

GEWEX

Kevin Trenberth: Chair SSG

Peter van Oevelen: Director IGPO

D. Lettenmaier/J. Evans, J. Polcher (GHP)

C. Kummerow (GRP)

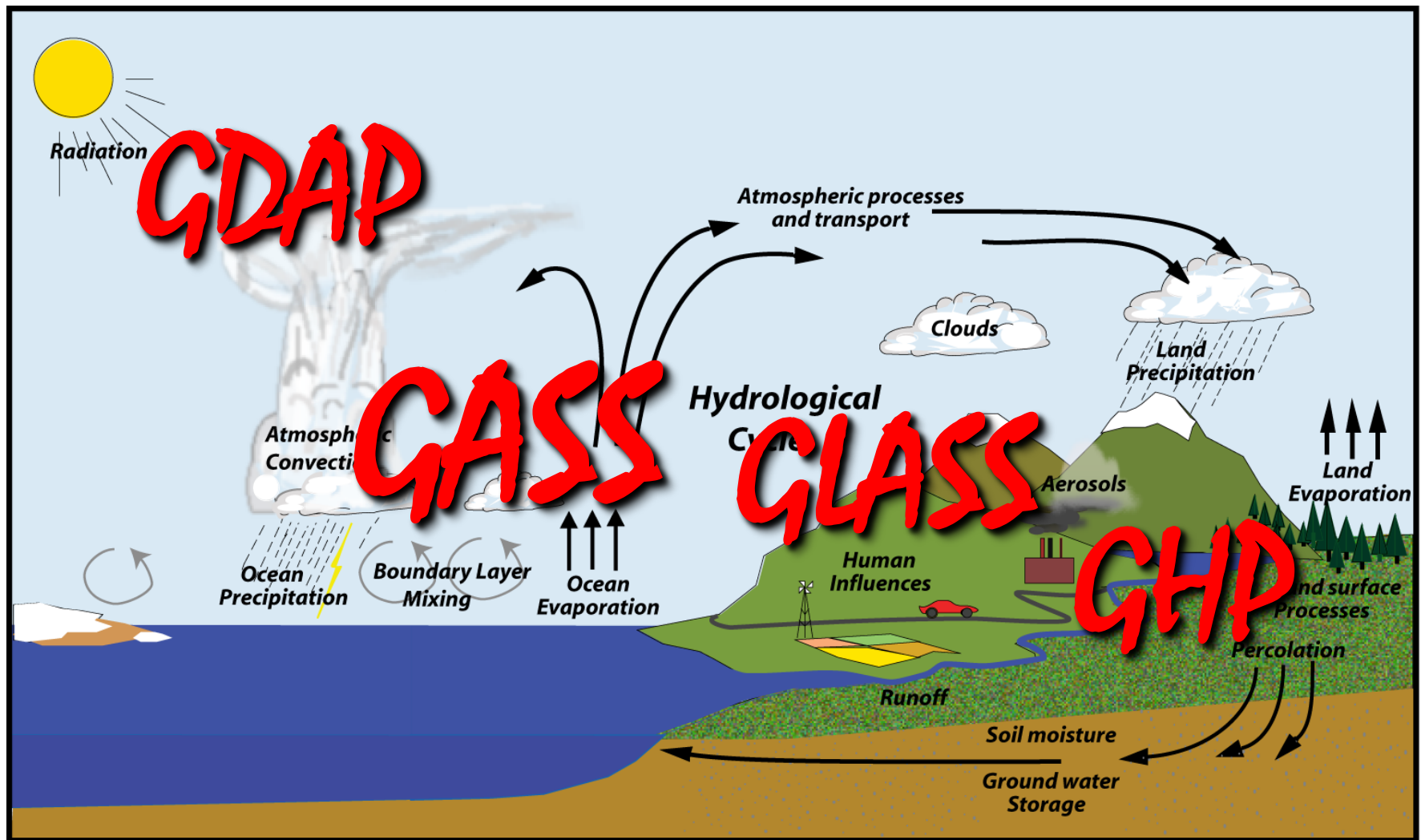
J. Santanello, M. Best (GLASS)

J. Petch, S Klein (GCSS)

B. Holtslag, G. Svensson (GABLS)

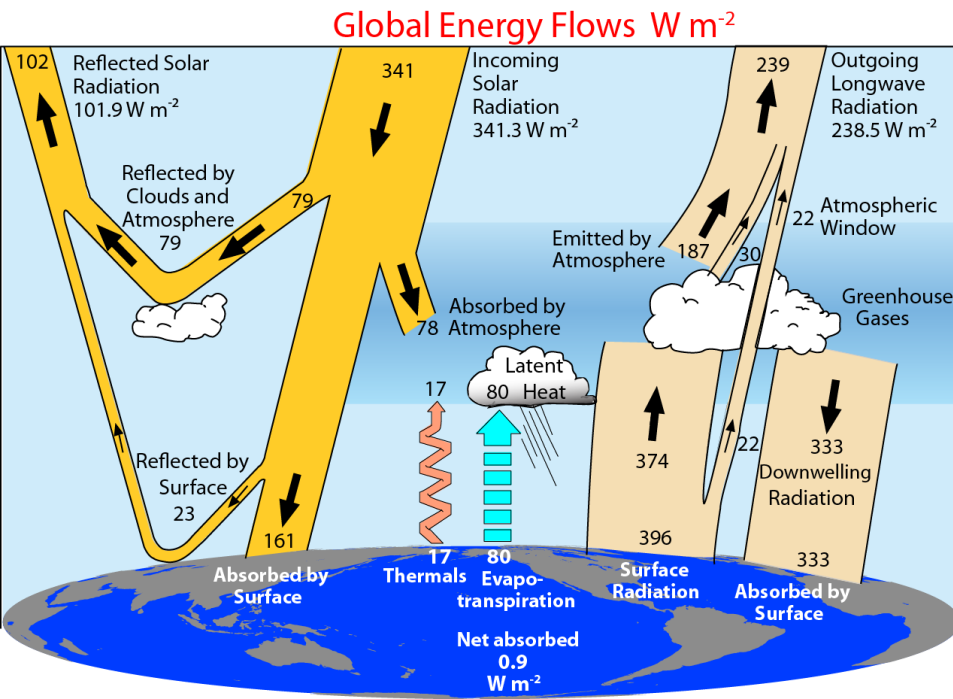


GEWEX: Major components



GEWEX Data and Assessments Panel

- Radiative processes and understanding
 - Develop and improve of radiative transfer codes, comparisons
- Global Data sets
- Global In-situ observational networks, development and standardization (radiation, soil moisture)
- Reprocessing of datasets
- Assessment and intercomparison studies
- <http://www.gewex.org/GDAP.html>



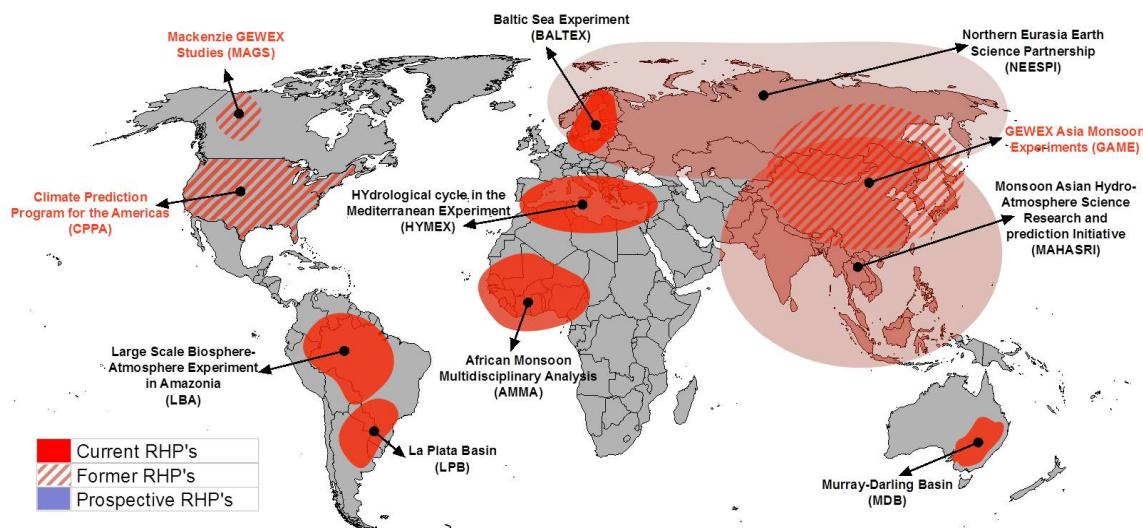
Global datasets

- Aerosols
- Clouds
- Radiation
- Water Vapor
- Precipitation
- Surface fluxes

GEWEX Hydroclimatology Panel

- **Regional hydroclimate projects**
- Globally distributed extensive **regional data sets** : water and energy cycle observations (in situ and space borne and modeling data)
- **Global Data Centers**; data management system / GEO Prototype for Water Cycle Observations
- **Regional climate and hydrological modeling and process Descriptions** (Monsoons, Extremes, etc)
- **Hydrological Applications and Forecasting** (Drought monitoring, Hydrological Ensemble Predictions...)
- <http://www.gewex.org/projects-ghp.html>

GEWEX REGIONAL HYDROCLIMATE PROJECTS



RHPs

BALTEX
HYMEX
LBA
LPB
MAHASRI
MDB
AMMA
NEESPI

proposed

SaskRB
NAWP
TPE
HYVIC

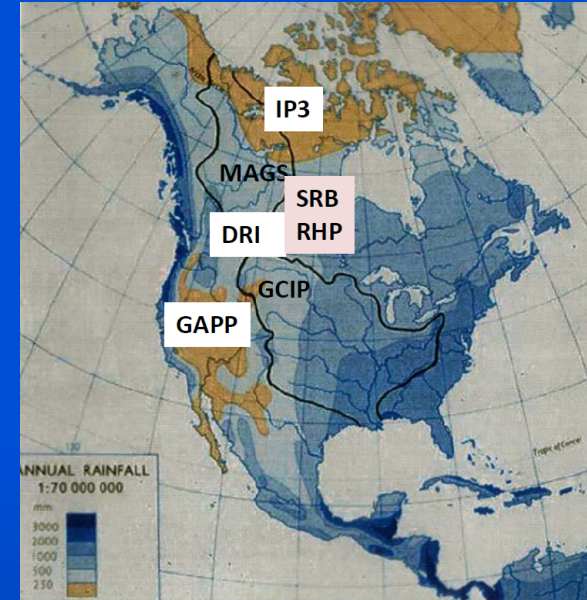
GEWEX RHPs North America

Past:

- * GCIP (Mississippi 1994-2000)
- * GAPP (US and part Mexico 2000-2004)
- * MAGS (McKenzie basin)
- * CPPA (Americas 2005-2009)

Future:

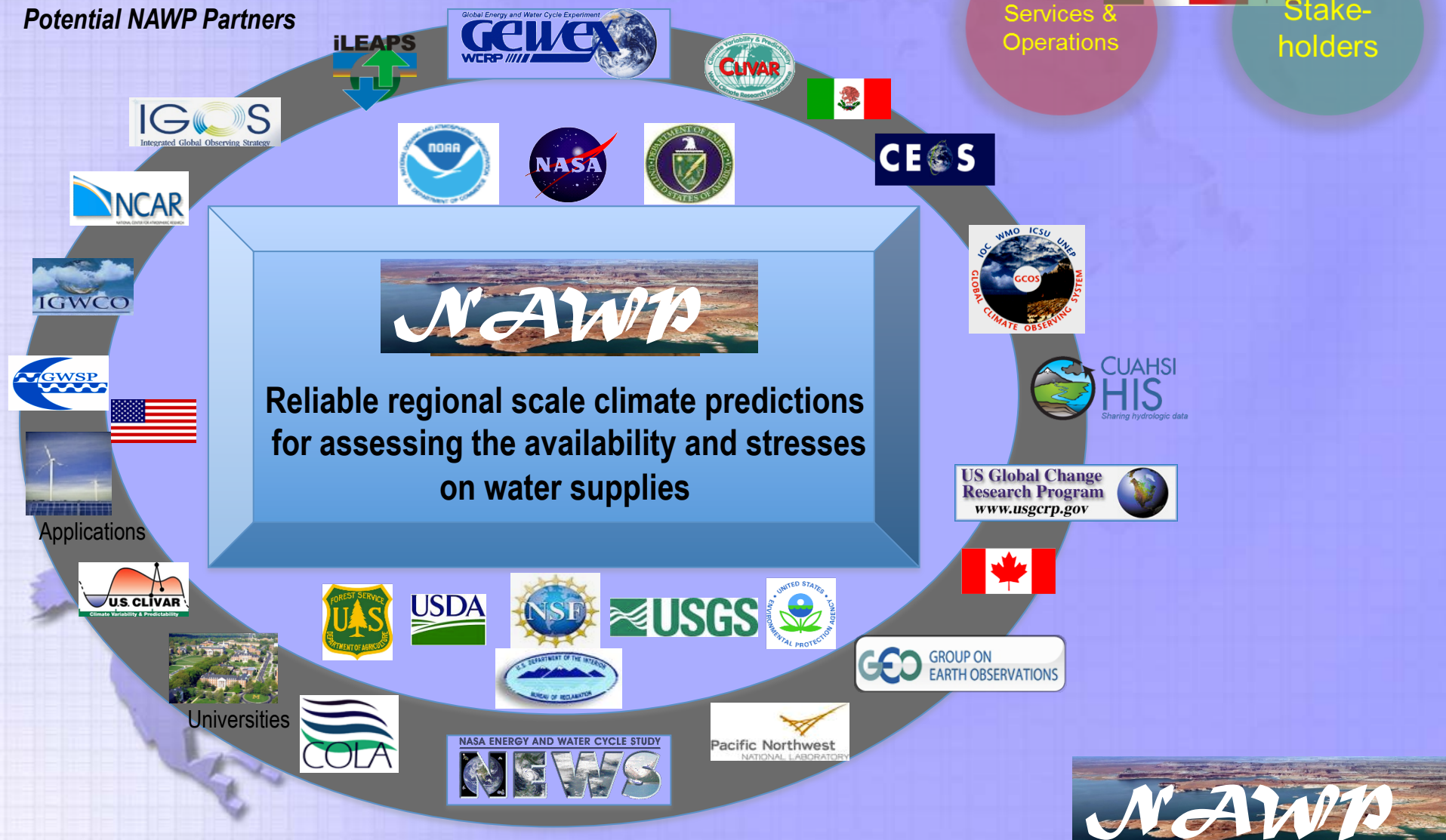
- * **NAWP: North American Water Project**
- * Was **TRACE: Terrestrial Regional North American hydroClimate Experiment**
- * workshop April 2011: <http://www.trace-rhp.org>
- * **Saskatchewan River Basin.**
- * workshop March 2011



NAWP: Partnerships

- A North American contribution to the Global Energy and Water Cycle Experiment (GEWEX), with links to other programs

Potential NAWP Partners



Saskatchewan River Basin

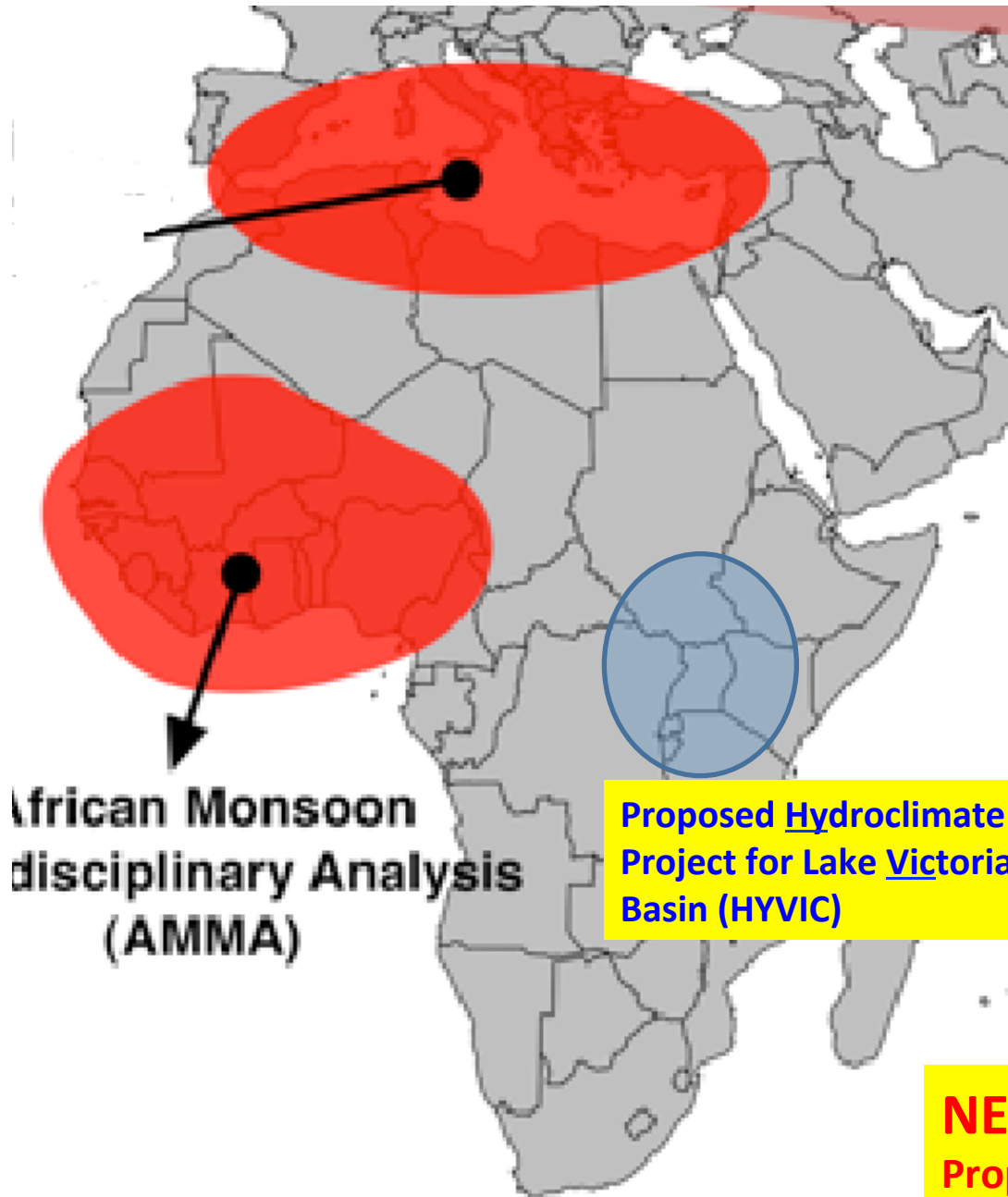
Aiming to deliver world-class research sites and data



Area 400,000 km²

- Drains from continental divide in Alberta, through Saskatchewan to Manitoba
- Transboundary basin; poses generic science and management challenges

Proposed Regional Hydroclimate Project (RHP)



What is the water balance?
What are the trends?
Why are the changes occurring?
What does it mean for water resources in the future?
What are the implications and risks for management of hydroelectric power generation, water, agriculture, and other leading sectors?

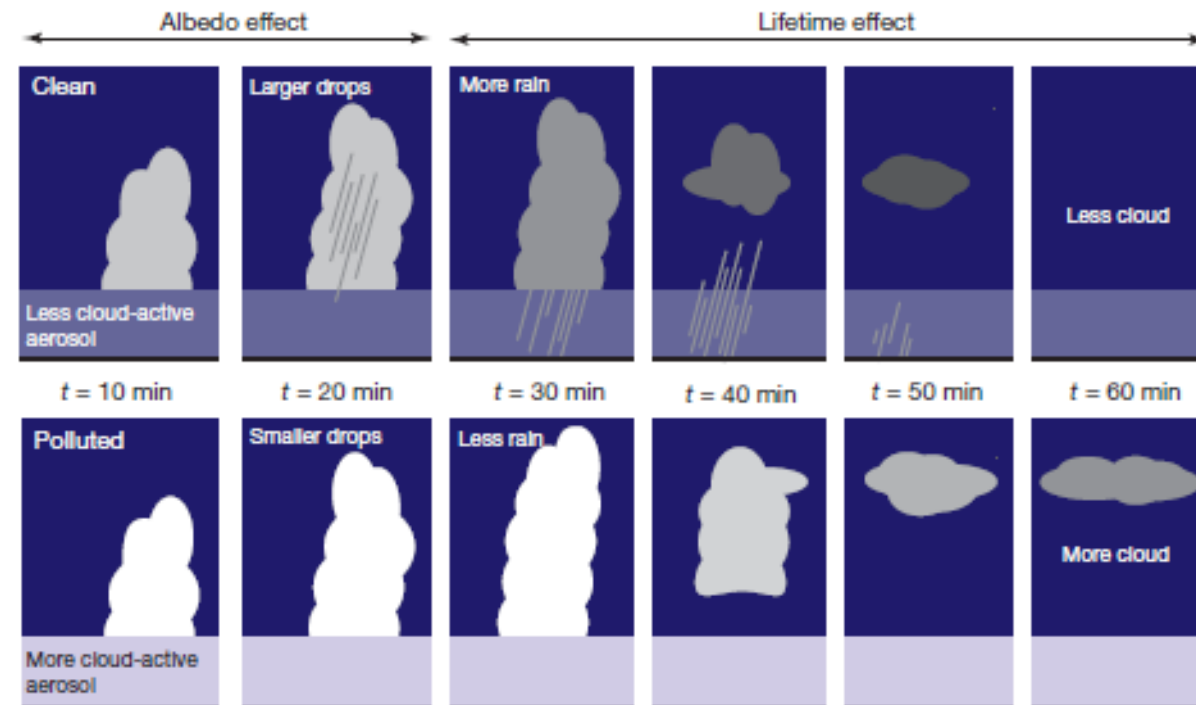
Fred Semazzi

NEXT STEPS – Draft Science Plan & Proposed HYVIC Workshop (early 2013)

GEWEX Modeling: GASS

Global Atmosphere System Study

- Atmospheric processes, esp. clouds, convection, microphysics
- Model Parameterization evaluation and development
- Data sets and tools, intercomparisons
- Atmospheric Boundary Layer
- Strong cooperation with NWP via WGNE
- http://www.gewex.org/gass_panel.html



Projects

Boundary Layer clouds

Polar clouds

Convection, clouds

GABLS3

MJO

Single Column Models

Cloud Resolving Models

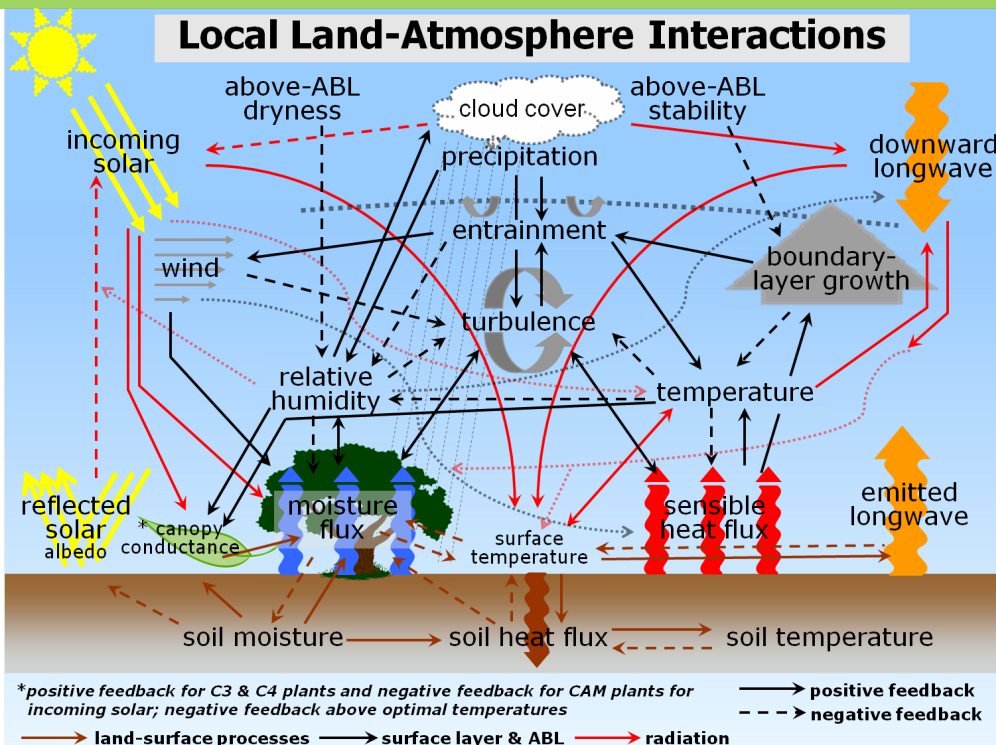
GASS-GHP links

GEWEX Modeling.

GLASS

Global Land Atmosphere System Study

- Land surface modeling
- Model Parameterization and development from land surface process
- Data sets and tools, intercomparisons
- Land-atmosphere coupling
- Model Data Fusion
- Strong cooperation with NWP via WGNE
- http://www.gewex.org/glass_panel.html



Projects

GLACE

LoCo

PILDAS

GSWP-3

PALS

PILPS

ALMIP2

LUCID2

GLASS-GHP links

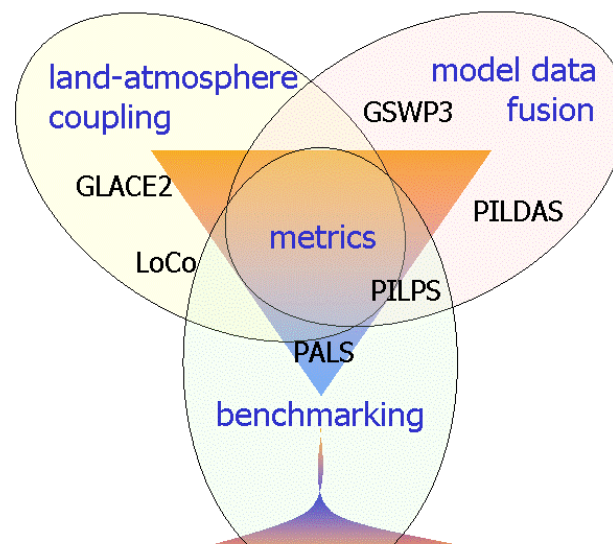
GLASS Status and Activities

- The **GLASS Mission Statement** is formulated as follows: ***Support improved estimates and representation of land states and fluxes in models, the interaction with the overlying atmosphere, and maximize the utilized fraction of inherent predictability.***
- **For the next 3 years** our contribution will be based on the inertia of developments that comprise the present structure (**Model Data Fusion – Benchmarking – Coupling**), introduced in 2009.

Ongoing Projects (POCs):

- GLACE2** (Bart vd Hurk)
- LoCo** (Joe Santanello)
- PILDAS** (Rolf Reichle)
- GSWP-3** (Hyungjun Kim)
- PALS** (Gab Abramowitz)
- ALMIP2** (Aaron Boone)
- GLASS-GHP** Links (Mike Ek)

The structure of GLASS



- LAC: Addressing land-atmosphere interaction/coupling/feedbacks in models
- MDF: Incorporates data assimilation and parameter estimation/calibration studies
- Benchmarking: Standardized way to evaluate models and their 'goodness'
- Metrics: Diagnostics and quantification at the heart of each component

Joint GEWEX/GLASS-GHP project: Land Model Benchmarking

- **GLASS** tools, i.e. ***P**rotocol for the **A**nalysis of **L**and **S**urface models (PALS)*: www.pals.unsw.edu.au.
- **GHP** reference site/model output data sets for different regions, seasons, variables: evaluate **energy**, **water** & **carbon** budgets.

GSWP: Global Soil Wetness Project

GLACE: Global Land Atmosphere Coupling Expt

LoCo: Local Land Atmosphere Coupling

PILPS: Project for intercomparison of Land Surface Parameterization Schemes

PALS: Protocol for Analysis of Land Surface Models

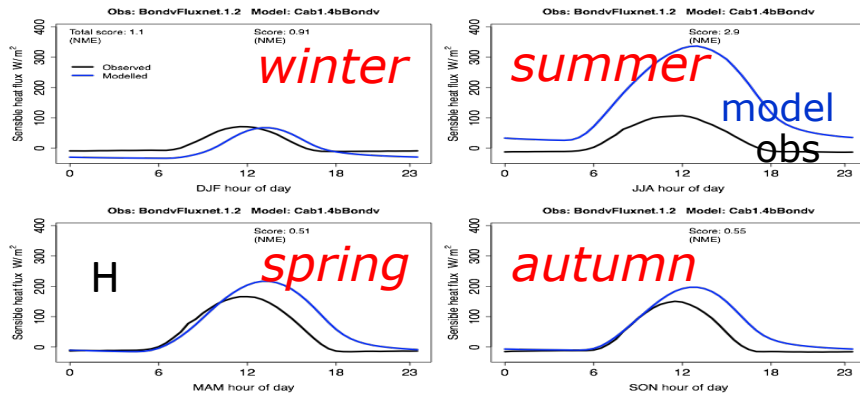
ALMIP: AMMA Land-surface Model Intercomparison Project

PILDAS: Project for the Intercomparison of Land Data Assimilation Systems

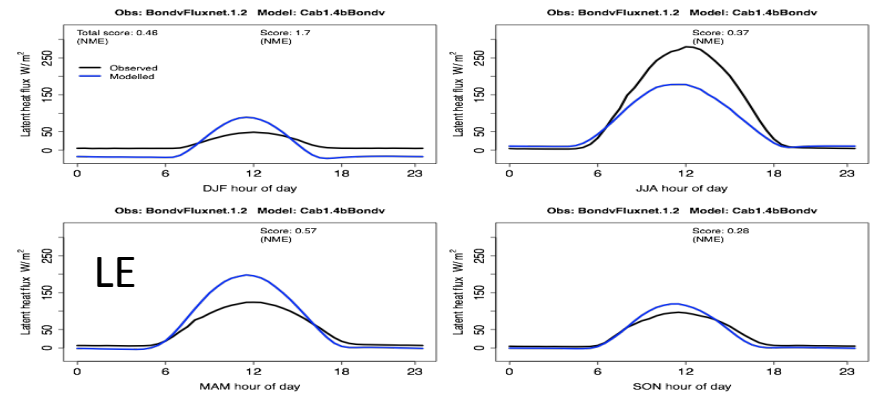
Joint GEWEX/GLASS-GHP project: Land Model Benchmarking

PALS example: CABLE LSM, Bondville, IL, USA (cropland), 1997-2006, avg. diurnal cycles

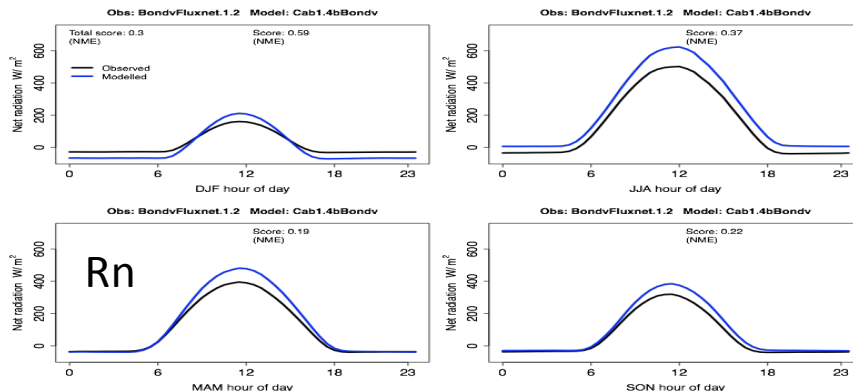
Sensible heat



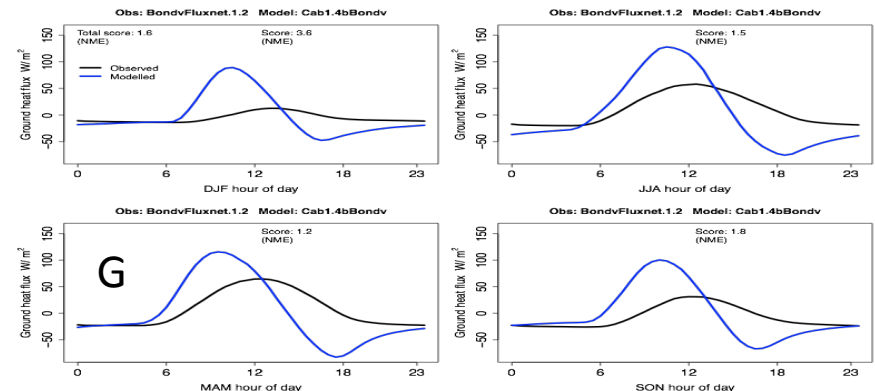
Latent heat



Radiation

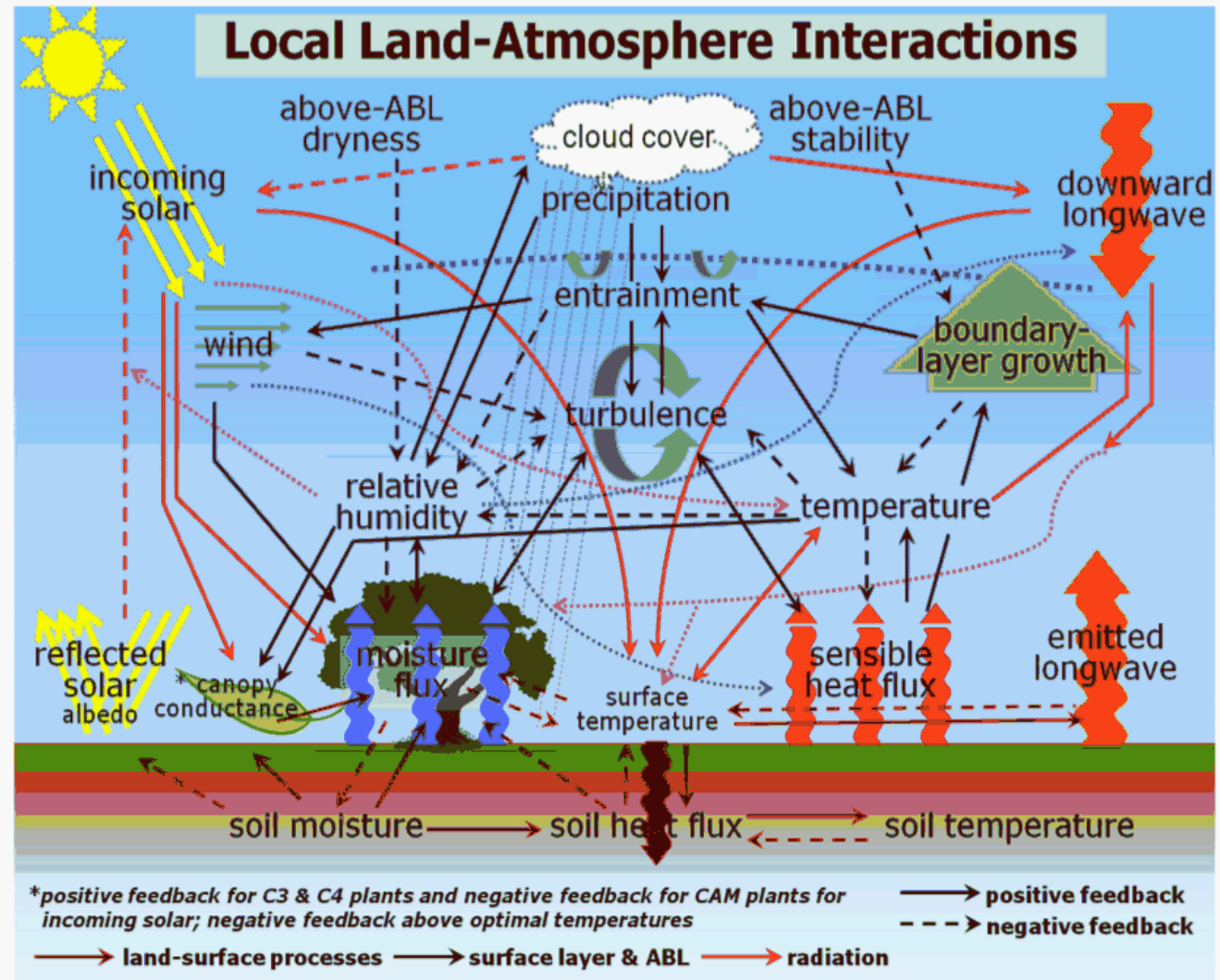


Ground heat



LoCo: Local land-atmospheric modeling

- NEAR-SURFACE LOCAL COUPLING: *Evaporative fraction change with changing soil moisture vs turbulence, canopy control, soil hydraulics & soil thermodynamics*
- GHP/CEOP reference site data sets; fluxnet



From "GEWEX Imperatives: Plans for 2013 and Beyond"

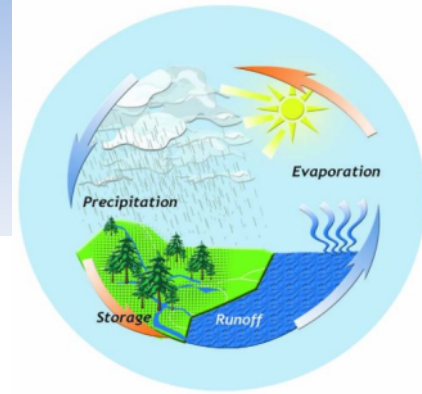
Fig. 3.1. Schematic of the complex interactions between the land surface, atmospheric boundary layer (ABL), and radiation via many variables (temperature, relative humidity, wind and associated turbulence, cloud cover, etc). Adapted from Ek and Holtslag (2004 *J. Hydromet.*, 5, 86-99), courtesy Mike Ek and Kevin Trenberth.



SOME ACCOMPLISHMENTS by GEWEX in 2011-12

- ***"GEWEX Imperatives: Plans for 2013 and Beyond"*** is a living document: drafted, reviewed and available in response to JSC guidelines for the future. This outlines the future strategic directions of GEWEX. The document has stood the test of time well and is being extensively used by the GEWEX panels in planning.
- The **GEWEX Newsletter** has been published quarterly to keep all interested parties informed about the process and activities. Also monthly e-zine.
- The **GEWEX Grand Science Questions (4)** have been developed and published, as per JSC directions, and a comprehensive 14 page description is available. There is a summary of each, and descriptions of the context, list of specific questions, prospects for advancements, and benefits for society.

GEWEX: post 2013

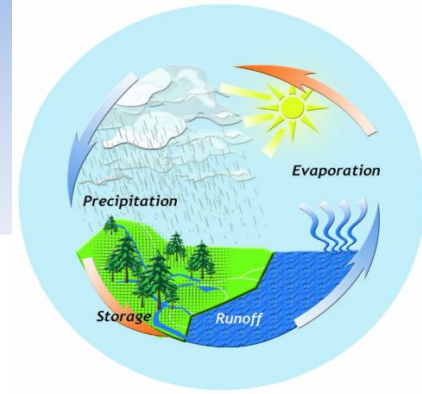


Vision statement

Water and energy are fundamental for life on Earth. Fresh water is a major pressure point for society owing to increasing demand and vagaries of climate.

Extremes of **droughts**, **heat waves** and **wild fires** as well as **floods**, **heavy rains** and **intense storms** increasingly threaten to cause havoc as the **climate changes**. Other challenges exist on how **clouds and aerosols** affect energy and climate. Better **observations** and **analysis** of these phenomena, and improving our ability to **model** and predict them, will contribute to increasing **information** needed by society and decision makers for future planning.

GEWEX: post 2013



Mission statement

To measure and predict global and regional energy and water variations, trends, and extremes (such as heat waves, floods and droughts), through improved observations and modeling of land, atmosphere and their interactions; thereby providing the scientific underpinnings of climate services.

Imperatives: Headlines

Datasets: Foster development of climate data records of atmosphere, water, land, and energy-related quantities, including metadata and uncertainty estimates.

Analysis: Describe and analyze observed variations, trends and extremes (such as heat waves, floods and droughts) in water and energy-related quantities.

Processes: Develop approaches to improve process-level understanding of energy and water cycles in support of improved land and atmosphere models.

Modeling: Improve global and regional simulations and predictions of precipitation, clouds, and land hydrology, and thus the entire climate system, through accelerated development of models of the land and atmosphere.

Applications: Attribute causes of variability, trends and extremes, and determine the predictability of energy and water cycles on global and regional bases in collaboration with the wider WCRP community.

Technology transfer: Develop diagnostic tools and methods, new observations, models, data management, and other research products for multiple uses and transition to operational applications in partnership with climate and hydro-meteorological service providers.

Capacity building: Promote and foster capacity building through training of scientists and outreach to the user community.

GEWEX Receives Praise in Report:

on Achieving and Sustaining Earth Observations

The US Office of Science and Technology Policy released a report in 2010 addressing US Earth observation capabilities. In the report GEWEX received recognition as a program that coordinates Earth observations successfully.

The myriad of observations taken today vary widely in purpose and scope and are appropriately distributed among hundreds of programs ... To a large degree, these observations have been only loosely coupled, coordinated, and integrated, although there are notable exceptions, such as the Global Energy and Water Cycle Experiment (GEWEX). GEWEX successfully integrates activities both nationally and internationally to better observe, understand, and model the hydrological cycle and energy fluxes in the Earth's atmosphere and at the surface, providing a great example of what can be done.

The report is available at: <http://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp-usgeo-report-earth-obs.pdf>.

Grand Science Questions:

Global water resources

Focus on doable next 5-8 years

3 GSQ water related,
1 GSQ energy and process oriented



GEWEX Grand Science Questions:

How can we better understand and predict **precipitation variability** and **changes**?

How do changes in the **land surface** and **hydrology** influence **past** and **future changes** in **water availability** and **security**?

How does a warming world affect **climate extremes**, and especially **droughts**, **floods** and **heat waves**, and how do **land area processes**, in particular, contribute?

How can understanding of the **effects** and **uncertainties** of **water** and **energy exchanges** in the current and changing climate be improved and conveyed?



GEWEX Science Questions: water and energy cycles

How can understanding of the effects and uncertainties of water and energy exchanges in the current and changing climate be improved and conveyed?

- *improve **consistency** between net solar and infrared radiation and sensible and latent heat fluxes at the surface*
- *understand **cloud-aerosol-precipitation interactions** and their **feedbacks** on the climate system.*
- *determine **processes**: must be replicated in climate models.*
- *better understand **uncertainties** in observations and models*

New satellite, in situ observations, upgraded GEWEX datasets, global reanalyses of atmosphere and ocean, improved modeling, and advanced diagnostics play key roles.

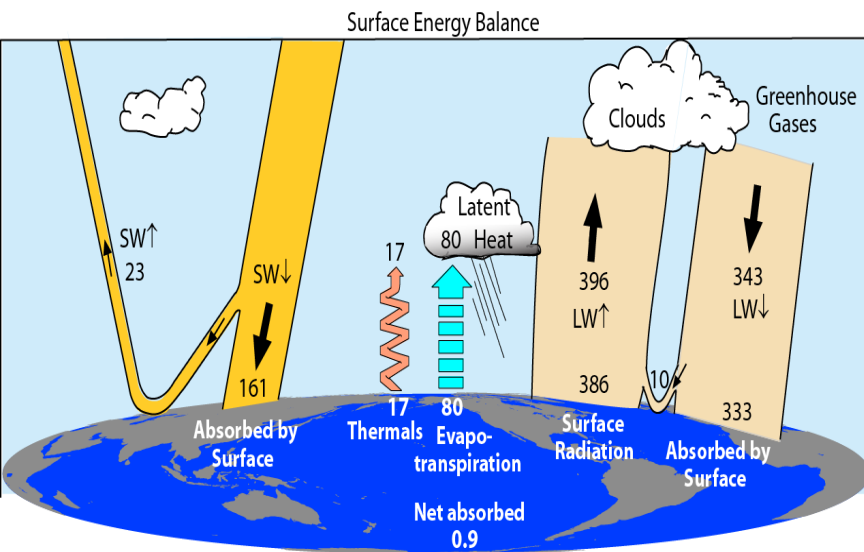


GEWEX Science Questions

- Can we close the **energy budget**?
- At the earth's surface?
- Regionally?
- Consistently over time?

GEWEX Science Questions

- Can we balance the **energy budget** at the earth's surface? How is the energy balance changing over time and how is it manifested in terms of changes in ocean heat content, sea ice, land ice, and other storage on earth? i.e. can we do an inventory of changes in heat that matches TOA imbalance continually over time?



SFC: TFK

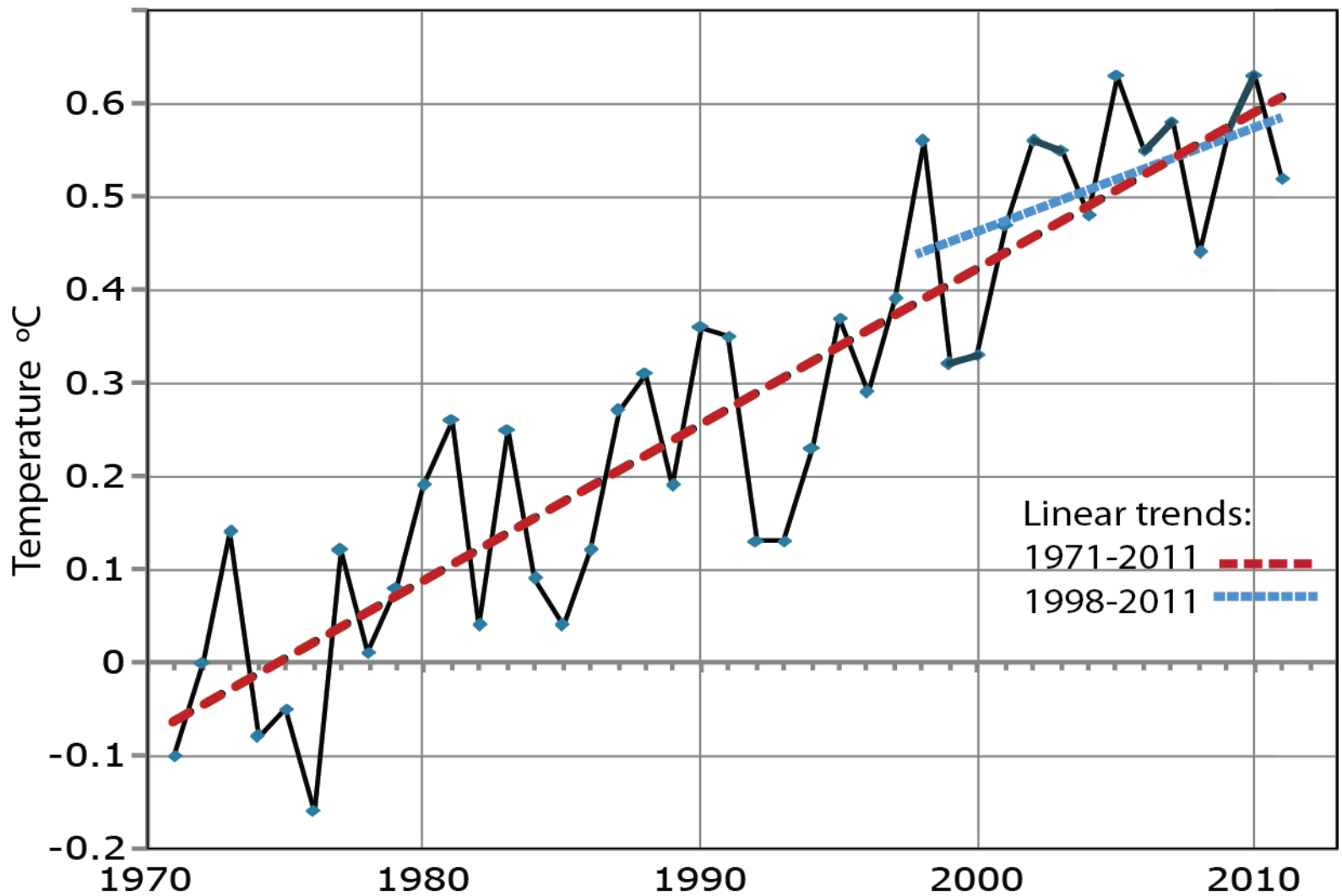
SW +161
 LW -396+333= -63
 SH -17
 LH -80 (-76 GPCP)

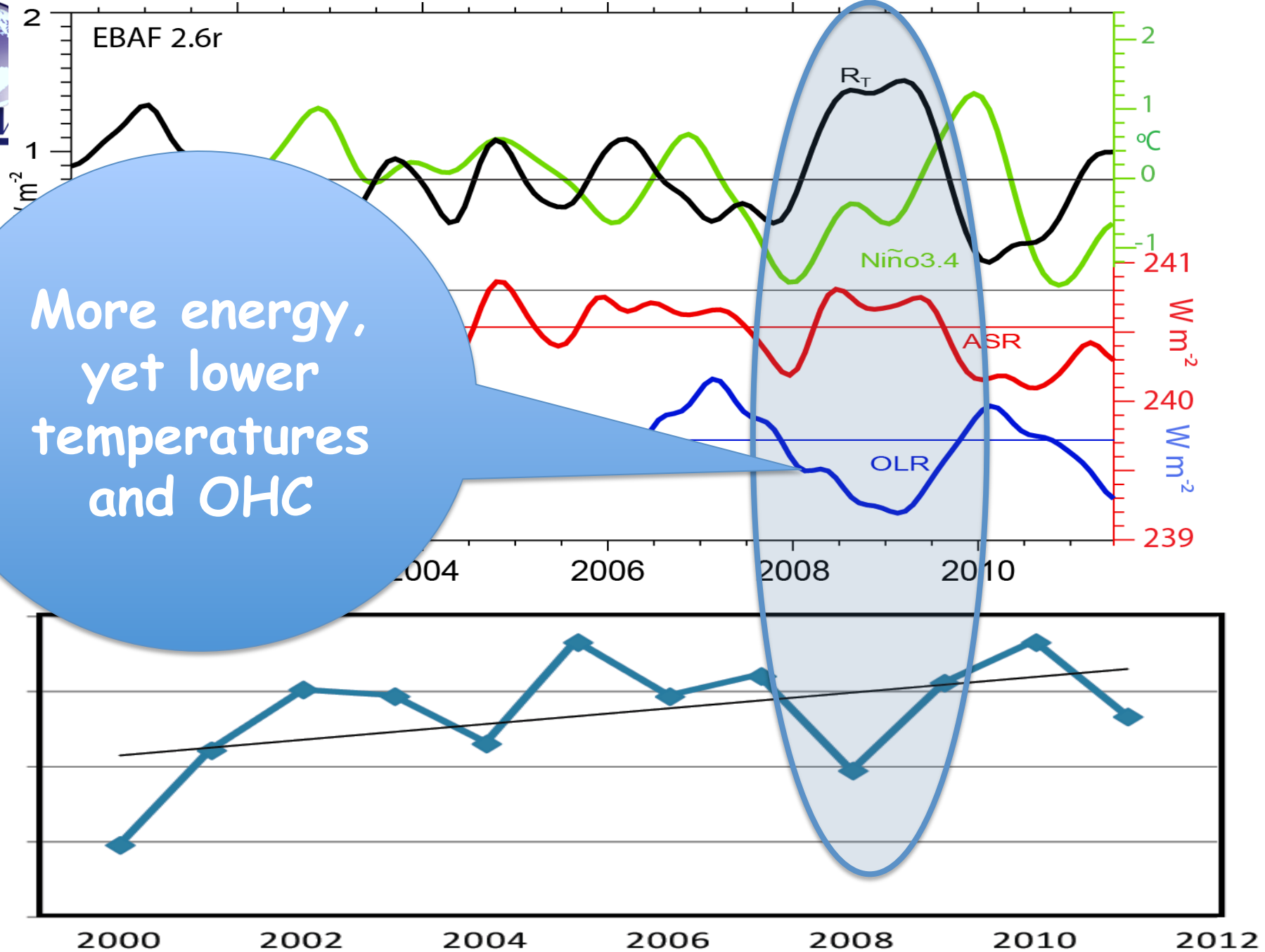
SRB (Kato pers. comm 2012)

+163
 -398+344=-54
 (-17)
 (-91)
 11

20 W m⁻² imbalance

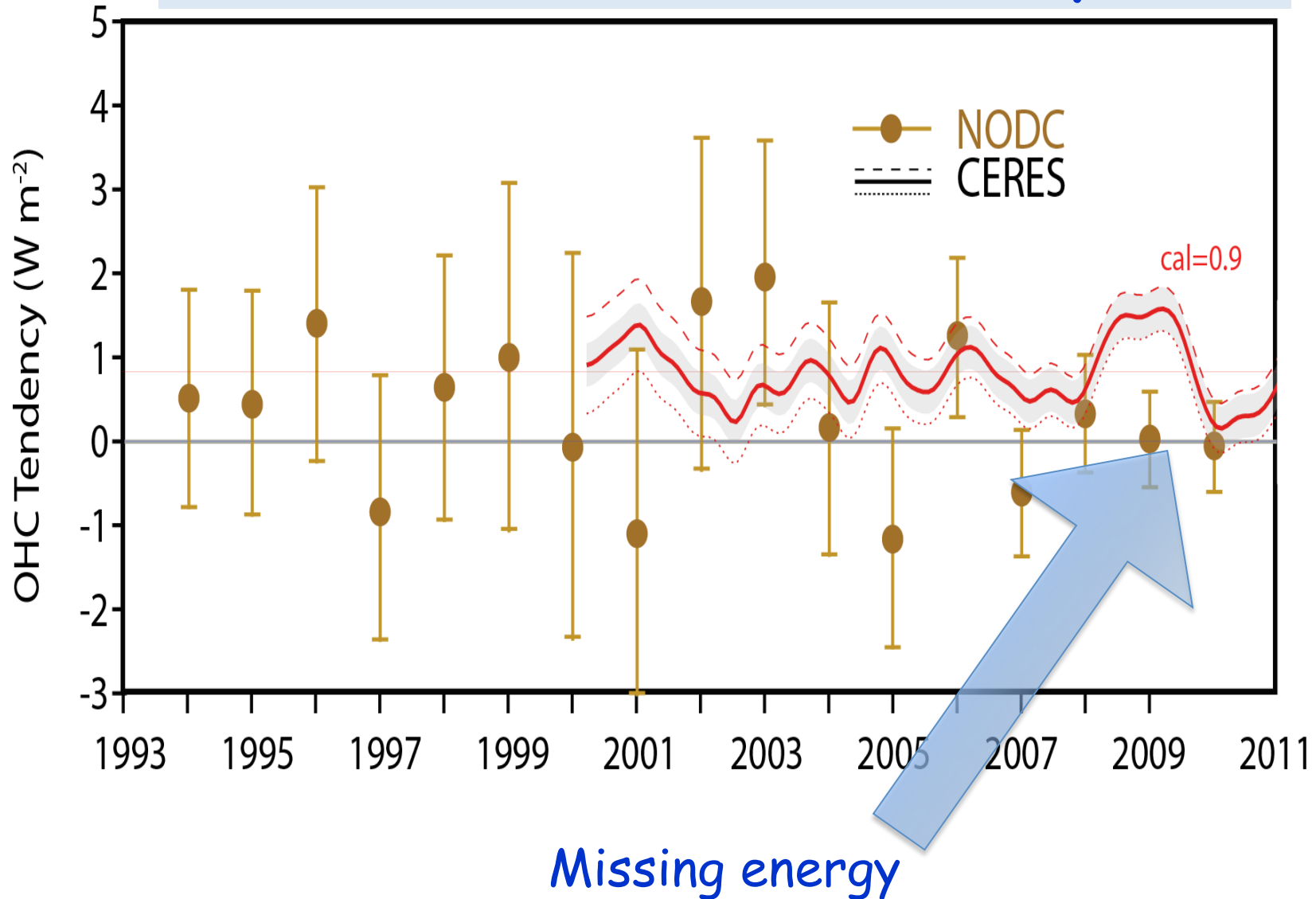
Global mean Temperature

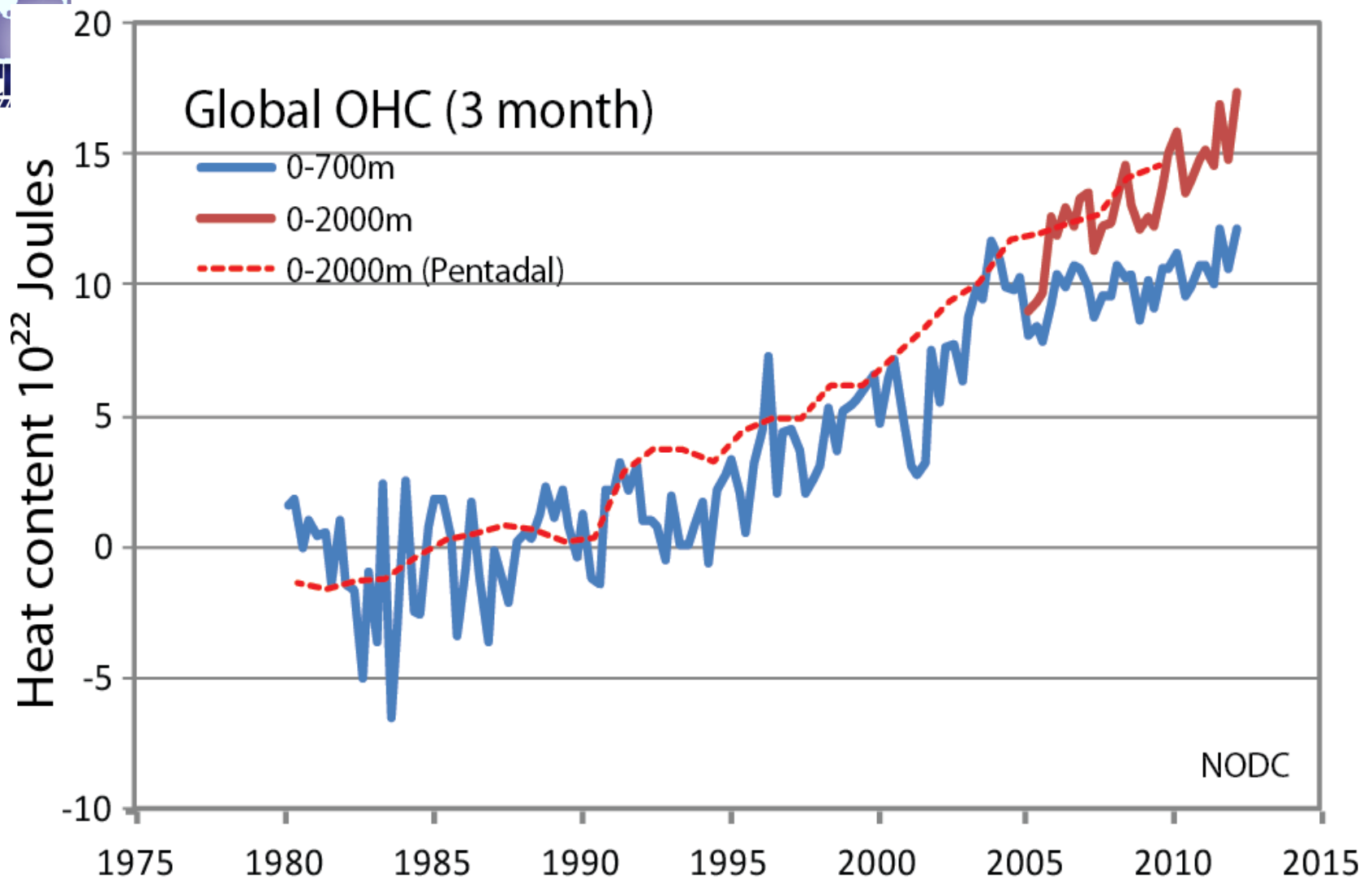




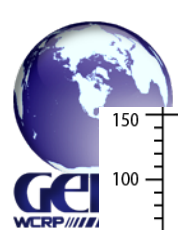


CERES data have excellent precision, but not absolute accuracy





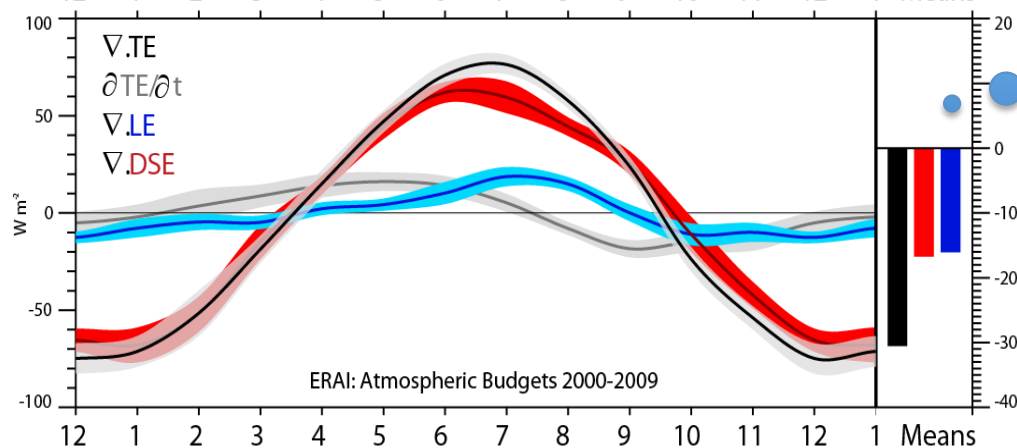
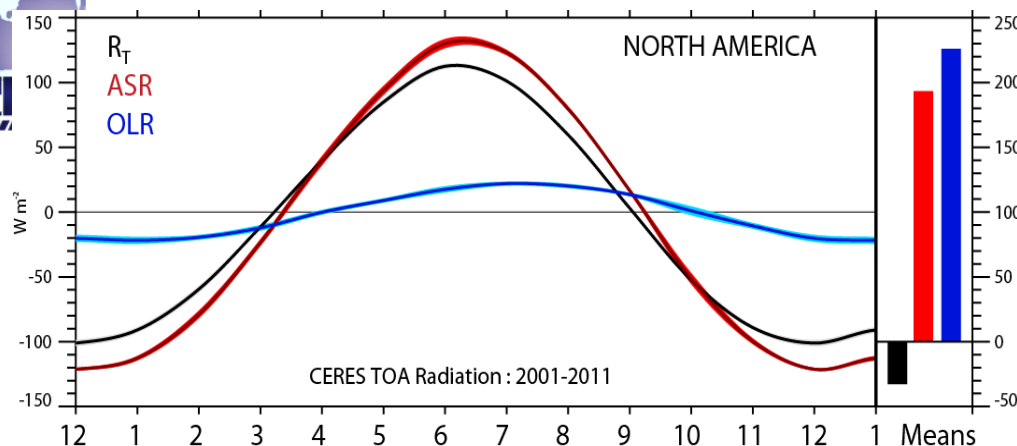
Increasing discrepancy between OHC 0-700m vs 0-2000m



Mean annual cycle

Annual means

Regional energy balance

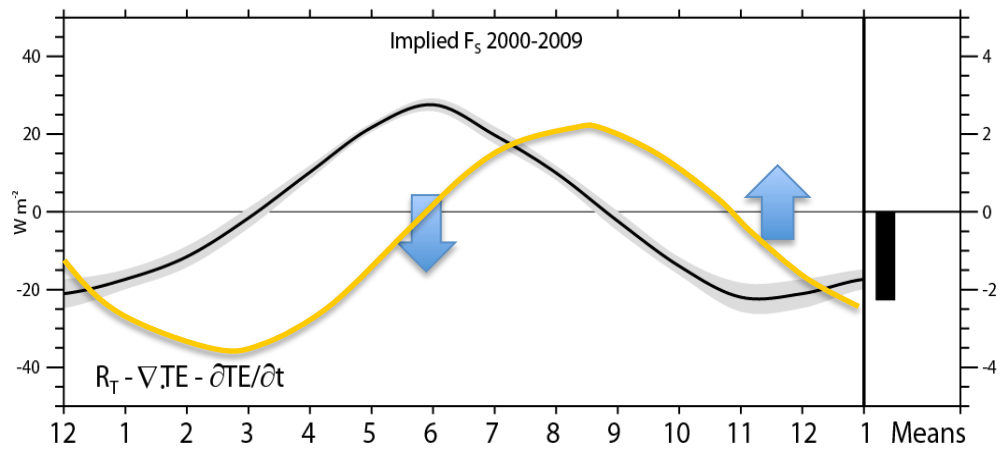


ERA-I

Net imbalance as implied surface flux down.

Annual cycle of imbalance => storage?

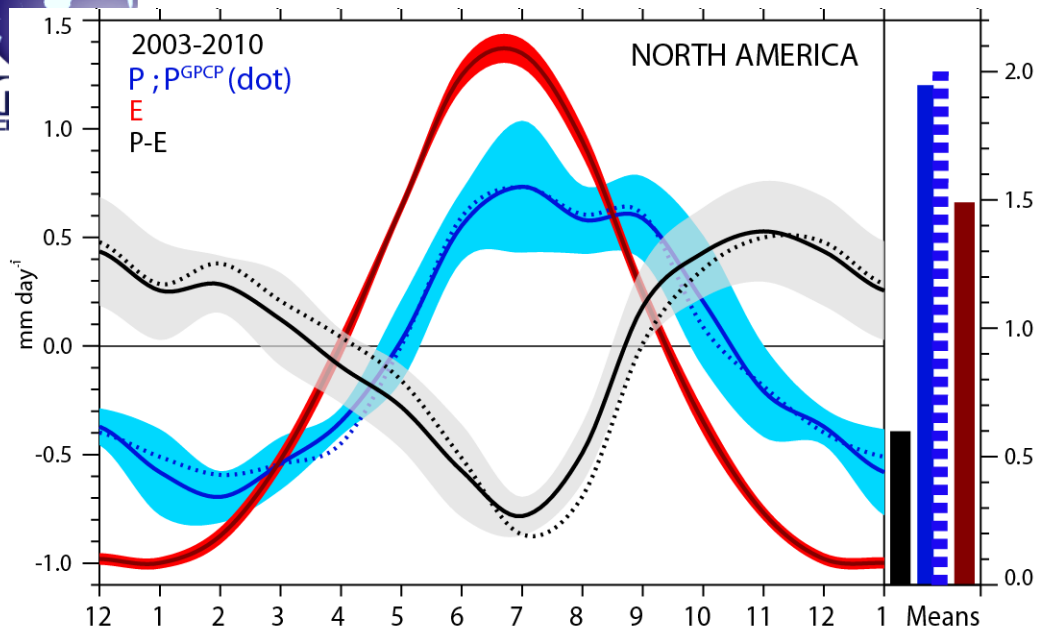
Implied soil T min in Mar and max in Sept, ampl about 15C





Mean annual cycle

Annual means



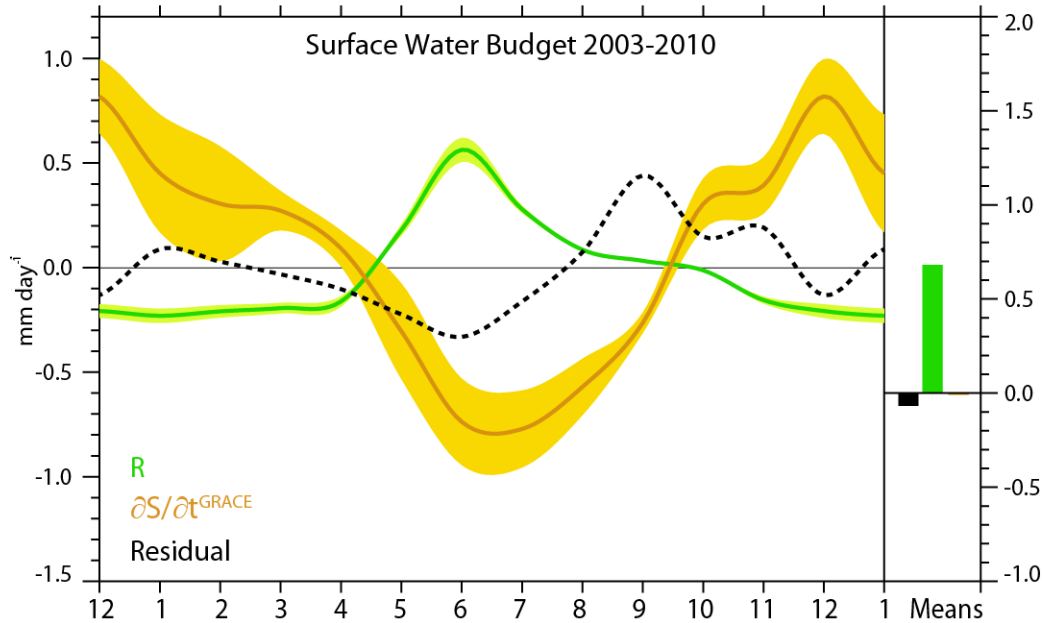
ERA-I

E model

P model

P-E budget

P^{GPCP} (dashed)

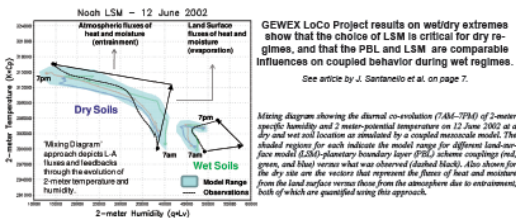


Δ Storage GRACE

Runoff Dai et al

Residual = P-E - R

Results from
Local Land-Atmosphere Coupling (LoCo) Project



See the GEWEX Newsletter for Nov 2011:

<http://www.gewex.org/>

<http://www.gewex.org/gewexnews/Nov2011.pdf>

- Also Inside
- Four Grand Science Challenges Identified for GEWEX (page 2)
 - GEWEX welcomes new SSG members (page 4)
 - Workshop planned on application of ORACLE data to climate modeling and analysis (page 5)
 - Highlights from the 24th Session of the GEWEX SSG (page 5)
 - GLASS Panel results (page 18)
 - Results of ECMWF/IOASLS Workshop on diurnal cycles and the stable boundary layer (page 18)
 - Announcements (back):
 - Global Drought Information System Workshop, 11–13 April 2012
 - 1st Pan-Global Atmospheric System Studies (GASS) Meeting, 16–14 September 2012

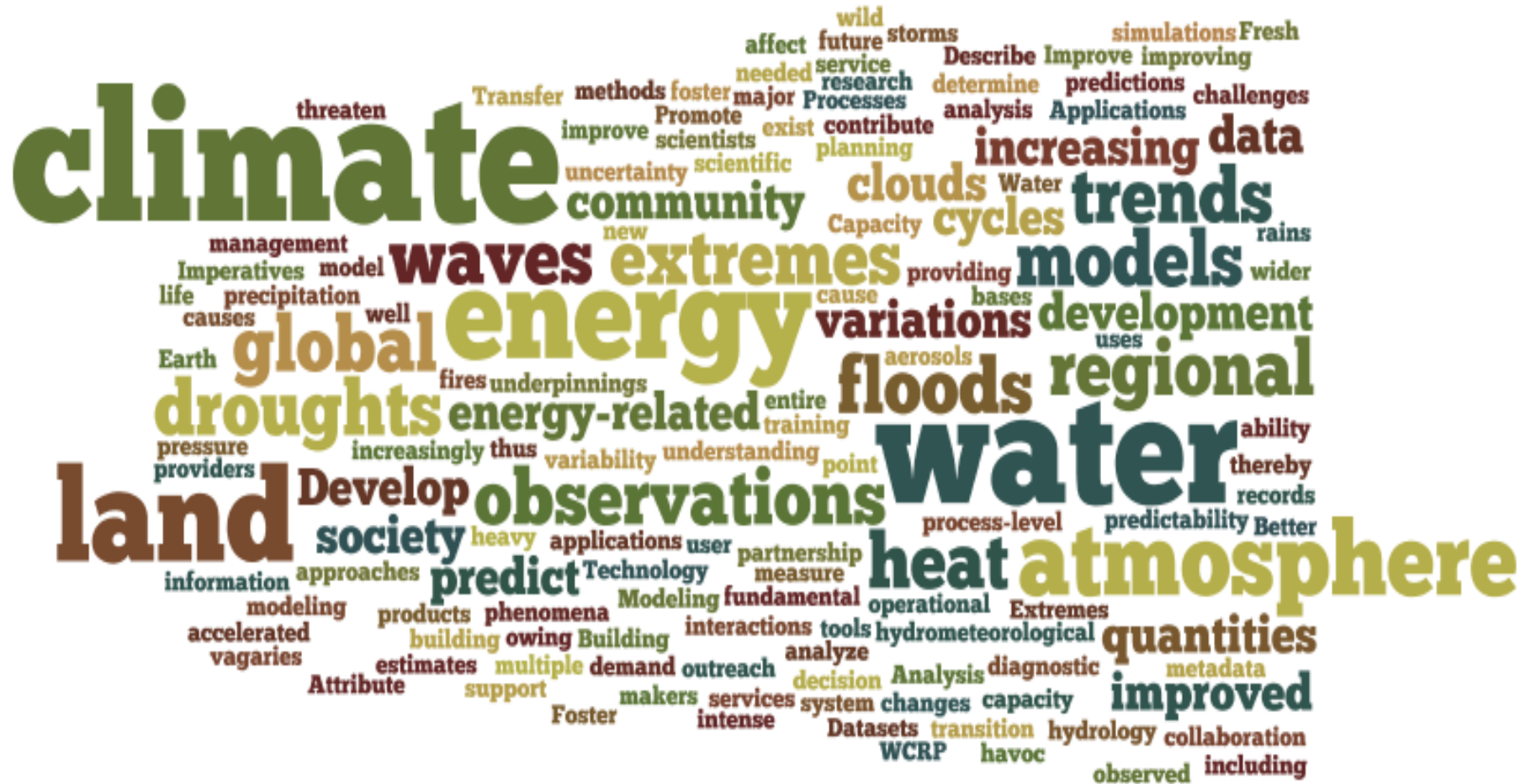
4th World Climate Research Programme
International Conference on
Reanalysis

7–11 May 2012
Silver Spring, Maryland, USA

CALL FOR ABSTRACTS

Deadline Extended to
13 February 2012
(details on back)





Wordle of mission, vision, and imperatives

CLEW

WE HAVE TO
RE-THINK
THE GEWEX
NAME

THIS IDEA
GREW
FROM WHAT?

scottadams@aol.com

www.dilbert.com

THE JSC OF
WCRP THINKS
IT MUST
LOOK NEW

HOW ABOUT
CLEW:
CLIMATE-LAND-
ENERGY-
and-WATER

5-7-08 © 2008 Scott Adams, Inc./Dist. by UFS, Inc.

THESEUS BALL
OF THREAD
USED TO
GET OUT OF
LABYRINTH?

OR WE COULD
DROP THE CL:
EW!



GEWEX: new name?

- Global Energy and Water Variability and Predictability = GEWVAR
 - Global and Regional Energy and Water = GREW
 - Climate Land Atmosphere Water and Energy = CLawe
 - Climate Land Energy and Water = CLEW =
- Greek Mythology: The ball of thread used by Theseus (Ghassem?) to find his way out of the labyrinth (ESSP?)



New name?

We conducted a poll.

1. GEWEX should only change if others change:

2. Could all have a CL theme:

like *CliC*, *CLEW*, *CliMar**, *CliSP*

1. Climate and Marine xxx ... Martin?
2. Climate and Stratospheric Processes
3. Climate and the Cryosphere
4. Climate Energy and Water

* Or CLOVAR:

Climate of the Oceans, VARIability and predictability



GEWEX: new name?

After a preliminary solicitation, a doodle poll was taken on the following options:

1. No change - keep Global Energy and Water Cycle Experiment (GEWEX)
2. Redefine GEWEX - Global Energy and Water Exchanges
3. Change name to CLEW (Climate, Land, Energy and Water)

Results: 127 responses Choices ranked 1, 2, 3 or Score 0 to 10

Redefine GEWEX: 1.58 7.10

No name change: 2.09 4.54

Change name: 2.32 3.40



New name?

Results: Strong preference for retaining GEWEX
but as

Global Energy and Water Exchanges

We can also use a different font and/or color?

Comment by one person:
We must not lose the X-factor



Interactions with CLIVAR

- WCRP changes (mission, name etc):
- Surface fluxes: e.g. ocean fluxes (mtg in Nov 2012)
- Drought: the DIG activity and how it relates to other extremes
- Extremes: the joint CCI/CLIVAR/JCOMM Expert Team (ET) on Climate Change Detection and Indices (ETCCDI) and extremes in GEWEX
- Monsoons: AAMP, MAHASRI, MAIRS? (need to unite)
- Africa: VACS, as well as potential HYVIC RHP but also AMMA, for example. (need one African effort for WCRP)
- South America: VAMOS, LPB, and continuation (split?)



Interactions with CLIVAR

WCRP changes: GEWEX concerns

- We can be an umbrella/haven/base for panels, but we are not going to force it!
- We can do things jointly, but experience suggests a primary lead project office is essential (Is the activity more ocean or land oriented?)
- With CLIVAR: all land-atmosphere stuff should be joint, incl monsoons, maybe extremes, and we should avoid duplication (much easier said than done)



On aging panels

- Even if panels/WGs start off in the right way and with balance and minimal overlap, they develop and evolve as tasks are completed, members change...
- Mission creep is common
- Some gaps can develop
- Overlaps can become severe
- **Need for occasional revamp of panels.**
- **Now is the time.**

Future of crosscuts?

- A lot more attention is warranted on a "**global synthesis**" activity that integrates CLIVAR and GEWEX (+CliC and SPARC) activities along with the obs and modeling.
- Was done in CLIVAR under "climate variability and predictability: being lost."
- Need for a **single WCRP monsoon** activity and a **single WCRP extremes** activity

Global synthesis: 1

- Previously GCSS, and now GASS deals with the global atmosphere, not just that over land.
- We proposed a WG on **atmospheric processes**. This must be global.
- GASS is part of WGNE wrt the modeling
- GASS should continue to take the lead on the global **atmospheric processes (moist, trop)**. SPARC clearly leads on stratospheric dynamics and tropospheric-stratospheric interactions, but does not deal with moist physics.
- GASS should continue to be overseen by **IGPO** on behalf of WCRP.



Global synthesis: 2

- AAMP** takes the lead on **global monsoons** with activities on **Africa, Asia, and South America**.
- AAMP has some activities that also come under GASS, such as the MJO, and they should be consolidated
 - AAMP is the healthiest of all the monsoon activities as they stand.
 - It is focused on processes and has moved into consideration of land processes in monsoons. It should continue to focus on **commonalities, processes and phenomena**; then regional.
 - **ICPO** should take the lead on overseeing the monsoon activity which would have emphasis on the variability and predictability, (vs the precipitation and hydrology). The latter would remain in GEWEX.
 - Key focus should be a single monsoon web site

Global synthesis: 3

- **ETCCDI** takes the lead on **extremes** with distributed activities in **GEWEX** and **CLIVAR**. Whether ETCCDI is the right body is a question and will depend on the joint ownership of that panel. Otherwise ETCCDI would be a key part of this activity.
- The extremes activities should be guided by the new WCRP extremes Grand Science Question and this will necessarily involve a great expansion over what currently exists in ETCCDI.
- The extremes activity could be centered anywhere but probably belongs with land (**GEWEX**): includes drought, ETCCDI, and activities in RHPs.
- It must engage with CLIVAR and CliC.



2012 GEWEX Meetings

19-22 Feb	Chapman Conference on Remote Sensing of the Water Cycle	Kona, HI	P. van Oevelen*, S. Benedict*
22-24 Feb	8 th IGWCO Community of Practice Science and Planning Meeting	Kona, HI	P. van Oevelen, R. Lawford*
7-11 May	4 th WCRP International Conference on Reanalyses	Silver Spring, MD	
16-20 July	33 rd Session of the WCRP Joint Scientific Committee	Beijing, China	P. van Oevelen, K. Trenberth
1-3 Aug	12 th Meeting of the GEWEX Baseline Surface Radiation Network (BSRN) Project	Potsdam, Germany	
10-14 Sept	1 st GEWEX Pan-Global Atmospheric System Studies (GASS) Meeting	Boulder, CO	
10-14 Sept	GEWEX/GLASS LoCo Workshop and Panel Meeting	Boulder, CO	
26-28 Sept	GDAP Water Vapor Assessment Workshop	Frankfurt, Germany	
1-3 Oct	GDAP Meeting	Paris, France	
11-13 Oct	GHP Meeting	Sydney, Australia	
15-18 Oct	25 th Session of the GEWEX SSG	Sydney, Australia	

GEWEX

