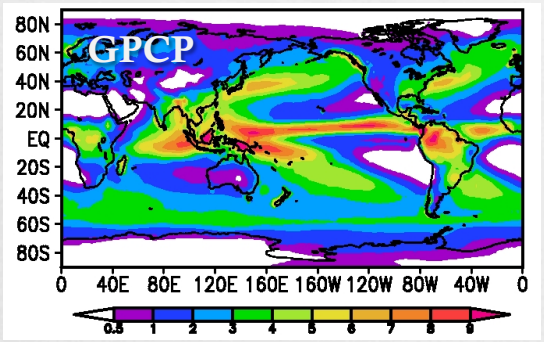
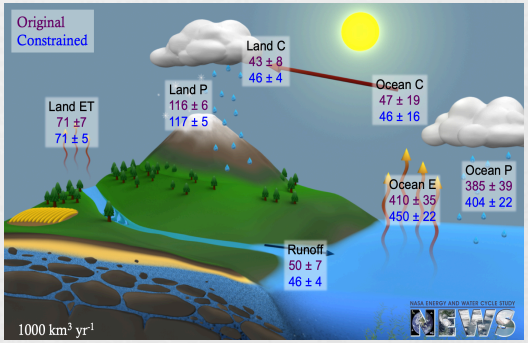
GDAP Panel Highlights

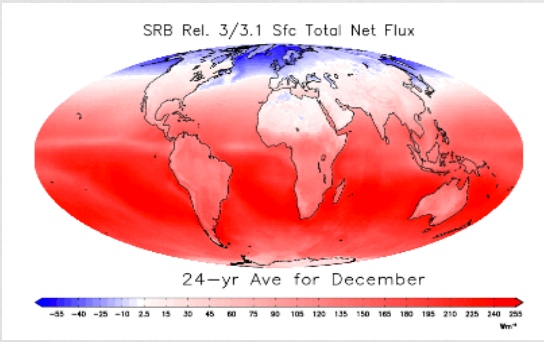
Tristan L'Ecuyer and Remy Roca

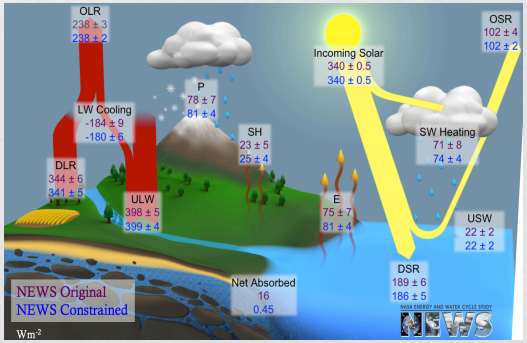
Realizing a New Vision

Products → Processes









GDAP: Assessment → Analysis

GDAP
GEWEX Data Analysis Panel

Endorsed Products

- Matured Products: ISCCP, GPCP, SRB, SeaFlux, LandFlux
- New Products: GEWEX Integrated Product, ISCCP-NG
- Ground Networks: BSRN, GPCC
- Engagement with External Groups
  - ARM and other well-instrumented super sites
  - Reanalyses

GDAP Science Drivers

Science Focus	Activity
Energy imbalance and climate sensitivity	EEI Assessment
Cloud dynamics and feedbacks	ISCCP-NG
Global land-atmosphere interactions	GEWEX Integrated Product and Ground Networks
Global energy and water cycle variability	Land closure assessment
Precipitation extremes	Precipitation Assessment

Meetings and Workshops

- GCOS – Marrakech, March 2019
- GEWEX SSG – Geneva, April 2019
- DOE Precipitation Metrics Workshop – Maryland, July 2019
- GAP workshop – Oxford, October 2019
- ISCCP-NG workshop – Darmstadt, October 2019
- GDAP panel meeting – Tucson, January 2020

GEWEX Integrated Product

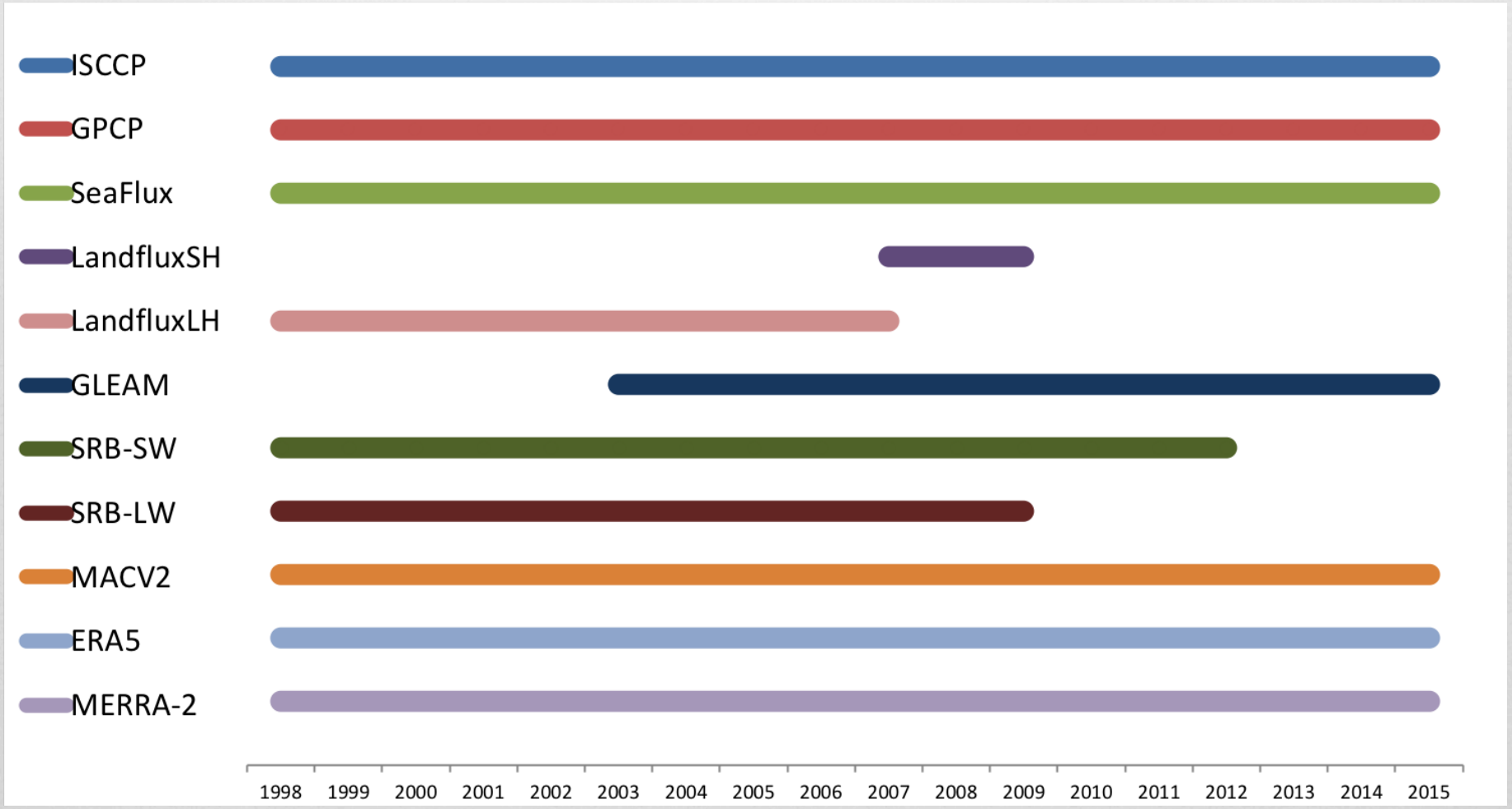
NEW PRODUCT MOTIVATED BY SCIENCE FOCI

- Began in 2009 under GRP (predecessor to GDAP) to create a '*Unified Product*' to homogenize all parameters and assumptions that exist across distinct E&WC products
- Homogenizing parameters proved too challenging due to downstream dependencies so project was redefined by GDAP in 2015 to create "*Integrated Product*" that simply put the different products into a single file on a uniform equal-area grid
- Product released in 2019 supplies all energy and water cycle parameters from GEWEX-supported products and several ancillary fields at 1°, 3-hourly resolution, on an equal area grid, from 1998-2015
- Future enhancements are being considered

- Chris Kummerow

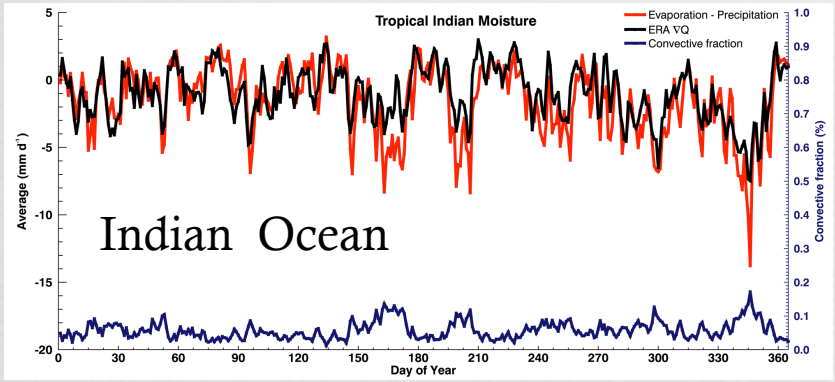
GEWEX Integrated Product

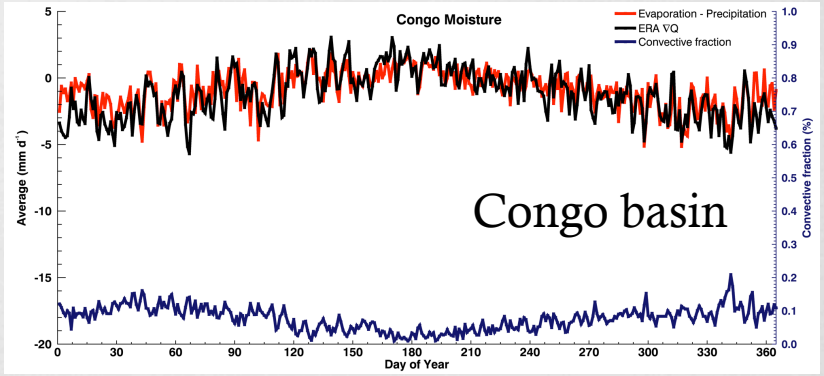
1°, 3-hourly, 1998-2015



Application to Energy and Water Cycle Closure

- Data for 2007
- 4 tropical regions: 2 ocean and 2 land
- Moisture balance, Atmos. & Sfc. energy balance





$$E - P = \nabla \cdot Q$$

Following Brown and Kummerow (2014)

GEWEX Integrated Product Workshop

Theme: Land Surface-Atmosphere interactions from global water and energy perspective

Objectives:

- Better understand the uses and limitations of the newly released GEWEX Global, 1 degree, 3-hourly Integrated Water and Energy Products for use in land surface – atmosphere interactions
- Assess the overall consistency of the GEWEX integrated product at the local scale
- Identify additional parameters that should be included going forward including those from established ground-based measurement sites like ARM

GDAP
GEWEX Data Analysis Panel

Anticipated Outcomes

- New initiatives centered on bridging local- and global-scale observations through direct interaction between global and ground-based observation communities (e.g. ARM)
- Process studies centering on understanding land-atmosphere interactions
- A GDAP continental-scale land energy and water cycle closure assessment
  - Closure constraints provide a critical sanity check on uncertainty estimates assigned to individual fluxes
  - Prior results suggest that uncertainty estimates may be too optimistic at *continental* scales
  - Extension to smaller regions and shorter timescales allows variability and trends to be assessed possibly revealing components to target for improvement
  - Easily extended to reanalyses and CMIP

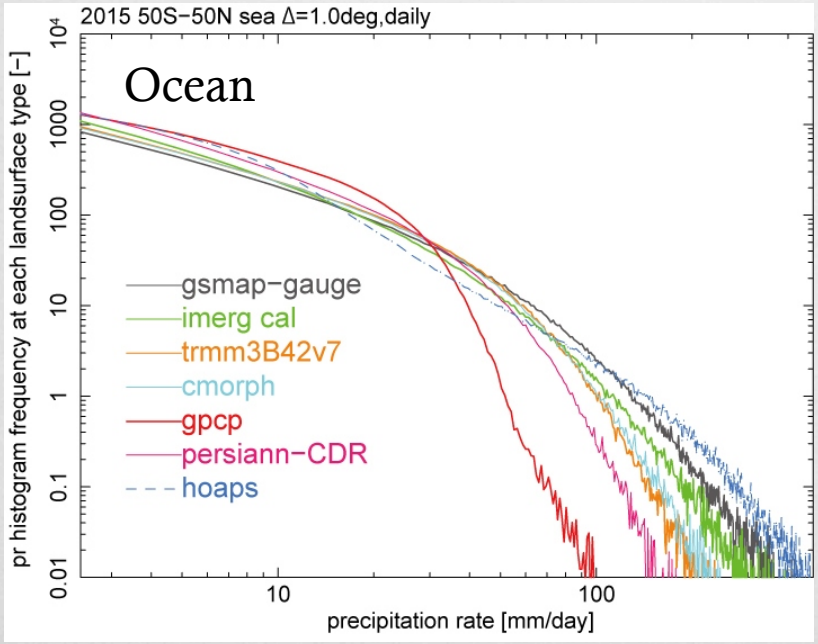
Precipitation Assessment

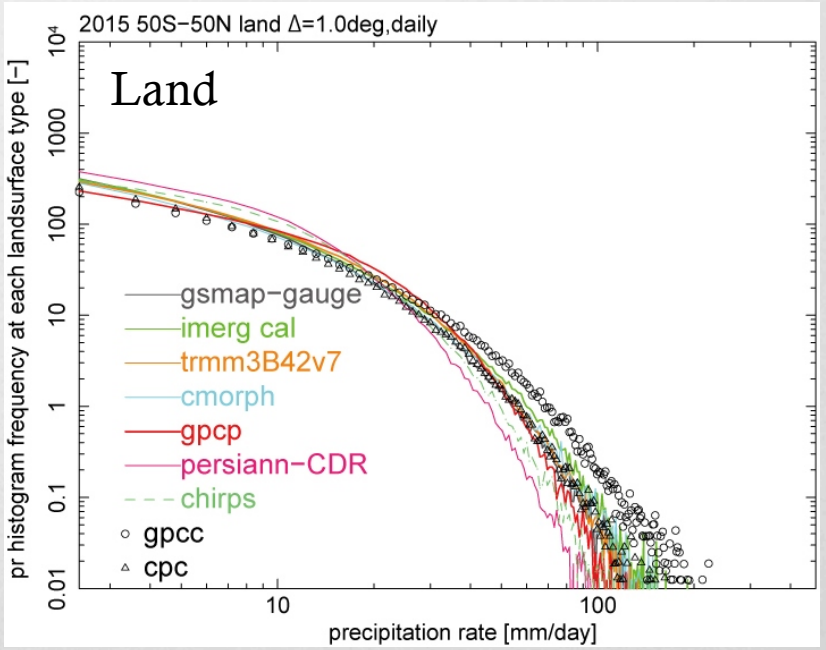
ASSESSING UNCERTAINTY IN A PRINCIPAL COMPONENT OF THE GLOBAL WATER CYCLE

- Began as a joint effort between IPWG and GDAP
- Initial scope reduced due to inactivity of several participants (esp. IPWG)
- Report planned for 2020 covering:
  - Algorithms and data products
  - Real-time meteorological and hydrological applications
  - Climate applications including closure
  - Extremes
- Database: FROGS database provides access to daily, 1° gridded precipitation from more than 30 rain gauge, satellite, and reanalysis products (Roca et al, 2019)

Example

- Comparing 1°×1°, daily rain histogram for selected global rainfall products in 2015
- Large differences in oceanic rainfall extremes





GDAP
GEWEX Data Analysis Panel

Earth's Energy Imbalance Assessment

HOW WELL DO WE UNDERSTAND EEI AND ITS VARIABILITY?

Method	EEI (Wm^{-2})	OHC rate ($10^{22}J\ yr^{-1}$)	Notes
In situ ocean	0.65 ± 0.11	0.96 ± 0.18	0-2000 m; update of Johnson et al. (2018);+ deep ocean contribution 0.04 Wm^{-2}; update of Purkey & Johnson (2010; PJ10); This uncertainty does not take into account the uncertainty due to data distribution, which can amount to around a tenth of Wm^{-2}
Net heat flux	10-15 ± 15		Irradiances from Kato et al. (2018); sensible & latent heat flux from L'Ecuyer et al. (2015)
Satellite sea level Altimetry-GRACE	0.53 ± 0.38	0.79 ± 0.56	ΔSL_{thermo}= 1.02 $mmyr^{-1}$; expansion efficiency of heat = 0.12 mYJ^{-1} (Levitus et al., 2012);
Ocean reanalyses	0.74 ± 0.14	1.10 ± 0.23	0-2000 m; update of von Schuckmann et al. (2018); + deep ocean contribution (PJ10); This uncertainty likely underestimate the uncertainty in deep ocean warming by about 0.5 Wm^{-2} (see Palmer et al. 2017)

- Goals:
  - assess distinct methods for determining EEI and reconcile uncertainties;
  - quantify EEI variability and the factors that influence it;
  - determine the scales on which EEI and regional energy imbalances can be quantified (e.g. on what scales can TOA and SFC measures be reconciled?);
  - explore potential of current EEI estimates to constrain climate sensitivity.

GDAP
GEWEX Data Analysis Panel

ISCCP-Next Generation

ADVANCED NEW PRODUCT TO SUPPORT CLOUD SCIENCE

First Workshop: 28-31 October, EUMETSAT, Darmstadt, Germany

Main Discussion Topics

Input: Ingesting the Raw L1b from the Advanced Geo Imagers and generating a global gridded (L1g) of the common channels on a specified grid with certain temporal resolution.

Output: Developing L2g and L3 products based on the L1g and other data to make information to feed applications.

Applications: Use our current knowledge to inform the ISCCP-NG L1g and L2g efforts to optimize their efforts to generate a data-set that has utility for the coming decades.

Governance: The specification of roles and support by space and research agencies and how to implement them in international framework..

Next Steps

- Report at CGMS 48 on 24-29 May, 20202 in Xi'an to engage the space agencies and develop terms of reference for ISCCP-NG.
- White Paper to WCRP.
- New Topical Group in the CGMS International Cloud Working Group (ICWG) will discuss optimal L1 and L2 spatial, spectral and temporal sampling.
- ISCCP-NG discussion at GSICS meeting 16-20 March 2020 in Seoul, South Korea.
- A 2nd ISCCP-NG Workshop will be planned for sometime in 2021.

GDAP
GEWEX Data / Analysis Panel

ISCCP-Next Generation

ADVANCED NEW PRODUCT TO SUPPORT CLOUD SCIENCE