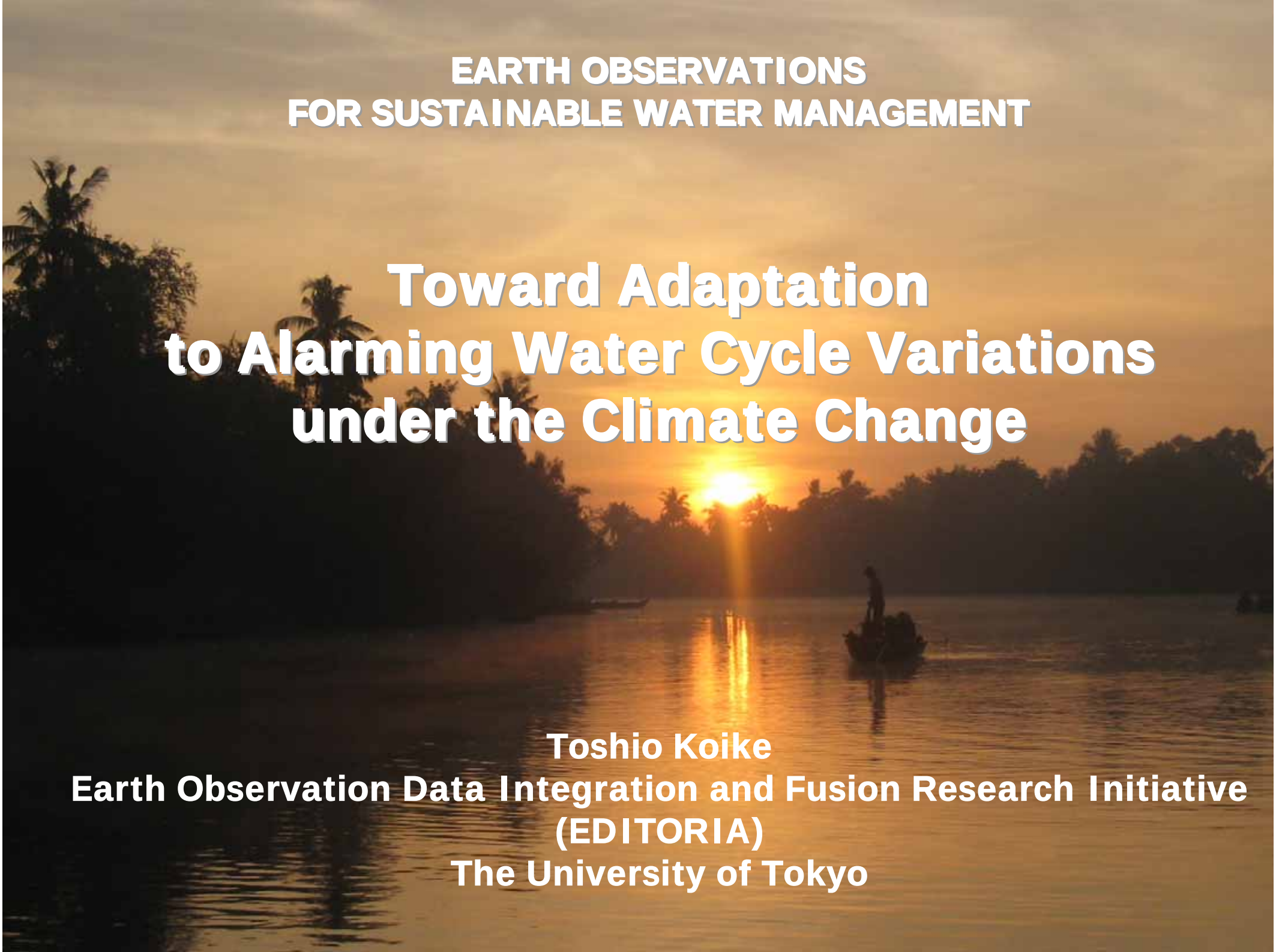


EARTH OBSERVATIONS
FOR SUSTAINABLE WATER MANAGEMENT

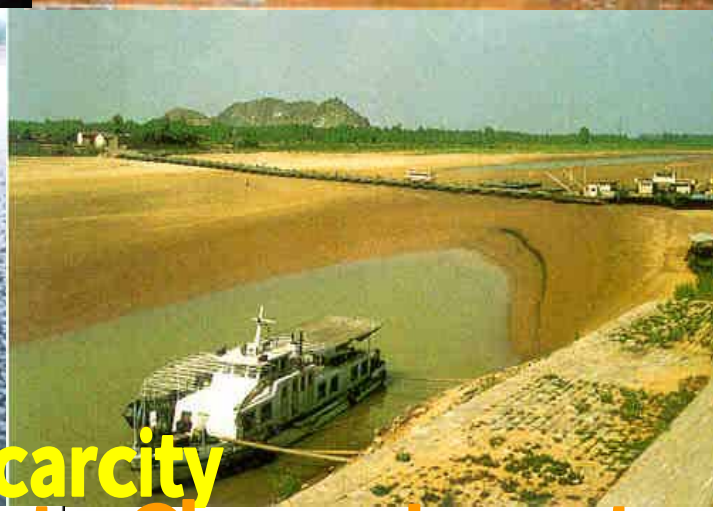
Toward Adaptation to Alarming Water Cycle Variations under the Climate Change

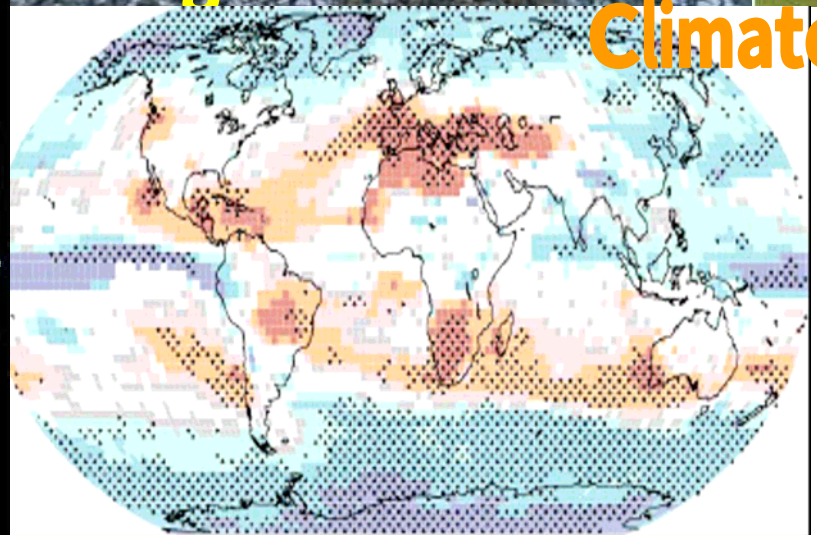
Toshio Koike
Earth Observation Data Integration and Fusion Research Initiative
(EDITORIA)
The University of Tokyo

Floods and Land Slides

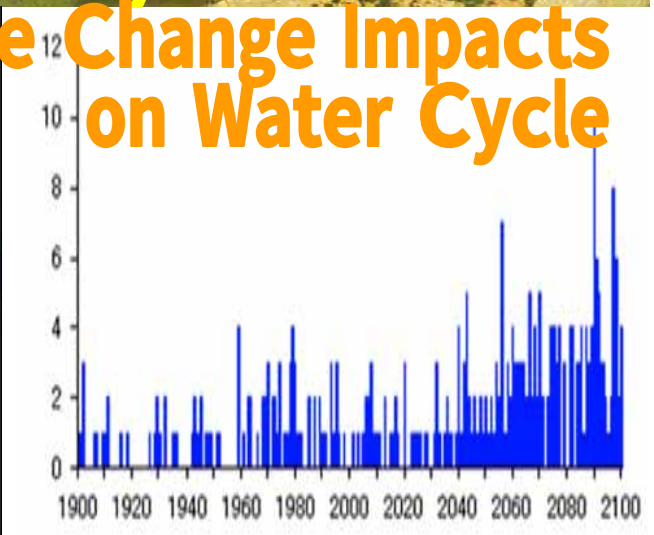
Water Pollution and Ecosystem Degradation

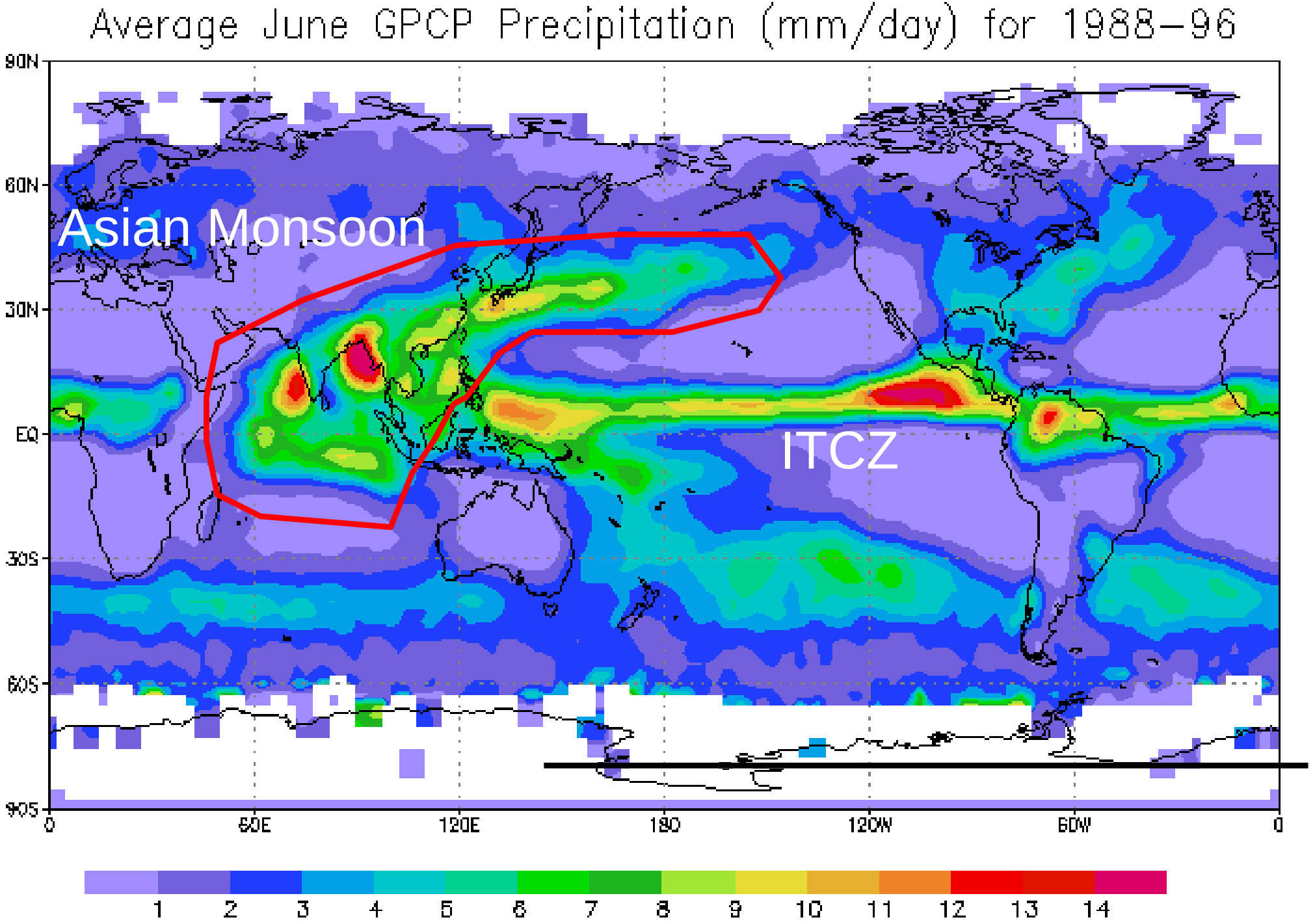
Drought and Water Scarcity





Climate Change Impacts on Water Cycle

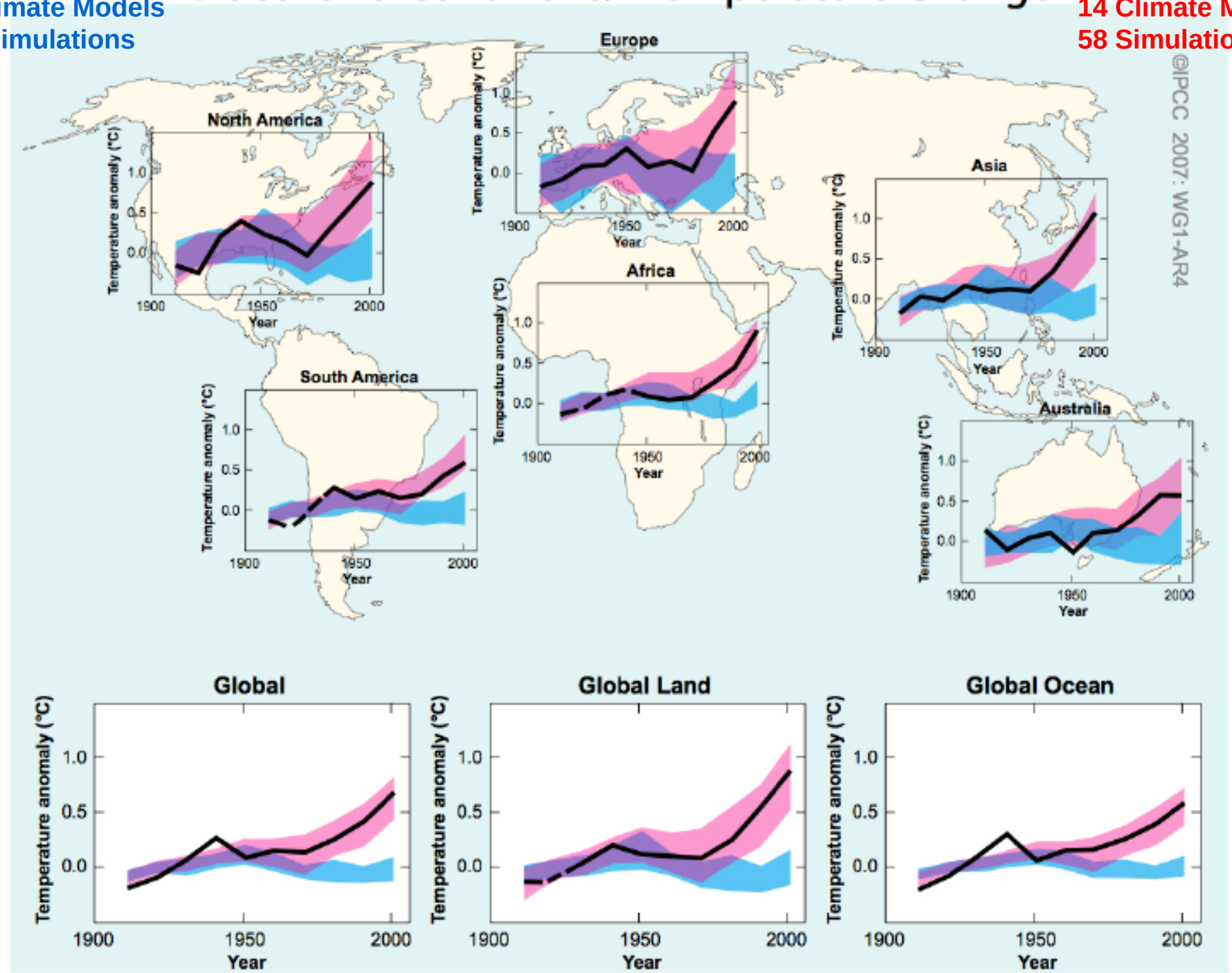



Average June GPCP Precipitation (mm/day) for 1988–96
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0
Asian Monsoon
ITCZ
1
2
3
4
5
6
7
8
9
10
11
12
13
14

natural
5 Climate Models
19 Simulations

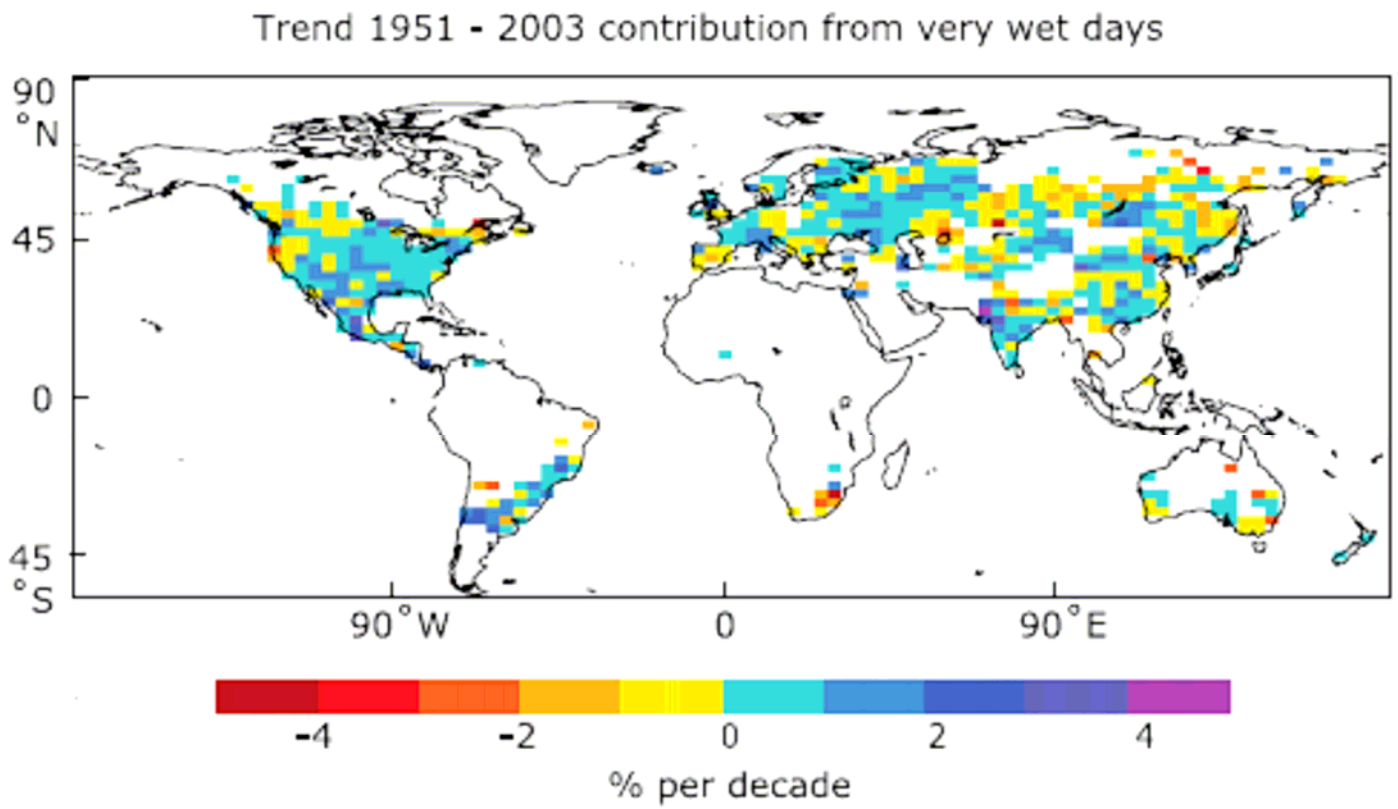
Global and Continental Temperature Change

+ Anthropogenic
14 Climate Models
58 Simulations

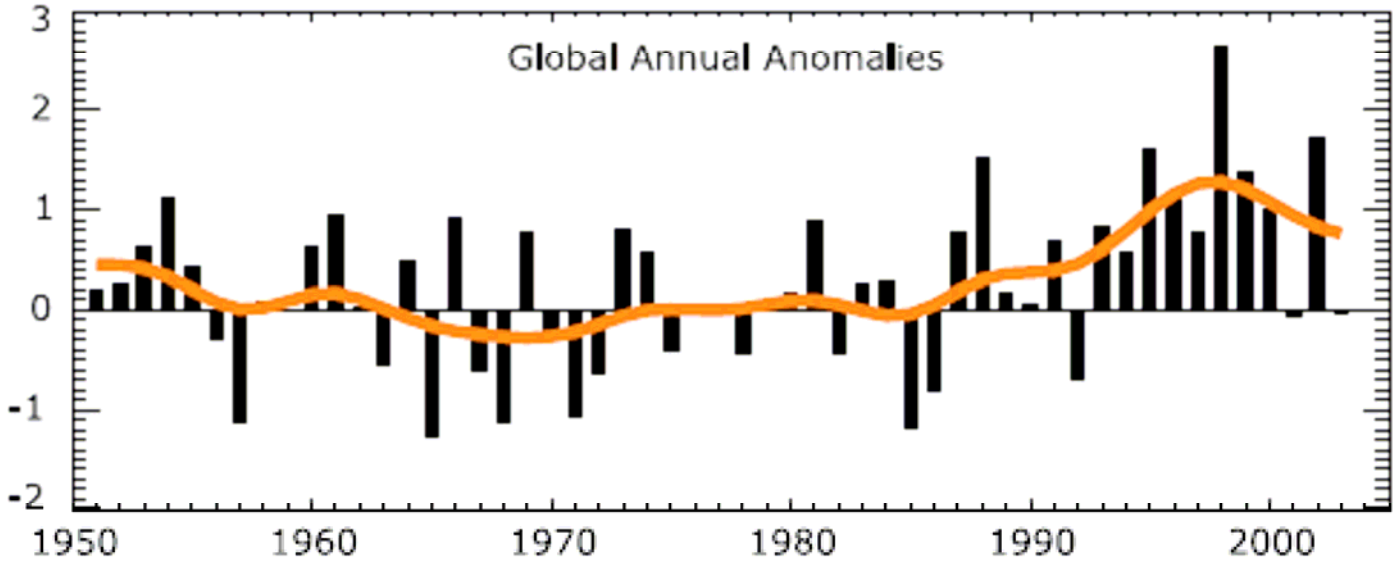


Changes in heavy precipitation frequencies >> Changes in precipitation totals

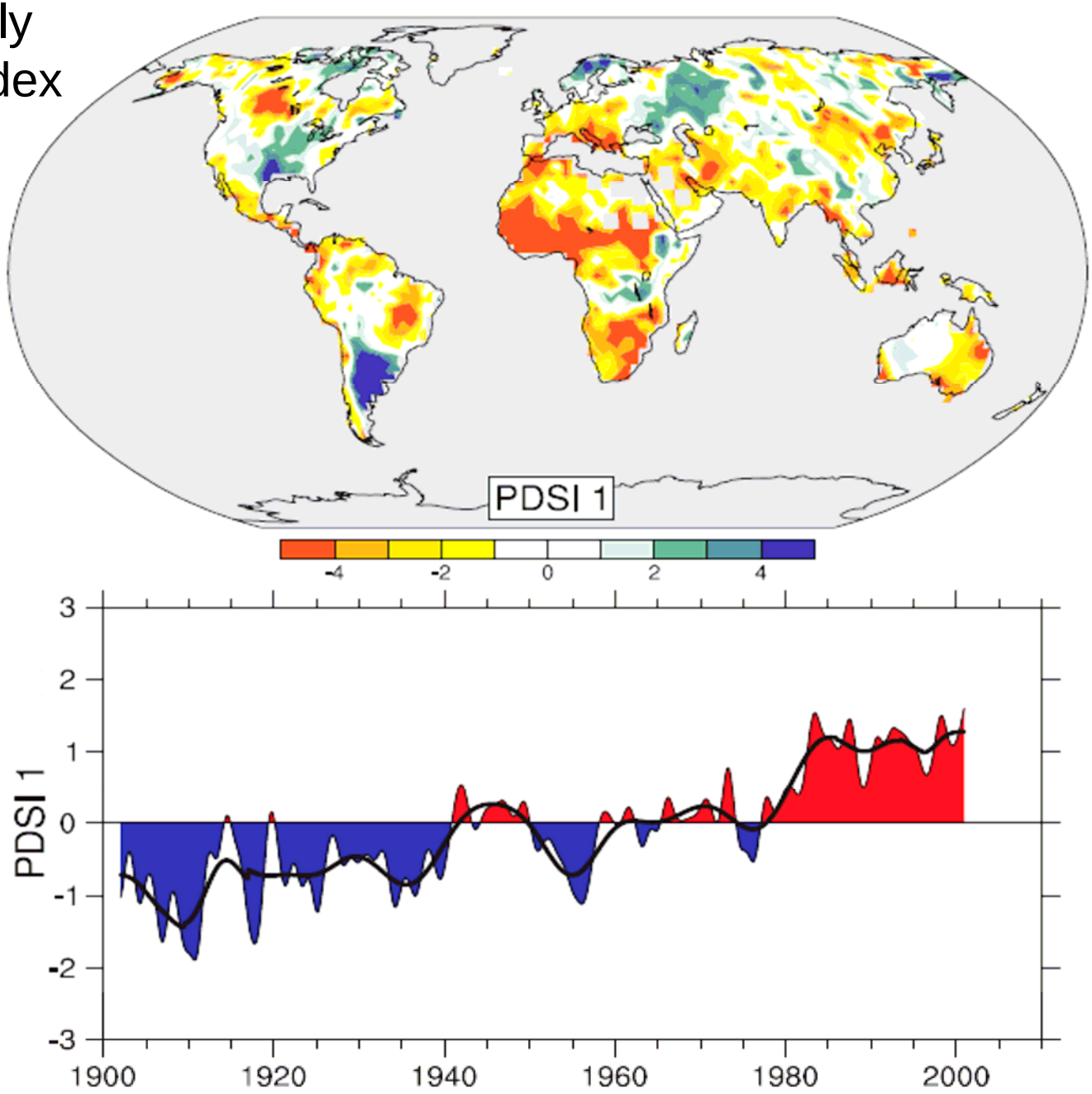
Observed trends for 1951 to 2003 in the contribution to total annual precipitation from very wet days



Anomalies (%) of the global annual time series (1961 to 1990)



Spatial pattern of the monthly Palmer Drought Severity Index (PDSI) for 1900 to 2002.



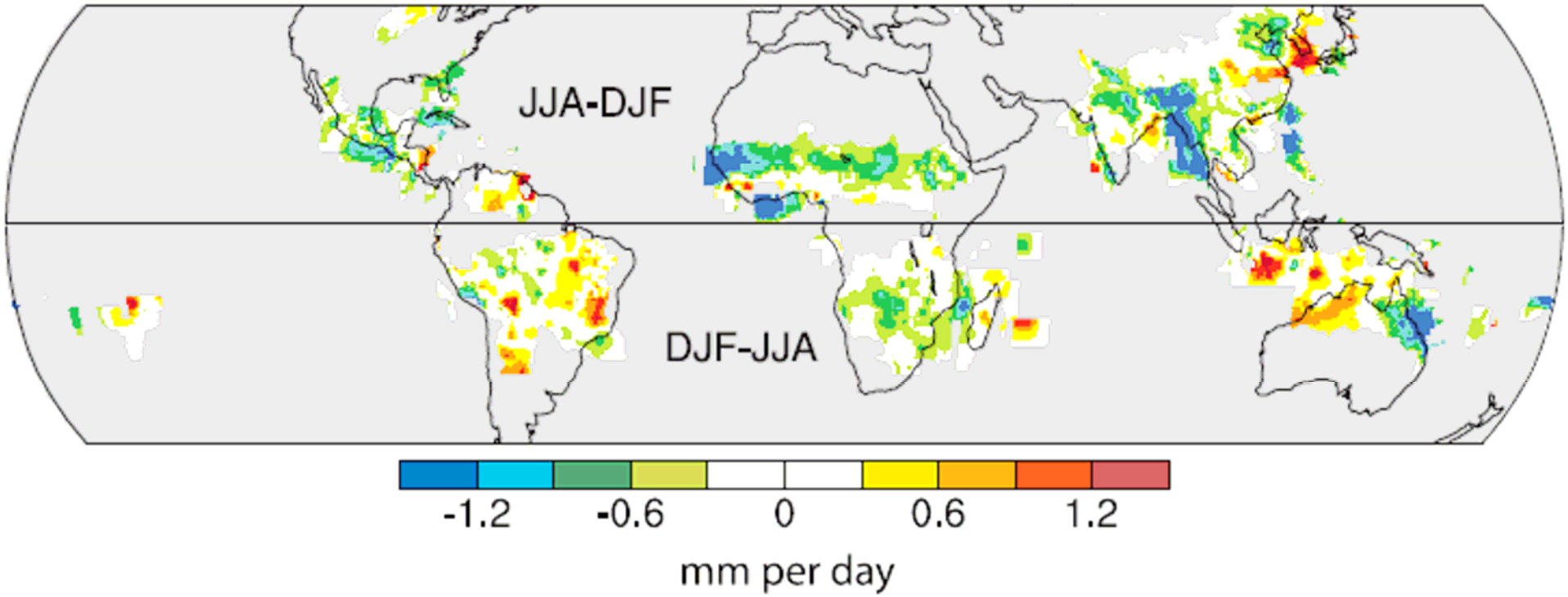
Area affected by drought increase.

PDSI: a prominent index of drought and measures the cumulative deficit in surface land moisture by incorporating previous precipitation and estimates of moisture drawn into the atmosphere into a hydrological accounting system.

Extreme Weather Events
in late 20th century, human contribution, and future trend

Phenomenon[a] and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend [b]	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	*Very likely* [c]	*Likely* [d]	*Virtually certain* [d]
Warmer and more frequent hot days and nights over most land areas	*Very likely* [e]	*Likely (nights)* [d]	*Virtually certain* [d]
Warm spells / heat waves. Frequency increases over most land areas	*Likely*	*More likely than not* [f]	*Very likely*
	Likely	*More likely than not* [f]	**> 90 %**
	Likely in many regions since 1970s	*More likely than not*	**> 66 %**
	Likely in some regions since 1970	*More likely than not* [f]	**> 66 %**
Increased incidence of extreme high sea level (excludes tsunamis) [g]	*Likely*	*More likely than not* [f, h]	*Likely* [i]

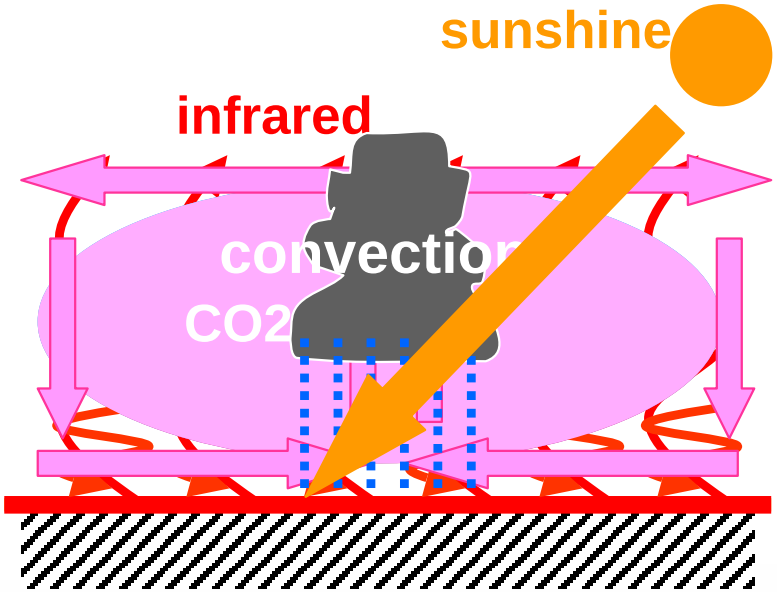
Monsoon Rainfall
increase or decrease ?

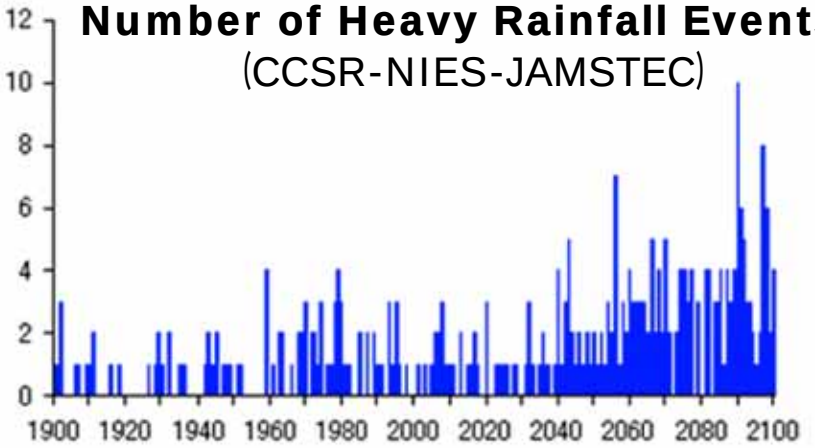


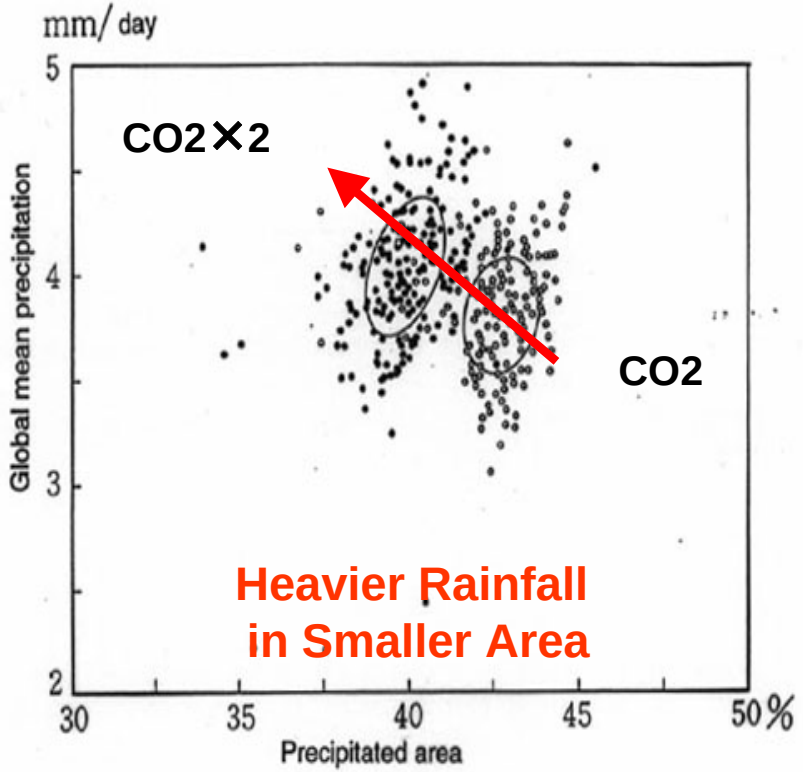
Change in the mean annual range of precipitation:
]1976 to 2003 minus 1948 to 1975 periods (mm per day).

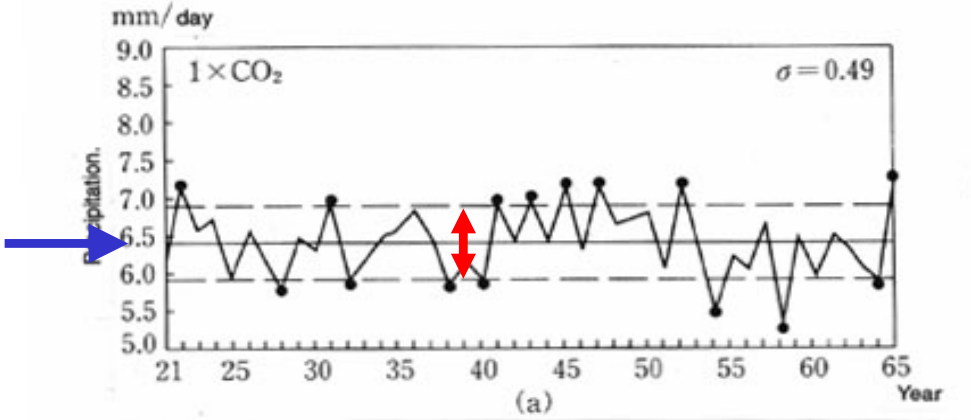

WE NEED
SCIENCE AND TECHNOLOGY,
COOPERATION FRAMEWORK,
AND PEOPLE.

Impacts of the Global Warming on the Water Cycle

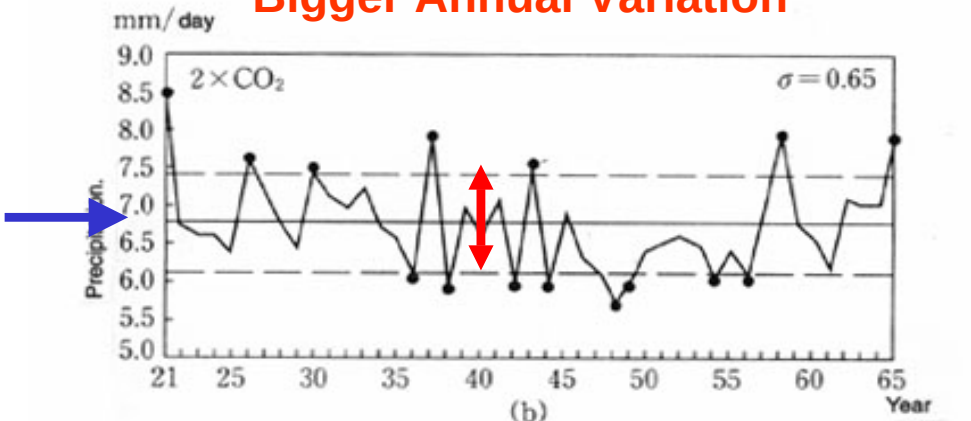








Bigger Annual Variation



GEOSS Asian Water Cycle Initiative (AWCI)

Data Integration

satellite

ocean

•Discovery Work Flow Assist
•Data Quality Manager
•Data Crawler
•ETL
•Data Navigator
•Meta Data Manger

Data Management Layer •DBMS

File System Layer

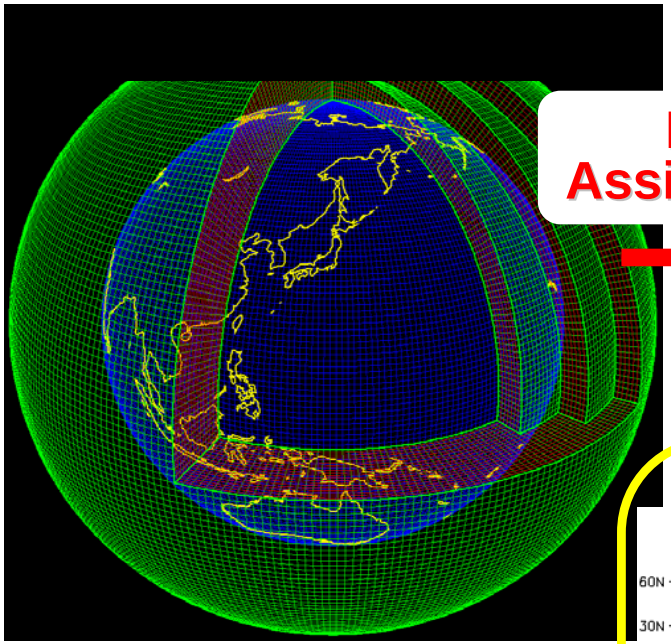
•Storage Management System
•Power management System

Storage Layer

Disk Array

Tape Library

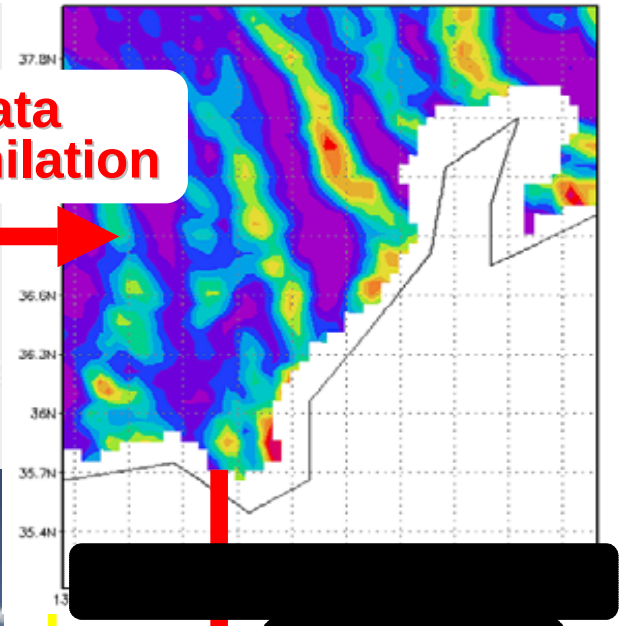
Global Data to Local Information



Data Assimilation

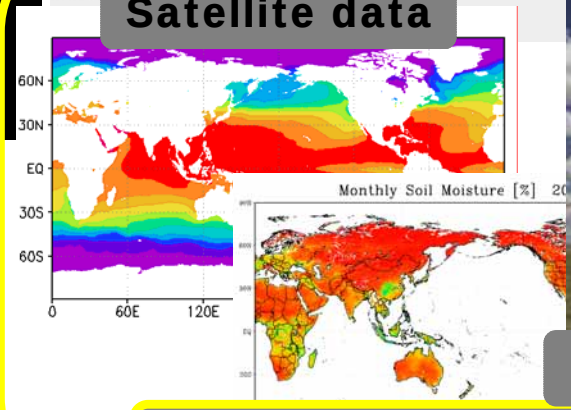
Improved prediction

Data Assimilation



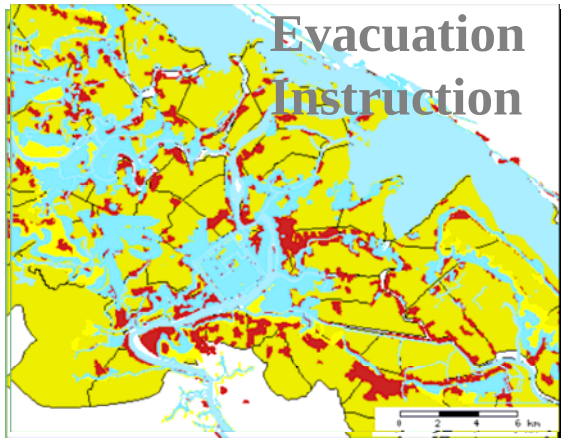
Improved Initial Condition

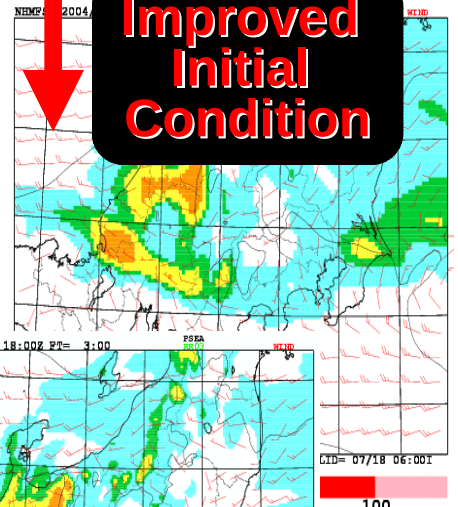
Satellite data

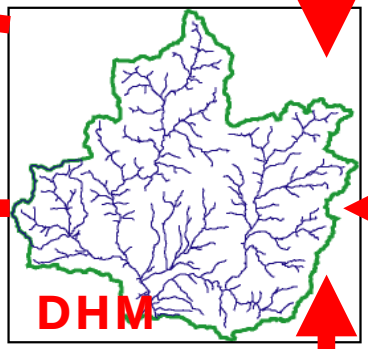


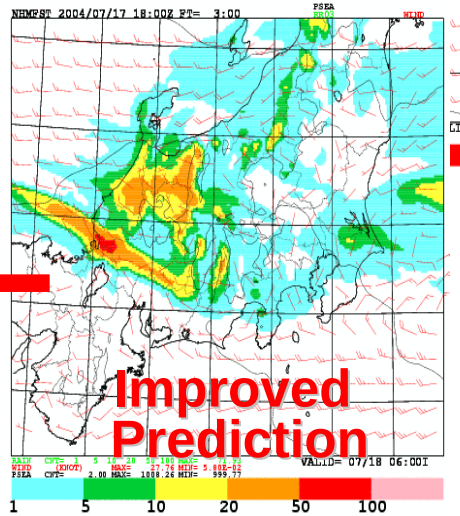
In-situ data

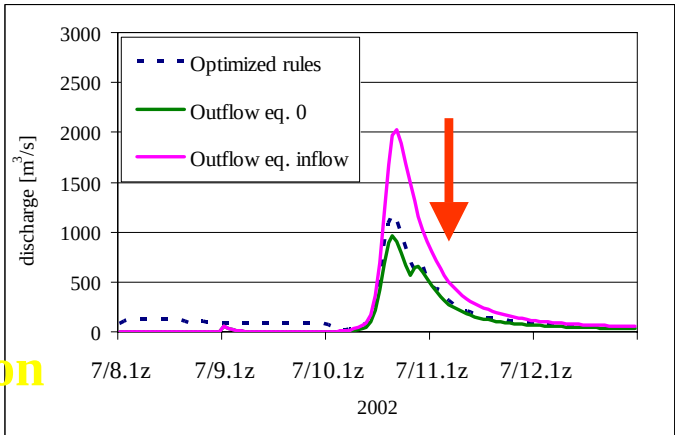
Centralized Data System











Flood Peak Reduction

Socio-Economic Data

A Global Earth Observation System of Systems

GEOSS


1st Asian Water Cycle Symposium, Tokyo, Nov. 2005


1st Task Team Meeting, Bangkok, Sep. 2006


1st Capacity Building Workshop, Sep. 2006


2nd Asian Water Cycle Symposium, Tokyo, Jan. 2007


1st GEOSS AP Symposium, Tokyo, Jan. 2007


1st International Coordination Group Meeting, Bali, Sep. 2007


3rd Asian Water Cycle Symposium, Beppu, Dec. 2007

GEOSS
Asian Water Cycle Initiative (AWCI)

To promote integrated water resources management by making usable information from GEOSS, for addressing the common water-related problems in Asia.

Uniqueness

- A River Basin of Each Country
- Observation Convergence
- Interoperability Arrangement
- Data Integration
- Open Data & Source Policies
- Capacity Building
- Early Achievements

GEOSS Asian Water Cycle Initiative (AWCI)

17 River Basins for Initial Demonstration

TOWARD SOUND DECISION MAKING ON WATER RESOURCES MANEGEMENT IN ASIA-PACIFIC REGION

documenting the variations
documenting the societal issues
summarizing the on-going and planed adaptations
realizing end-to-end approaches
providing usable information for effective adaptations

building capacity

STEP FORWARD!