

GDAP Report

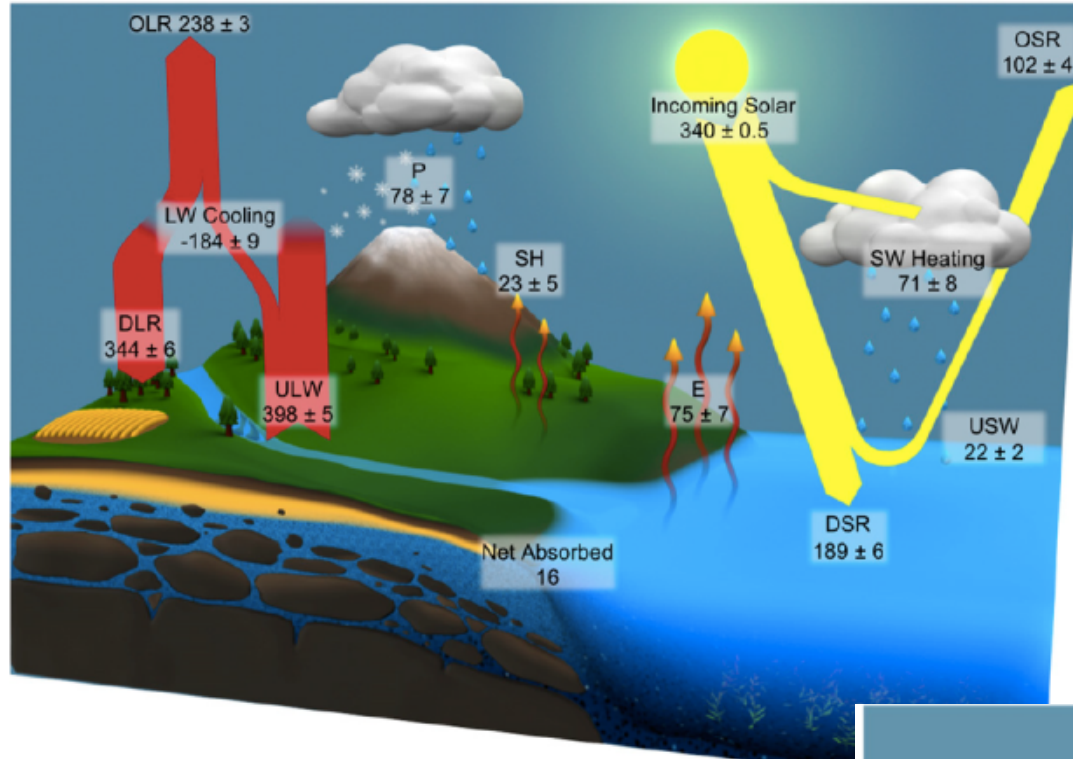
Rémy Roca, Chair

Tristan L'Ecuyer, Vice Chair

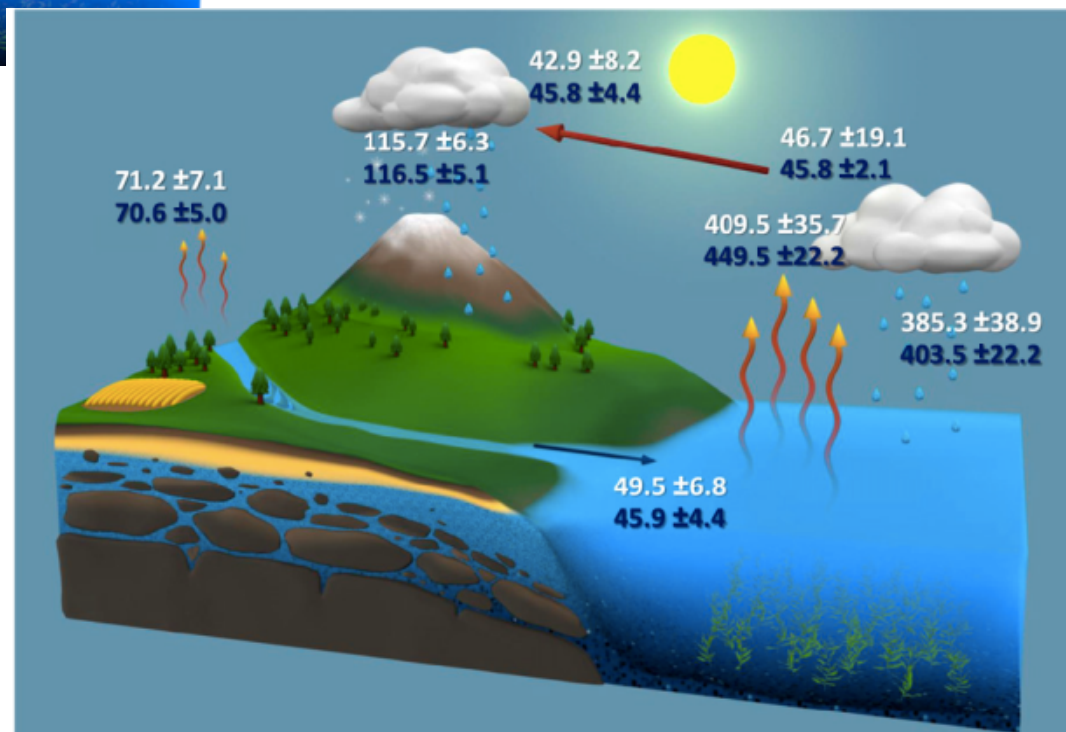
Jörg Schulz, Ex- Chair

Matthew McCabe, Ex-Vice Chair

Credits to all GDAP members, data project and assessment leads
and reviewers



Global Energy and Water Exchange



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

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GEWEX Data Products and Integration of them

Clouds and radiation ISCCP (Bill Rossow and NOAA NCEI)

Aerocom MAC (Stefan Kinne)

Surface Radiation Budget (Paul Stackhouse)

Precipitation GPCP (Bob Adler et al.)

Evaporation: SEAFLUX (Carol Anne Clayson)

LandFlux (Matt McCabe, Carlos Jimenez)

Soil Moisture (Wouter Dorigo)

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

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.

NOAA's Comprehensive Large Array-Data Stewardship System (CLASS)

NOAA HOME WEATHER OCEANS FISHERIES CHARTING SATELLITES CLIMATE RESEARCH COASTS CAREERS

NOAA COMPREHENSIVE LARGE ARRAY-DATA STEWARDSHIP SYSTEM (CLASS)
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Release Info

- » Version 7.1.2.1
October 27, 2016

Other Links

- » CLASS Home
- » NCEI
- » NESDIS
- » NOAA

Image source: Suomi NPP VIIRS

CLASS

NEWS

Celebrating 5 Year Anniversary for Suomi NPP (10/28/16):
Suomi National Polar-orbiting Partnership (S-NPP) is celebrating its 5 year anniversary from launch on 10/28/2011. We'd like to congratulate the Joint Polar Satellite System (JPSS) program for a successful satellite launch and the continued orbit and data transmission back to earth. We would also like to congratulate the NOAA JPSS ground system for tracking, receiving and transmitting the data to CLASS for archival and access. To date, the CLASS has archived 5.64 Petabytes of S-NPP data with more than 18 Petabytes of data delivered to its user community. Congratulations to all!

Suomi NPP data access status (updated 02/25/16):
The majority of S-NPP products are available for ordering through CLASS. For those datasets available for public access the begin dates are indicated next to the product names under the many JPSS search pages. A complete table of SNPP products showing product maturity level date ranges has recently been added to the CLASS FAQ under the NPP FAQ section. Also, links to the Readme files have been moved from the CLASS front page to this table located at the following
URL: http://www.nsof.class.noaa.gov/release/data_available/npp/npp_public_data_table.htm

For further assistance please check out the **STAB Science Documents** website for IDPS Algorithm Theoretical

SEARCH FOR DATA

- Environmental Data from Polar-orbiting Satellites
- Environmental Data from Geostationary Satellites
- Defense Meteorological Satellite Program (DMSP)
- Suomi National Polar-orbiting Partnership (NPP)
- Sea Surface Temperature data (SST)
- RADARSAT
- Altimetry / Sea Surface Height Data (JASON)
- Global Navigation Satellite Systems (GNSS)
- Other - Miscellaneous products in CLASS

SEARCH COLLECTION METADATA

GO



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

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



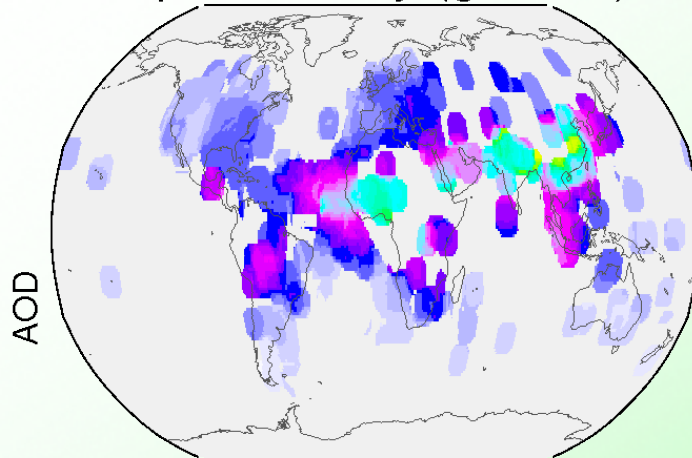
relying on OBSERVATIONS
of AERONET and MAN plus
background from modeling
(no direct use of satellite data)



use **observations** if you can

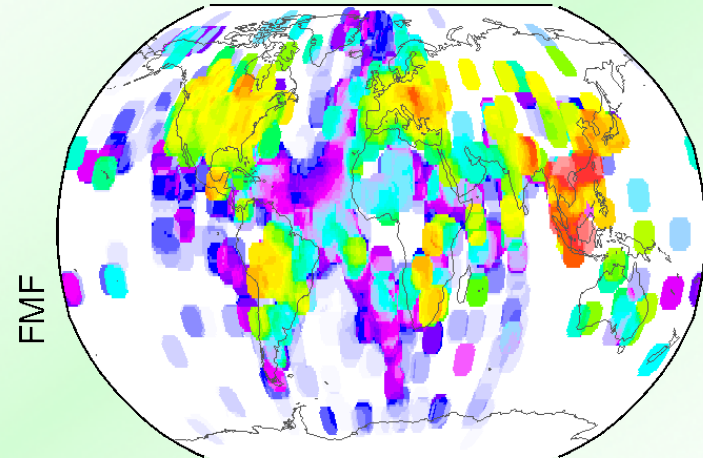
AOD

sun-photometry (ground)



AOD

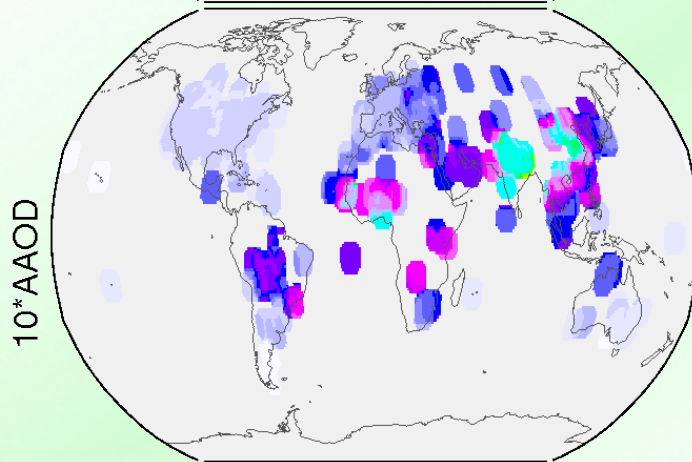
aerosol properties at 550nm



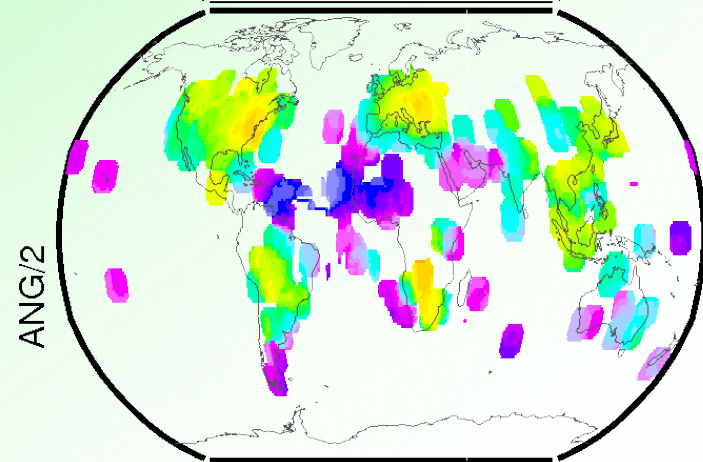
FMF

FMF

AAOD
(10 times)

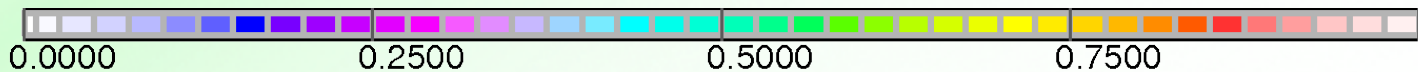


10*AAOD



ANG/2

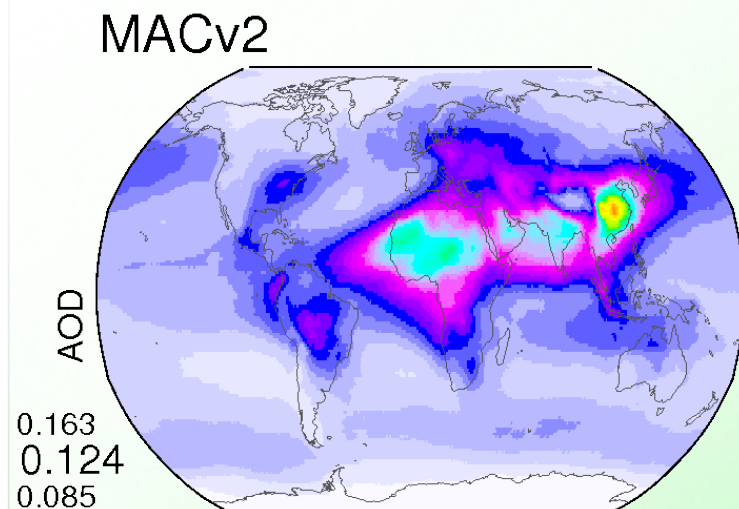
ANG
(div by 2)



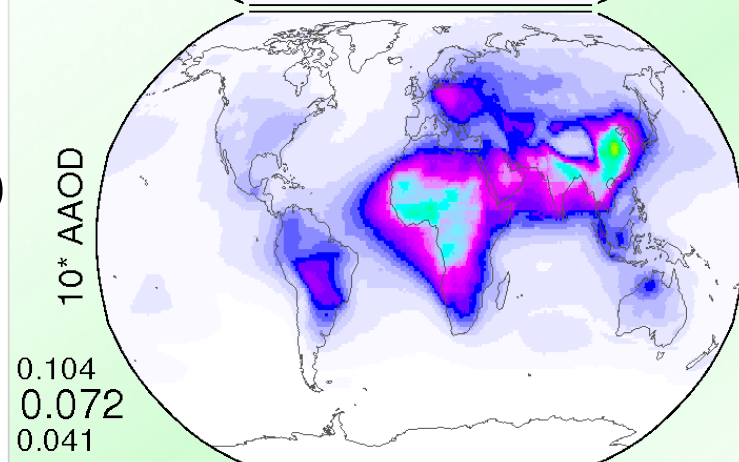
**annual
means**

extended with model context → MACv2

AOD



AAOD
(10 times)



aerosol properties at 550nm

fr AOD

0.530
0.450
0.369

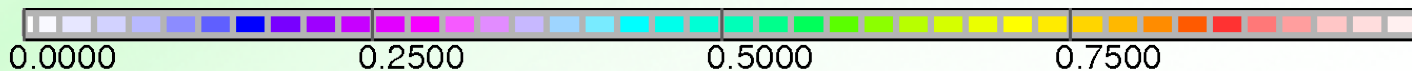
0.5* ANG

0.447
0.374
0.301

FMF

ANG
(div by 2)

annual
means



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>

NASA/GEWEX Surface Radiation Budget (SRB) Project

SRB Rel. 3.0/3.1 Sfc Total Net Flux, 24 Yr Average for Oct

The Global Energy and Water Exchanges (GEWEX) is an integrated program of research, observations, and science activities with the goal of providing data sets to support accurate predictions of global and regional climate change. Research in the areas of Earth radiation budget, hydrometeorology, and modeling/prediction contribute to meeting the goal of GEWEX.

The NASA/GEWEX SRB project is a major component of the GEWEX radiation research. The objective of the NASA/GEWEX SRB project is to determine surface, top-of-atmosphere (TOA), and atmospheric shortwave (SW) and longwave (LW) radiative fluxes with the precision needed to predict transient climate variations and decadal-to-centennial climate trends.

Special Release Announcement

The NASA/GEWEX SRB project team announces a modified version of the GEWEX Longwave data set. Denoted as version 3.1, this version corrects for a numerical instability issue that was found to affect a small number of 3 hourly grid box TOA outgoing and surface downward fluxes. The approximate number of grid boxes affected ranged from 7-12 (out of 8 hours x 30 days x 44016 total grid boxes) per month. The 3-hourly values in those instances were significantly in error but had little effect on daily, 3-hourly monthly and monthly averaged values. Users analyzing 3 hourly fields are advised to obtain the new data set. Please contact us if you have more specific questions.



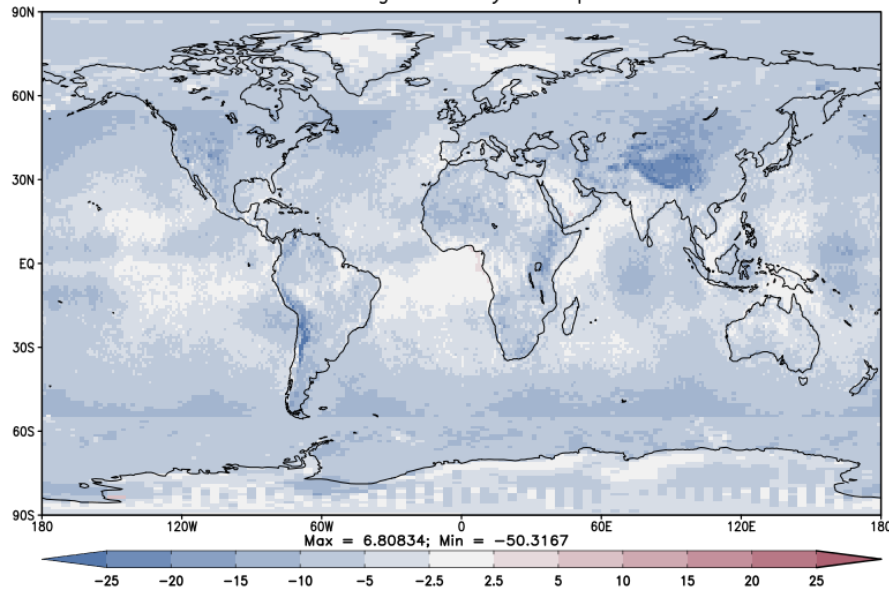
SRB Release 3 Data Products

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

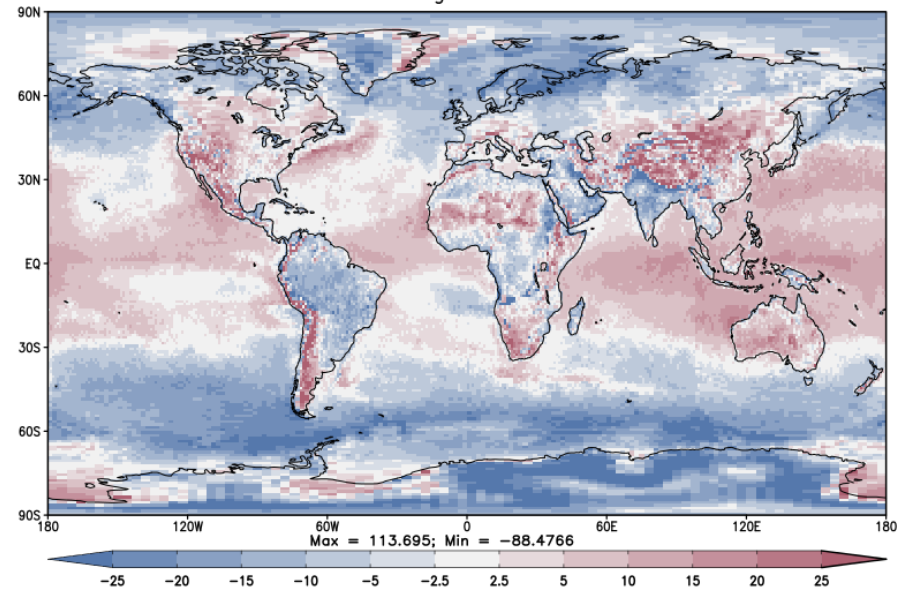
Data Types	Model Name	Temporal Resolution	Parameters
SW	GEWEX SW (Pinker/Laszlo) (v3.0)	3-hourly, Monthly Averaged 3-hourly, Daily and Monthly Averaged (UTC and local sun time)	All-sky: Surface down, up, PAR down; TOA Down, Up
			Clear-Sky: Surface Down, Up; TOA Up
	LPSA (Staylor/ Gupta) (v3.0)	Daily, 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

Annual Averaged Differences of new LW compared to CERES

global = -6.46483 60-90N = -5.69927 60-90S = -6.87631 20N-20S = -5.06755
 20-60N = -7.90291 20-60S = -6.94129
 Ver.4 nnHIRS, Beta - EBAF
 2007 Average: All-sky LW Up at TOA



global = -1.24364 60-90N = -9.59478 60-90S = -13.1995 20N-20S = 4.17874
 20-60N = 0.767373 20-60S = -5.1411
 Ver.4 nnHIRS, Beta - EBAF
 2007 Average: LW dn at Sfc



- GEWEX SRB Rel 4-IP:
 - New inputs from ISCCP nnHIRS and HXS processed were assessed and new algorithms processed for $1^\circ \times 1^\circ$
 - 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

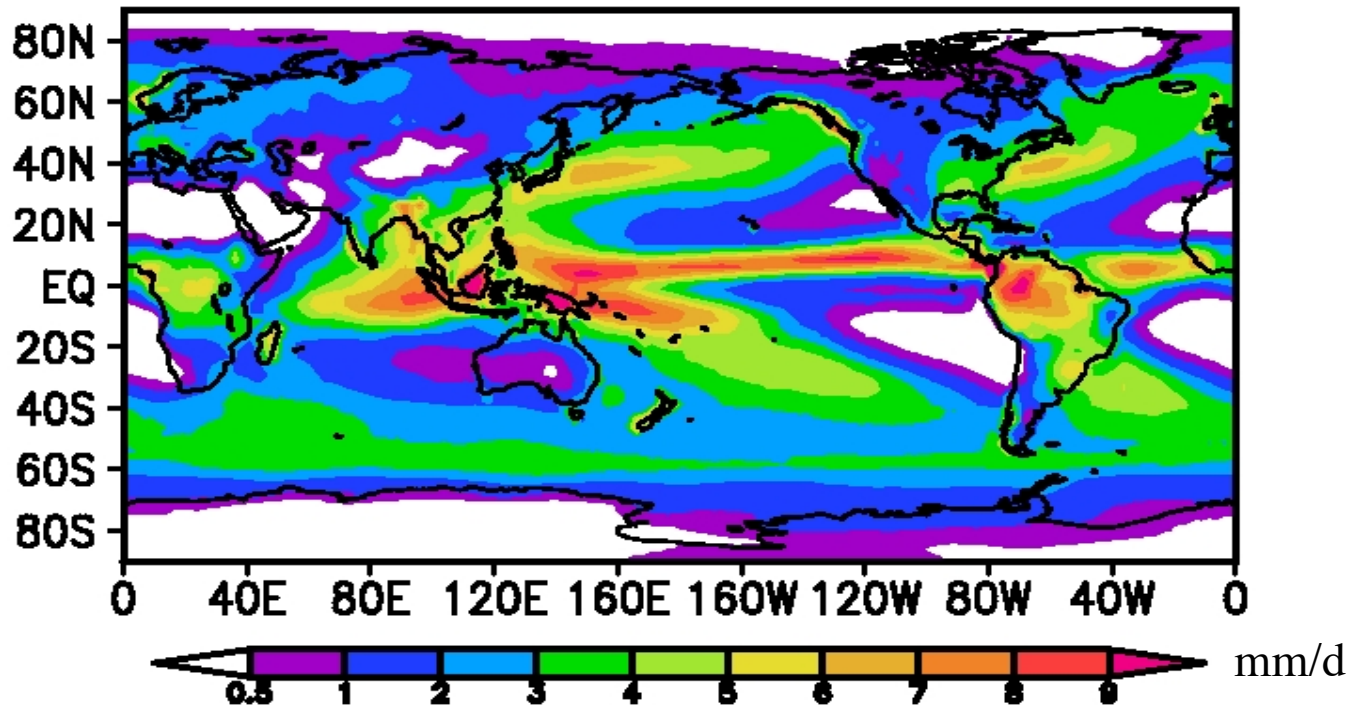
Summary and Conclusions

- Next Steps:
 - Will reprocess both SW and LW fluxes with Version 1 HXS at $1^\circ \times 1^\circ$; 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 $\frac{1}{2}^\circ \times \frac{1}{2}^\circ$ nearly completed
 - Using full equal area sampling and data production grid
 - Will provide data provides at the $\frac{1}{2}^\circ \times \frac{1}{2}^\circ$ equal angle

Global Precipitation Climatology Project (GPCP)

Robert Adler

U. of Maryland



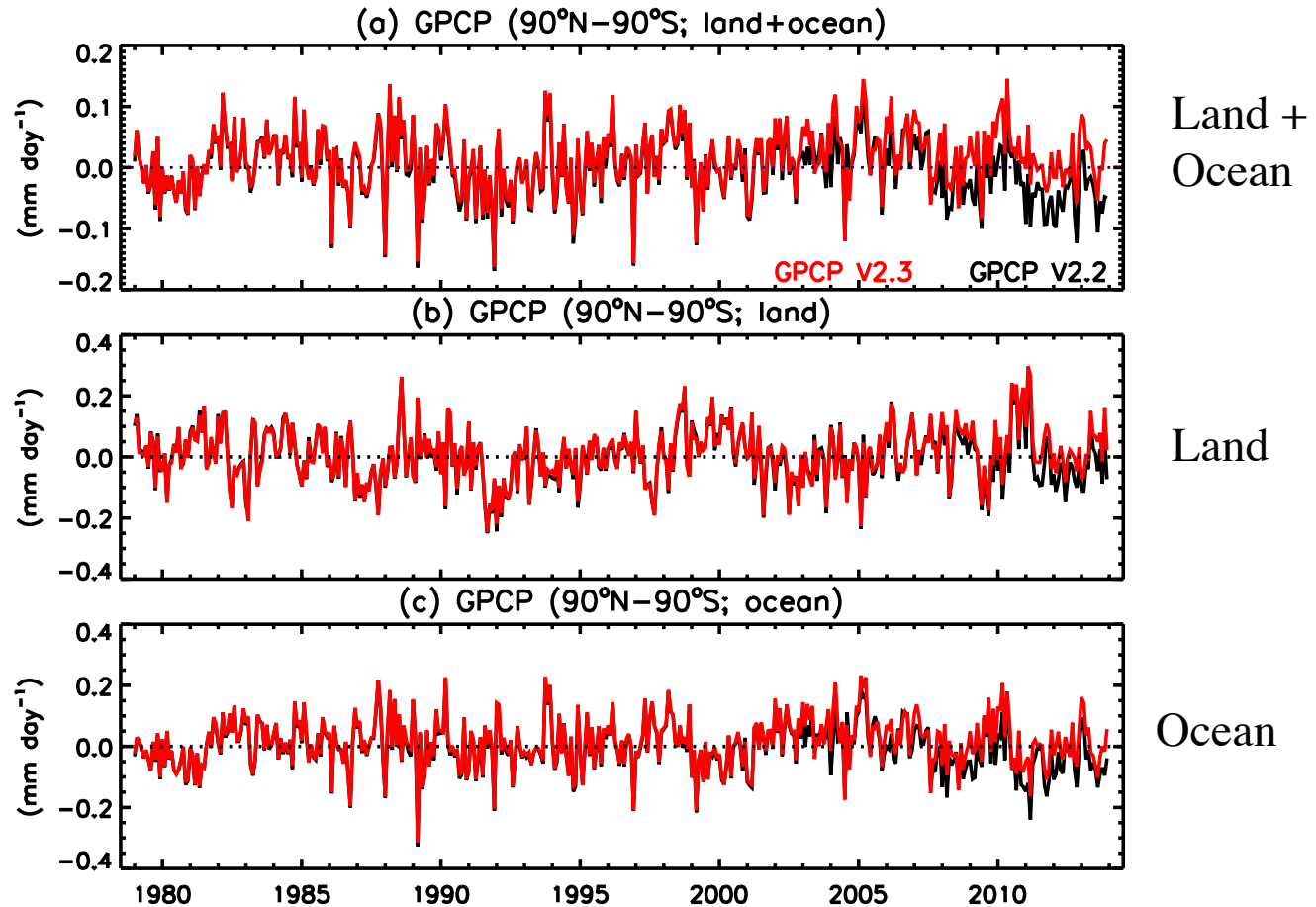
GPCP is an often-used analysis based on satellite and gauge data (1979-near present).

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

Adler et al., 2003 J. Hydromet

Huffman et al., 2009 GRL

GPCP New V2.3 vs. V2.2



- Differences due to cross-calibration errors (SSM/I to SSMIS and TOVS to AIRS) over ocean and use of new GPCC “Full” gauge analysis
- Biggest difference after 2009 ($\sim 1.8\%$ over ocean)
- Regionally biggest difference 40–60N over ocean

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



1930

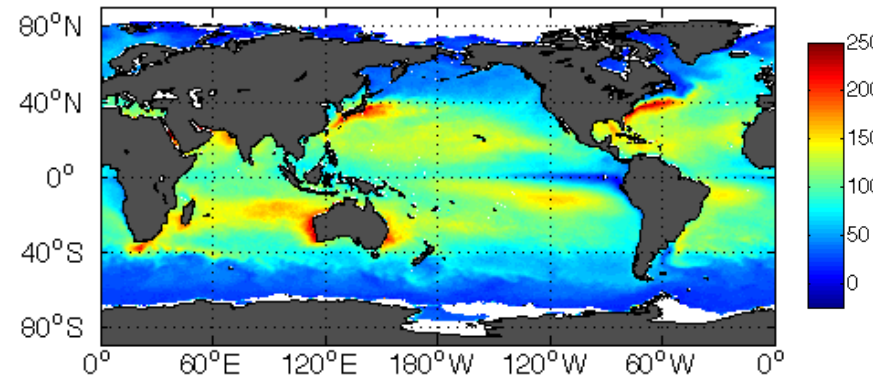
SeaFlux

- 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°, 3 hourly) turbulent flux dataset

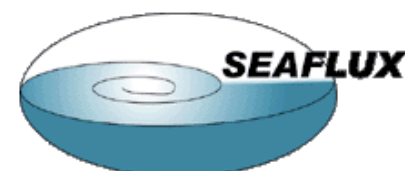
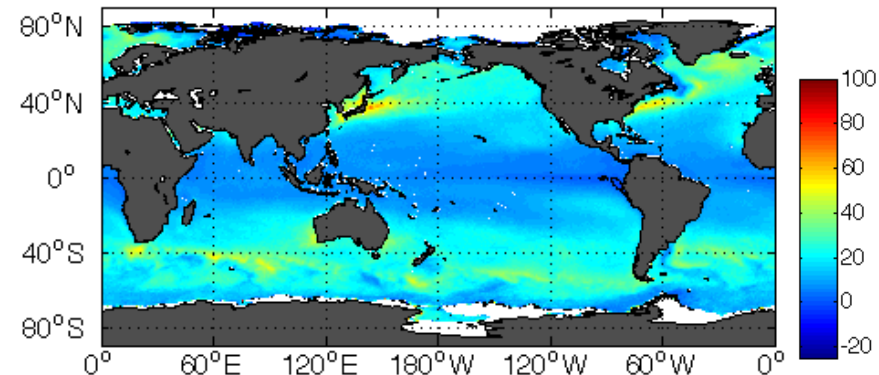
SeaFlux CDR version 2

- 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

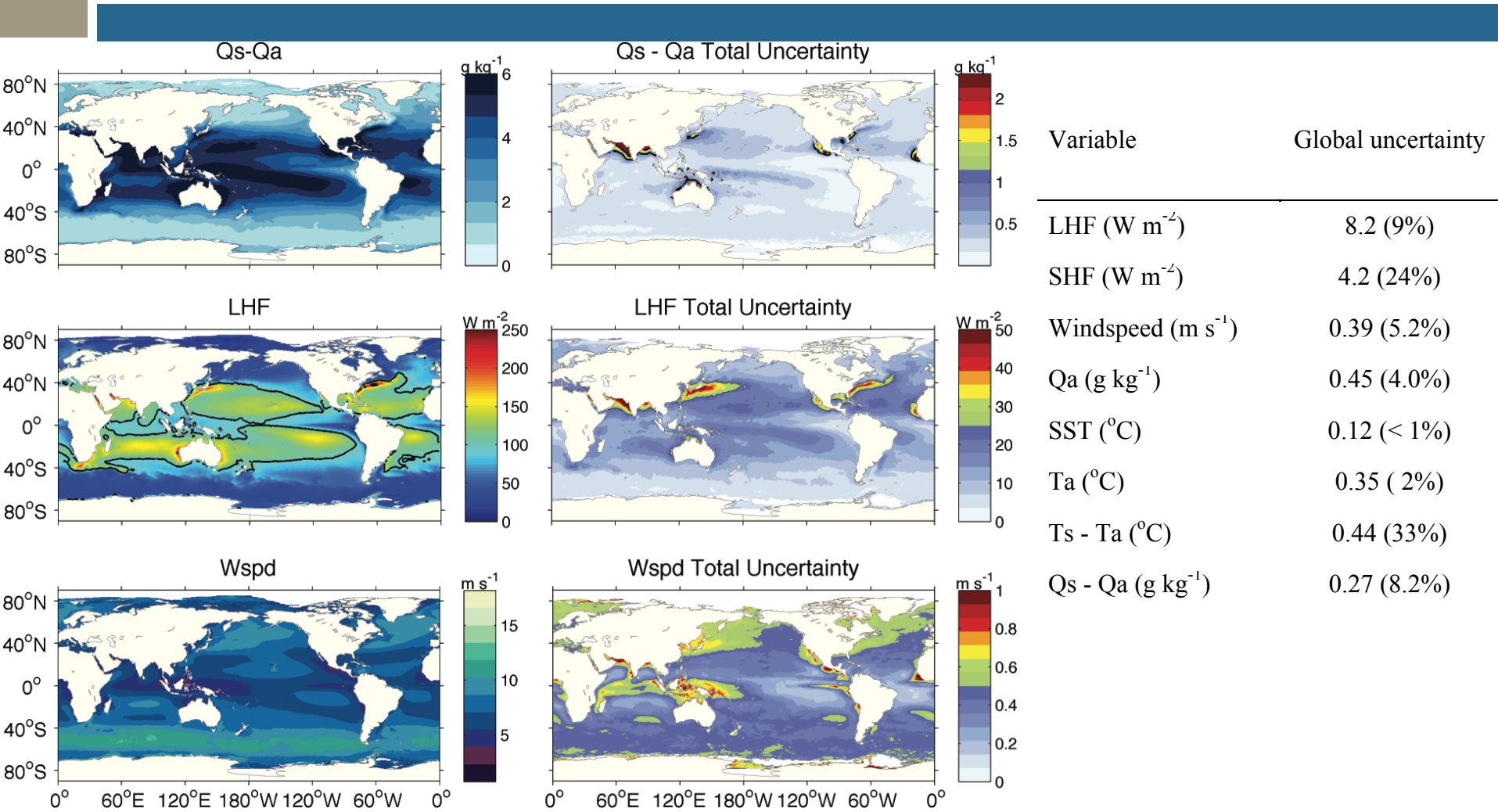
1999 Latent Heat Flux



1999 Sensible Heat Flux



Uncertainty estimates of 10-year means



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:

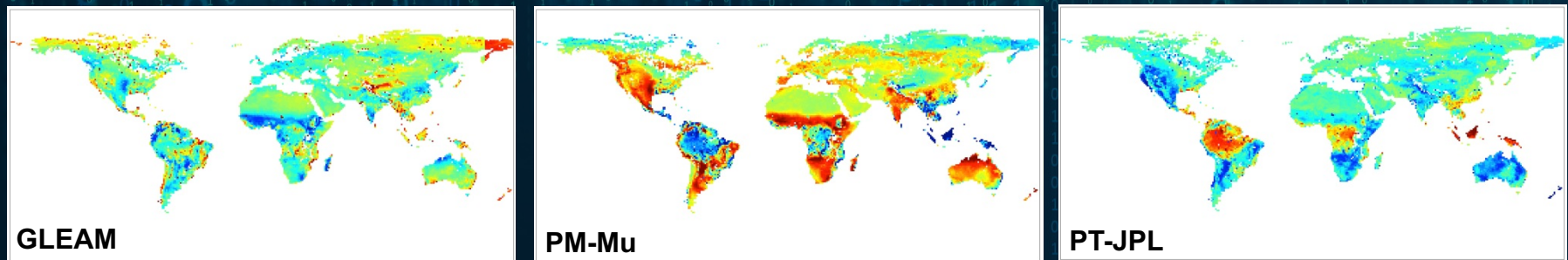
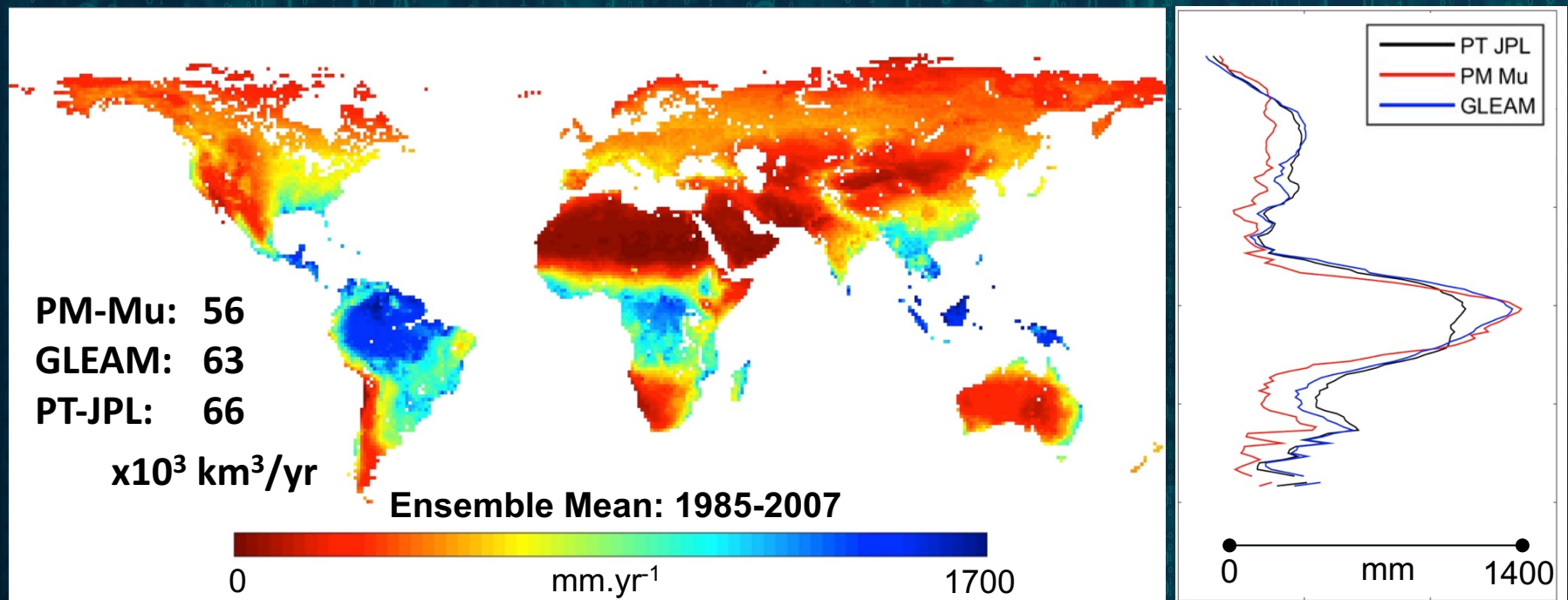
- **Fluxes cannot** be monitored directly (needs to be inferred)
- **No** obvious best methodology
- **No** clear understanding of product quality (benchmarking)



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



Global LandFlux Simulations



Model Mean - Ensemble Mean: 1985-2007

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)

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

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

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

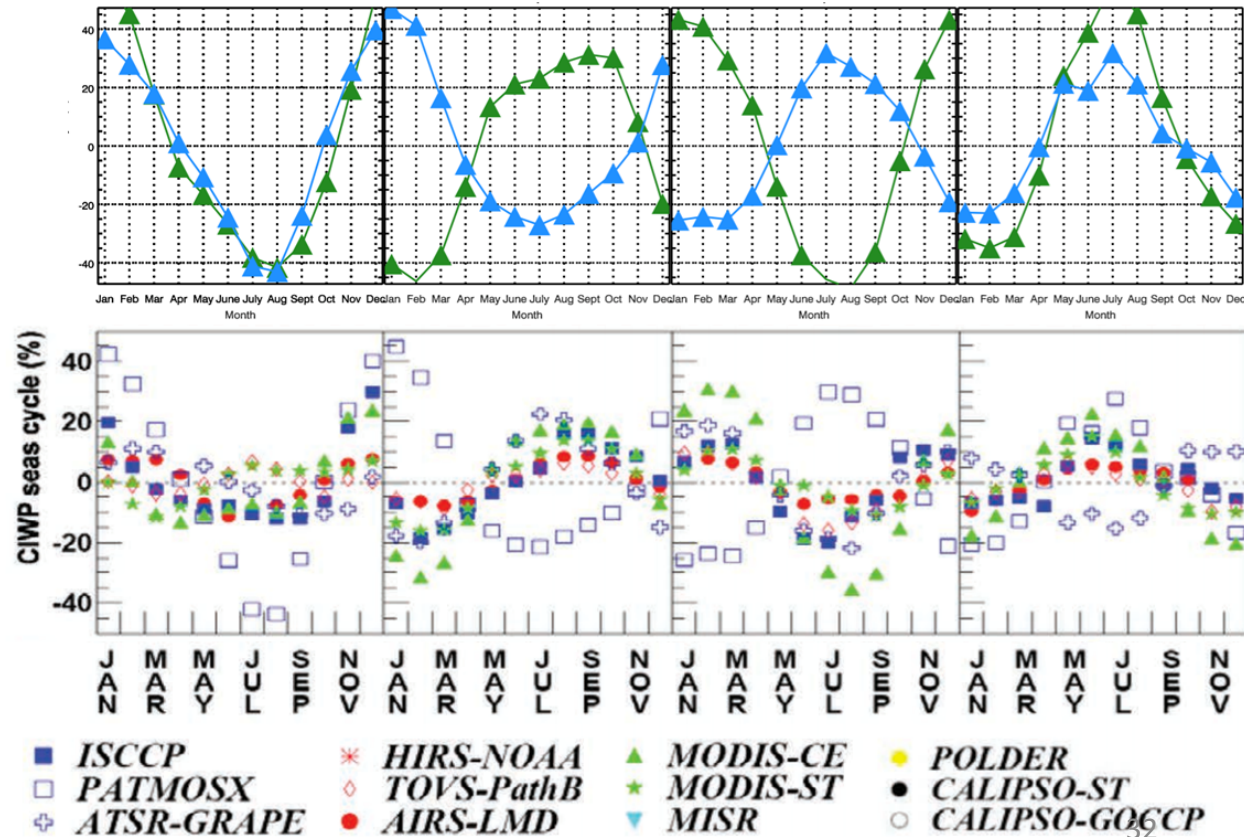
ISCCP <i>GEWEX cloud dataset</i>	1984-2007	<i>(Rossow and Schiffer 1999)</i>
MODIS-ScienceTeam	2001-2009	<i>(Menzel et al.2008; Platnick et al. 2003)</i>
★ MODIS-CERES	2001-2009	<i>(Minnis et al. 2011)</i>
★ TOVS Path-B -> HIRS-CM SAF	1987-1994	<i>(Stubenrauch et al. 1999, 2006) ->CM SAF</i>
★ AIRS-LMD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

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 unnoticed.

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

Cloud Ice Water Path



The GEWEX water vapor assessment (G-VAP)

Marc Schröder, Maarit Lockhoff, Kathrin Graw, Lei Shi

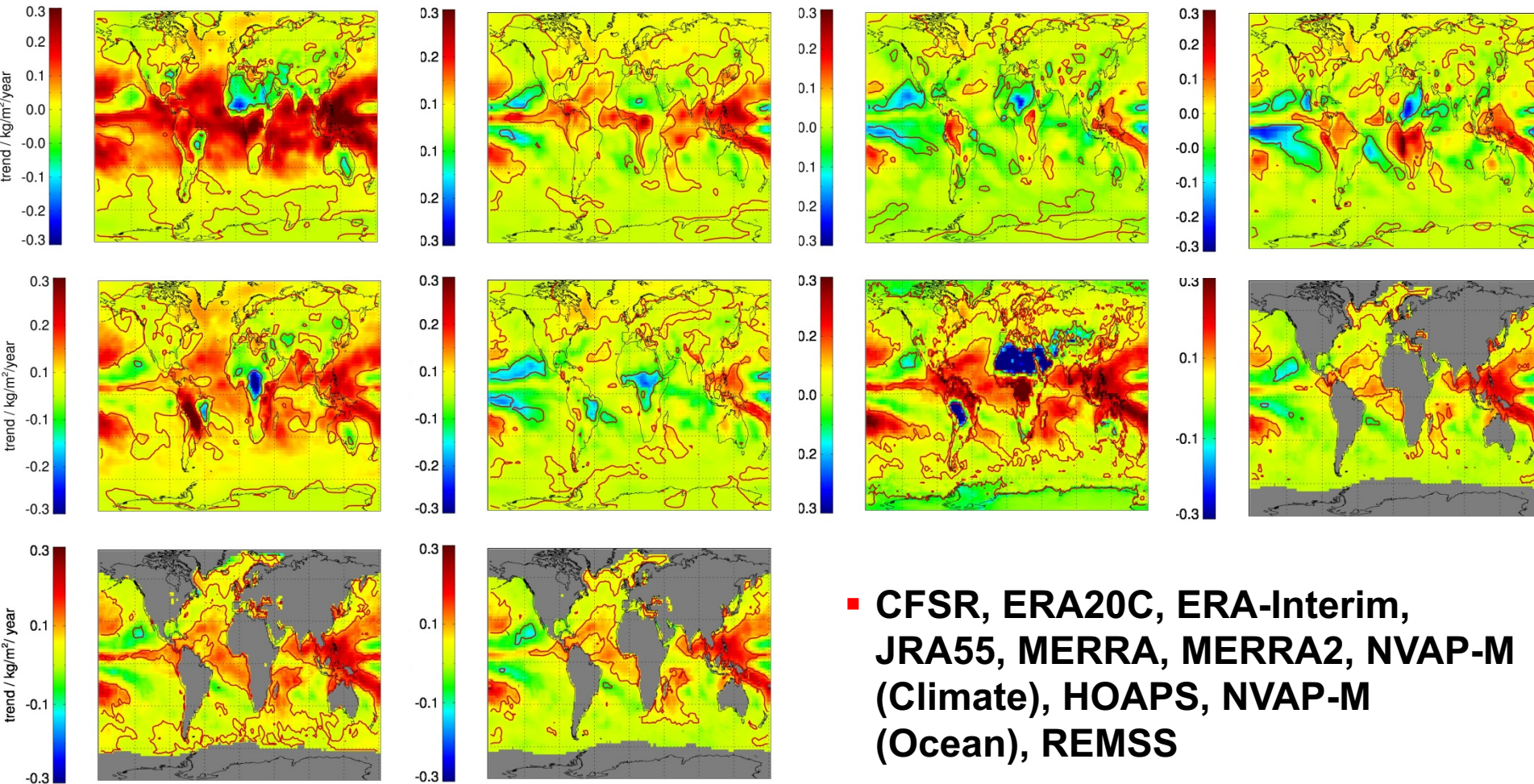
Thanks goes to

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.

Trend estimates



- 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.

Updated from Schröder et al. (2016)



AOT (AEROSOL) assessment

AOT – Aerosol Optical Thickness



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



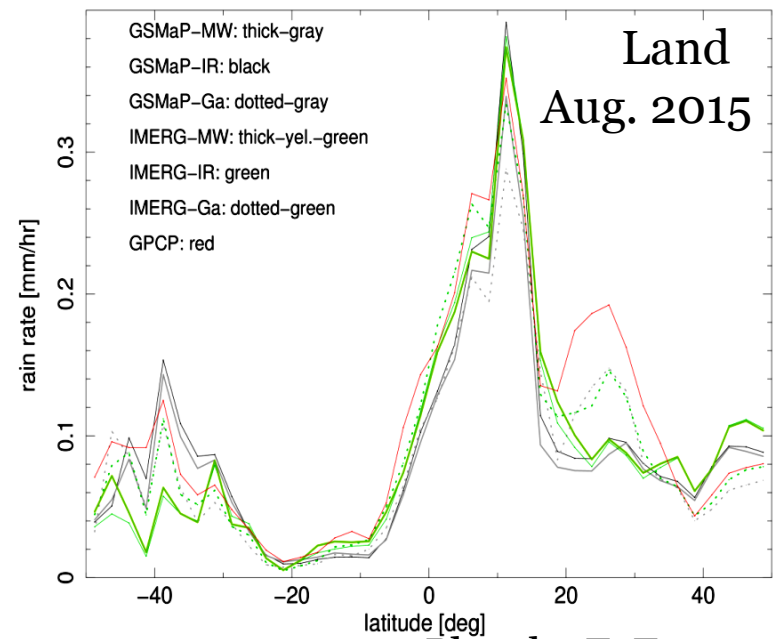
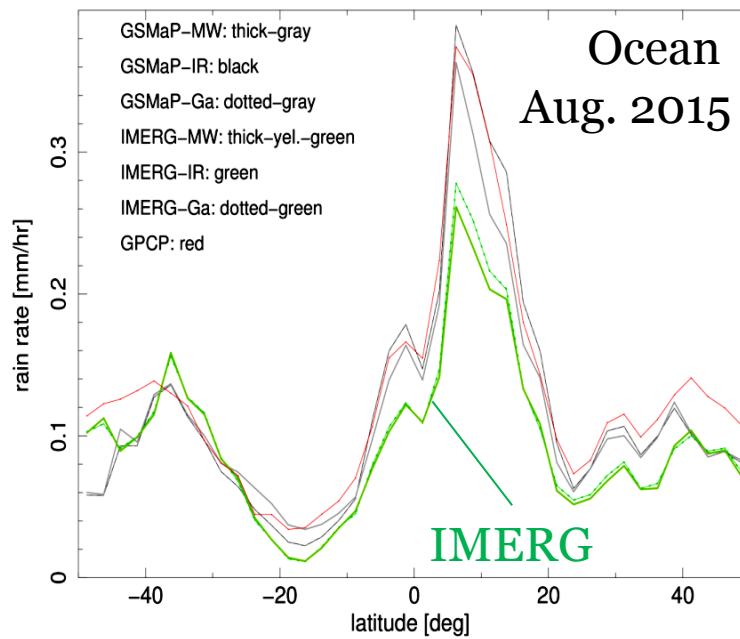
GDAP Precipitation Assessment

HIRO MASUNAGA AND CHRIS KUMMEROW



Global multi-satellite datasets

- ▶ Zonal mean rainfall (August 2015)
 - ▶ Global multi-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



Towards Soil 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 of 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 to serve as the **official guideline for a soil moisture assessment activity** has not been finalised and no review by GDAP was performed;
- Assessment start uncertain.

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);

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.