GEOSS Water Cycle Integrator (WCI)

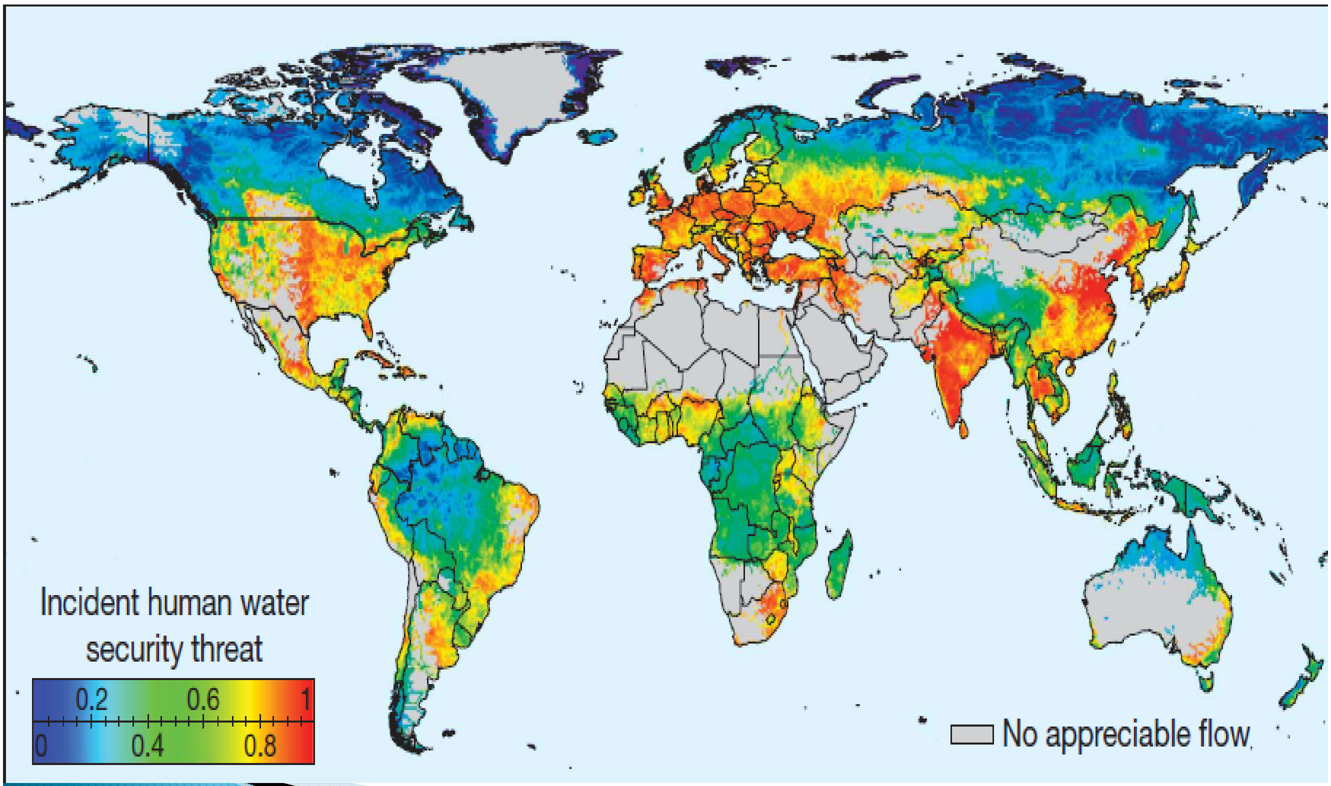
a proposal based on the experiences
through
Coordinated Enhanced Observing Period (CEOP) of WCRP/GEWEX
and
GEOSS Asian Water Cycle Initiative (AWCI)

Water Vulnerability in the World

- **Root Problems**

  Many of the wars of the 20th century were about oil, but wars of the 21st century will be over water." – *I. Serageldin World Bank Vice President*

Global Water Availability Risk



Vorasmairty et al Nature 2010

Water Vulnerability in the World

- **Root Problems**

  Many of the wars of the 20th century were about oil, but wars of the 21st century will be over water." *– I. Serageldin World Bank Vice President*

- **Climate Change Impacts by IPCC AR4**

  Africa: By 2020, between 75 and 250 million of people are projected to be exposed to increased water stress.

  Asia: By the 2050s, freshwater availability in Central, South, East and South-East Asia, particularly in large river basins, is projected to decrease.

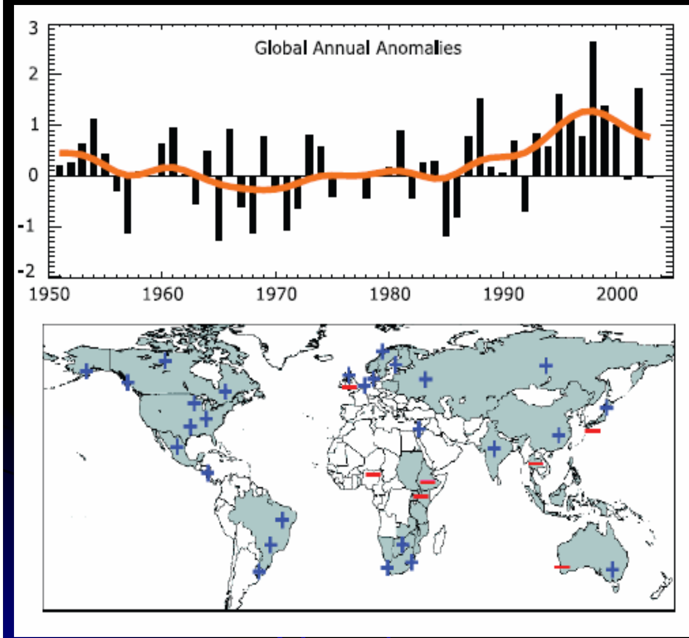
  Australia and New Zealand: By 2030, water security problems are projected to intensify in southern and eastern Australia and, in New Zealand, in Northland and some eastern regions.

  Europe: Negative impacts will include increased risk of inland flash floods and more frequent coastal flooding and increased erosion.

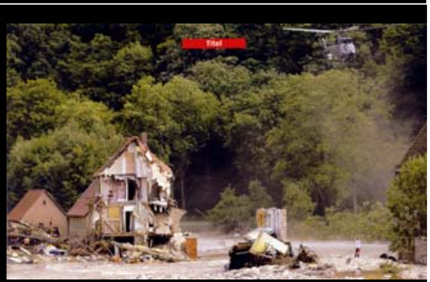
  Latin America: Changes in precipitation patterns and the disappearance of glaciers are projected to significantly affect water availability for human consumption, agriculture and energy generation.

  North America: Warming in western mountains is projected to cause decreased snowpack, more winter flooding and reduced summer flows, exacerbating competition for over-allocated water resources.

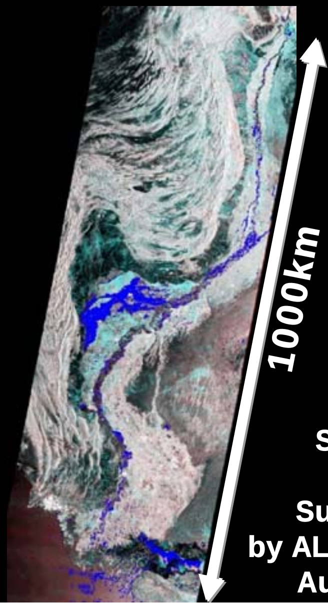
Heavy Precipitation Events: Frequency increases over most areas



Anomalies (%) of the global annual time series defined as the percentage change of contributions of very wet days from the base period average (*IPCC AR4, 2007*).

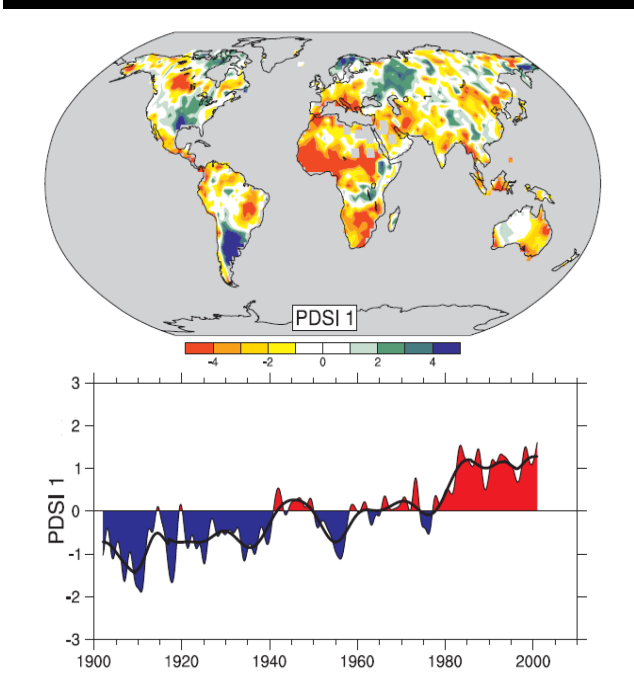


Sever Floods in Europe Summer 2002



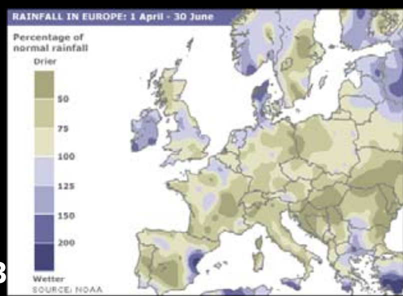
Sever Floods in Pakistan Summer 2010 by ALOS/PALSAR Aug. 27, 2010

Area affected by droughts increases

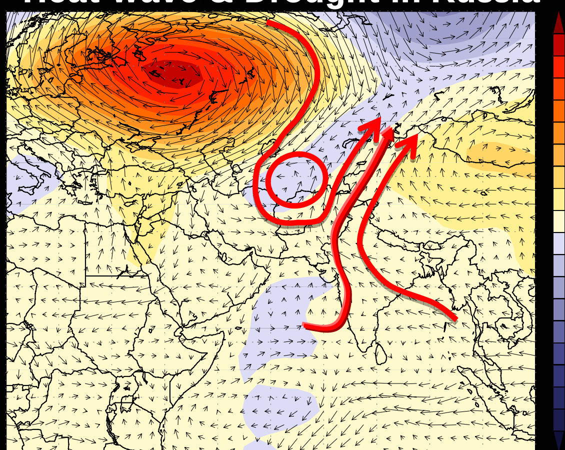


Monthly Palmer Drought Severity Index (PDSI) (*IPCC AR4, 2007*)

Heat wave & Drought in Europe Summer 2003

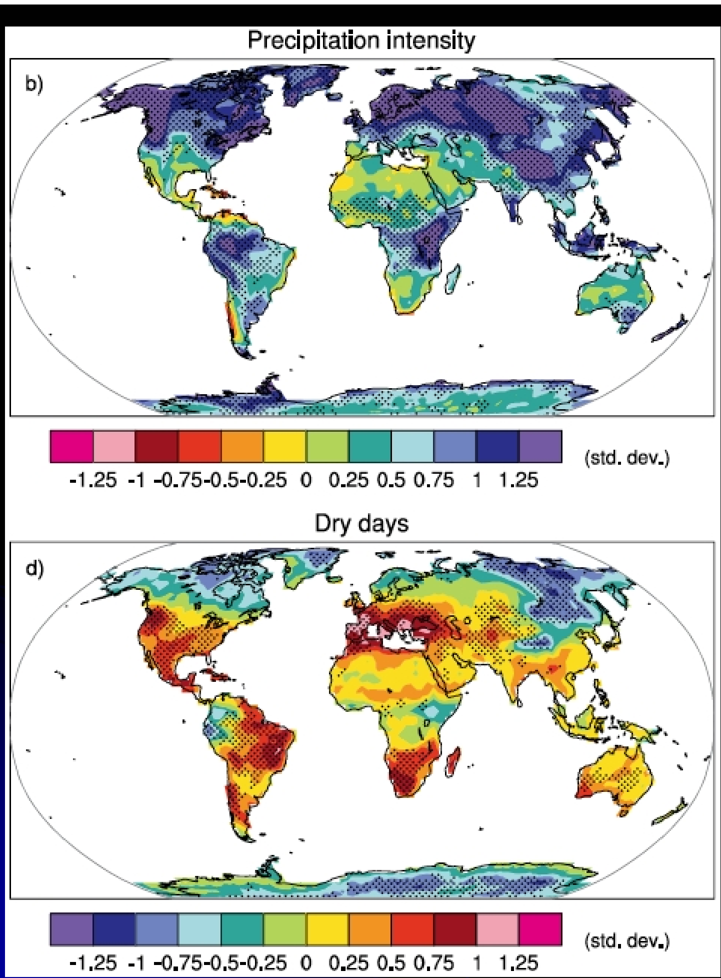


Summer 2010
Heat wave & Drought in Russia



Sever Floods in Pakistan

Projected changes in extremes



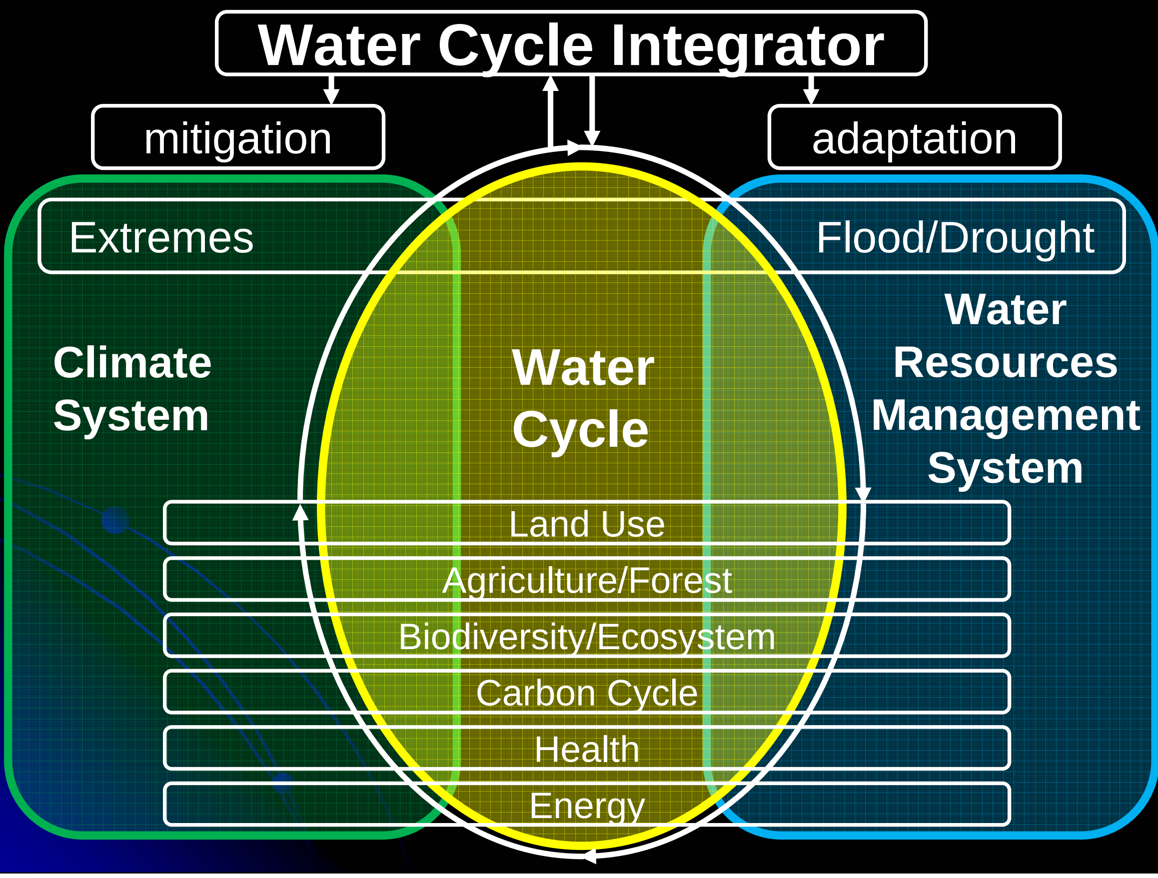
It is *very likely* that heavy precipitation events will continue to become more frequent.

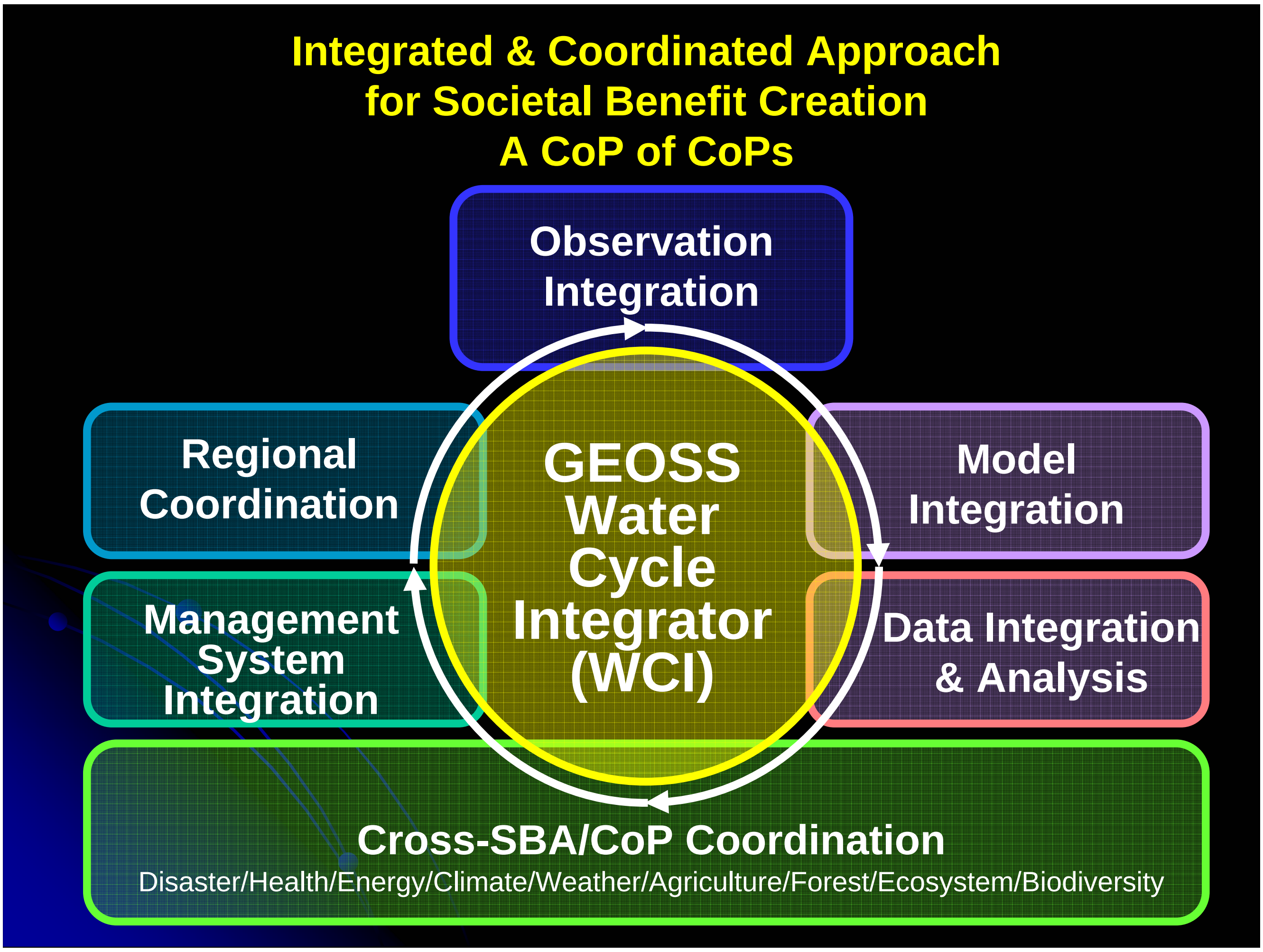
> 90%

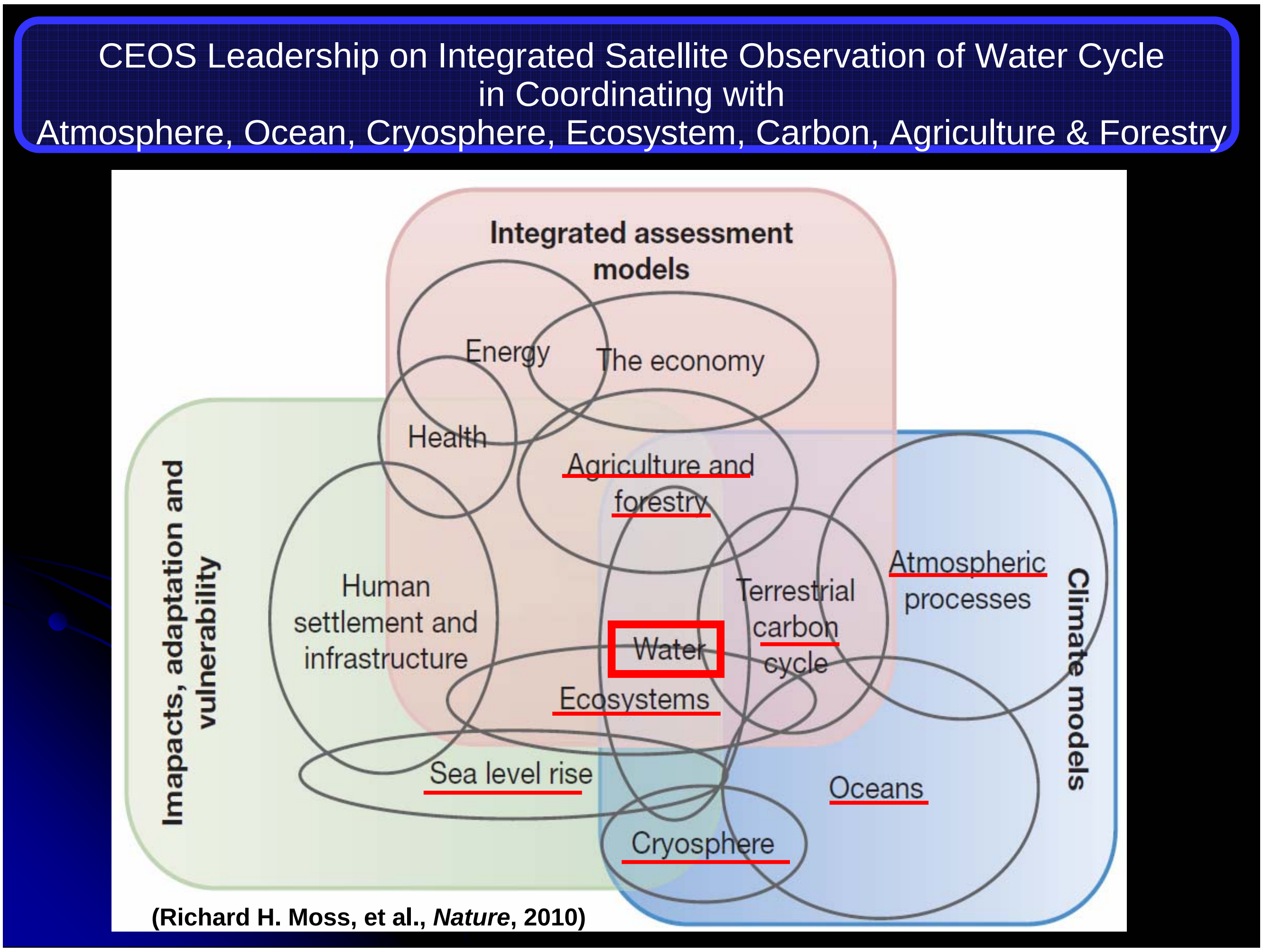
It is *likely* that area affected by drought increases.

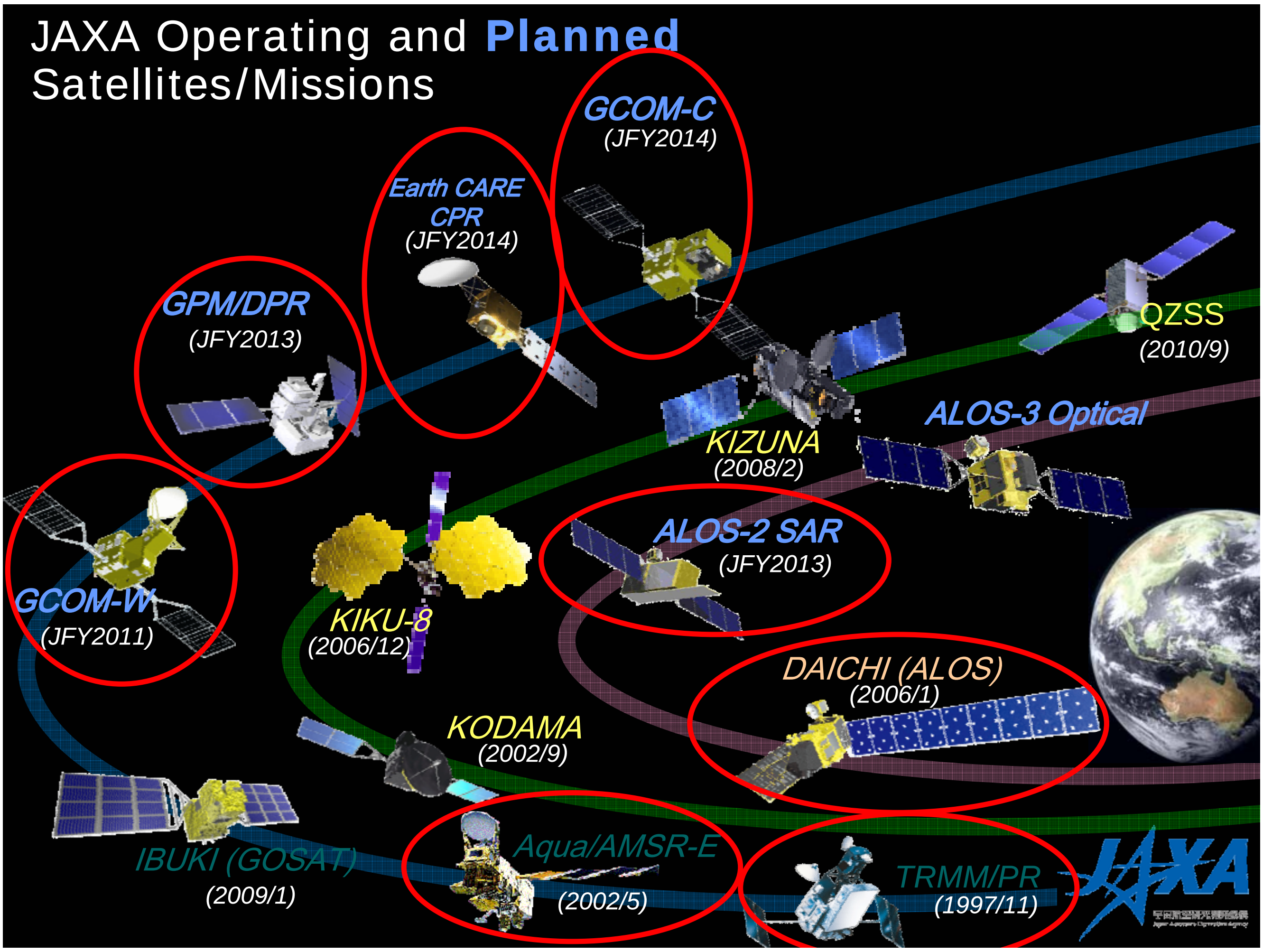
> 67%

Comprehensive Approach to Issues at Present and in Future




Integrated & Coordinated Approach
for Societal Benefit Creation
A CoP of CoPs
Observation Integration
Regional Coordination
Model Integration
GEOSS Water Cycle Integrator (WCI)
Management System Integration
Data Integration & Analysis
Cross-SBA/CoP Coordination
Disaster/Health/Energy/Climate/Weather/Agriculture/Forest/Ecosystem/Biodiversity


CEOS Leadership on Integrated Satellite Observation of Water Cycle
in Coordinating with
Atmosphere, Ocean, Cryosphere, Ecosystem, Carbon, Agriculture & Forestry
Integrated assessment models
Energy
The economy
Health
Agriculture and forestry
Human settlement and infrastructure
Terrestrial carbon cycle
Atmospheric processes
Water
Ecosystems
Sea level rise
Oceans
Cryosphere
Imapacts, adaptation and vulnerability
Climate models
(Richard H. Moss, et al., Nature, 2010)



JAXA Operating and Planned Satellites/Missions
GCOM-C
(JFY2014)
Earth CARE CPR
(JFY2014)
GPM/DPR
(JFY2013)
QZSS
(2010/9)
ALOS-3 Optical
KIZUNA
(2008/2)
GCOM-W
(JFY2011)
ALOS-2 SAR
(JFY2013)
KIKU-8
(2006/12)
DAICHI (ALOS)
(2006/1)
KODAMA
(2002/9)
IBUKI (GOSAT)
(2009/1)
Aqua/AMSR-E
(2002/5)
TRMM/PR
(1997/11)
JAXA

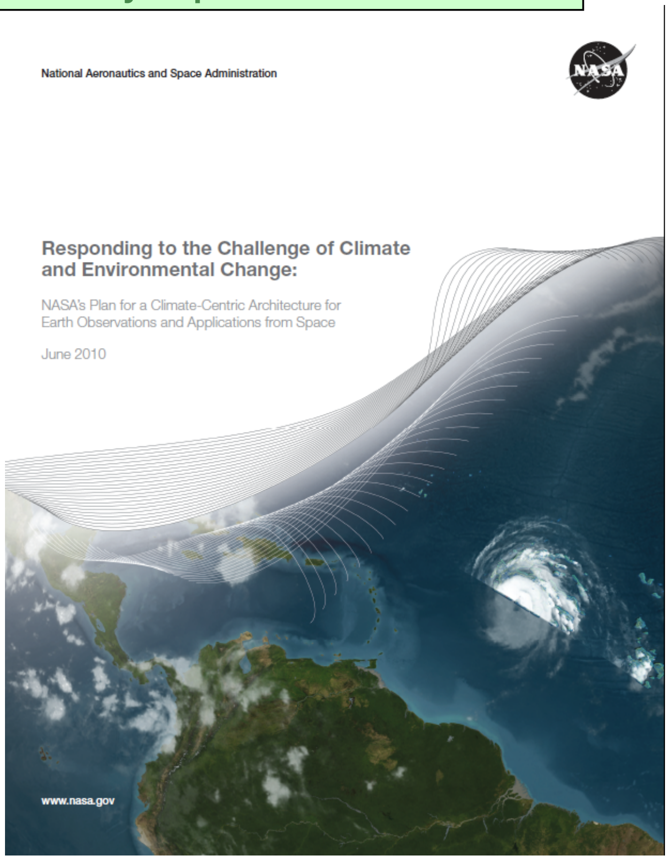
NASA Operating Missions (International Collaboration)
NASA
OSTM/Jason 2
Jason
QuikSCAT
ACRIMSAT
Landsat-7
EO-1
SORCE
TRMM
Aqua
Terra
GRACE
CALIPSO
CloudSat
Aura

SWOT is one of the key surface hydrology missions recommended in the 2007 NRC Earth Science Decadal Survey Report.

TABLE ES.2 Launch, orbit, and instrument specifications for the recommended NASA missions. Shade colors denote mission cost categories as estimated by the NRC ESAS committee. Pink, green, and blue shadings represent large ($600 million to $900), medium ($300 million to $600 million), and small (<$300 million) missions, respectively. Missions are listed in order of ascending cost within each launch timeframe. Detailed descriptions of the missions are given in Part II, and Part III provides the foundation for selection.

Decadal Survey Mission	Mission Description	Orbit	Instruments	Rough Cost Estimate
Timeframe 2010 – 2013, Missions listed by cost				
CLARREO (NASA portion)	Solar radiation: spectrally resolved forcing and response of the climate system	LEO, Precessing	Absolute, spectrally-resolved interferometer	$200 M
SMAP	Soil moisture and freeze/thaw for weather and water cycle processes	LEO, SSO	L-band radar L-band radiometer	$300 M
ICESat-II	Ice sheet height changes for climate change diagnosis	LEO, Non-SSO	Laser altimeter	$300 M
DESDynI	Surface and ice sheet deformation for understanding natural hazards and climate; vegetation structure for ecosystem health	LEO, SSO	L-band InSAR Laser altimeter	$700 M
Timeframe: 2013 – 2016, Missions listed by cost				
HyspIRI	Land surface composition for agriculture and mineral characterization; vegetation	LEO, SSO	Hyperspectral spectrometer	$300 M
ASCENDS	Day/night, all-latitude, all-season CO_2	LEO, SSO	Multifrequency laser	$400 M
SWOT	Ocean, lake, and river water levels for	LEO, SSO	Ka-band wide swath radar	$450 M
GEO-CAPE	Atmospheric gas columns for air quality forecasts; ocean color for coastal ecosystem health and climate emissions	GEO	High and low spatial resolution hyperspectral imagers	$550 M
ACE	Aerosol and cloud profiles for climate and water cycle; ocean color for open	LEO, SSO	Backscatter lidar Multiangle polarimeter	$800 M
LIST	Land surface topography for landslide	LEO, SSO	Laser altimeter	$300 M
PATH	High frequency, all-weather temperature and humidity soundings for weather forecasting and SST[a]	GEO	MW array spectrometer	$450 M
GRACE-II	High temporal resolution gravity fields for tracking large-scale water movement	LEO, SSO	Microwave or laser ranging system	$450 M
SCLP	Snow accumulation for fresh water availability	LEO, SSO	Ku and X-band radars K and Ka-band radiometers	$500 M
GACM	Ozone and related gases for intercontinental air quality and stratospheric ozone layer prediction	LEO, SSO	UV spectrometer IR spectrometer Microwave limb sounder	$600 M
3D-Winds (Demo)	Tropospheric winds for weather forecasting and pollution transport	LEO, SSO	Doppler lidar	$650 M

[a] Cloud-independent, high temporal resolution, lower accuracy SST to complement, not replace, global operational high accuracy SST measurement.



ESA's Living Planet Programme

www.esa.int/livingplanet

esa

- **Earth Explorer** — **Research** driven
  - Core Missions
  - Opportunity Missions
- **Earth Watch** — **Operational** Service driven
  - Operational Meteorology
    - Meteosat
    - MSG
    - EPS (MetOp)
    - MTG
    - Post EPS
  - GMES
    - Sentinel 1 A/B
    - Sentinel 2 A/B
    - Sentinel 3 A/B
    - Sentinel 4
    - Sentinel 5

GOCE 3-2009

CryoSat 4-2010

ADM-Aeolus 2011

SMOS 11-2009

EarthCARE 2013

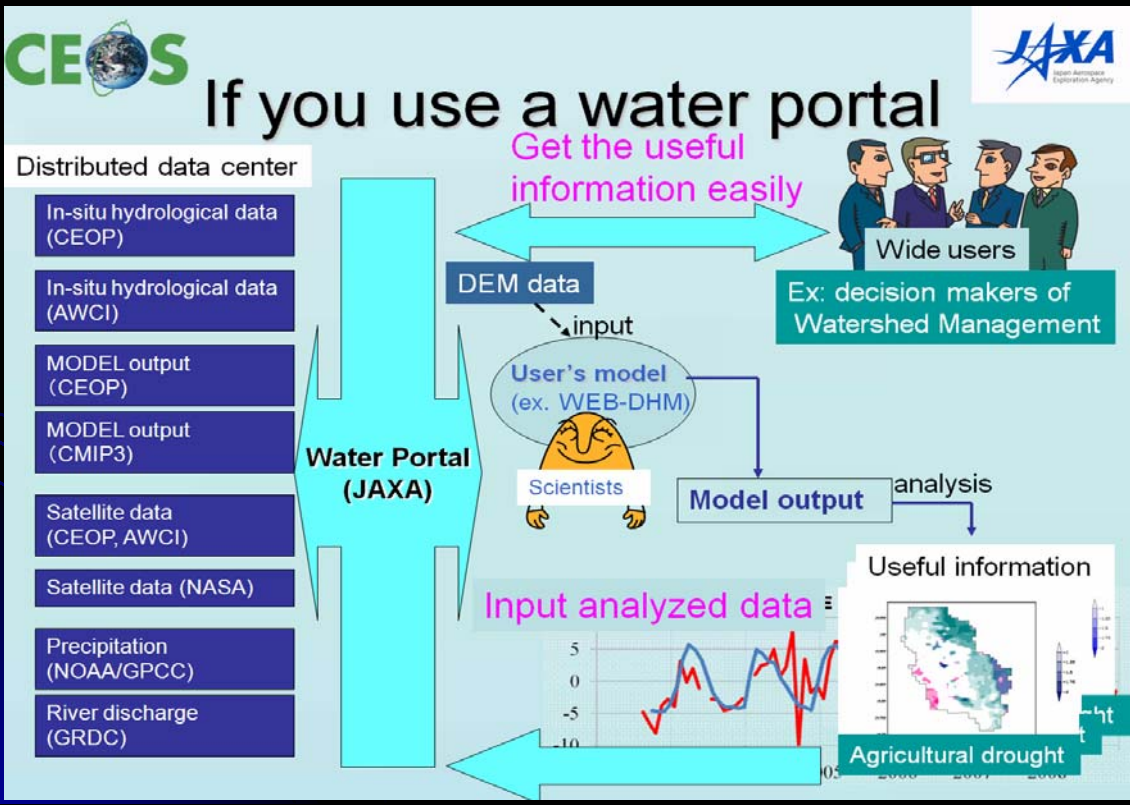
Swarm 2010

?

Earth Explorer 7 2016 ← + 3 Candidate Core Explorers

European Space Agency

CEOS Leadership on Data Integration and Analysis: WGISS Water Community of Practice Portal



Experiences through

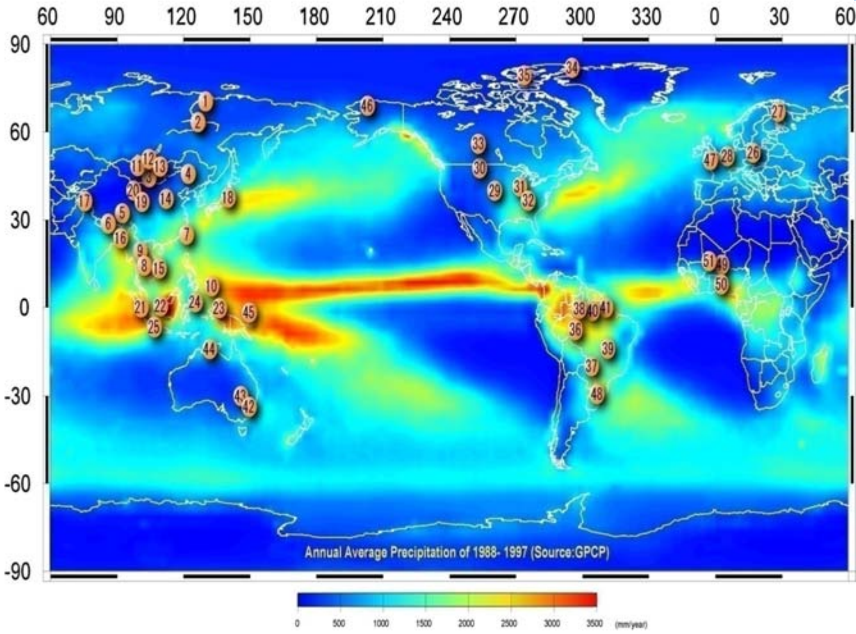
Coordinated Enhanced Observing Period (CEOP) of WCRP/GEWEX

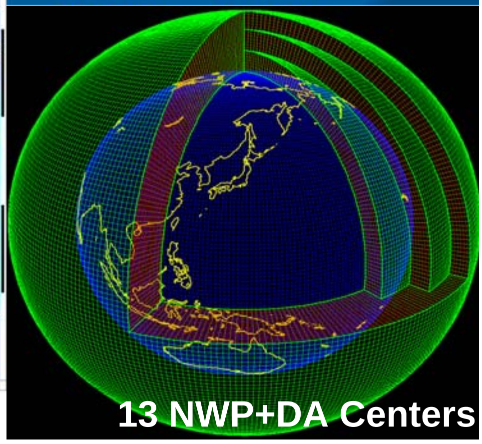
a water cycle science integrator in collaboration among WCRP, CEOS and the national and regional numerical weather prediction centers

Coordinated Energy and Water Cycle Observations Project

Convergence of Observations

A Prototype of the Global Water Cycle Observation System of Systems

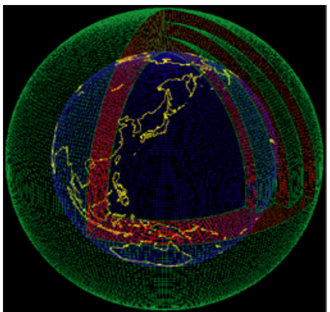


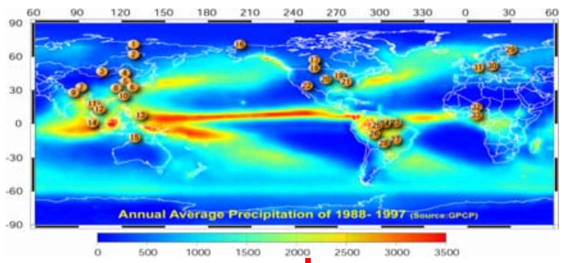


Coordinated Energy and Water Cycle Observations Project

Interoperability Arrangement

A well organized collecting, processing, storing, and disseminating shared data, metadata and products





In-Situ Data Archiving Center at NCAR (National Center for Atmospheric Research) of USA

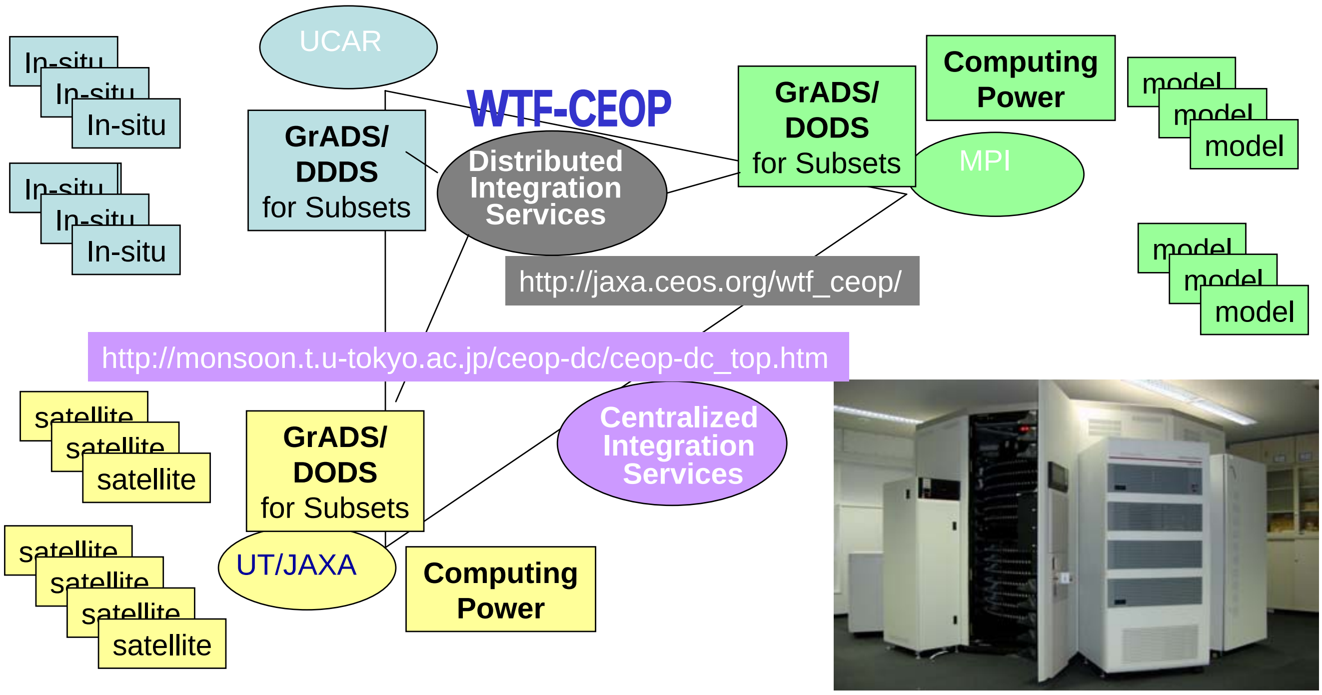
Model Output Data Archiving Center at the World Data Center for Climate, Max-Planck Institute for Meteorology of Germany

Data Integrating/Archiving Center at University of Tokyo and JAXA of Japan

Coordinated Energy and Water Cycle Observations Project

Data Management

Distributed- and Centralized- Data Integration Functions



Experiences through
GEOSS Asian Water Cycle Initiative (AWCI) of WCRP/GEWEX

an integrator between water cycle science–operation in collaboration among GEO, national countries, science communities and space agencies


Thank You for Your Leadership and Supports!
Thank You.