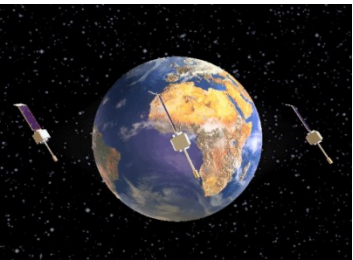


THE GLOBAL ENERGY AND WATER CYCLE PROJECT

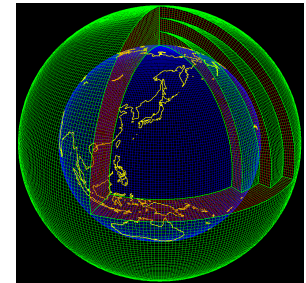
Rick Lawford and Peter van Oevelen
December 11, 2008
San Francisco, CA

GEWEX DEVELOPS AND APPLIES PLANETARY EARTH SCIENCE, OBSERVATIONS AND MODELS TO THE PROBLEMS OF CLIMATE AND WATER RESOURCES”

PRECIPITATION IS A CENTRAL FOCUS OF THE GLOBAL ENERGY AND WATER CYCLE EXPERIMENT (GEWEX)

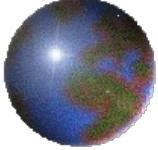


GEWEX
WCRP // // //



THE PROGRAM ENTAILS:

- GLOBAL DATA SETS DERIVED FROM SATELLITE DATA, *IN SITU* DATA AND DATA ASSIMILATION CAPABILITIES,**
- MODEL DEVELOPMENT AND PREDICTABILITY STUDIES**
- FIELD CAMPAIGNS AND PROCESS STUDIES**
- APPLICATIONS**



GEWEX ORGANIZATION

GEWEX ORGANIZATION

Radiation Panel (W. Rossow, Chair)

- **BSRN** **Baseline Surface Radiation Network** (E. Dutton)
- **CIRC** **Continuous Intercomparison of Radiation Codes** (L. Oreopoulos)
- **GACP** **Global Aerosol Climatology Project** (M. Mishchenko)
- **GPCP** **Global Precipitation Climatology Project** (R. Adler)
- **GVaP** **Global Water Vapor Project** (TBD)
- **I3RC** **Intercomparison of 3-D Radiation Codes** (R. Cahalan)
- **ICRCCM** **InterComparison of Radiation Codes in Climate Models**
- Shortwave (H. Barker) - Longwave (R. Ellingson)
- **ISCCP** **International Satellite Cloud Climatology Project** (W. Rossow)
- **LandFlux** **Land Surface Fluxes** (TBD)
- **SRB** **Surface Radiation Budget Project** (P. Stackhouse)
- **SeaFlux** **Sea Surface Fluxes** (C. Clayson)
- **WGCAP** **Working Group for Cloud and Aerosol Profiling** (T. Ackerman)
- **WGDMA** **Working Group on Data Management and Analysis** (W. Rossow)
- **WGPRN** **Working Group for Precipitation Radar Networks** (V. Levizzani)

Modelling and Prediction Panel (C. Jakob, Chair)

- **GABLS** **GEWEX Atmospheric Boundary Layer Study** (B. Holtslag)
- **GCSS** **GEWEX Cloud System Study** (P. Siebesma)
 - **Boundary Layer Clouds** (P. Siebesma)
 - **Cirrus Cloud Systems** (S. Dobbie)
 - **Precipitating Convective Cloud Systems** (J. Petch)
 - **Polar Clouds** (J. Pinto)
 - **GPCI - GCSS Pacific Cross-section Intercomparison** (J. Teixeira)
- **GLASS** **GEWEX Global Land/Atmosphere System Study** (A. Pitman; B. van den Hurk)
 - **ALMA Assistance for Land-surface Modelling Activities** (T. Oki)
 - **GLACE-2 Global Land/Atmospheric Coupling Experiment** (R. Koster)
 - **GSWP-2 Global Soil Wetness Project** (P. Dirmeyer)
 - **LoCo Local land-atmospheric Coupling** (B. van den Hurk)
 - **PILPS Project for Intercomparison of Land Surface Parameterization Schemes** (A. Pitman)

Coordinated Energy and water-cycle Observations Project (T. Koike, J. Roads, Co-Chairs)

Regional Hydroclimate Projects (RHPs)

- **AMMA** **African Monsoon Multidisciplinary Analysis Project** (A. Gaye)
- **BALTEX** **Baltic Sea Experiment** (H.J. Isemer)
- **CPPA** **Climate Prediction Program for the Americas** (J. Huang)
- **LBA** **Large-Scale Biosphere-Atmosphere Experiment in Amazonia** (J. Maia)
- **LPB** **La Plata Basin Project** (H. Berbery)
- **MAHASRI** **Monsoon Asian Hydro-Atmospheric Science Research and prediction Initiative** (J. Matsumoto)
- **MDB** **Murray-Darling Basin Water Budget Project** (A. Seed)
- **NEESPI** **Northern Eurasia Earth Science Partnership Initiative** (P. Groisman)

Cross-cutting Studies

- **Water and Energy Budget Studies** (J. Roads)
- **Extremes** (R. Stewart)
- **Stable Water Isotope Working Group** (D. Noone)
- **Aerosols** (W. Lau)
- **Global Models** (M. Bosilovich)
- **Regional Climate Models**
 - **Inter-Continental Transferability Study** (B. Rockel)
 - **Regional Modelling for Variability and Extremes** (R. Arritt)
 - **GEWEX Modelling and Prediction Panel** (C. Jones)
- **Land Surface Models** (M. Rodell)
- **Hydrologic Applications Project** (E. Wood)

Regional Studies

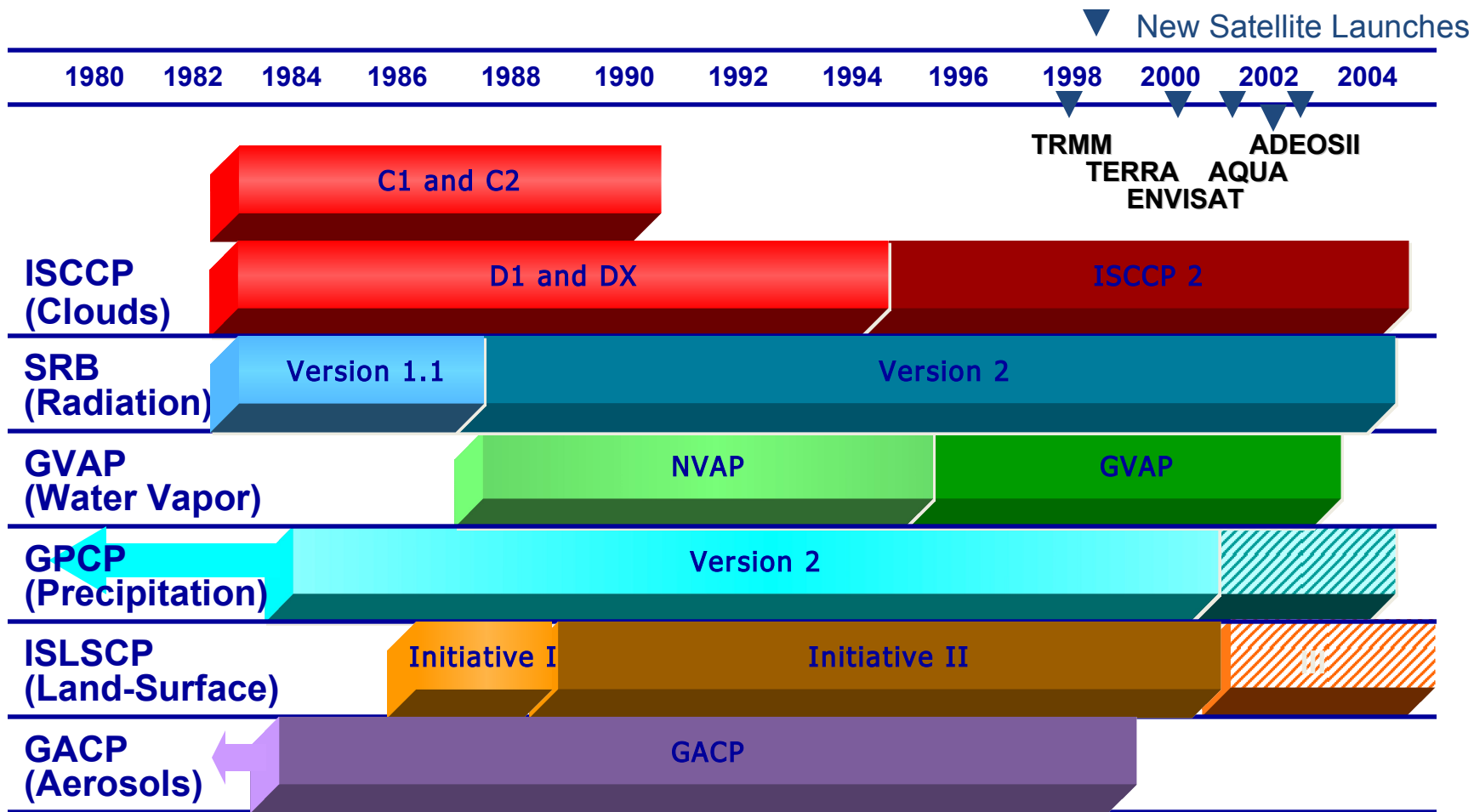
- **High Altitude** (G. Tartari)
- **Monsoon** (J. Matsumoto)
- **Polar** (T. Ohata)
- **Semi-arid** (C. Fu)

Data Infrastructure

- **In Situ, River Basins** (S. Williams)
- **Model Output** (M. Lautenschlager)
- **Satellite** (J. Bates)
- **Data Integration and Dissemination** (K. McDonald)

Affiliated Global Organizations

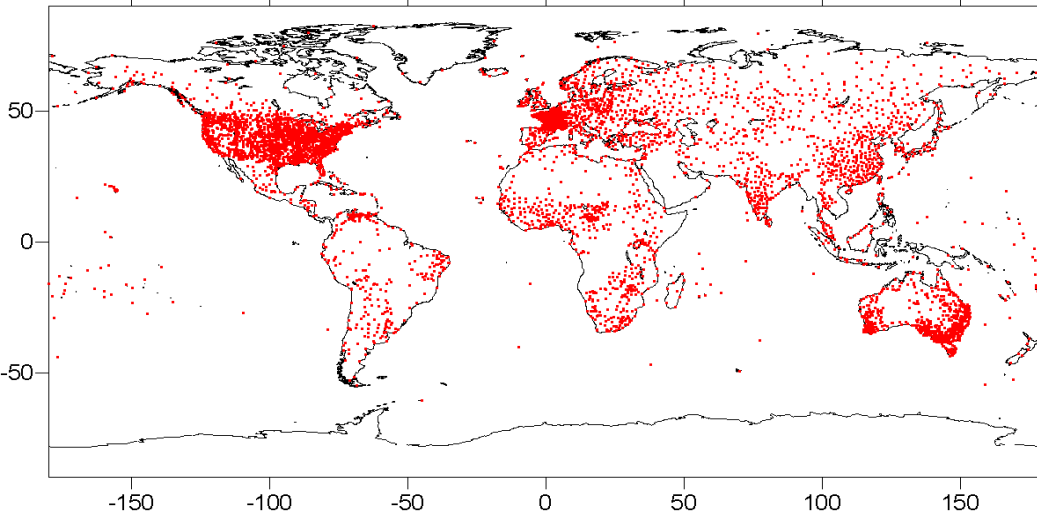
- **IAHS** **International Association of Hydrological Sciences** (A. Hall)
- **GPCC** **Global Precipitation Climatology Centre** (T. Fuchs)
- **GRDC** **Global Runoff Data Centre** (T. Maurer)



*Hatched lines represent planned data sets

GEWEX HAS PRODUCED A NUMBER OF PRODUCTS THAT ARE USEFUL IN MONITORING PRECIPITATION

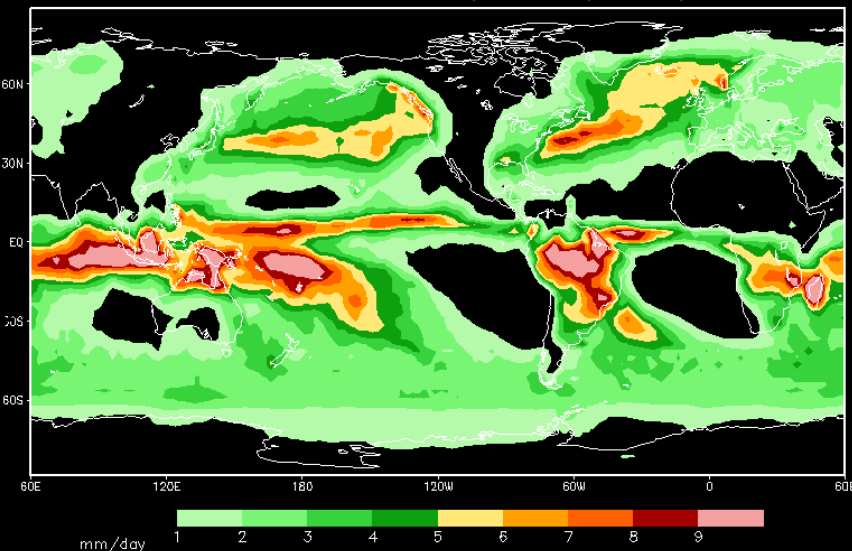
Niederschlagsstationen 1951 - 2000 (mind. 90% Datenbelegung => 5992 Stationen)

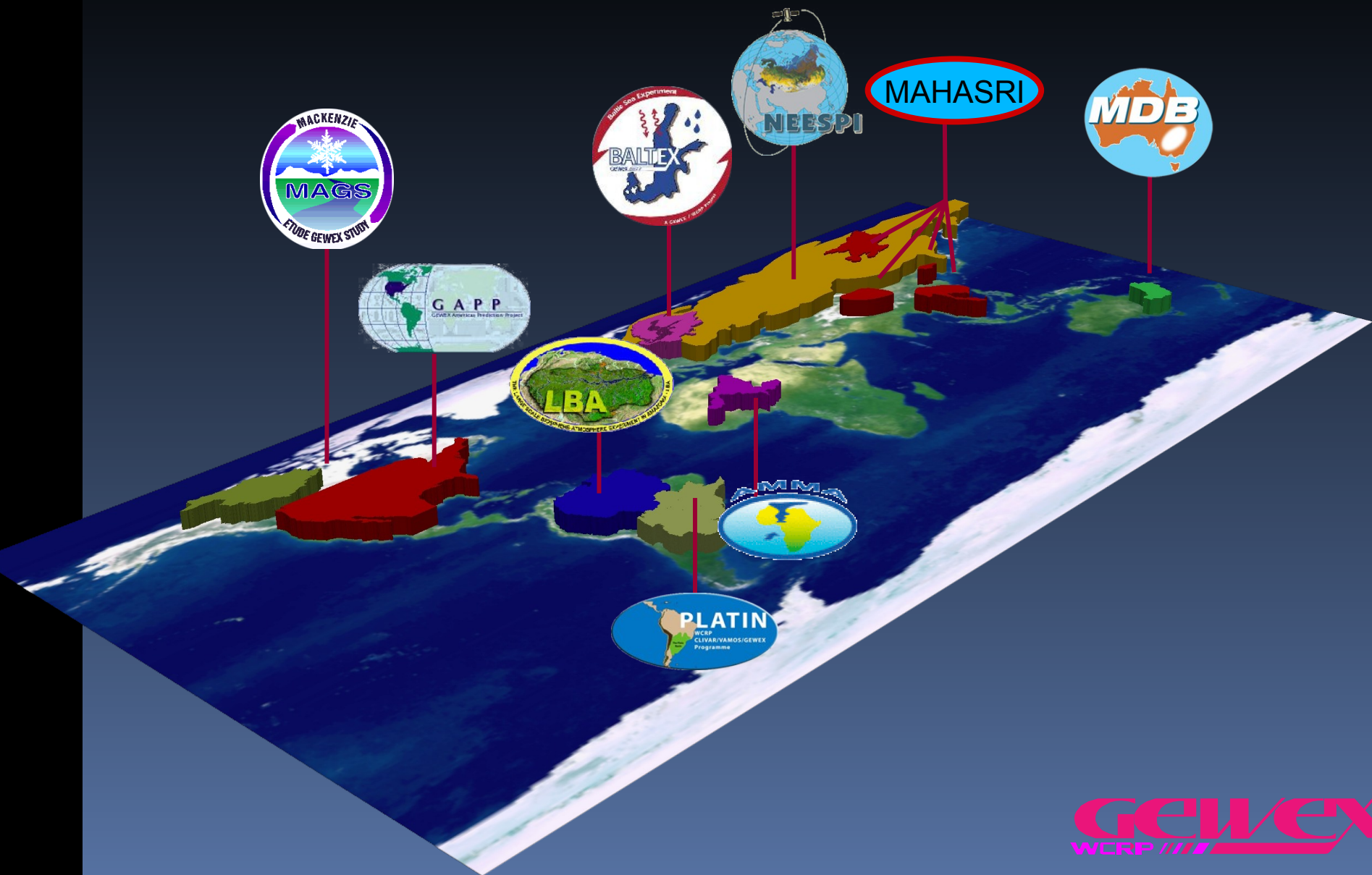


Averages based on in-situ data must account for the highly heterogeneous Gauge network. (Ref: GPCP)

Global Precipitation Climatology Project (GPCP) products combine in-situ and satellite based measurements. These data are useful to assess where drought is occurring but may be too coarse to fully represent precipitation maximum.

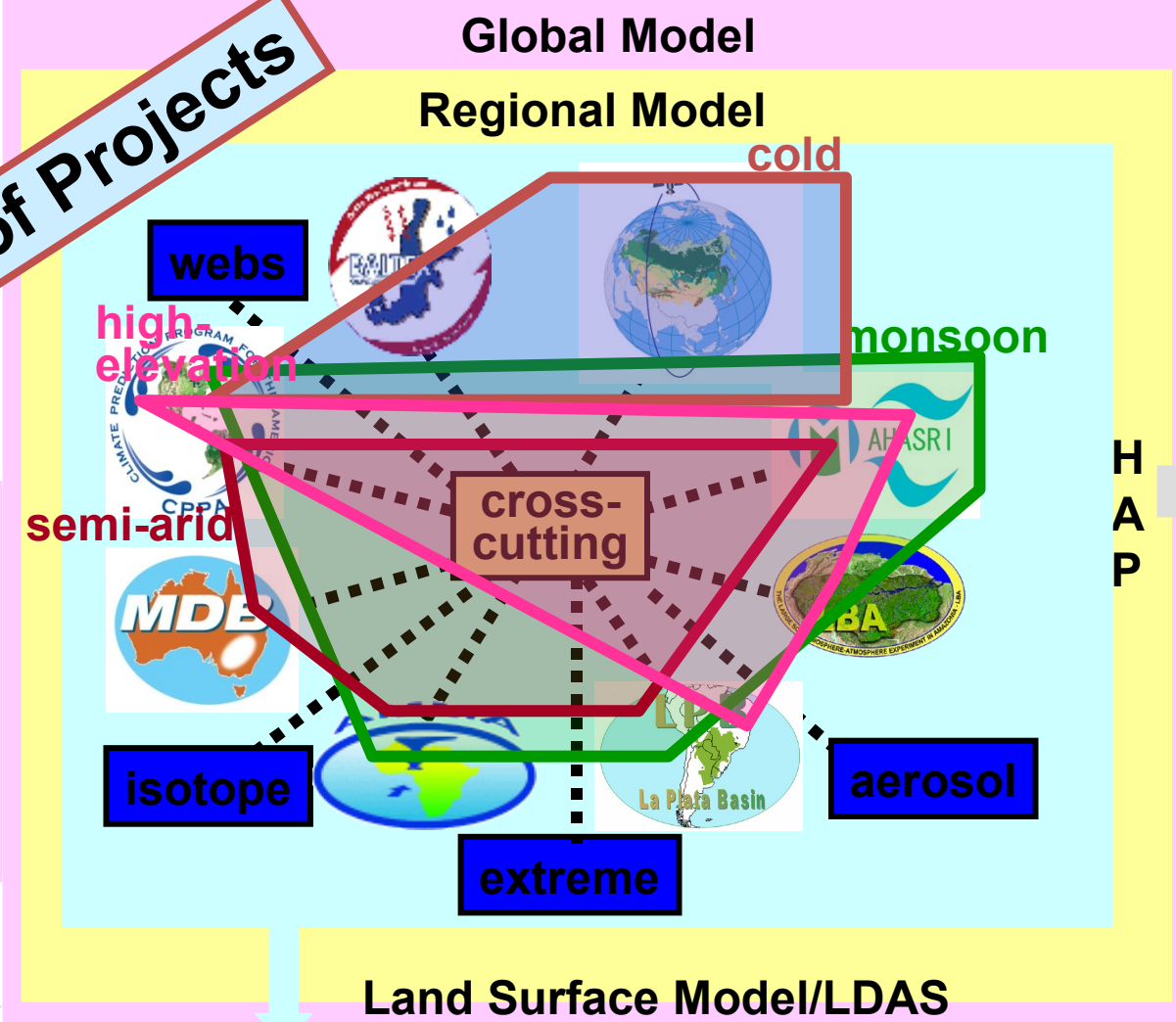
Mean Jan GPCP Precipitation (88-03)





A Project of Projects

- NWPCs/ACs**
 NCEP, JMA
 ECPC, BoM
 UKMO, CMC
 ECMWF
 CPTEC
 NCMWF
 EPSON MET
 GMAO GLDAS



H
A
P

Societal Benefits

Global Dataset Projects

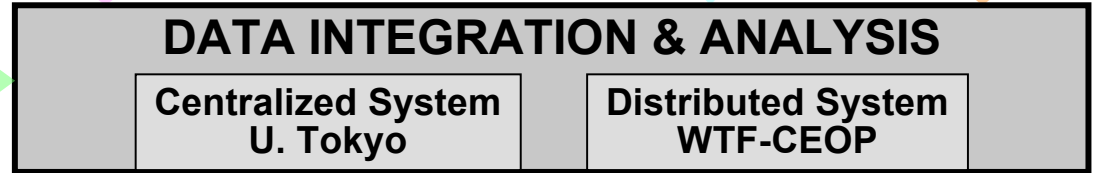
WDC-C
MPI-M

Reference Sites
River basins

NCAR/EOL

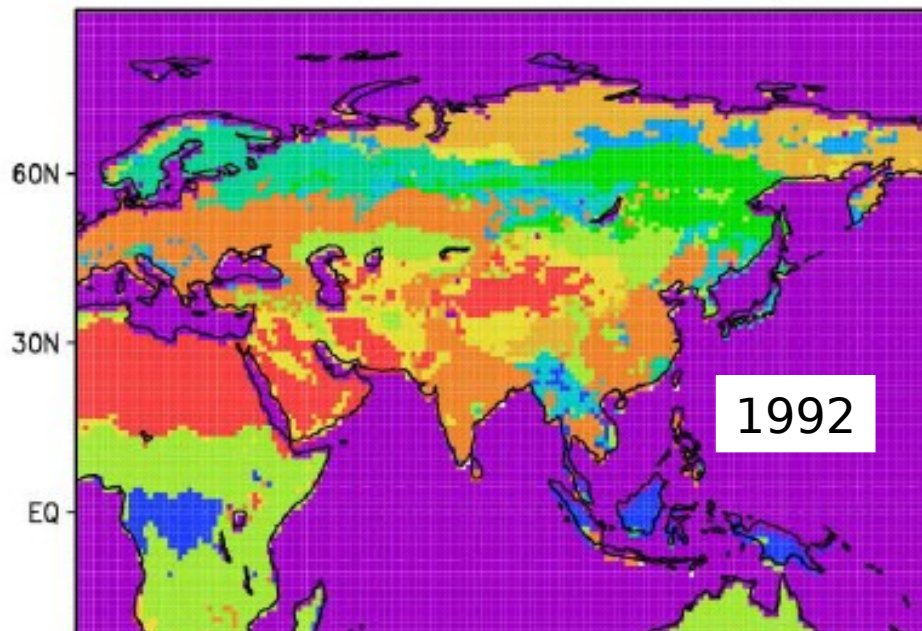
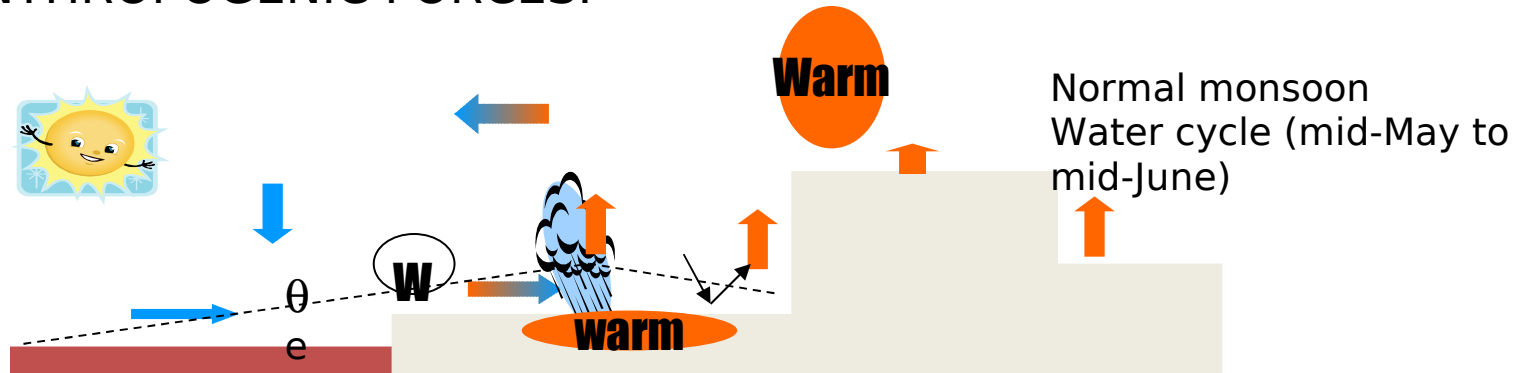
UT&JAXA

- Satellite data
CEOS
 JAXA
 NASA
 ESA
 NOAA
 EUMETSAT
 WGISS
 WGCV



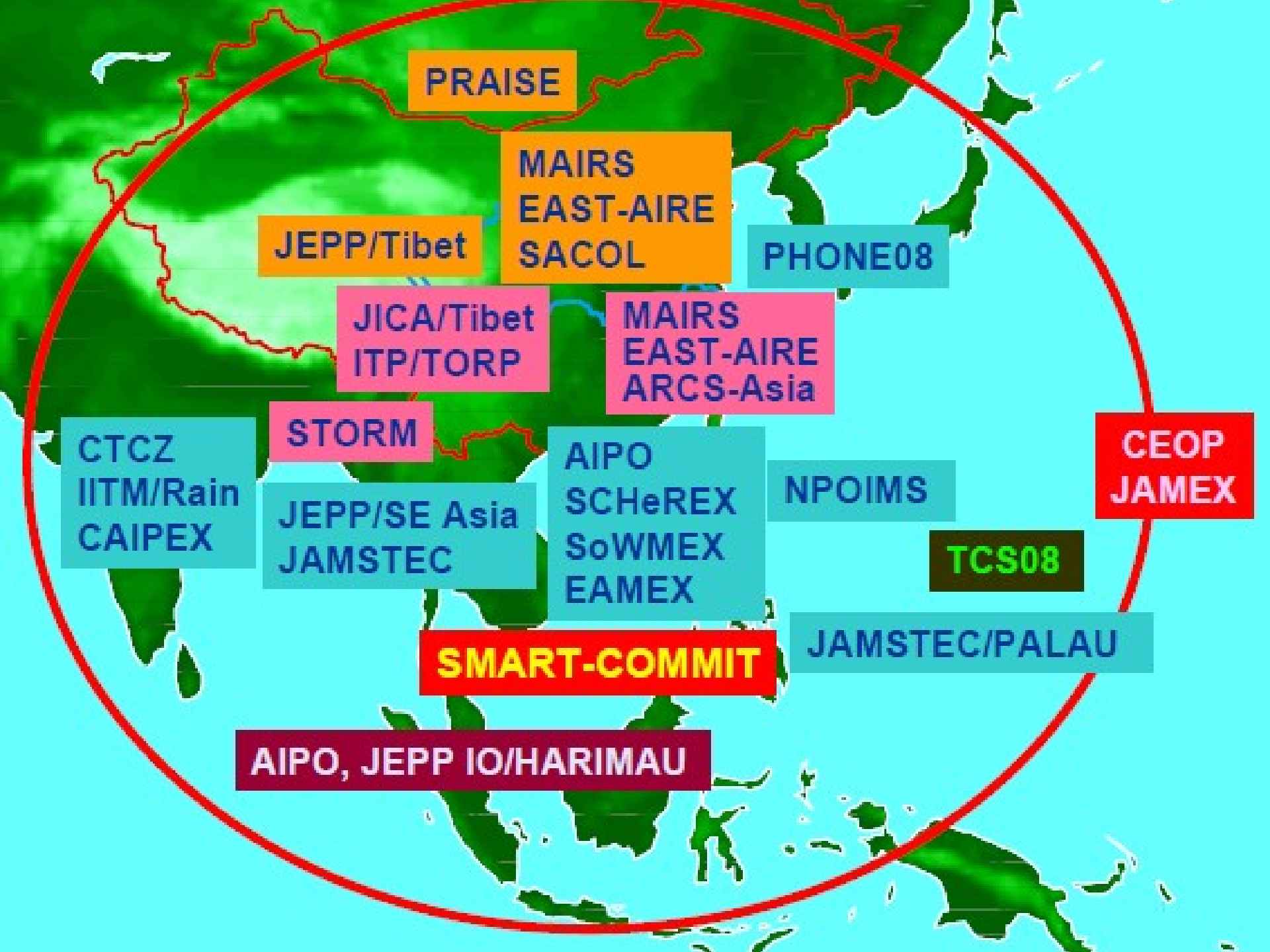
GEWEX AND MONSOONS (after Yasunari, Wu, Matsumoto)

GEWEX STUDIES EXAMINE THE PROCESSES DRIVING MONSOONS INCLUDING OROGRAPHIC AND LAND SURFACE PROCESSES AND ANTHROPOGENIC FORCES.



50-YEAR TREND IN PRECIPITATION REFLECTS:

- CHANGES IN AEROSOL LOADINGS
- CHANGES IN LAND SURFACE FORCING



PRAISE

MAIRS
EAST-AIRE
SACOL

JEPP/Tibet

PHONE08

JICA/Tibet
ITP/TORP

MAIRS
EAST-AIRE
ARCS-Asia

CTCZ
IITM/Rain
CAIPEX

STORM

AIPO
SChEREX
SoWMEX
EAMEX

NPOIMS

CEOP
JAMEX

JEPP/SE Asia
JAMSTEC

TCS08

SMART-COMMIT

JAMSTEC/PALAU

AIPO, JEPP IO/HARIMAU

GEWEX AND EXTREMES (after Stewart)

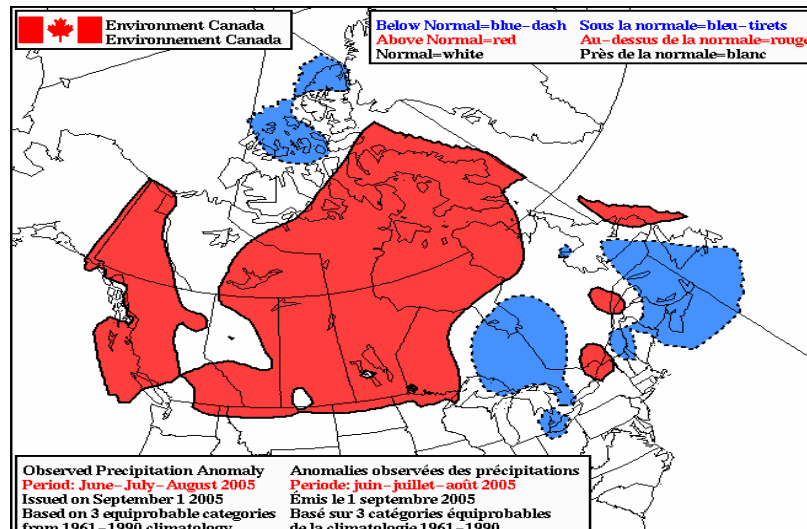
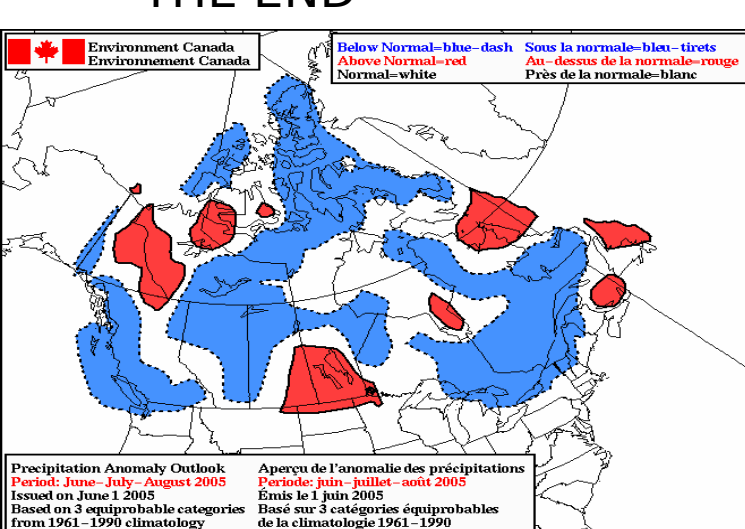
THE GEWEX APPROACH TO EXTREMES HAS FOCUSED ON CASE STUDIES TO GAIN BETTER UNDERSTANDING OF THE PROCESSES RESPONSIBLE FOR EXTREME EVENTS.

THIS APPROACH INVOLVES EXAMINING EACH PHASE OF THE EVENT:

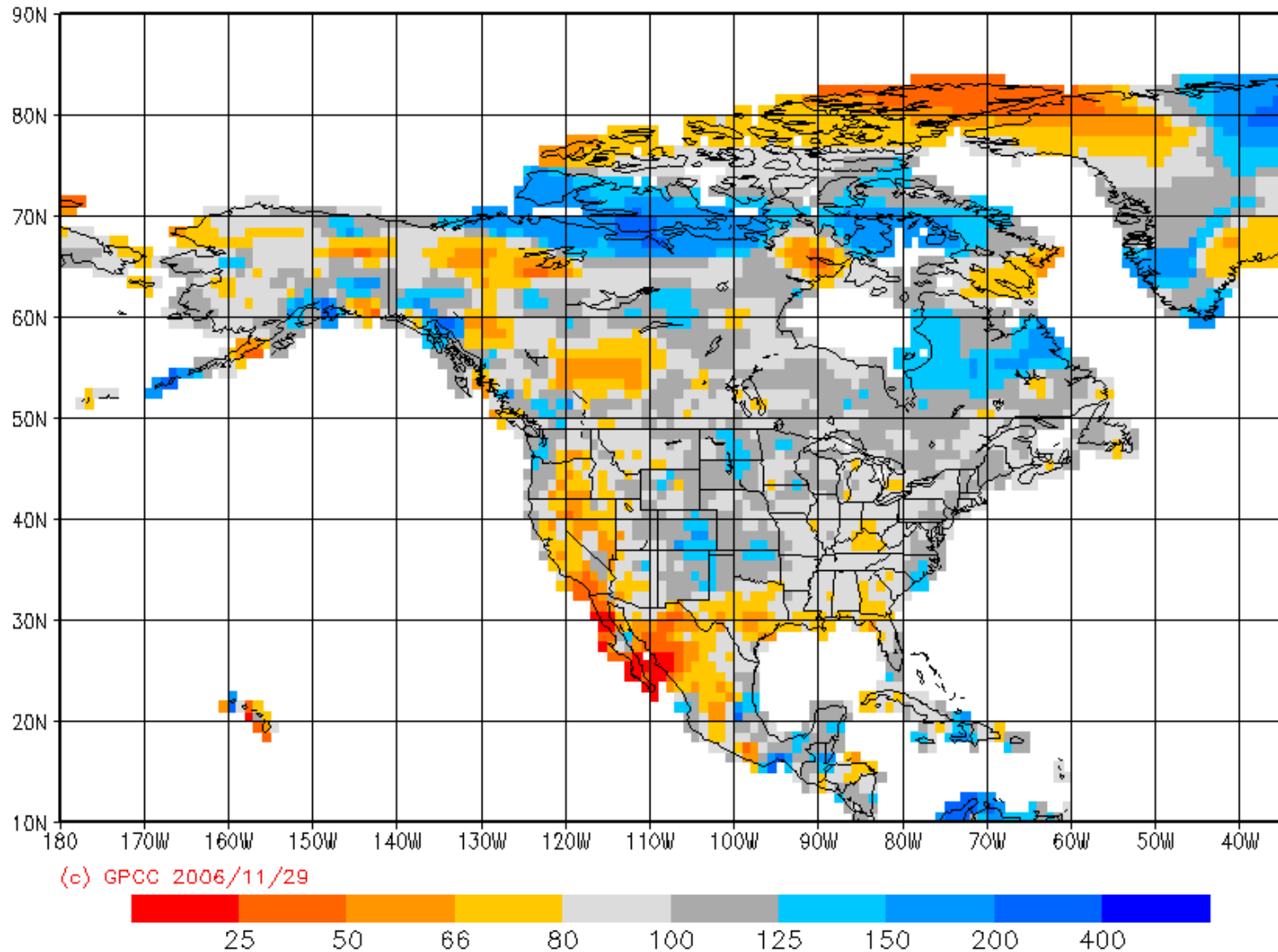
- THE BEGINNING
- THE INTENSITY
- THE PROCESSES OF CONTINUATION
- THE END



THE CASE OF CANADIAN DRI (1999-2005)



GPCC Full Data Product Version3 Gauge-Based Analysis 1.0 degree
precipitation percentage of normals 61/90 for year (Jan - Dec) 1999
(grid based)



GPCP Products can show extent and variability of drought.

(Courtesy of R. Stewart)

Extremes are now a major cross-cutting theme for EOP and WCRP

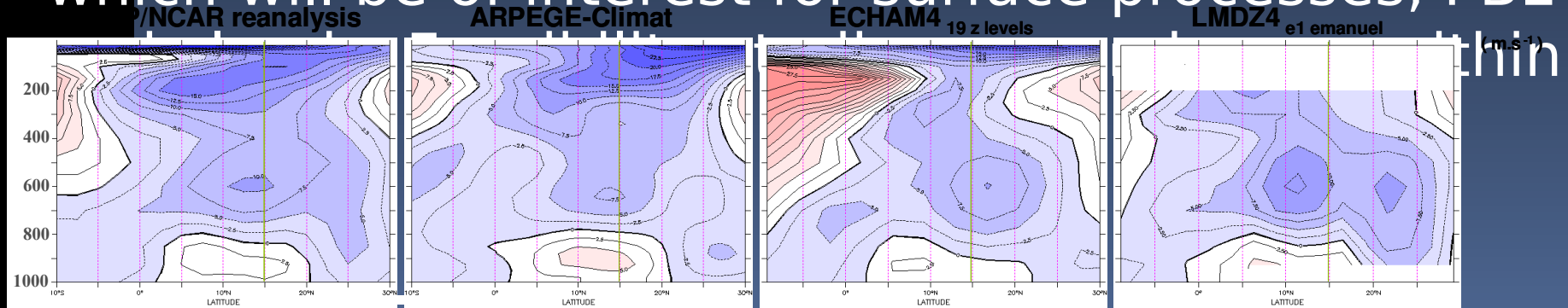
Overall objective ...

- To advance our understanding of hydro-extremes including their occurrence, characteristics, evolution and inter-connections for prediction and for addressing societal concerns

(R. Stewart)

The evolution of GMPP

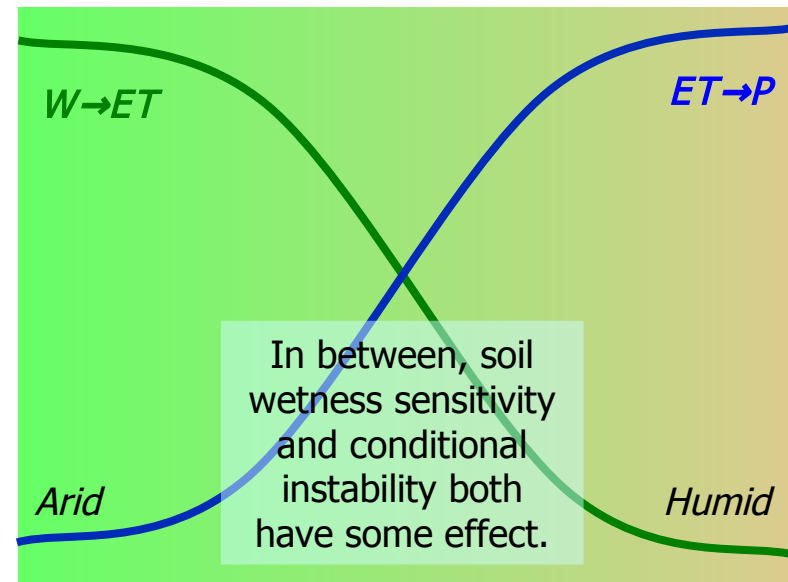
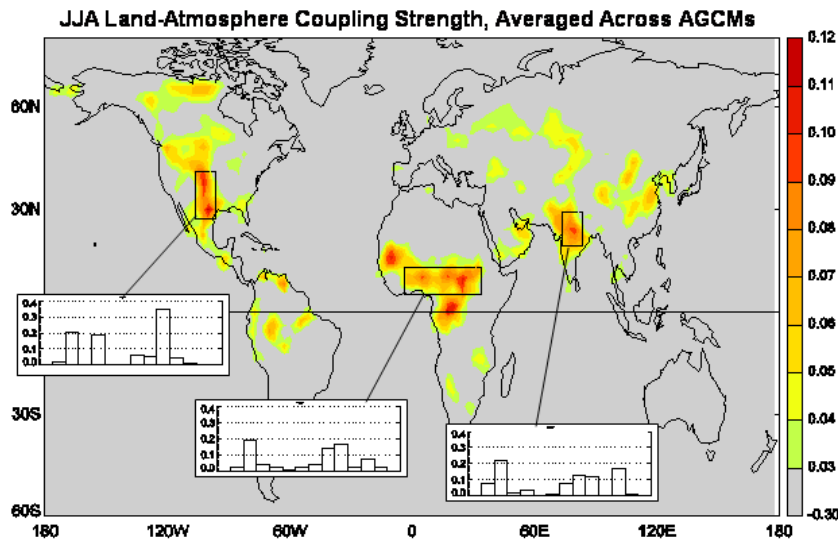
- The interactions between the surface, the planetary boundary layer and clouds are the focus for the coming years.
- Following the work on the Pacific transect by GCSS, GMPP plans to extend it to cover continental as well as oceanic surfaces.
- AMMA offers the ideal setting for such a transect which will be of interest for surface processes, PBL



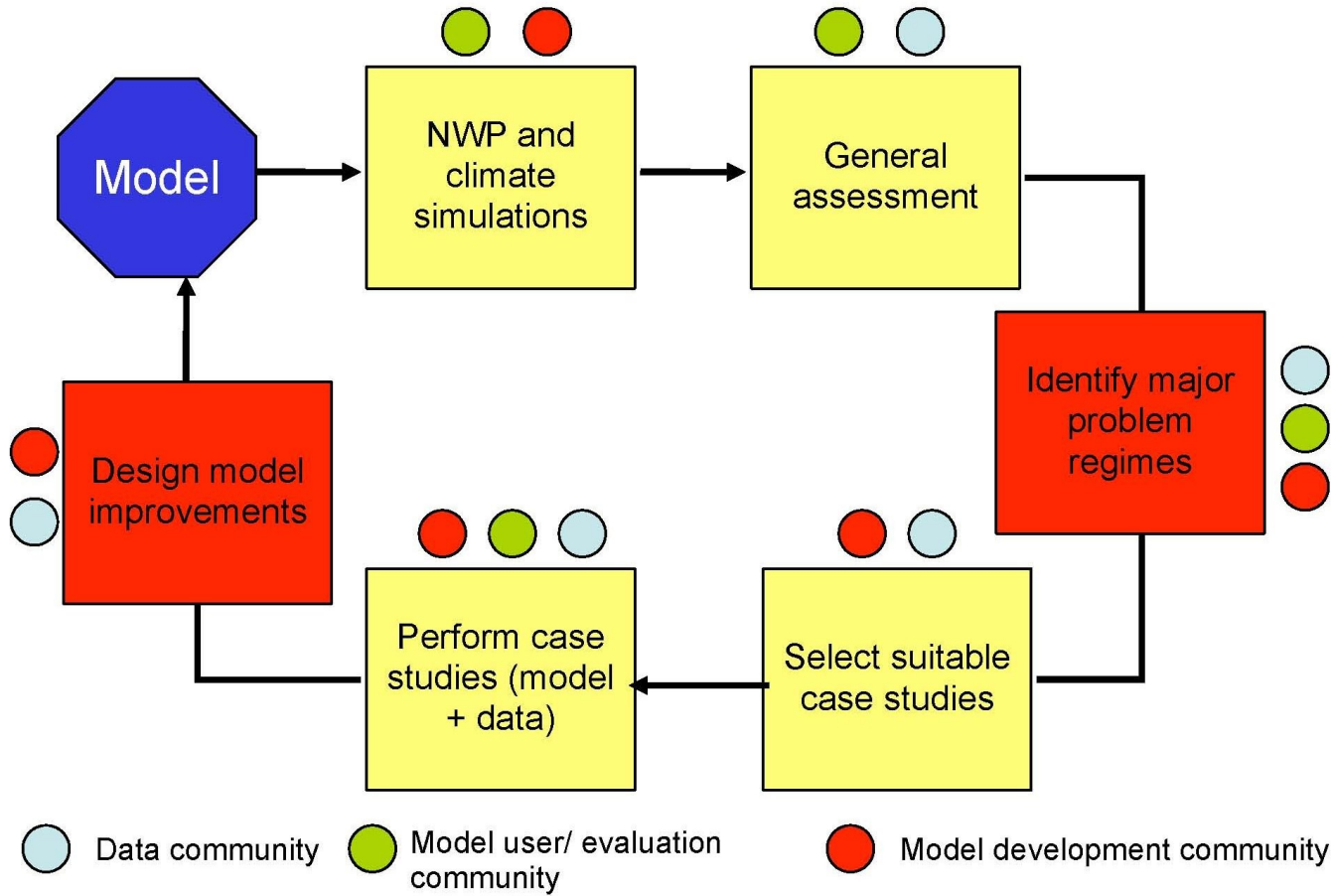
A first transect in July 2000: Zonal wind from NCEP/NCAR reanalyses, ARPEGE-Climat, ECHAM4 and LMDZ4.

Global Land Atmosphere Coupling Experiment

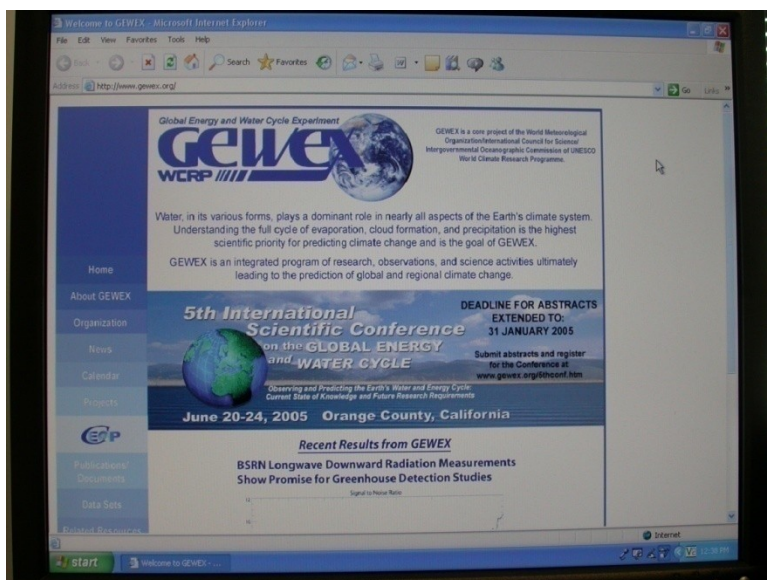
- Has identified areas where the role of land processes in climate is critical



GCSS Model Development Process



GEWEX OUTREACH:

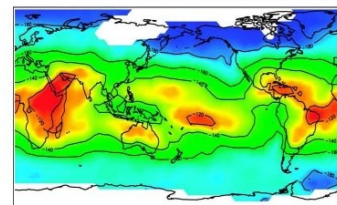


THE GEWEX HOME PAGE (www.gewex.org),

A GROWING ARCHIVE OF GEWEX HISTORY AND SCIENCE COMES THROUGH THE PRESENTATIONS FROM GEWEX MEETINGS THAT ARE PLACED ON THIS SITE.

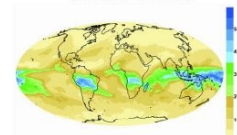


SPACE OBSERVATIONS OF WATER ISOTOPES PROVIDE A NEW TOOL FOR UNDERSTANDING THE WATER CYCLE



For the first time, global measurements of the ratio of deuterated water to H_2O are possible using observations from the Tropospheric Emission Spectrometer (TES) on board NASA's Aura spacecraft. Shown is the mean δD between 550 hPa to 500 hPa for November 2005 to December 2006. More depleted values of δD shown at the higher latitudes indicate a long history of condensation during transit from a lower latitude source, while less depleted values in the tropics reflect ventilation of recently evaporated boundary layer vapor into the free troposphere (above 550 hPa, where TES is sensitive). Knowledge of these differences makes possible depiction of water cycling in the atmosphere. See article by D. Noone et al. on page 9.

HIGHLY ACCURATE AIRS DATA PROVIDE NEW OPPORTUNITIES FOR IMPROVEMENTS IN GLOBAL MODELS



Atmospheric Infrared Sounder (AIRS) retrieved water vapor integrated from the top of the atmosphere down to the 500 hPa level, averaged over the month of January 2005.

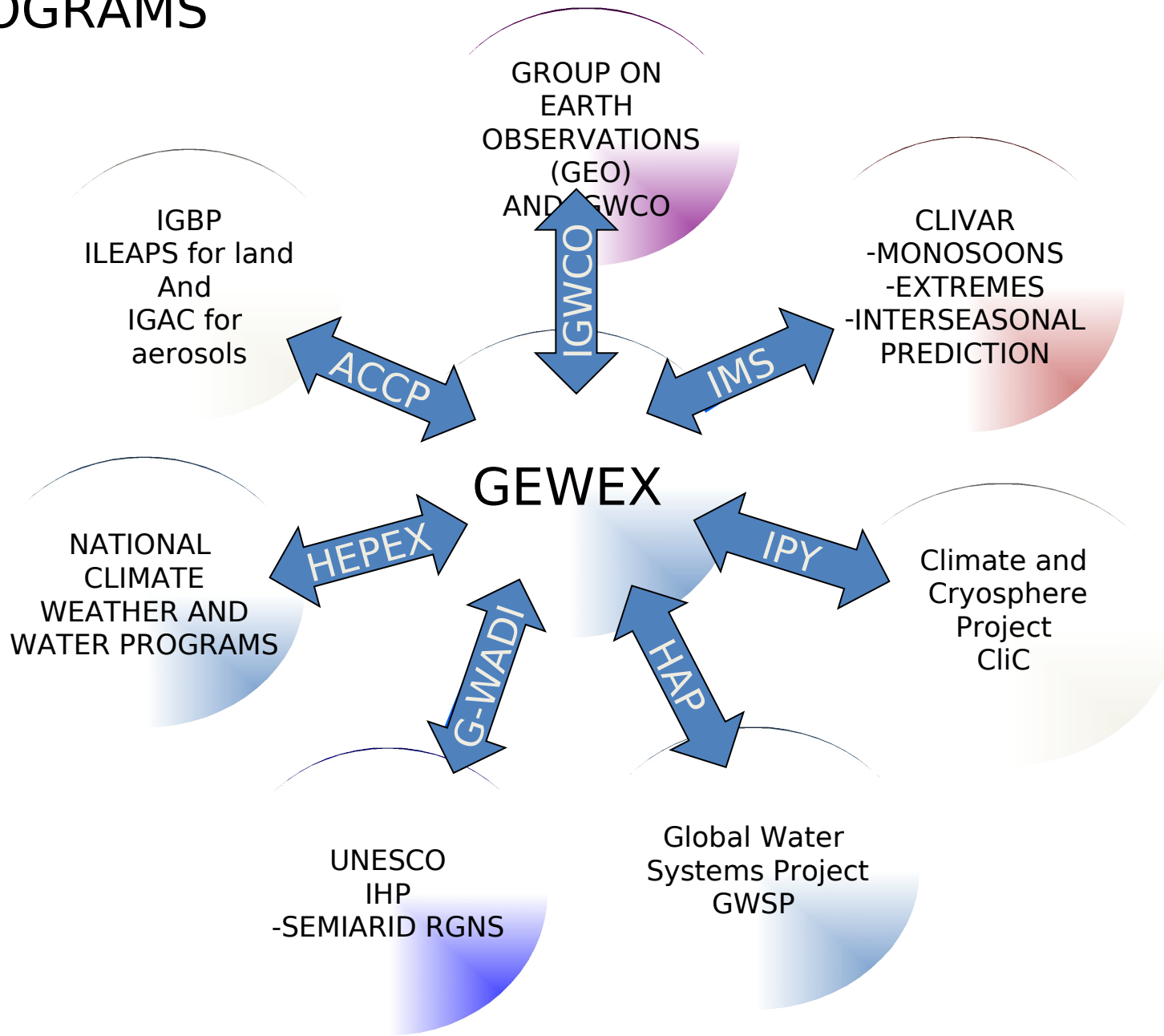
Other AIRS data show lower tropical and wetter extra-tropical atmospheres, as well as much larger moisture perturbations and extra-tropical CO_2 than current models depict. See article by M. Chahine et al. on page 11.

Newsletter Contents

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—GABLS Workshop	14

THE GEWEX NEWSLETTER COMMUNICATES RESULTS TO >2000 EXPERTS.

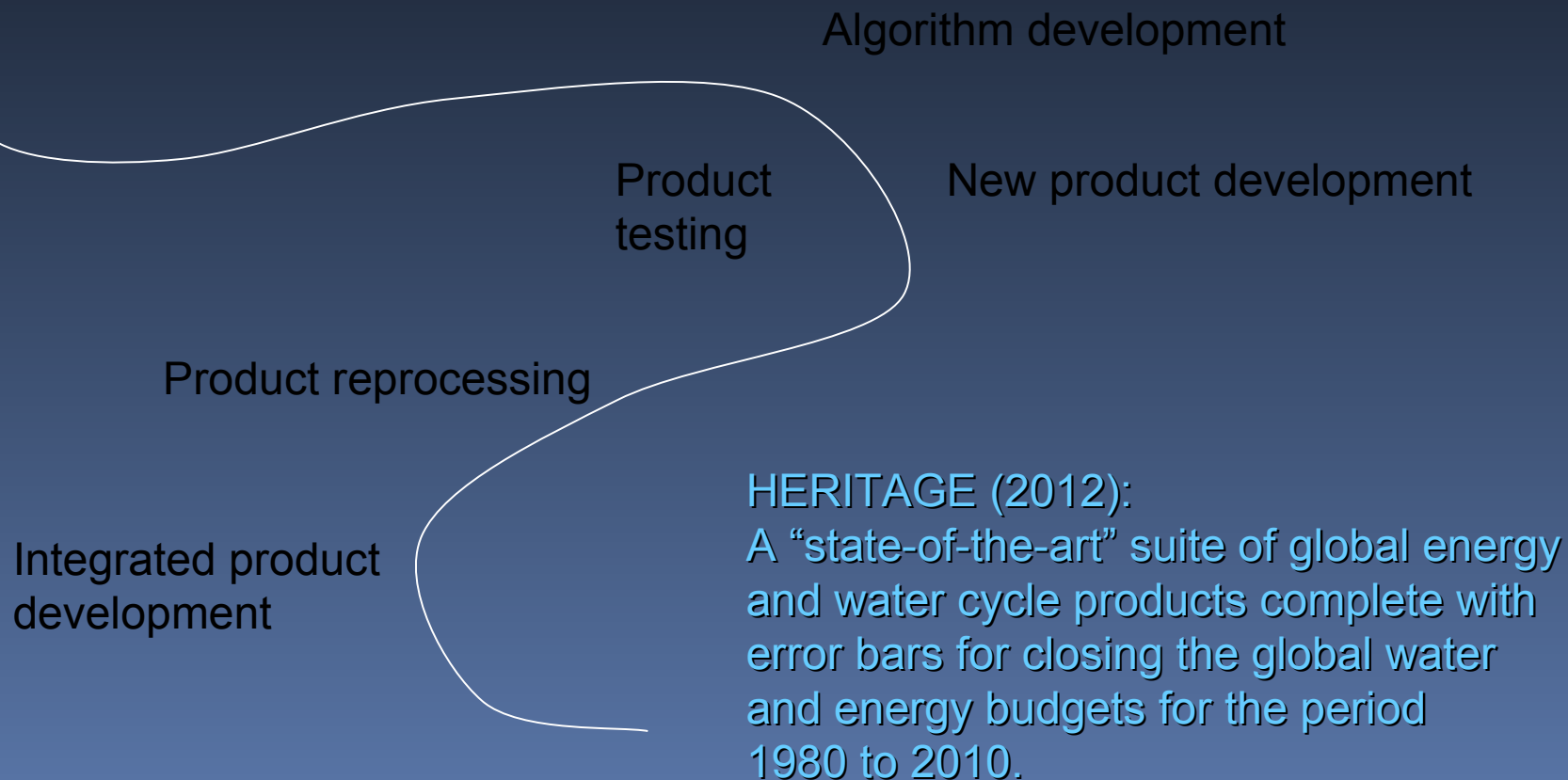
COLLABORATIONS BETWEEN GEWEX AND OTHER PROGRAMS



NAVIGATING THE GEWEX ROADMAP

Objective #1:

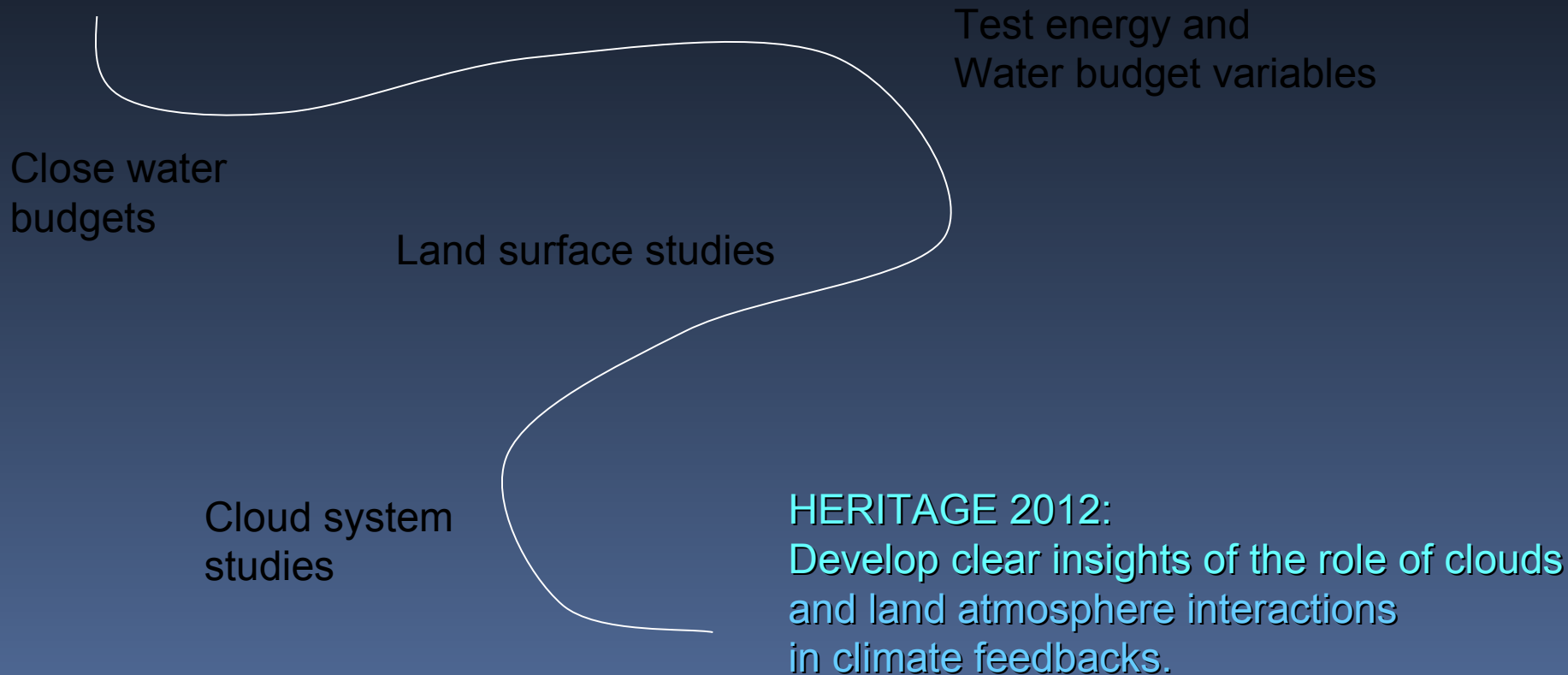
Produce consistent research quality data sets complete with error descriptions of the Earth's energy budget and water cycle and their variability and trends on interannual to decadal time scales, for use in climate system analysis and model development and evaluation.



NAVIGATING THE GEWEX ROADMAP

Objective #2:

Enhance the understanding of and quantify how energy and water cycle processes contribute to climate feedbacks.



NAVIGATING THE GEWEX ROADMAP

Objective #3:

Improve the predictive capability for key water and energy cycle variables and feedbacks through improved parameterizations to better represent hydrometeorological processes, and determine the geographical and seasonal characteristics of their predictability over land areas.

Field campaigns

Develop and test parameterizations

Regional climate modeling

2012: Provide a final review of the success of GEWEX in improving parameterization at operational Numerical Weather Prediction (NWP) and climate modeling centers and its impact on the predictive capabilities for key energy and water cycle variables, including hydrological prediction.

NAVIGATING THE GEWEX ROADMAP

Objective #4:

Undertake joint activities with operational hydrometeorological services, related ESSP projects like the GWSP, and hydrological research programs to demonstrate the value of GEWEX research, data sets and tools for assessing the consequences of climate predictions and global change for water resources.

Hydrologic model
development

Hydrological ensembles

Demonstration
projects

2012: Demonstrate benefits of improved hydrometeorological predictions for water resources (CEOP).