

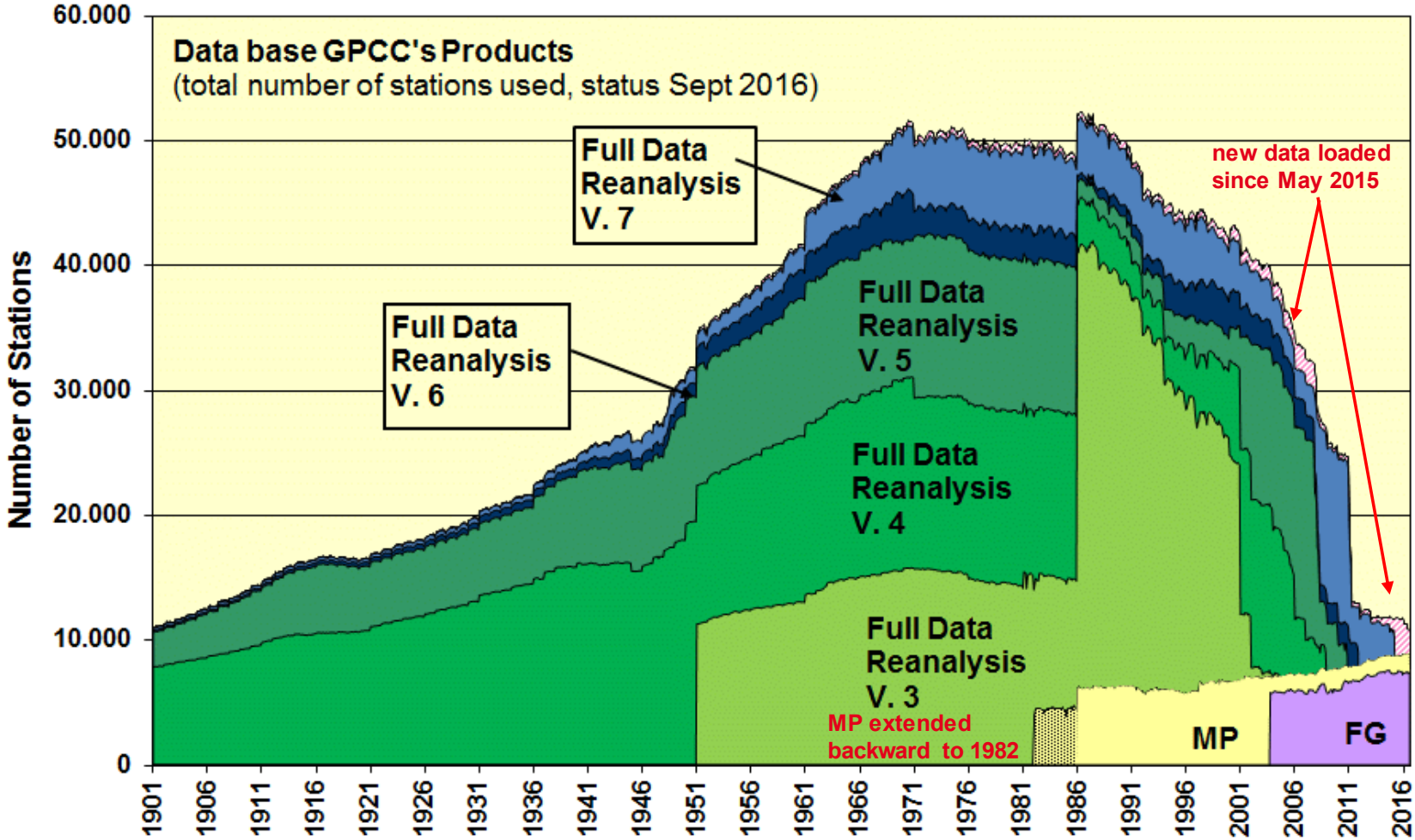
User requirements

- **Features of gridded precipitation data as required by the users:**
  - **Timeliness** **(for drought monitoring)**
  - **High resolution** **(for regional structures in global maps)**
  - **High accuracy** **(for verification of model results)**
  - **Homogeneity** **(for climate change and variability analysis)**

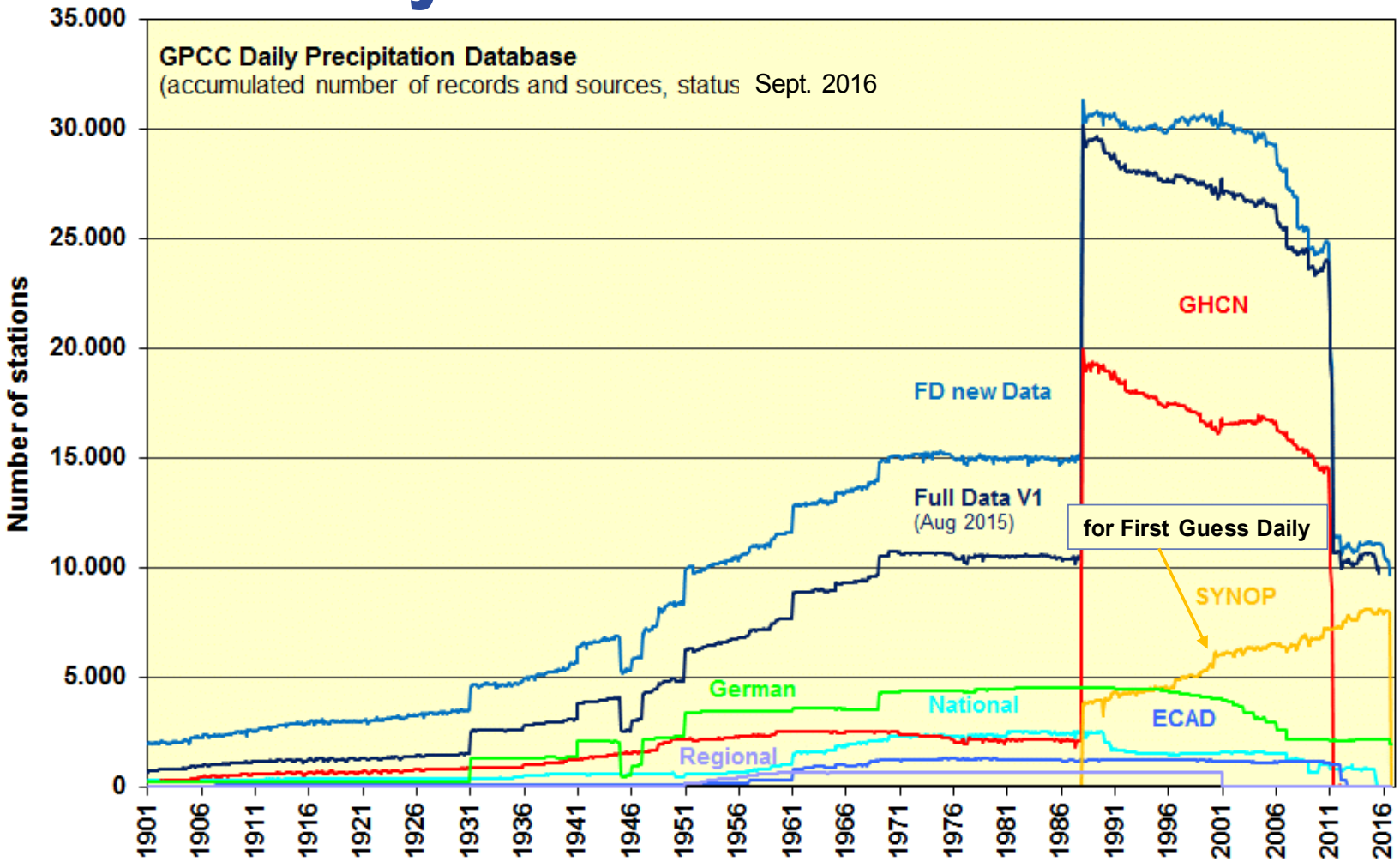
All of these requirements cannot be met by one single gridded data set

==> A portfolio of different analysis products has been designed and optimized with respect to the application purposes

Data base for different GPCC products



Daily data in GPCC data base



Daily precipitation analysis products

- **GPCC is providing the following daily gridded data sets:**

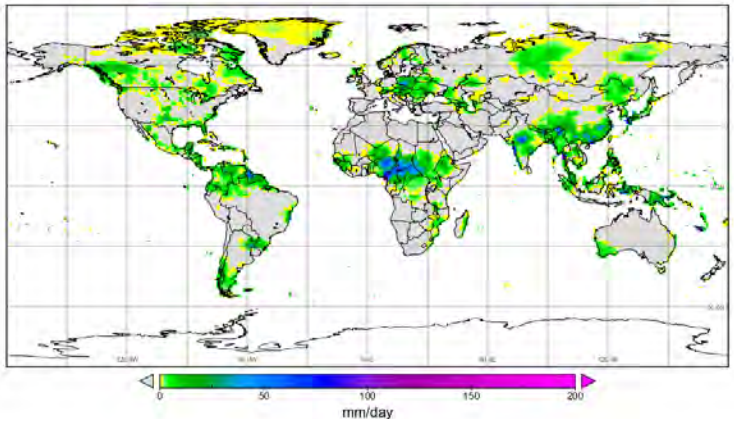
  - **A First Guess Daily Analysis available within 5 days after the end of the month via internet**
    Period: Jan. 2009 to present
    Data base: ca. 7,000-8,100 stations

  described in Schamm et al. (2014).

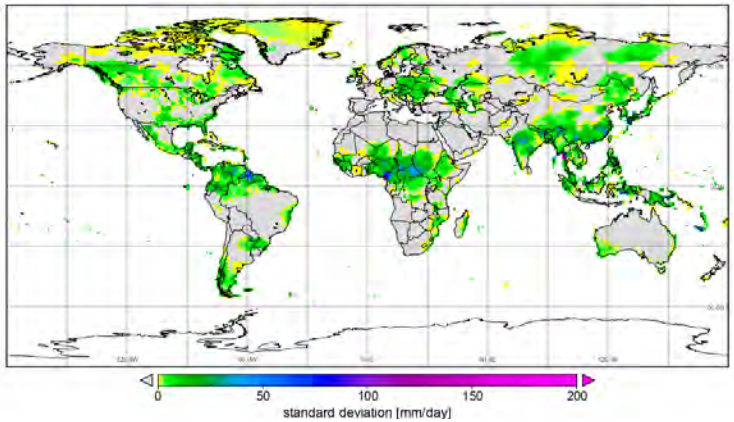
  - **The Full Data Daily Analysis (V.1) updated from time to time**
    Period: Jan. 1988 to 2013
    Data base: ca. 10,000-30,000 stations

Example: GPCC Full Data Daily: 06 July 1997

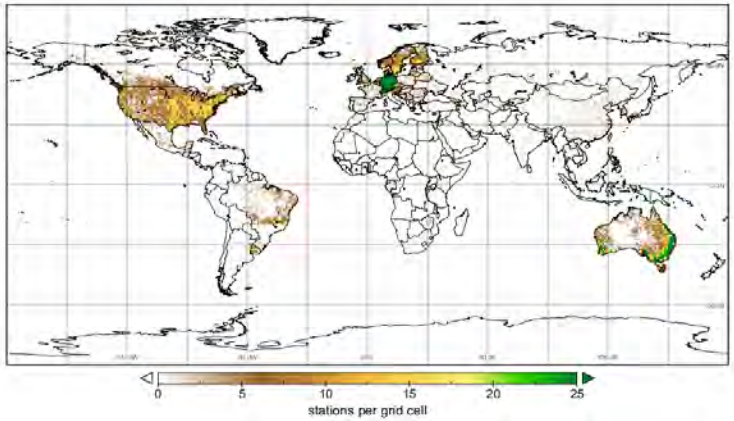
Total Precipitation



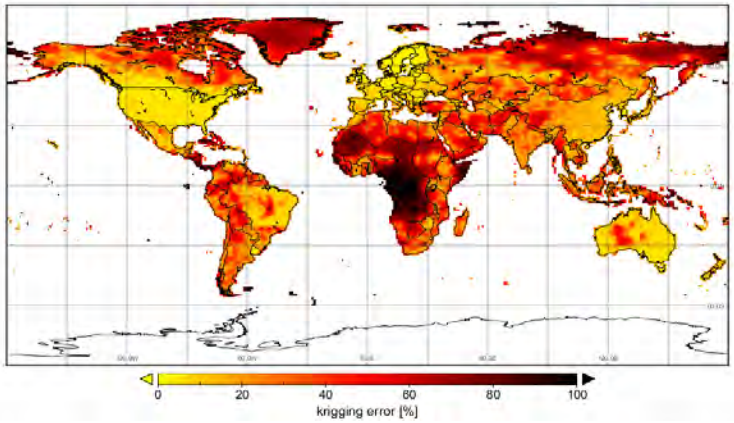
Standard Deviation



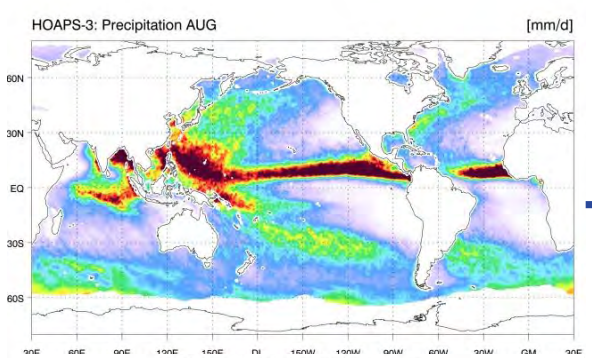
Number of Stations per grid cell

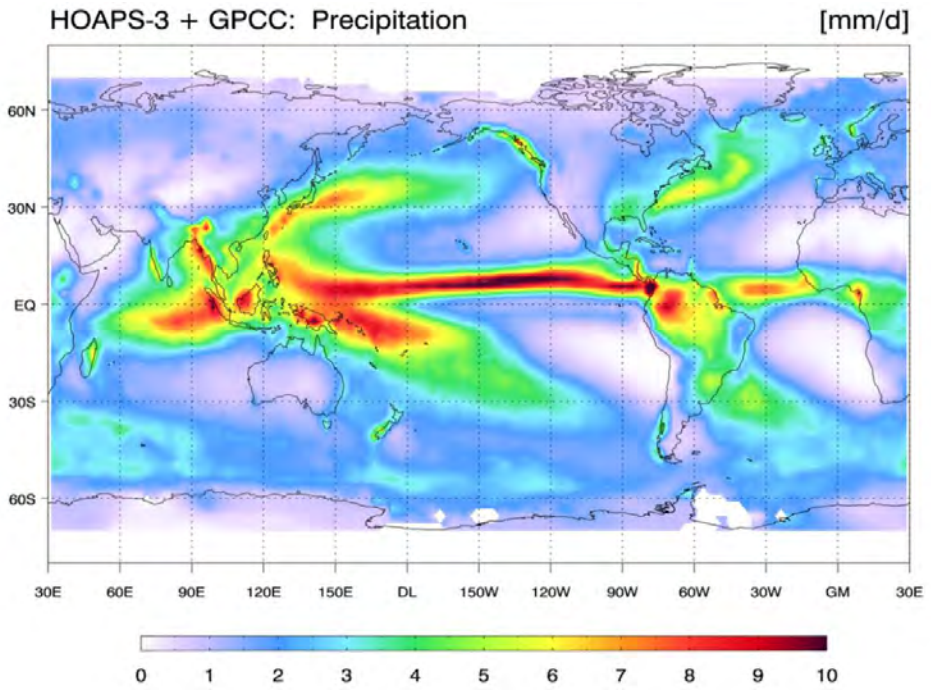


Kriging Error



Generation of a merged global gridded precipitation data set with HOAPS satellite-based data over ocean (CM SAF) and GPCC's in-situ based analysis over land with a daily resolution over the period 1988-2008





Visualize and Download GPCC Products

GPCC Product	Spatial Resolution	Time Coverage	Possible Application
First Guess Monthly	*1.0°*	*2004 - present*	*drought monitoring*
First Guess Daily	*1.0°*	*2009 - present*	*analysis of extremes*
Monthly Monitoring Version 5	*1.0°, 2.5°*	*1982 - present*	*calibration of satellite data*
Full Data Monthly Version 7	*0.5°, 1.0°, 2.5°*	*1901 - 2013*	*hydrological studies*
Full Data Daily Version 1	*1.0°*	*1988 - 2013*	*analysis of extremes*
HOMPRA Europe Version 1 (coming soon)	*1.0°*	*1951 - 2005*	*trend analysis*
VASClimo Dataset	*0.5°, 1.0°, 2.5°*	*1951 - 2000*	*trend analysis*
Precipitation Climatology Version 2015	*0.25°, 0.5°, 1.0°, 2.5°*	*1951/2000*	*for application as a reference, and for utilization of the anomaly interpolation method*
Interpolation Test Dataset	*1.0°*	*1988*	*comparison of interpolati*
Drought Index Version 1	*1.0°*	*2013 - present*	*drought monitoring*
GPCC Visualizer			*access to the GPCC Visualizer, where you can create maps with your own coordinates and parameters*
GPCC Home			*detailed information abou*

The Global Precipitation Climatology Centre (GPCC) is a specialized Centre supporting climate mo and research.
It is operated by DWD under the auspices of WMO. Product users are kindly asked to re to GPCC.

Imprint © DWD 1996-2015

Thank you for your attention !

ftp://ftp-anon.dwd.de/pub/data/gpcc/html/download_gate.html

ARM

CLIMATE RESEARCH FACILITY

ARM Updates for GDAP
October 2016

Jim Mather
ARM Technical Director

U.S. DEPARTMENT OF ENERGY | Office of Science

ARM Mission: Providing Atmospheric Observations in Diverse Climate Regimes

The ARM Climate Research Facility, a DOE scientific user facility, provides the climate research community with strategically located in situ and remote sensing observatories designed **to improve the understanding and representation, in climate and earth system models**, of clouds and aerosols as well as their interactions and coupling with the Earth's surface.

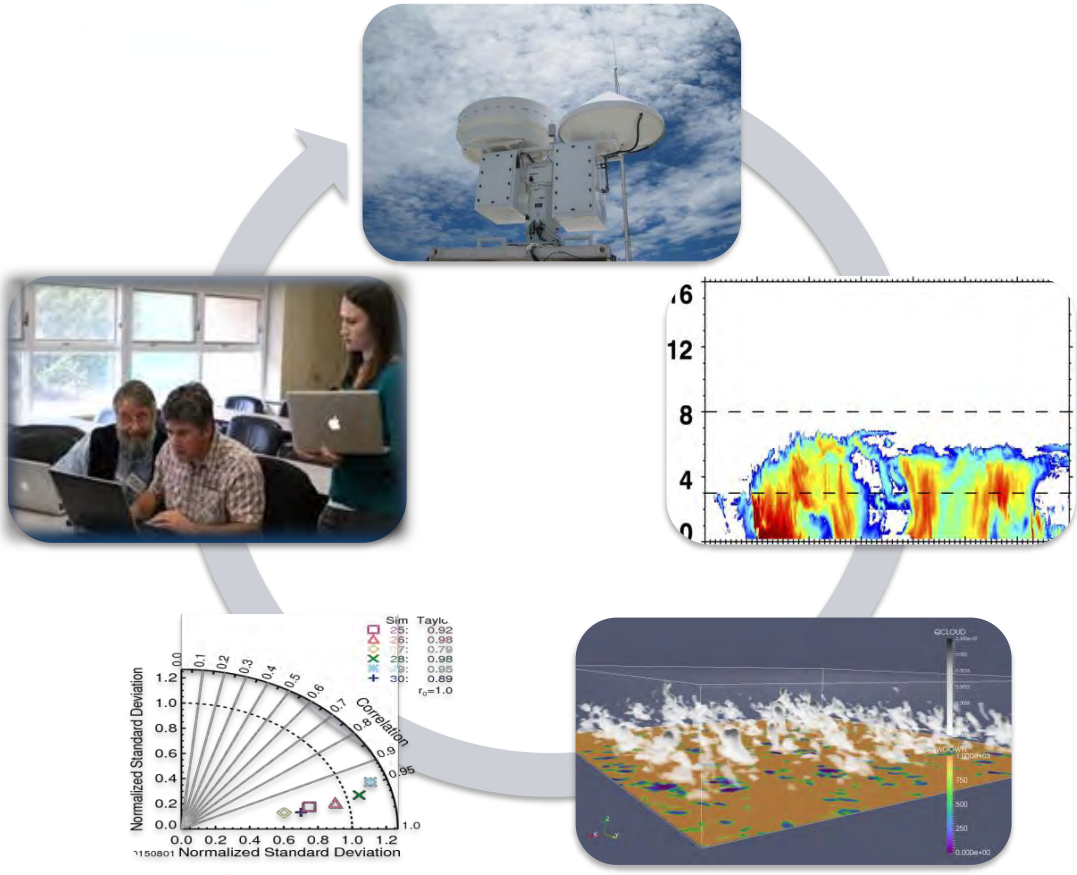
Southern Great Plains

North Slope of Alaska

Eastern North Atlantic

ARM
CLIMATE RESEARCH FACILITY

Integrating Observations and Models



Comprehensive strategy to integrate ARM observations and model simulations.

Decadal vision outlines strategy to address next-generation science questions.

- Optimize measurement facilities to better support high-resolution modeling
- Implement high-resolution modeling at ARM sites
- Develop diagnostic data products to bridge observations and models

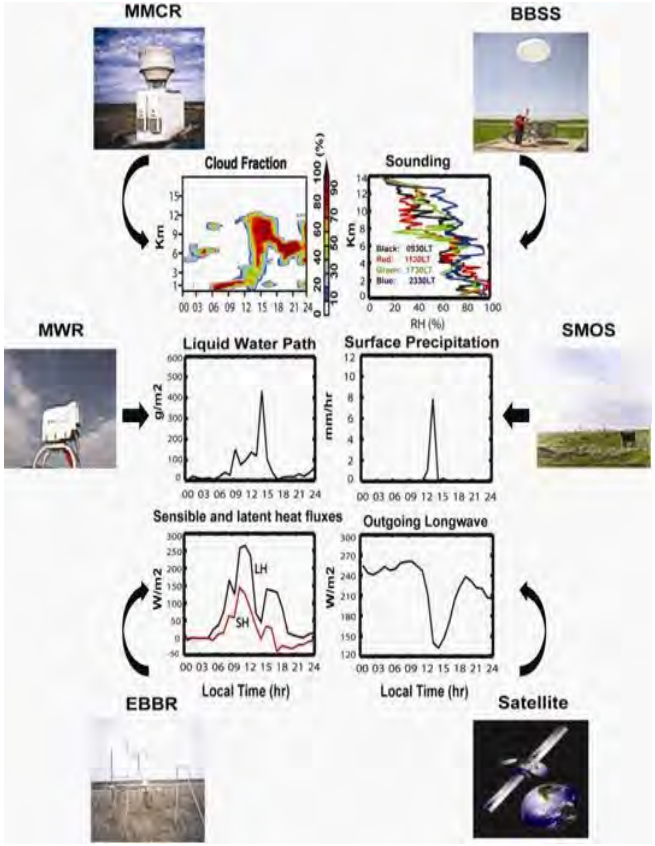
ARM CLIMATE RESEARCH FACILITY

https://www.arm.gov/publications/programdocs/doe-sc-arm-14-029.pdf

ARM Best Estimate (ARMBE)

Hourly Averages of Core Parameters
Currently Available at SGP, NSA, TWP, ENA

- **ARMBE-ATM**
  - P, T, RH, U Profiles
  - Surface sensible and latent heat fluxes
  - Surface precipitation
- **ARMBE-CLDRAD**
  - Cloud fraction profiles (Radar/lidar)
  - Integrated cloud fraction
  - Liq. Water Path/Precipitable Water
  - Surface radiative fluxes
- **ARMBE-LAND (SGP only)**
  - Soil temperature and moisture



Xie et al. 2010, BAMS

ARM CLIMATE RESEARCH FACILITY

U.S. DEPARTMENT OF ENERGY | Office of Science

Summary

- Continuous observations available at Oliktok and Azores
- AMF deployments
  - Current: Antarctica and Ascension Island
  - Upcoming: Southern Ocean, Argentina (deep convection), Arctic (marine)
- Implementing UAS operations at Oliktok (and elsewhere)
- Implementing joint observation/high-resolution modeling system
- Push to optimize operation of/and data processing for complex instruments (esp. scanning radars and aerosol systems)
- ARM Best Estimate family of products is more autonomous and configurable. Similarly, parameters from GDAP products could be extracted for ARM sites. In this way – joint parameter sets could be generated over multiple locations. The first step toward exploring this would be defining a set of core parameters that would constitute the joint set.

GEWEX New Activities

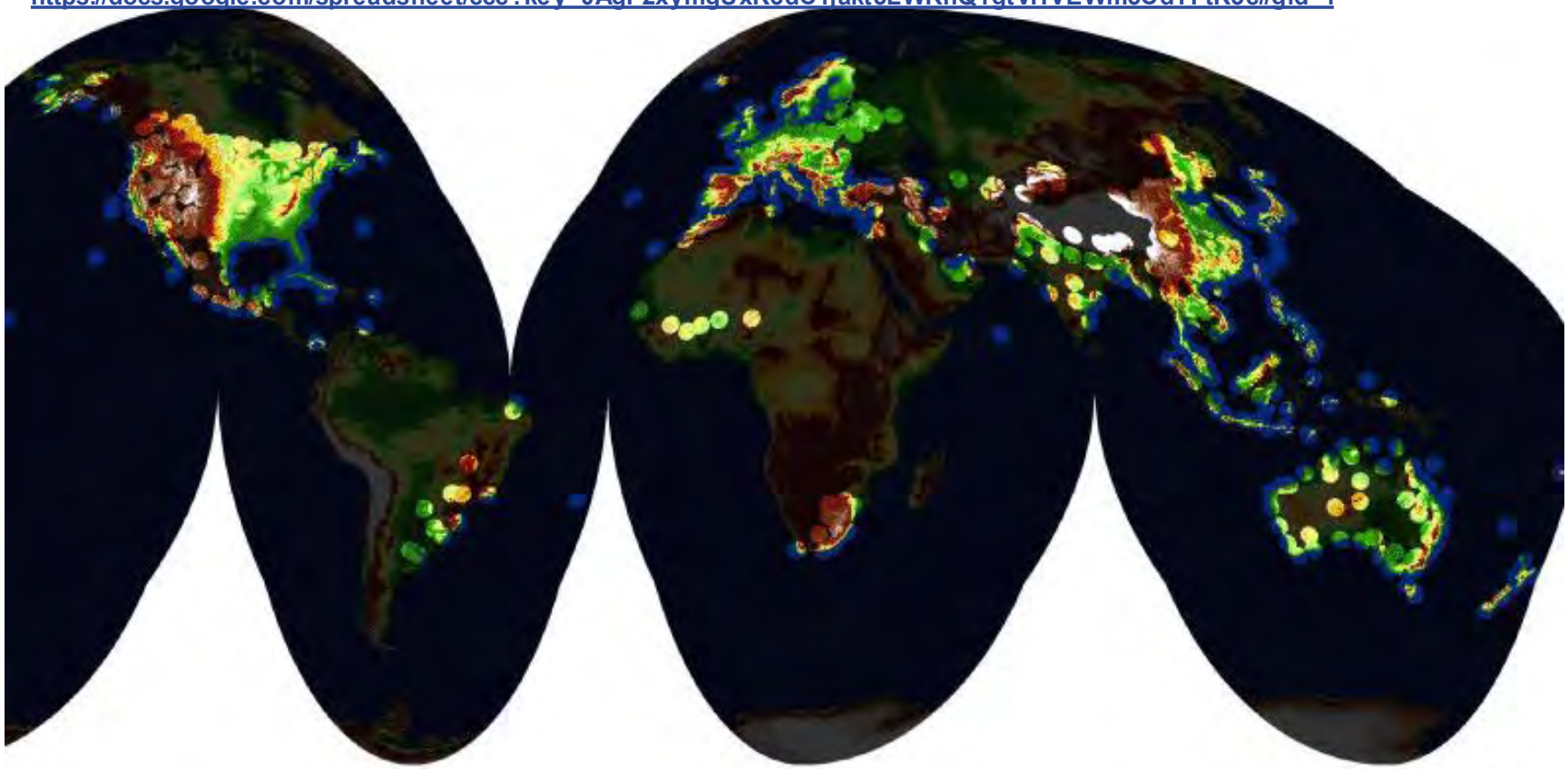
Precipitation from surface radar

UTTC PROES

Uncertainty Analysis

World wide weather radar coverage
> 800 systems listed by Heistermann et al., 2013

https://docs.google.com/spreadsheet/ccc?key=0AgF2xymgUxK3dC1jakt5LWRhQ1gtVHVEWm5CdTFtR3c#gid=1



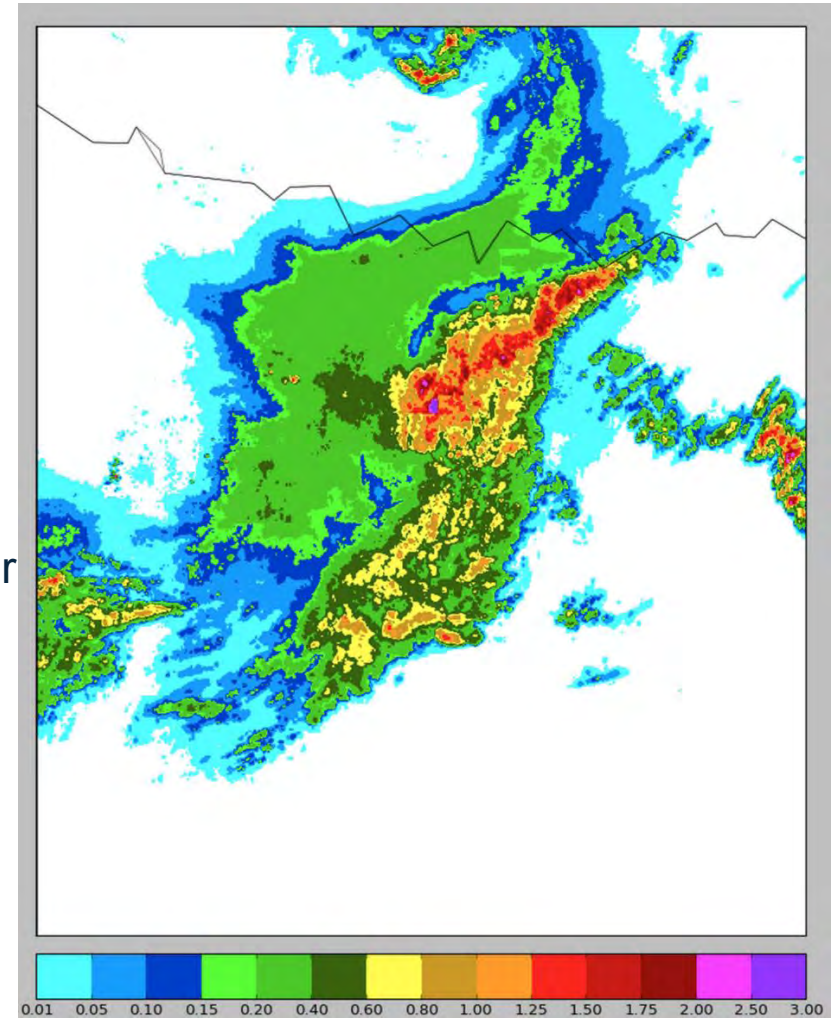
http://www.hydrol-earth-syst-sci.net/17/863/2013/hess-17-863-2013.pdf

Heistermann et al. (2013), HESS

Multi-sensor Precipitation

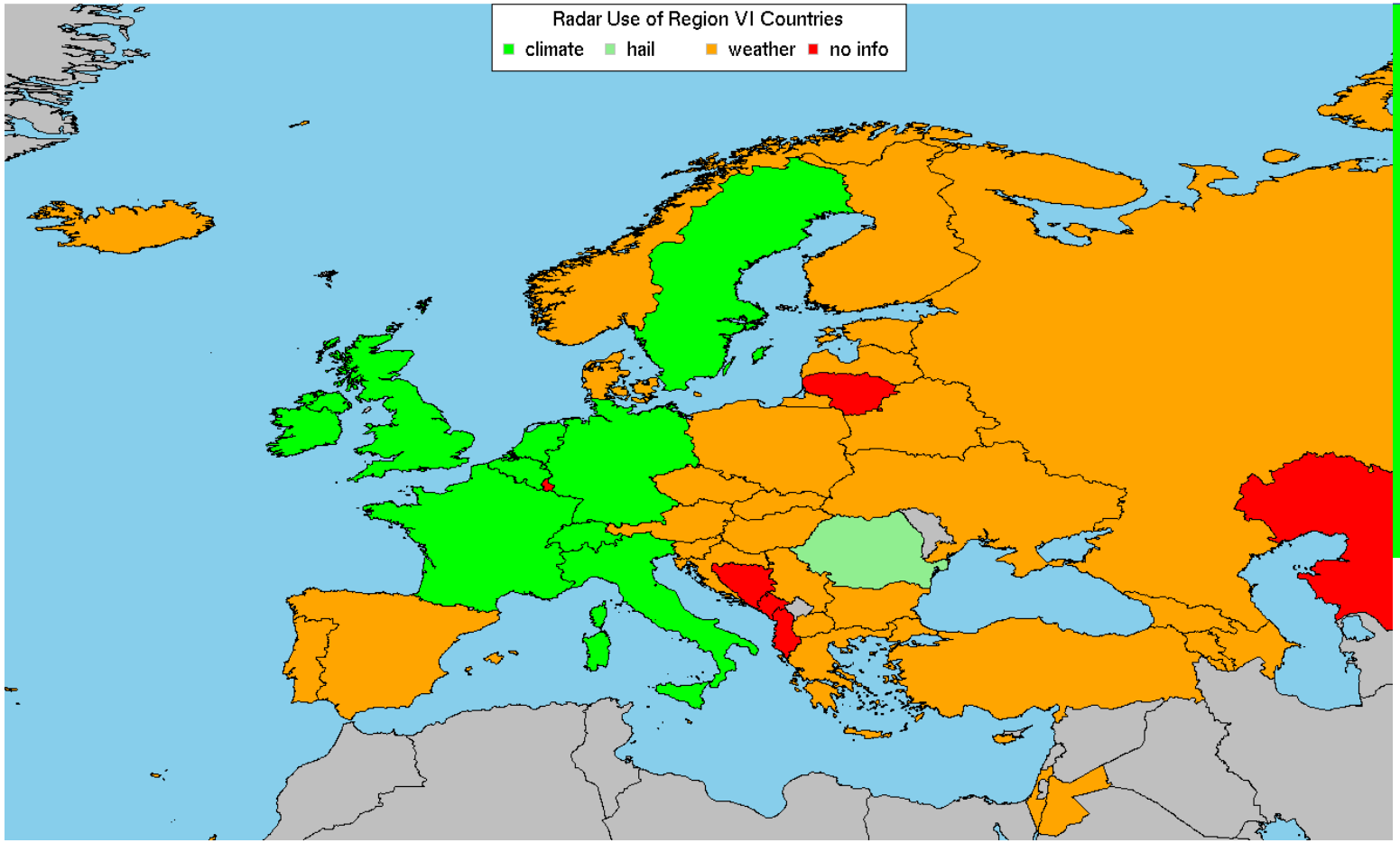
High-Resolution NEXRAD Reanalysis (NMQ/Q2)

- Provides rainfall amounts at 1-km resolution every five minutes
- Can easily scale to other time periods
  - Hourly, daily, seasonal totals
  - Peak rainfall over a given period
- Also provides hail identification and other information on precipitation type
- Will be available from around 2001 to 2012.



3 Examples in RAVI

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Length:

B: 10
CH: 11+
D: 15+
F: 10
IRL: 8
NL: 10
S: 6
UK: 8

Use of Weather Radar Data in WMO Region VI Countries (Fig. 2 in Keupp et al., 2016).
Climate: multi-annual time series produced / **hail: a hail climatology compiles** / **weather:** only information on radar use for weather purposes / no information yet received

WCRP Grand challenge: Weather and Climate extremes

- Precipitation extremes might (in some cases) not be detected by a rain gauge network (especially small-scale events)
- Combination of Radar (high spatial and temporal resolution and area coverage) and rain gauge data can be of help there

WMO CCL Task Team on the Use of Remote Sensing Data for Climate Monitoring, (TT URSDCM)

- Will consider the paper "Use of Weather Radar Data for Climate Data Records in WMO Region VI"

2 Challenges for global applications and in context of GCOS IP

Deutscher Wetterdienst
Wetter und Klima aus einer Hand
DWD

- Many Problems of real-time radar based QPE, persist in climate mode
- Short time series yet not exceeding 15yrs
- No ocean coverage
- Sensor modifications over time (Homogeneity)
- Small errors amplify when integrated across longer aggregation periods
- In-situ validation data not available everywhere
- Complexity and time variability of atmospheric conditions
- Calibration and retrieval algorithms need to be harmonized
- Climate Requirements assembled in CBS/OPAG-IOS/WxR_EXCHANGE/2.4

2 Challenges for global applications and in context of GCOS IP

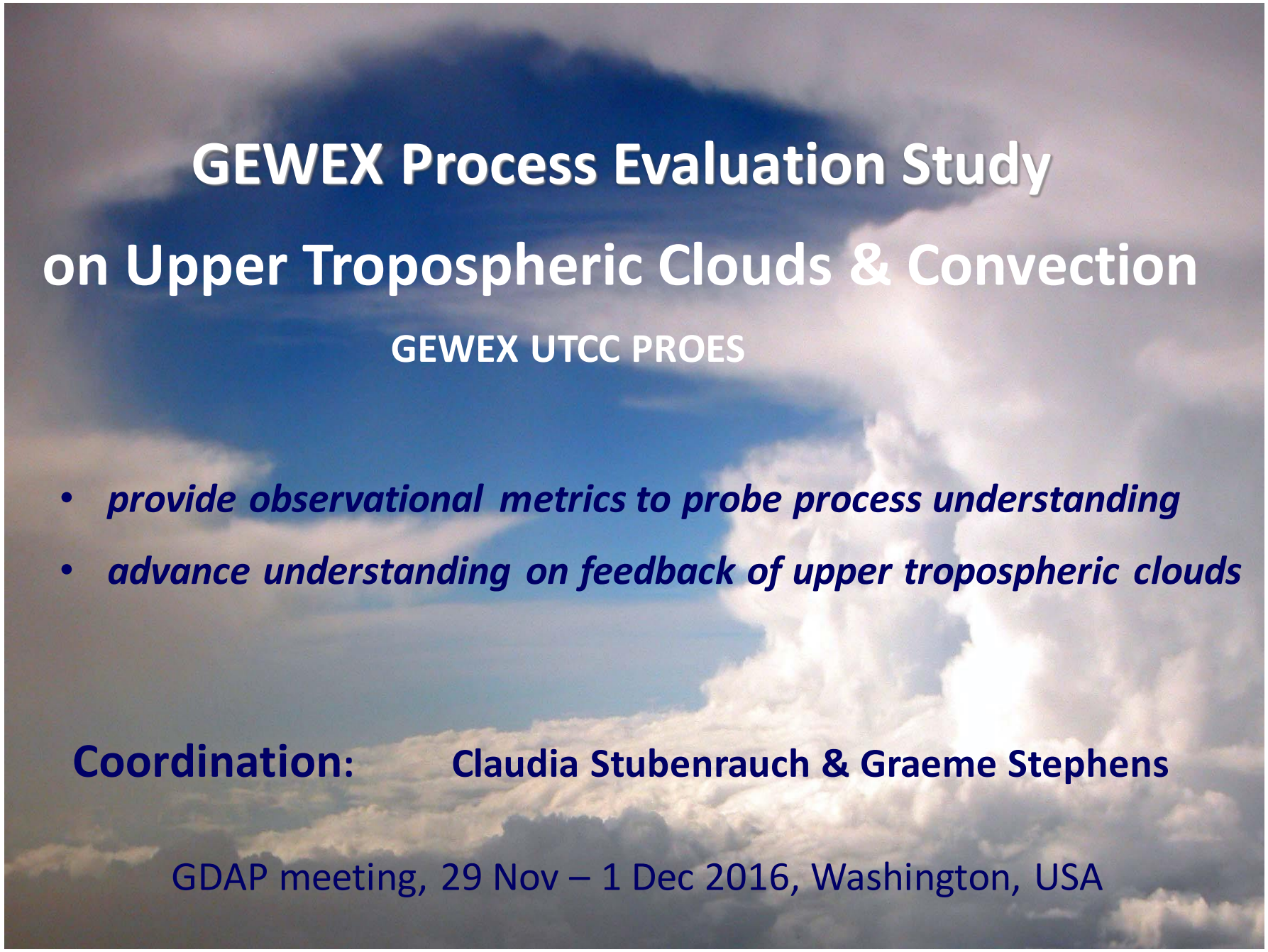
Deutscher Wetterdienst
Wetter und Klima aus einer Hand
DWD

- Original reflectivity data needs to be exchanged
- Data is national sometimes even not owned by WMO NMHSs but by companies in the field of flight security (e.g. in Austria)
- Adequate treatment and documentation of missing data
- QPE Methods need to be harmonized (Bias correction, radar-gauge adj.)
- Nothing in place similar to Satellite Data, e.g. EUMETSAT
- No international standards, data storage, and documentation yet in place

A data storage and documentation standard should be identified and applied ASAP to keep historic radar data assessable for future utilization. Otherwise we will continue to waste climate relevant and expensively raised radar data!

Summary

- Several countries have created reprocessed radar data sets;
- The GC Extreme is interested in it and could certainly try analysis with the existing products to provide feedback;
- GDAP Panel meeting discussed this area with no firm conclusion to engage or not;
- A potential plan would be to held an initial workshop that considers the needs of the GC Extremes (and others), availability of data and tools, discusses standards, and existing approaches and initializes a process that may lead to a baseline similar to what is achieved for satellite data;
- Andreas Becker (DWD) and Brian Nelson (NOAA) have agreed to follow up this topic and would try to organise a first workshop 2017/18 that would need financial support.



GEWEX Process Evaluation Study on Upper Tropospheric Clouds & Convection

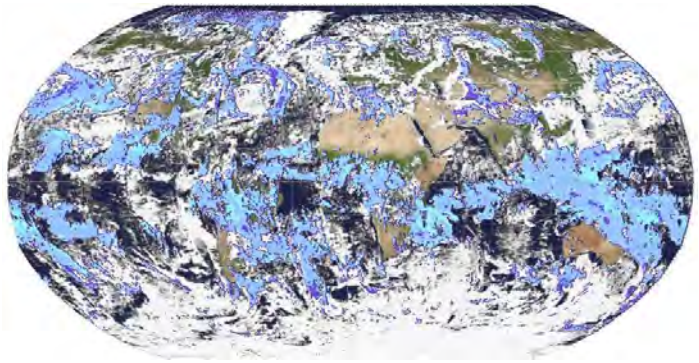
GEWEX UTCC PROES

- ***provide observational metrics to probe process understanding***
- ***advance understanding on feedback of upper tropospheric clouds***

Coordination: Claudia Stubenrauch & Graeme Stephens

GDAP meeting, 29 Nov – 1 Dec 2016, Washington, USA

UTCC PROES : Motivation



dark -> light blue,
according to decreasing ε_{cld}

UT clouds play a vital role in climate system by
modulating Earth's energy budget & upper tropospheric heat transport

They often form mesoscale systems extending over several hundred kilometres.

Cirrus form as outflow of convective / frontal systems
or in situ by large-scale forcing

How does convection affect UT clouds & vice versa?
Critical to feedbacks: cirrus radiative heating

How do cirrus change in warming climate? -> rad. heating -> atm. Circulation

What is the role of cirrus in modulating the Earth's climate?

Goal: understand relation between convection, cirrus anvils & rad. heating
provide obs. based metrics to evaluate detrainment processes in models

1. GEWEX UTCC PROES meeting

Paris, 16 *Nov 2015*

Feedback hypotheses

V. Ramaswamy, ***T. Mauritsen, S. Bony***

Ressources

1) observations: cloud systems and atmospheric environment

W. B. Rossow, H. Masunaga, D. Bouinol, ***R. Roca, G. Sèze, S. Protopapadaki, C.-K. Teo***

2) including the atmospheric flow: Cirrus origin and life cycle

J. Luo, B. Legras, R. Plougonven, A. Podglajen

3) processes and parameterizations (parcel, CRM, GCM)

Small scale process modelling *S. van den Heever*

Large scale development / evaluation of parameterizations (LMDZ, CNRM, ETHZ)

C. Risi, C. Rio, , J.-B. Madeleine, B. Gasparini

4) Radiative transfer

*T. L'Ecuyer ,****C. Stubenrauch***

next day: **Discussion on Synergetic data base**

J. Luo, G. Stephens, G. Sèze, S. Protopapadaki, S. Stubenrauch

interested in cirrus -> anchor data base to AIRS upper tropospheric cloud systems

GEWEX UTCC PROES discussions at IRS

Auckland, 17 *Apr 2016*

V. Ramaswamy (GFDL), A. Baran (MetOffice), D. Bouniol (CNRM), R. Roehrig (CNRM), B. J. Sohn (Seoul Univ.), S. Kato (Nasa Langley), H. Okamoto (Kyushu Univ.), M. Wendisch (Univ. Leipzig), S. Kinne (MPI-M), C. Stubenrauch (LMD)

1) parse the thematic question into specific actionable questions

2) see how these can be addressed within CFMIP activities

presentation at CFMIP conference attracted CRM community

3) LMDZ tests cloud system simulator to assess convection / detrainment / microphysics schemes

2) make an inventory of variables needed & sources, uncertainties

3) build synergetic data bases to address each of the questions instead of one synergetic data base which includes all information

next GEWEX UTCC PROES meeting

CUNY, New York, *28-29 Mar 2017* *hosted by Johnny Luo*

Preparation of synergetic data to be in a form that could be adopted to start to evaluate relations between UT clouds and convection in models.

1) outline what we have data wise
2) investigate what specific new diagnostics can be used for evaluating modelling at different scales
   (CRM which resolve convection and GCM which use parameterizations)
3) discuss data analysis methods to be investigated to take into atmospheric flow (separate cirrus originating from convection and in-situ) and system evolution
   ….

Participants inscribed so far:

Observations / radiative transfer : J. Luo, W. B. Rossow, H. Masunaga, T. L'Ecuyer, E. Jensen, H. Takahashi, G. Stephens, C. Stubenrauch, E. Zipser (?), C. Schumacher (?)

CRM modelling : S. van den Heever, W.-T. Chen

Climate modelling : T. Del Genio (GISS), R. Ramaswamy, L. Donner (GFDL), B. Gasparini (ETHZ), U. Burkhardt (DLR)

Summary & Outlook

motivation: ***advance on understanding feedback of UT clouds***

working group forming *(meetings: Nov 2015, Apr 2016, Mar 2017)*

focus on

1) tropical convective systems &

2) cirrus originating from large-scale forcing

- **cloud system approach, anchored on IR sounder data**

horizontal extent / convective cores/cirrus anvil/thin cirrus based on p, e

- **first relationships between convective strength & anvil properties**
- **prepare synergetic data,** incl. vertical dimension & atmosph. environment
- **determine heating rates**
- **investigate how cloud systems behave in CRM studies**

& in GCM simulations ***(under different parameterizations of convection/detrainment/microphysics)***

GEWEX links to WCRP Data Advisory Council

Under WCRP Data Advisory Council (WDAC)

- Discussion of need for coordination and highlighting surface flux issues
  - Land, ocean, ice
  - Biogeochemical, heat, moisture, momentum
  - Turbulent, radiative
  - In situ, remote
- "promote a stronger dialogue and profile of flux efforts across WCRP and with sister programmes "
- Formed Surface Flux Task Team (C. A. Clayson/Brian Ward, chairs)
  - Cuts across GEWEX, CLIVAR, other WCRP groups
  - Members:
    - Carlos Jimenez (Observatoire de Paris, land, satellite, obs;
    - Jim Edson (U. Conn, ocean, obs);
    - Pierre-Philippe Mathieu (ESRIN, satellite);
    - Peter Gleckler (LLNL, modeling);
    - Ronald Buss de Souza (National Institute for Space Research, Brazil, ocean, obs)
    - Paul Stackhouse (NASA Langley, radiative fluxes, satellite, scientist extraordinaire);
    - Hans Peter Schmid (Karlsruhe Inst. Tech., biosphere, obs);
    - Anton Beljaars (ECMWF, land, modeling);
    - Saigusa Nobuko (Japan, National Inst. for Env. Studies, land, obs);
    - Petra Heil (University of Tasmania, sea ice, obs, remote sensing, modeling);

WDAC - Obs4mips Task Team

- GDAP chair engaged in WDAC obs4mips task team;
- Data call was open until end of March 2016 to submit proposals not the data;
- GEWEX products are encouraged to be included:
  - GPCP is, ISCCP is via CFMIP, LANDFLUX and the ESA soil moisture have been proposed, some G-VAP water vapor products are also in,
  - Others (SRB, SEAFLUX) had issues to easily conform with the rules;
- Data needs for some CMIP experiments are still not well known -> More communication between CMIP and obs4mips is initiated via the CMIP panel chair (Veronika Eyring) to encourage more contacts of individual MIP leaders and obs4mips task team members.

Establishing best practise for assessment in WCRP

- **Compiled "Data Set Quality Assessments: Needs, Benefits, Best Practices and Governance"**
- This paper shall provide guidance towards a more homogeneous approach towards assessments of data set quality;
- Jörg Schulz, EUMETSAT, Chair GEWEX Data and Assessment Panel, Peter Gleckler, Lawrence Livermore National Laboratory, and many WCRP contributors hereby deeply acknowledged;
- Paper has been endorsed by WDAC in April 2016.

Membership

SSG-28 Actions

GDAP Membership

Rémy Roca, Chair	LEGOS	2017
Tristan LÈcuyer, Vice-Chair	University of Wisconsin	2017
Wouter Dorigo	Technical University Vienna	2016
Andrew Heidinger	NOAA/NESDIS	2016
Carlos Jimenez	Estellus, S.A.S., Paris	2017
Christian D. Kummerow	Colorado State University	2017
Hirohiko Masunaga	Nagoya University	2017
Claudia Stubenrauch	Lab. de Meteorol. Dynamique	2016
Tianjun Zhou	LASG/IAP/CAS, Beijing, China	2017

Actions from SSG-28 in red and older in green

- Dave to warm up Karin Lochte asking her what would be need to fulfil our wish. Send Dave a brief containing the details what we want. ✓
- ISCCP processing: Graeme to talk to Tom Carl , I can strengthen while I am there ✓
- Restrict radar to certain areas needed for the GCs, talk to Andreas Becker and Brian Nelson in April. ✓
- Update membership list and circulate with Sonia and Graeme – Found new chairs and leave selection of members to them
- Send G-VAP report to SSG after GDAP review - ongoing
- DOI registration for GEWEX data sets – what is the situation with the individual data set producer. Publication in data journal. – all strive for that, some have issues to find a publication agent
- Several data prices exist –awareness is small. – WDAC data price announcement has been distributed to GDAP
- Connect with GLASS – has not happened, missed their annual meeting
- Consider to do a global fluorescence data set in GDAP – not discussed at last GDAP
- Proposal for mobile ARM on GLASS Pannex activity / has been confirmed to be useful on last day.
- Link to SPARC – SPARC WAVACS has participated in G-VAP workshops, both agree to do complementary work (SPARC concentrating on water vapour above 200 hPa).