

水循環の包括的なモニタリングにおける AMSR/AMSR-Eの役割

Key Roles of AMSR/AMSR-E
in Comprehensive Monitoring of Water Cycle

- 水問題と水循環変動

Water Problems and Water Cycle Variations

- AMSR/AMSR-E の貢献

Contributions of AMSR/AMSR-E

東京大学大学院工学系研究科

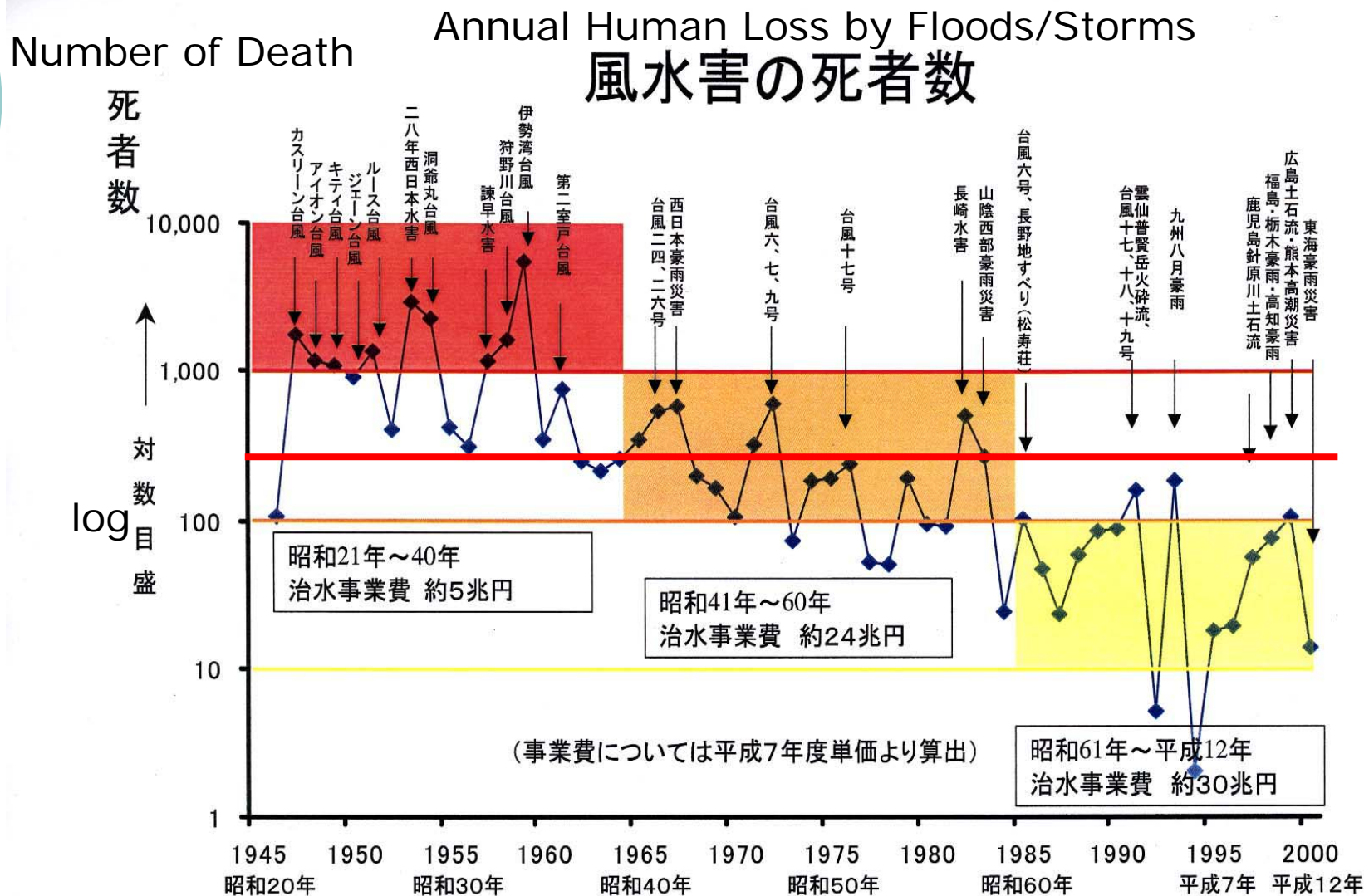
小池 俊雄

Toshio Koike, University of Tokyo

風水害 (日本)

Floods/Storms in Japan

長崎県長与: 172mm/hr, 1982
 徳島県海川: 1317mm/day, 2004
 (日本記録, Japan Record)



風水害 (アジア)

Floods/Storms in Asia

アジアにおける大規模な風水害による被害

Damages by Major Floods and Storms in Asia

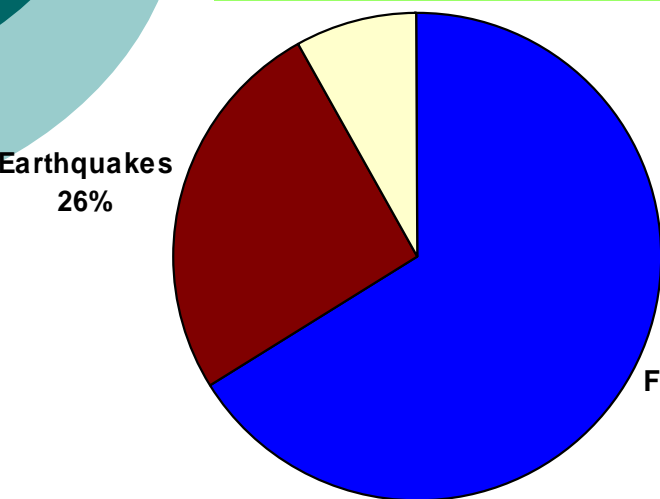
Year	地名Location	死者数Deaths
1991	バングラディッシュ Bangladesh	13,900
1991	フィリピン Philippines	6,000
1991	中国 淮河 Huai River, China	2,900
1998	中国 長江 Yangtze River, China	3,000
1998	インド, バングラディッシュ India and Bangladesh	2,425

風水害 (世界)

Floods/Storms in the World

'88~'97年の自然災害被害の3分の2は風水害

Two third of the natural catastrophes worldwide, from 1988 to 1997, is caused by **floods & storms**.



死者数:

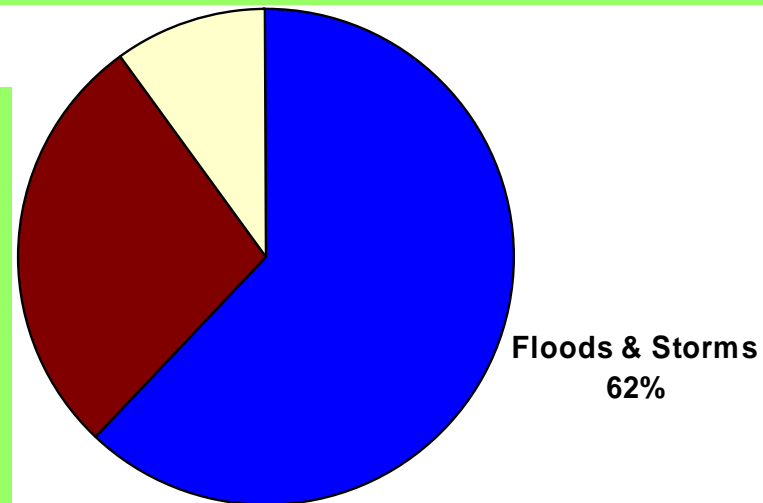
390,000

Human Loss

風水害
Floods & Storms

地震災害
Earthquakes

その他
Others



経済被害:

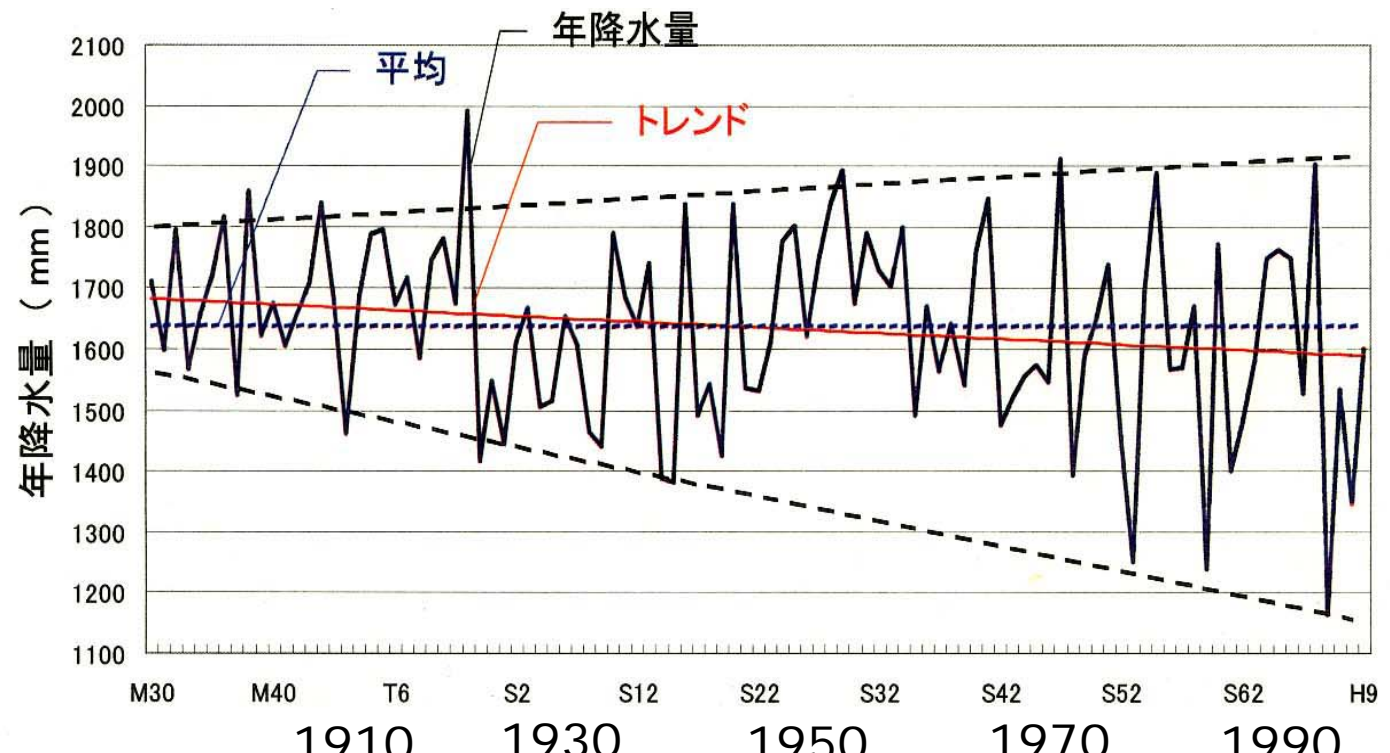
\$700 billion

Economic Loss

水不足と渇水 (日本)

Water Scarcity and Draught in Japan

年降水量の経年変化 Annual Rainfall Variation across the Ages



水不足と渇水 (アジア)

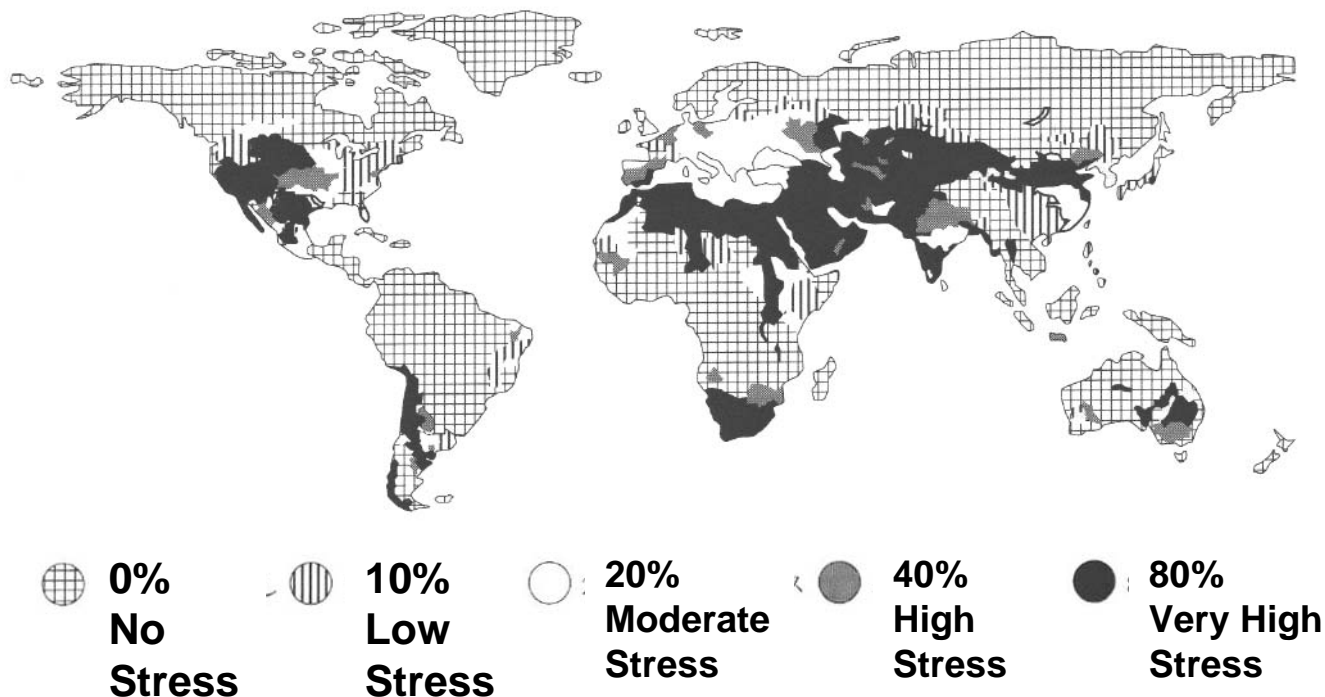
Water Scarcity and Draught in Asia

地域 Region	El Nino or La Nina	収穫面積 Harvested Area (each year-a year before) 1,000ha	収穫高 Yield (each year-a year before) 1000t
南アジア South Asia	エルニーニョ年 El Nino 65,72,76,82,87	-1,610	-6,190
	ラニーニャ年 La Nina 68,71,75,85,89	+ 585	+4,893
東南アジア Southeast Asia	エルニーニョ年 El Nino 65,72,76,82,87	- 533	- 34
	ラニーニャ年 La Nina 68,71,75,85,89	+ 981	+1,779

水不足と渇水 (世界)

Water Scarcity and Draught in the World

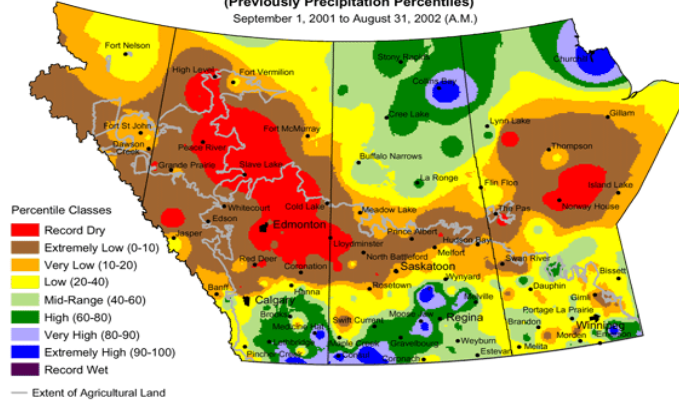
2025年, 40億人(世界人口の約半数)が厳しい水不足に直面
In 2025, it is projected that 4 billion people, a half of the world population, will live under a high water stress.



水不足と渇水 (世界)

Water Scarcity and Draught in the World

Current Precipitation Compared to Historical Distribution
(Previously Precipitation Percentiles)
September 1, 2001 to August 31, 2002 (A.M.)

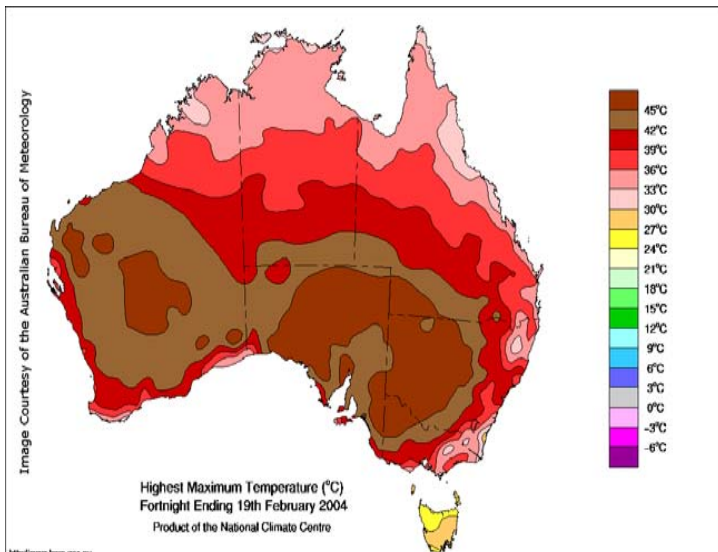


2002カナダ渇水

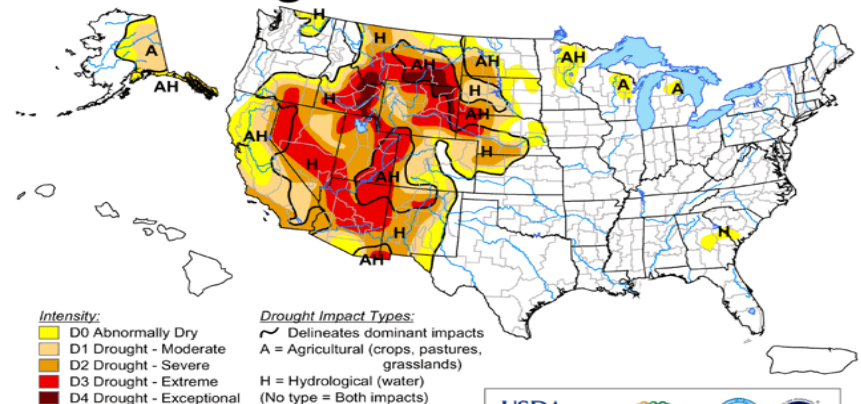
2004オーストラリア渇水

Prepared by PFRA (Prairie Farm Rehabilitation Administration) using data from the Timely Climate Monitoring Network and the many federal and provincial agencies and volunteers that support it.

2004米中西部渇水



U.S. Drought Monitor August 31, 2004
Valid 8 a.m. EDT



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

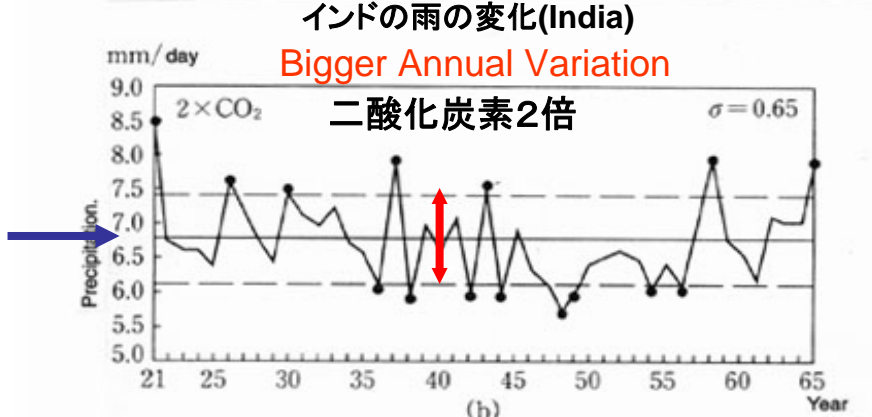
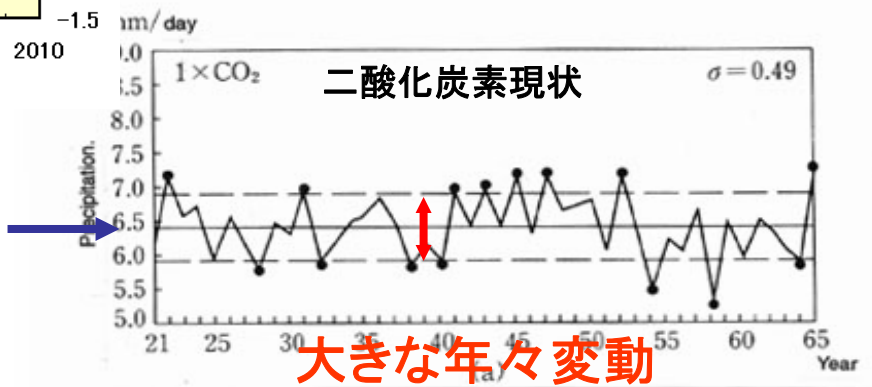
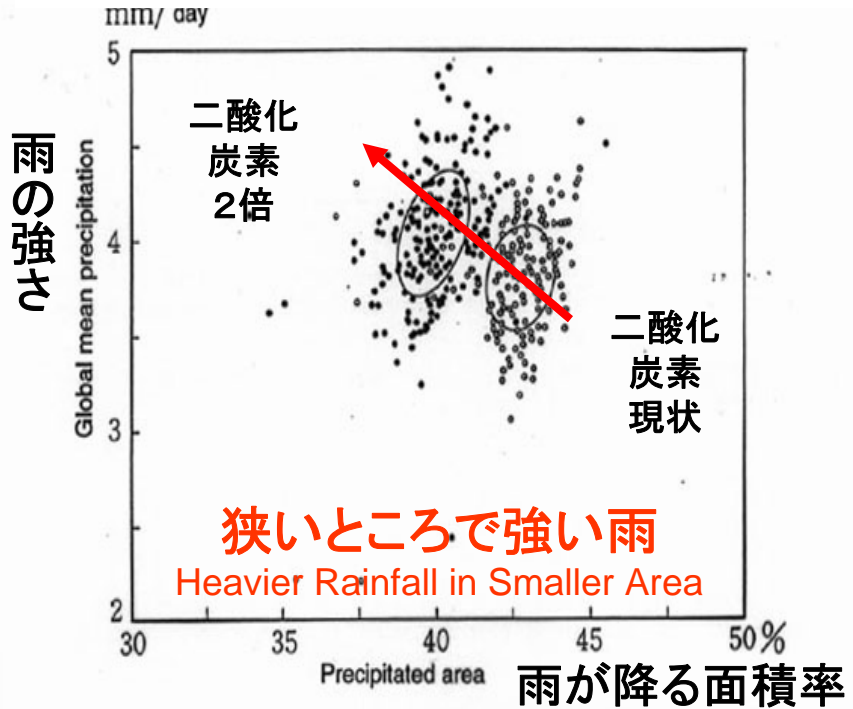
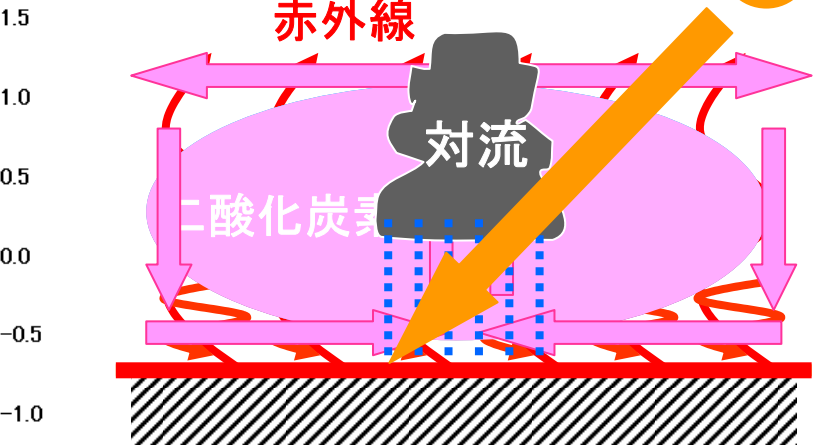
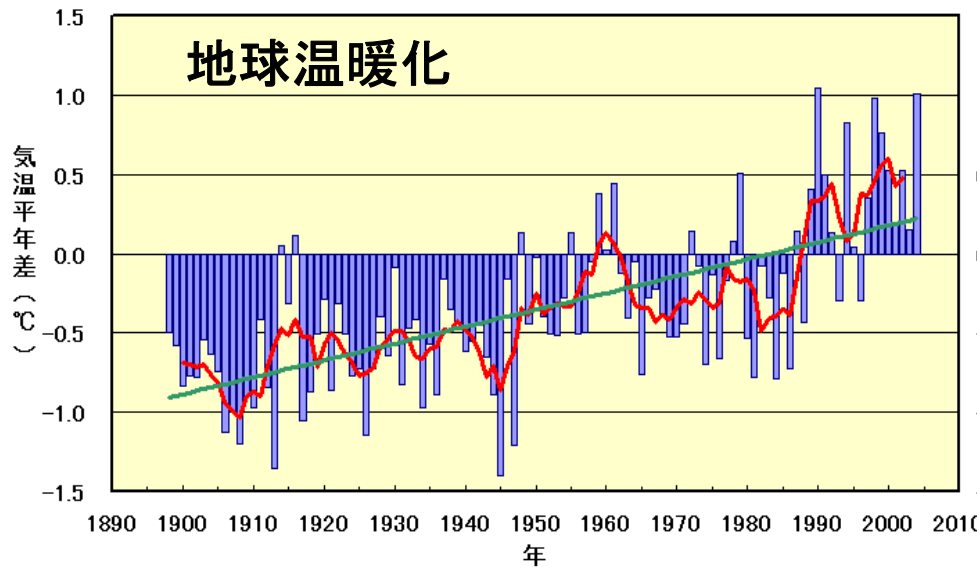


Released Thursday, September 2, 2004
Author: David Miskus, JAWFICPC/NOAA

<http://drought.unl.edu/dm>

Effects of Global Warming on Water Cycle

地球温暖化が水循環に与える影響



大きな年々変動

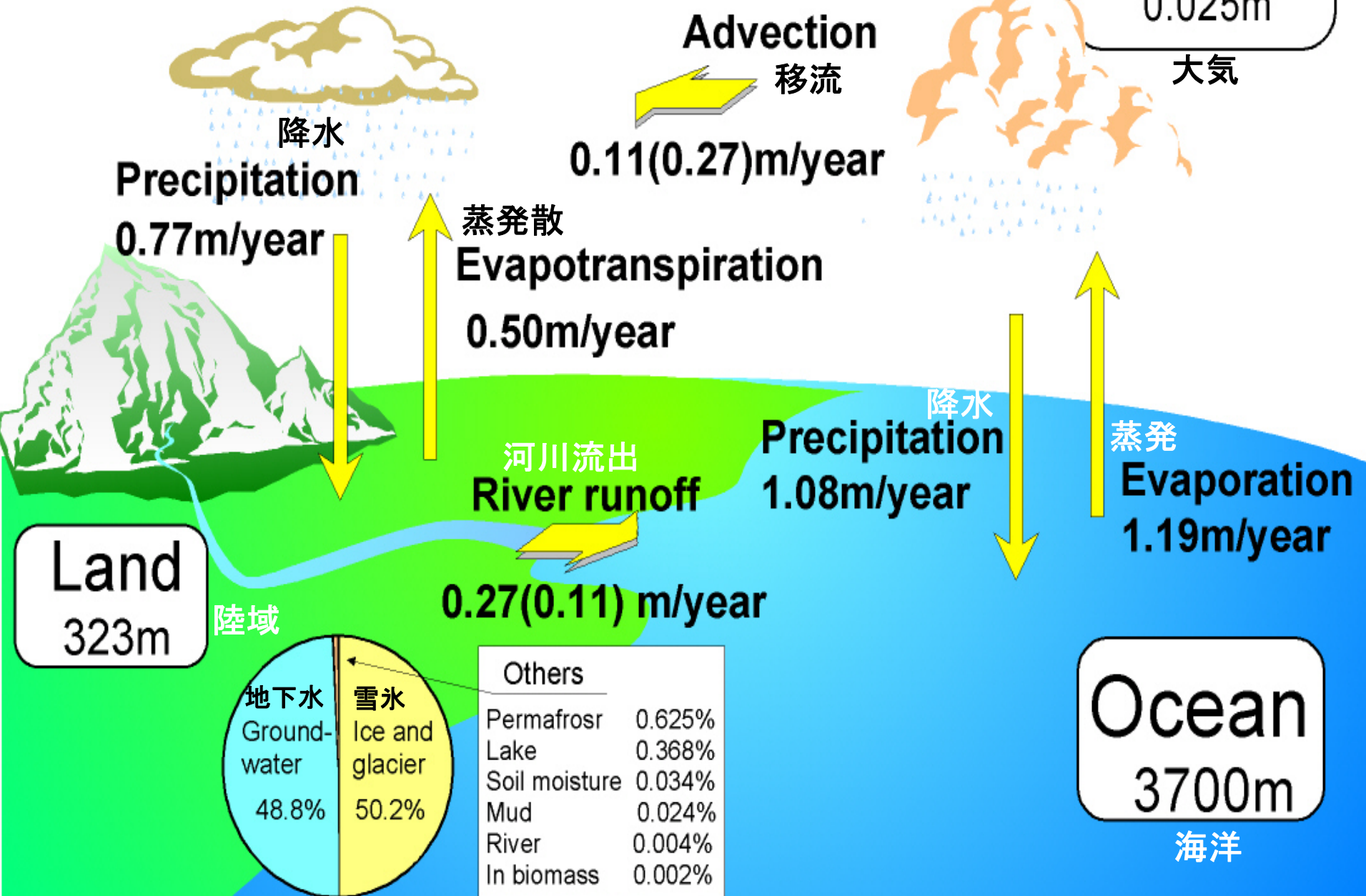
インドの雨の変化(India)

Bigger Annual Variation

(b)

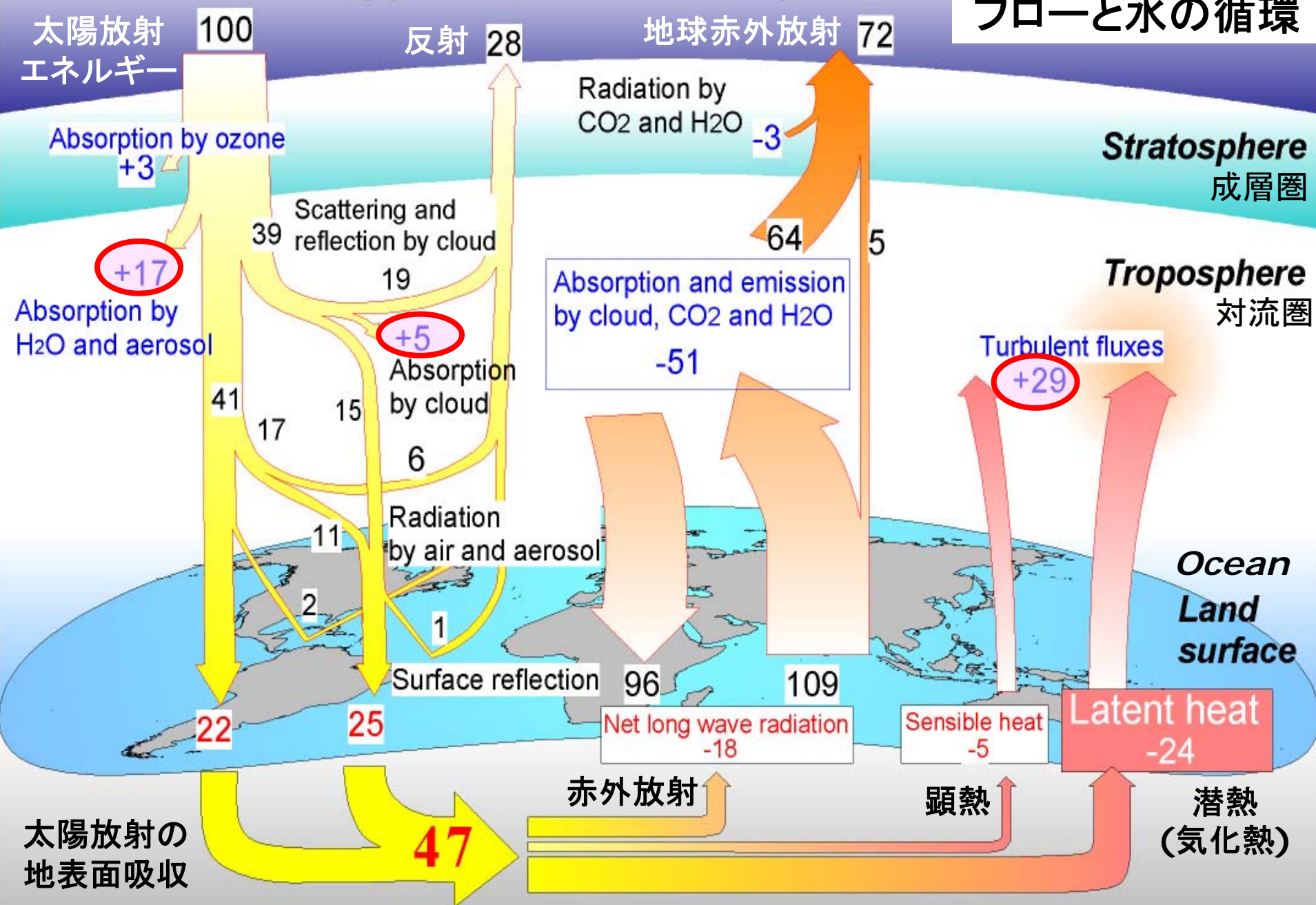
Water storage and flux

地球上の水の分布と循環



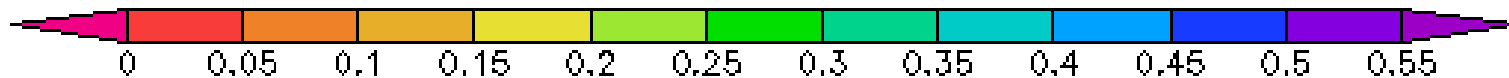
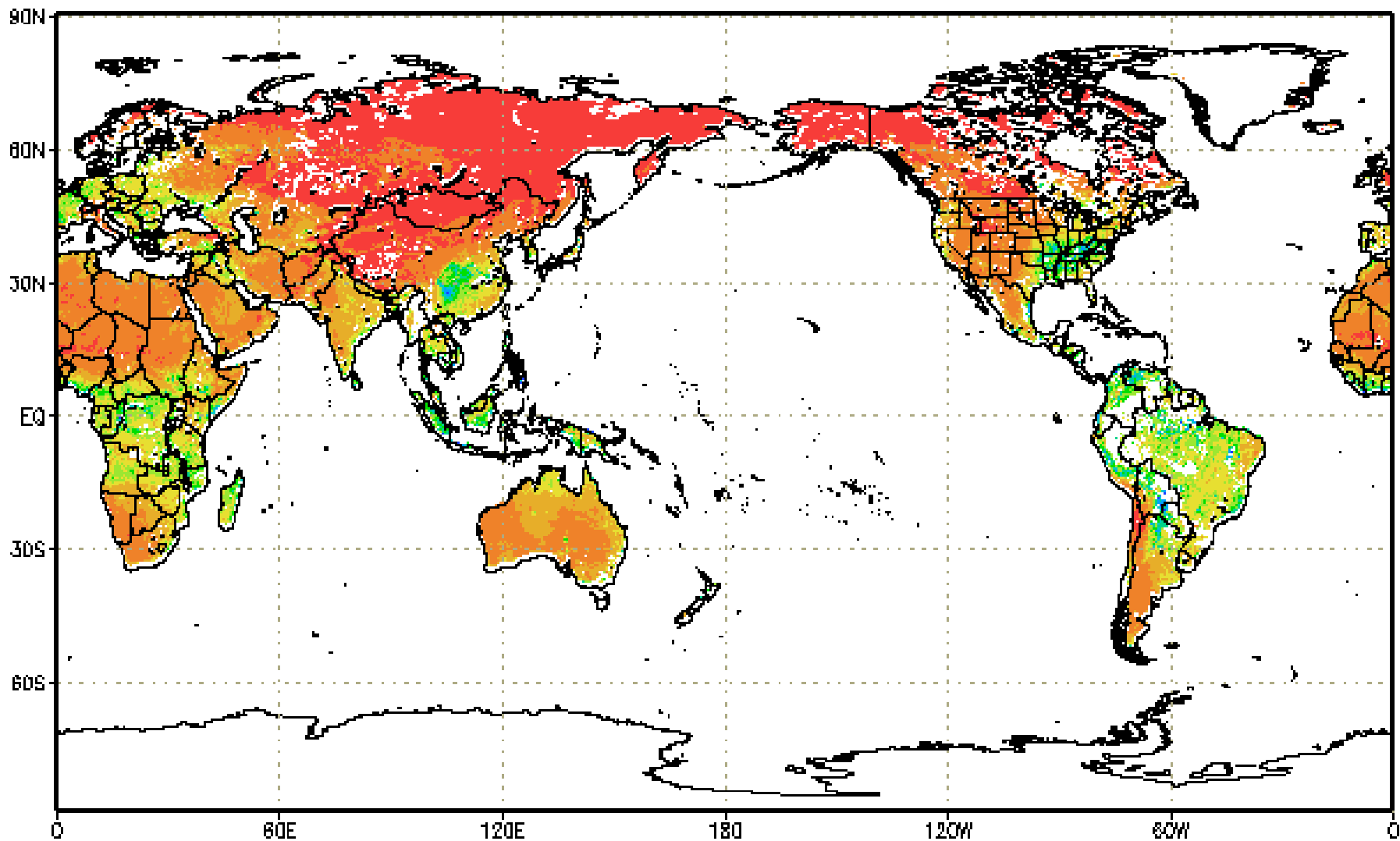
Global Energy and Water Cycle

地球のエネルギーフローと水の循環



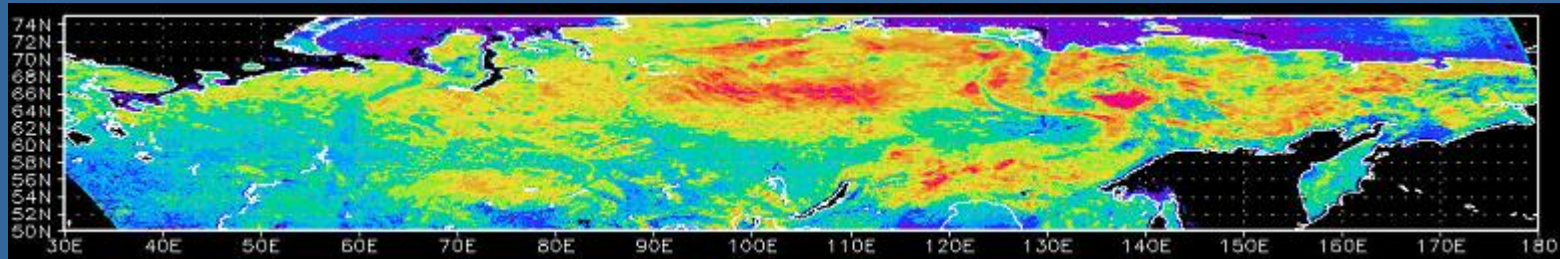
Dec.

Monthly Mv(%)

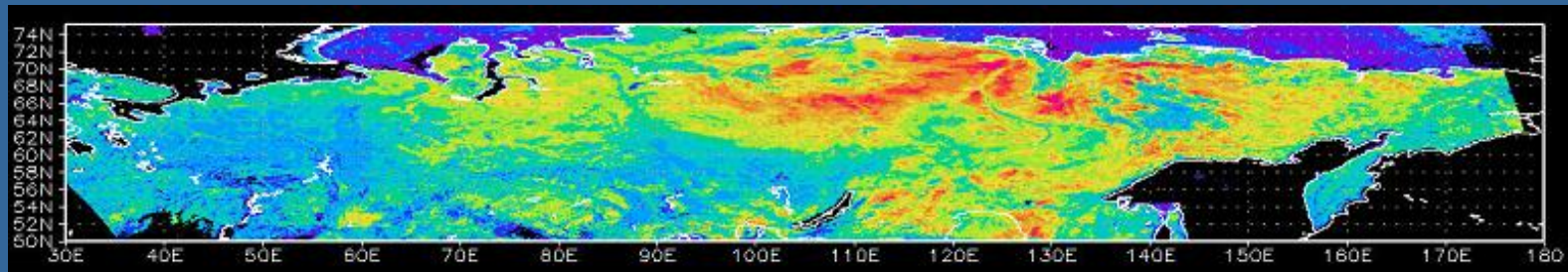


AMSR-Eによるシベリアの月平均積雪深(1月)分布

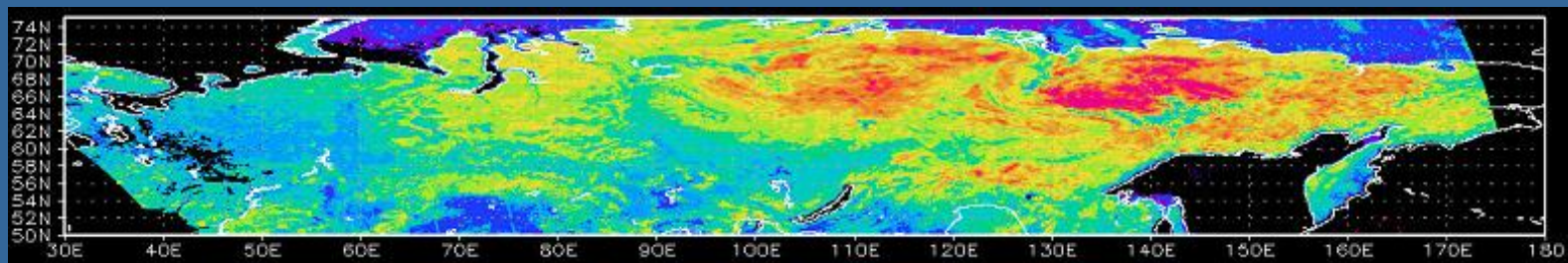
Monthly averaged Snow depth estimated by using AMSR-E



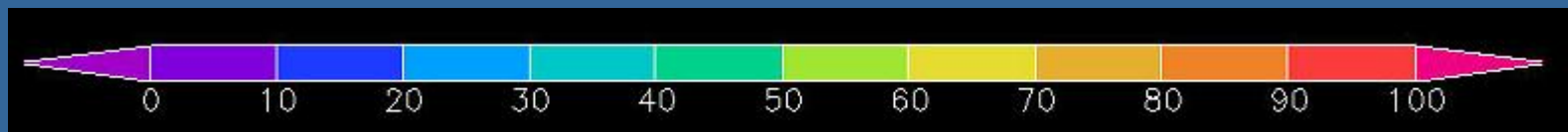
Jan.
2003



Jan.
2004

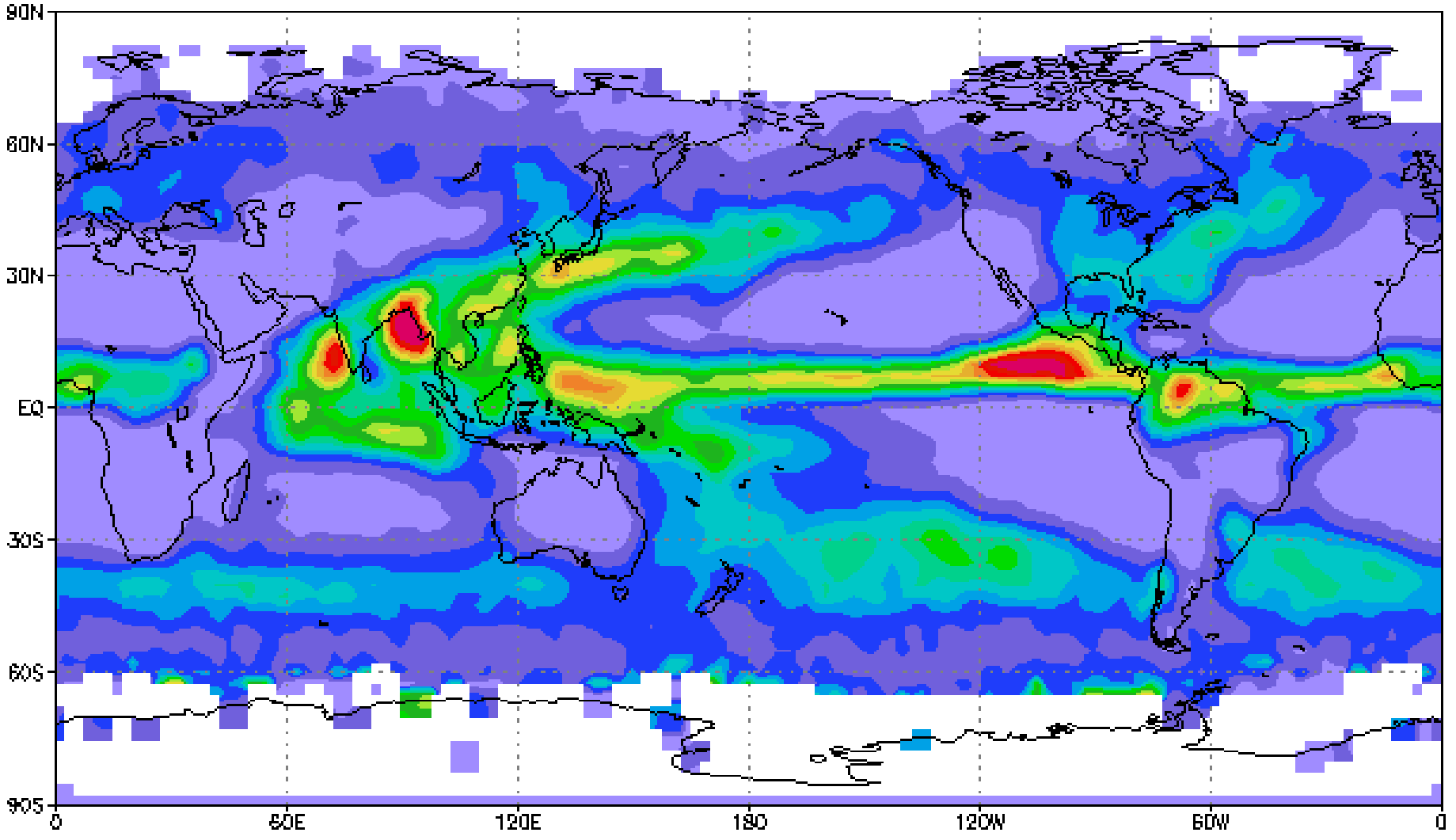


Jan.
2005

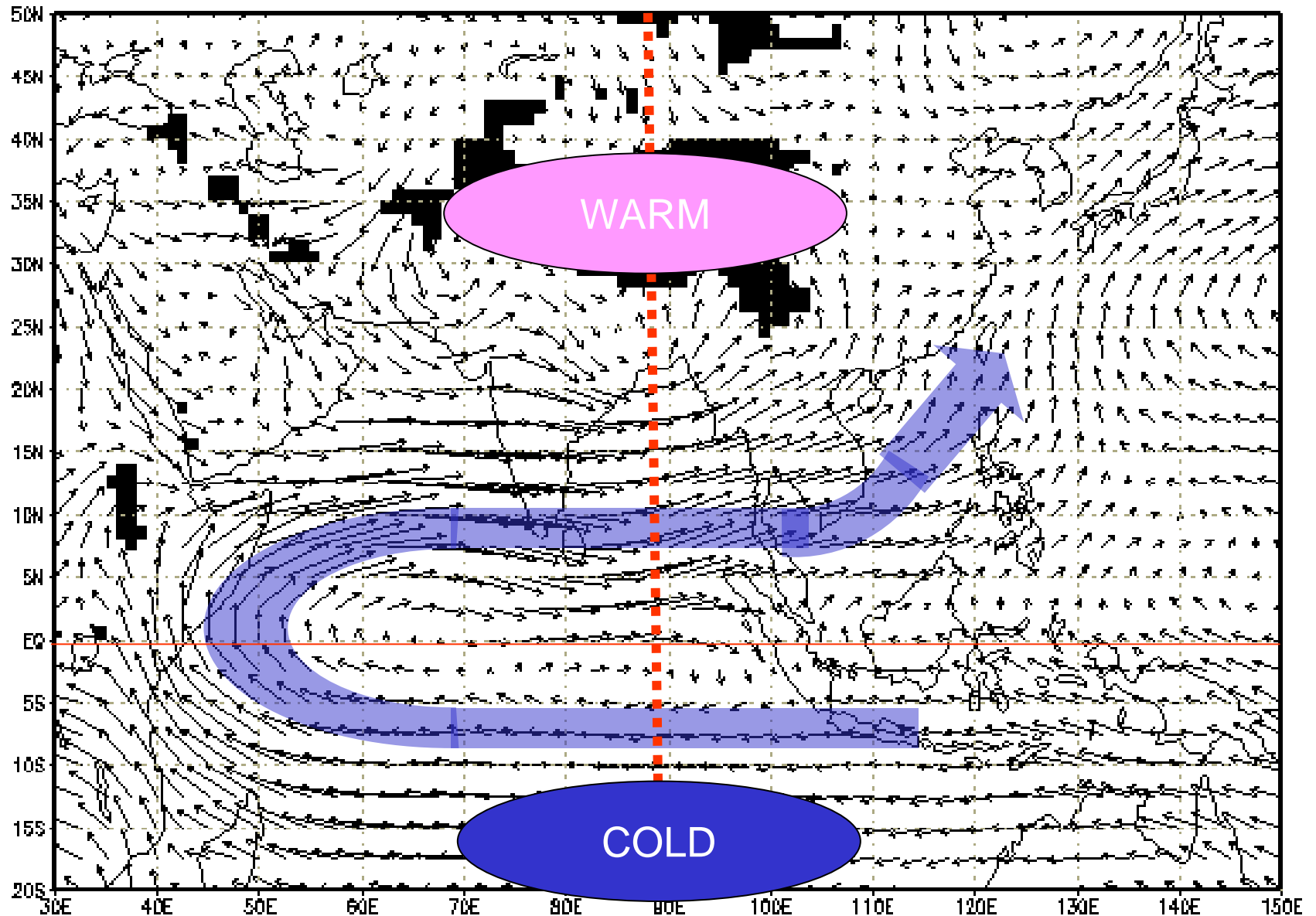


cm

Average June GPCP Precipitation (mm/day) for 1988–96

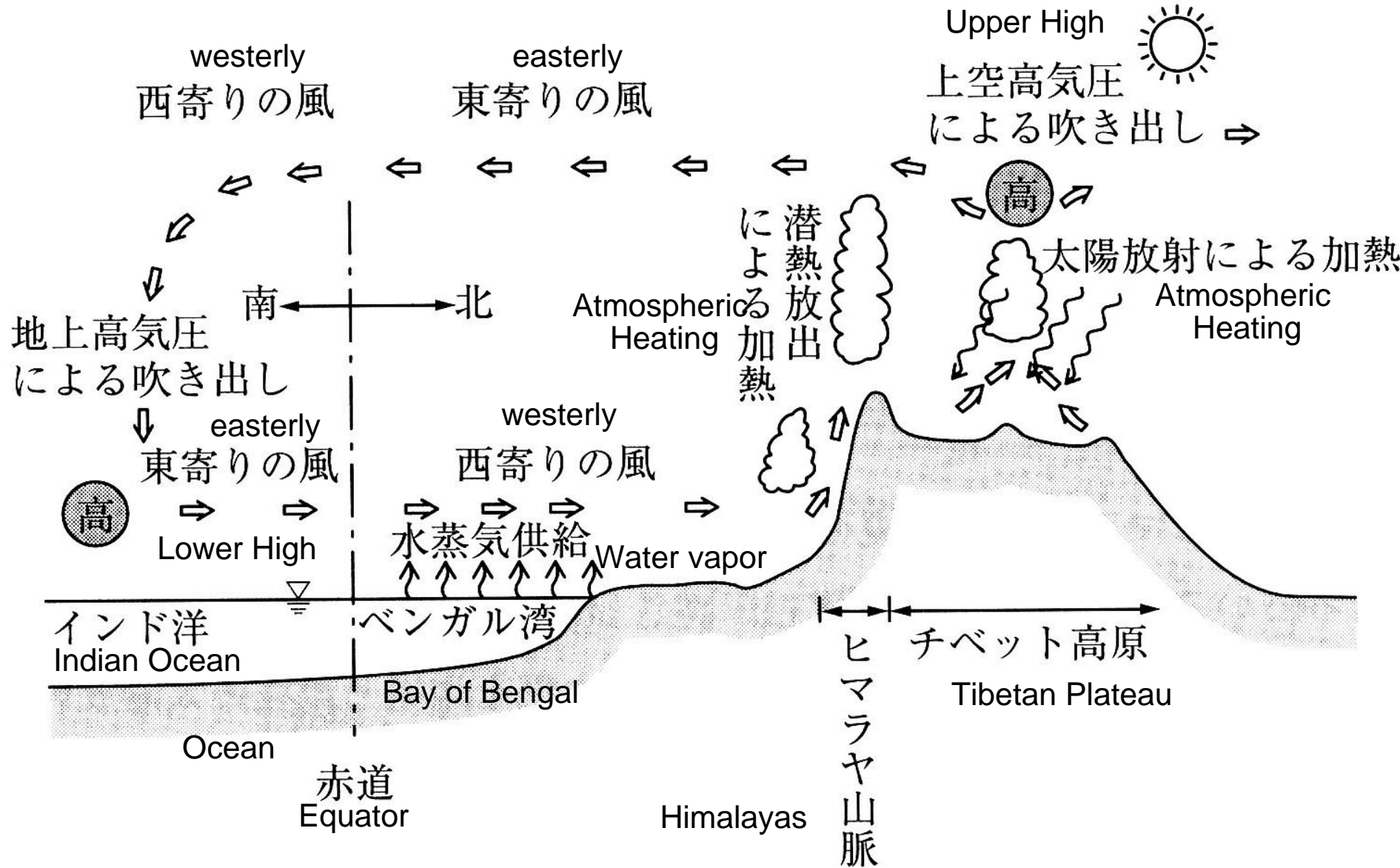


北半球夏の大气加熱とアジアモンスーン

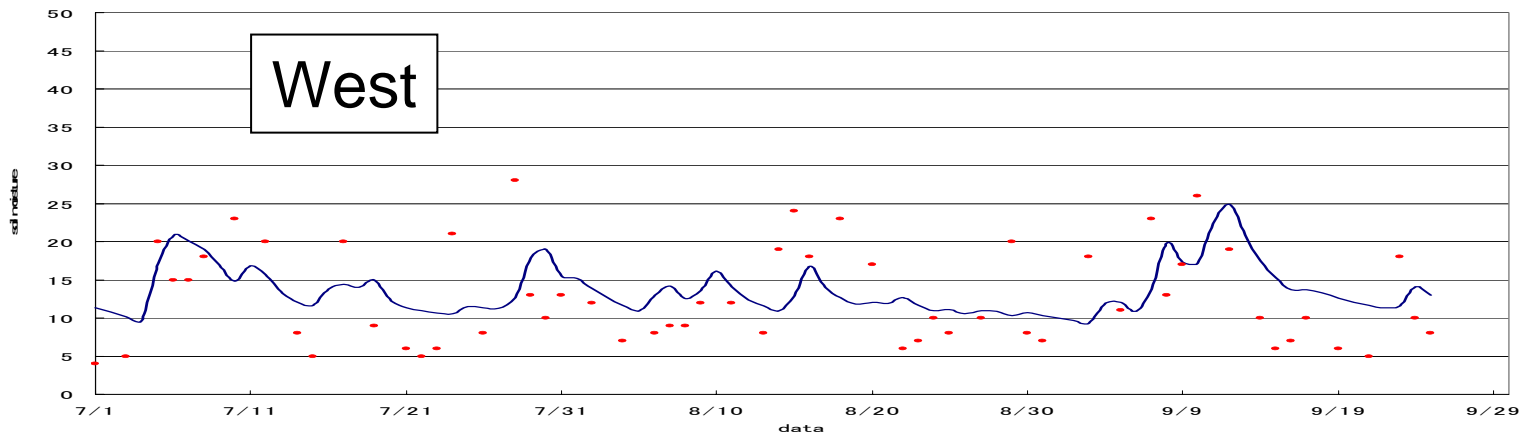


アジアモンスーン循環の構造

Asian Monsoon Circulation

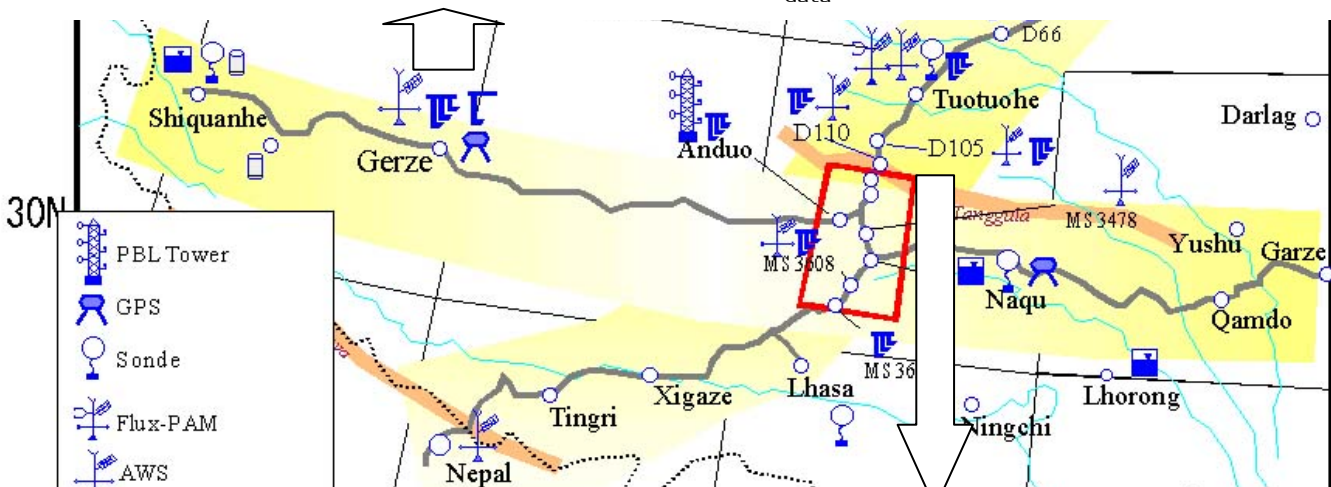


2003 validation time scale Gaize



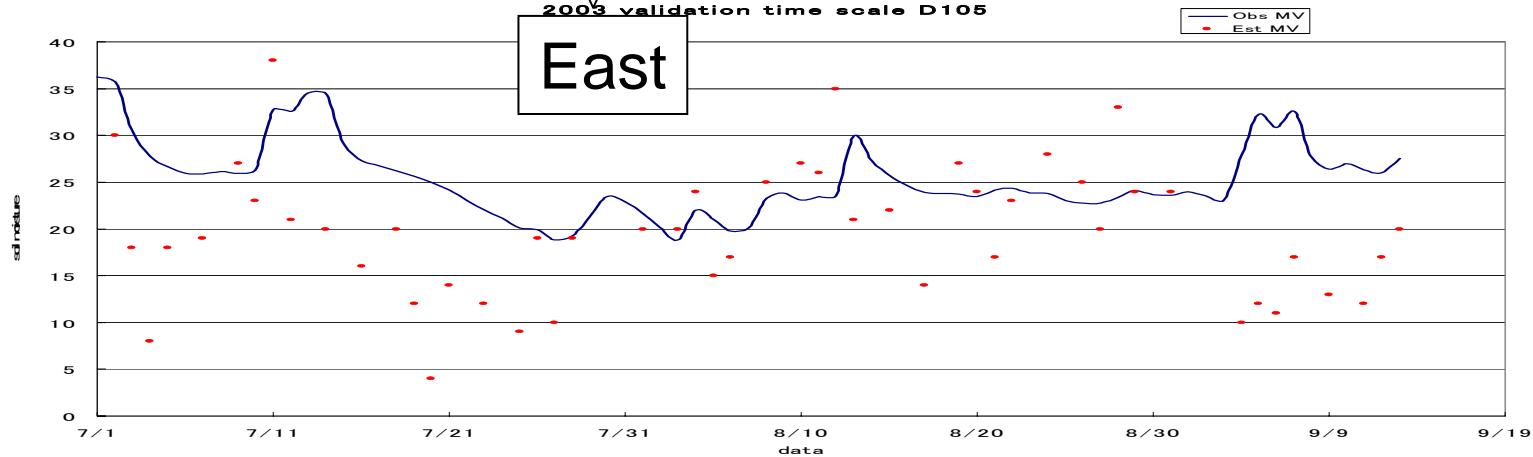
5.7%

average of
the absolute errors



8.1%

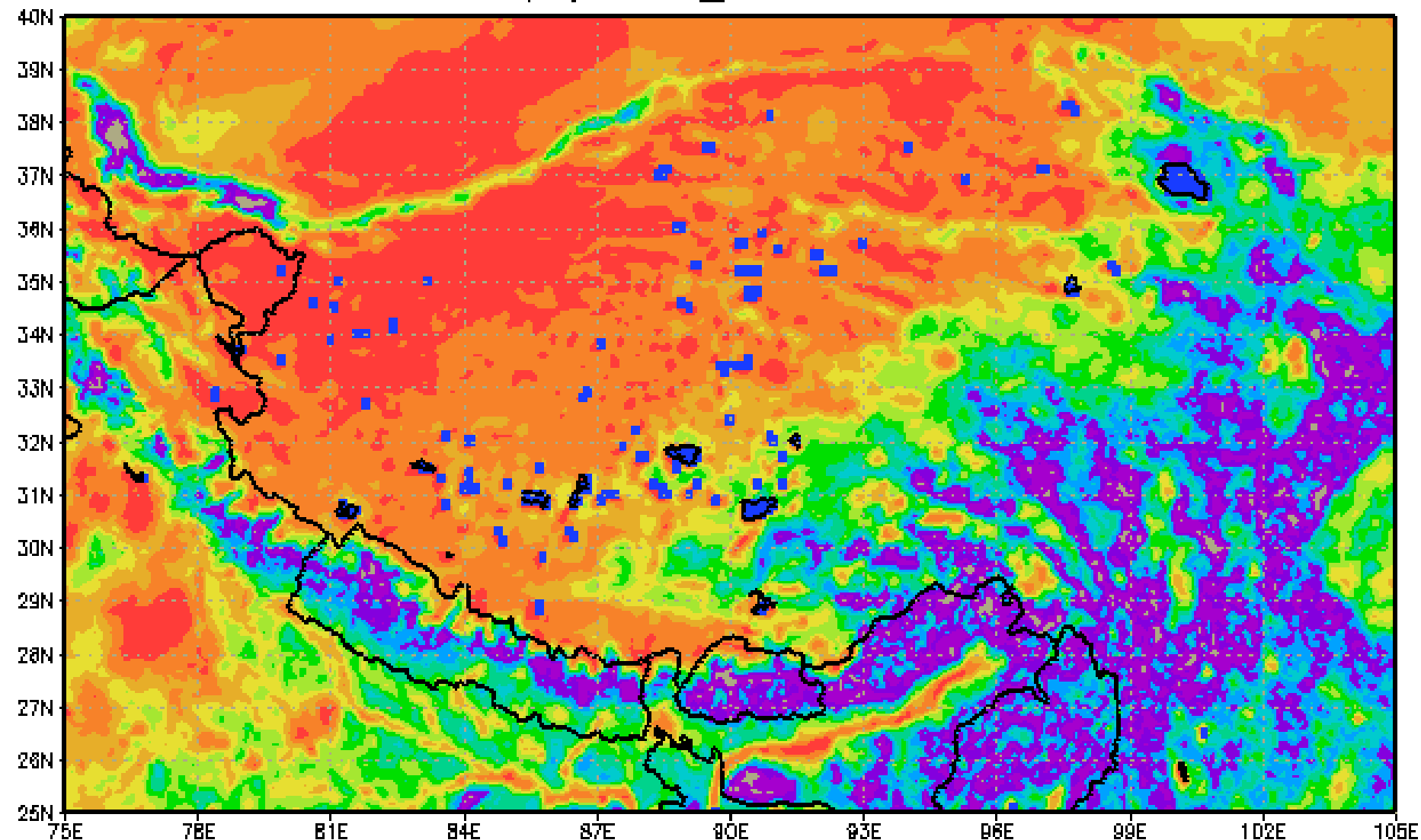
2003 validation time scale D105



チベット高原の土壤水分の季節分布

Seasonal Variation of the Soil Moisture in the Tibetan Plateau

6G Mv(%) tibet_D 2003SEP-last



現地観測データ
In-situ Observation Data

大気入力
Atmospheric
Focing

Land Data Assimilation System
陸面データ同化システム

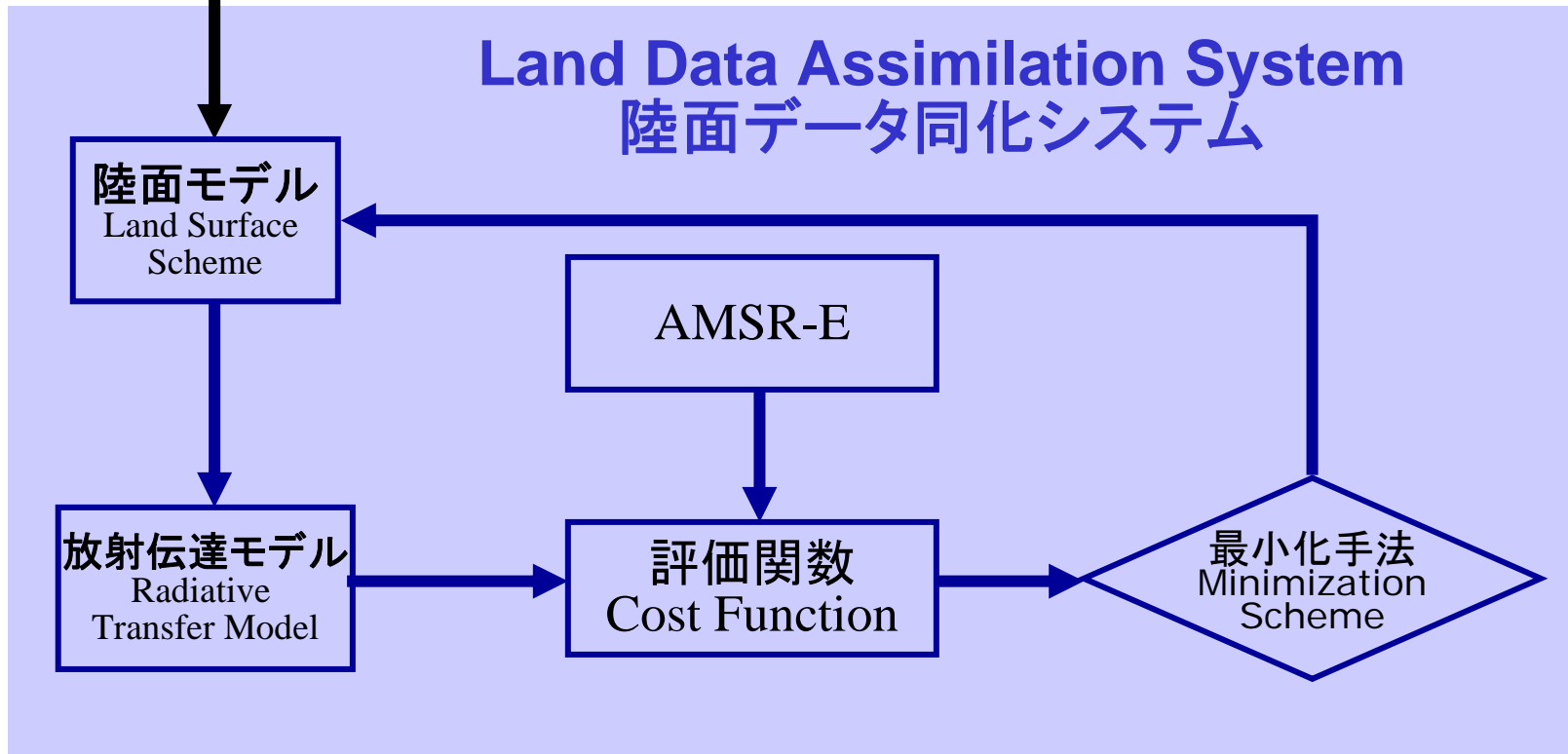
陸面モデル
Land Surface
Scheme

放射伝達モデル
Radiative
Transfer Model

AMSR-E

評価関数
Cost Function

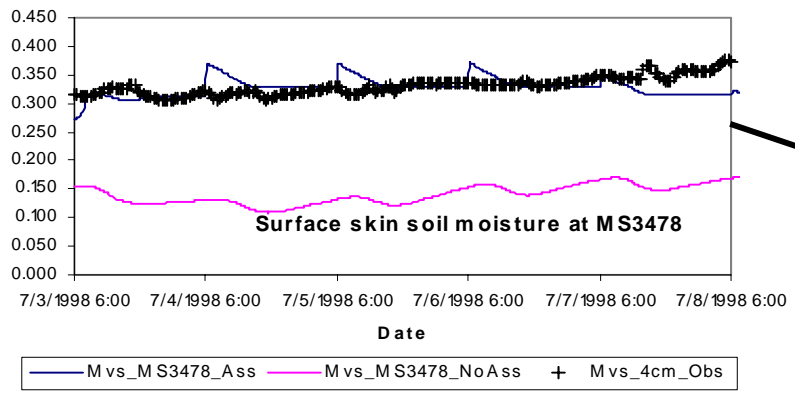
最小化手法
Minimization
Scheme



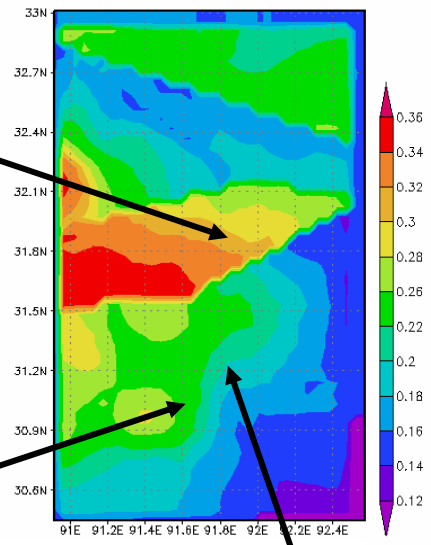
soil moisture

Assimilation

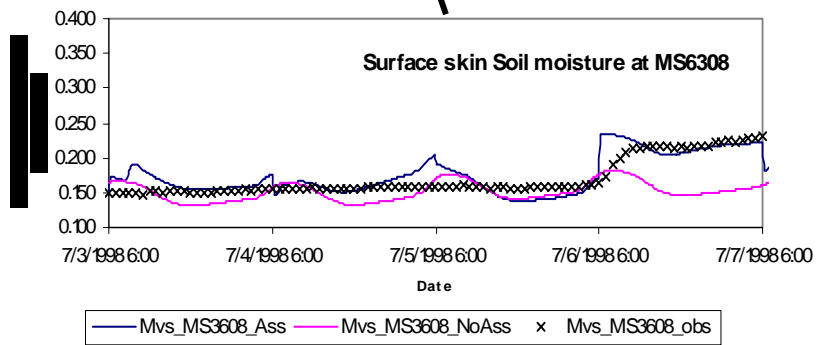
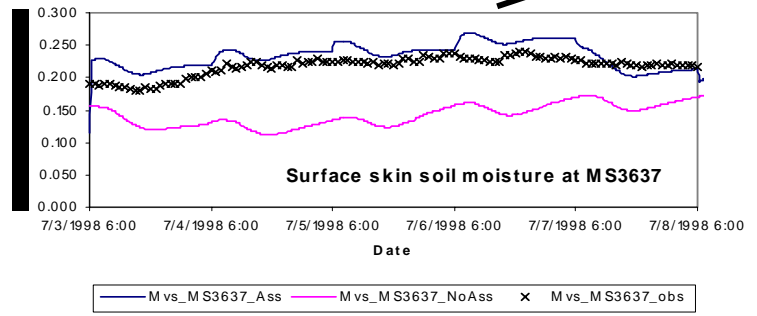
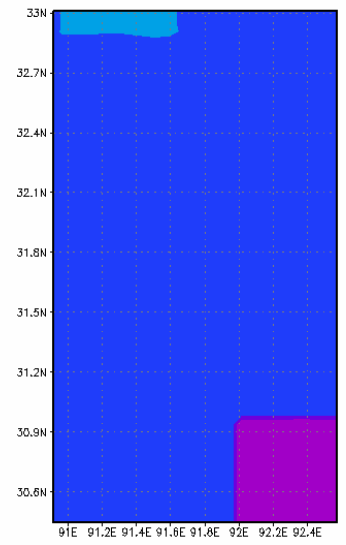
No Assimilation

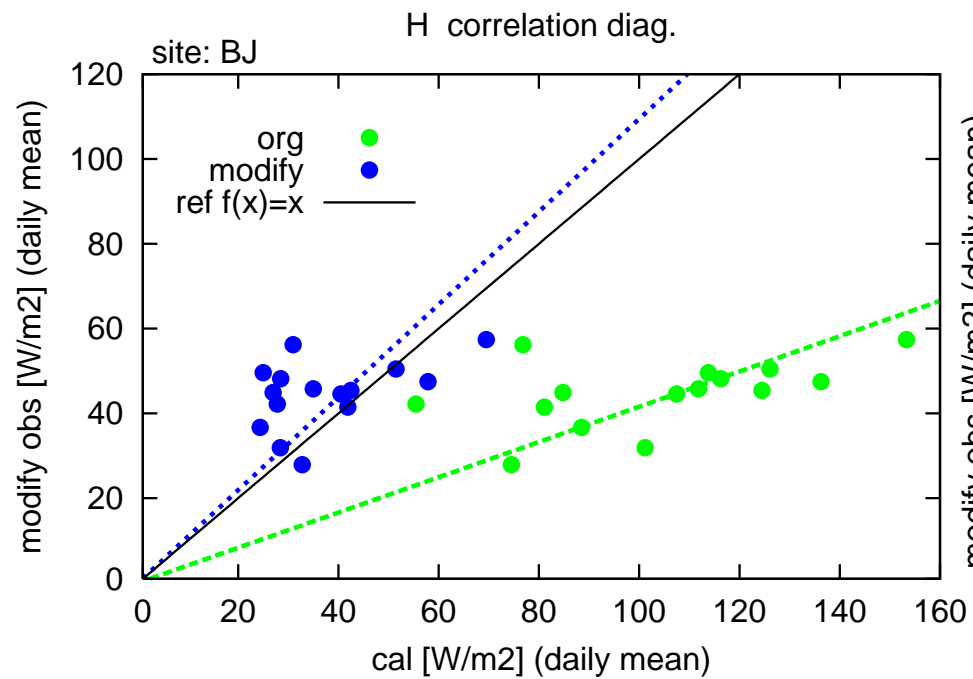


Average Surface soil Moisture [m3/m3] at 12LT - Assimilation

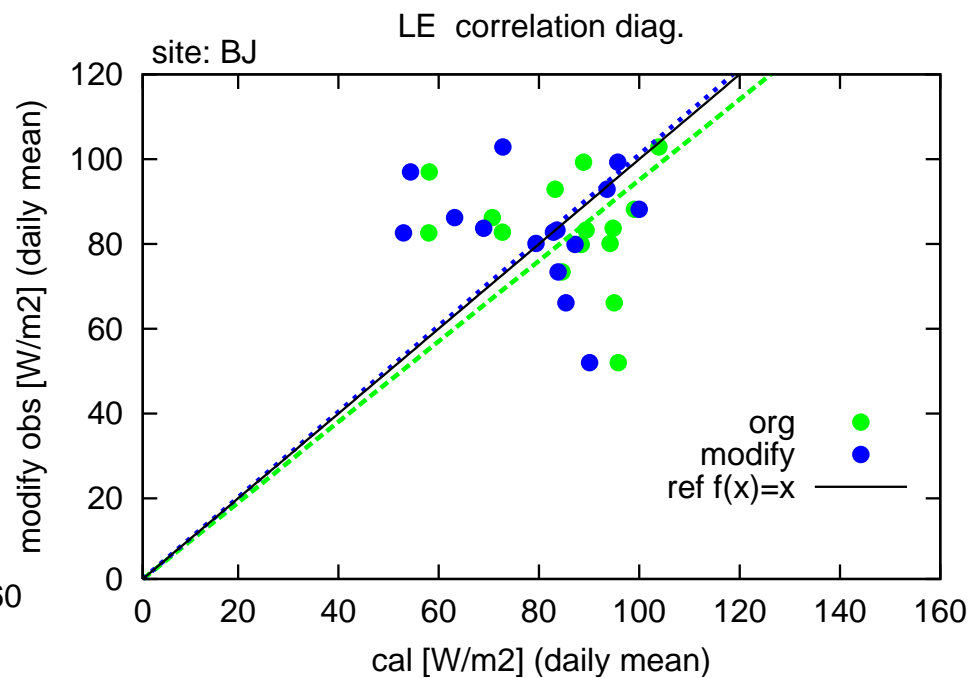


Average Surface soil Moisture [m3/m3] at 12LT - No Assimilation





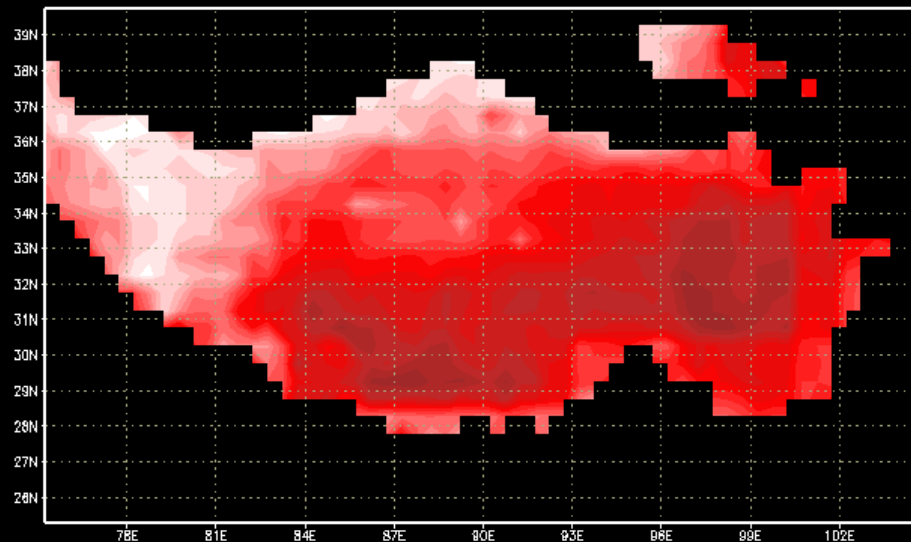
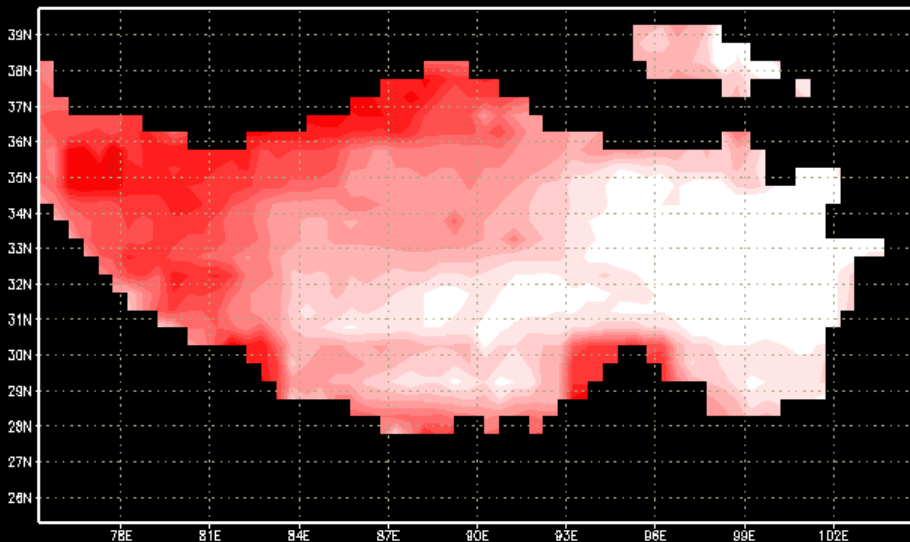
顕熱フラックス算定値
Sensible Heat Flux



潜熱フラックス算定値
Latent Heat Flux

H 0821-0831

LE 0821-0831



顕熱フラックス算定値
Sensible Heat Flux

潜熱フラックス算定値
Latent Heat Flux

大気-陸面結合データ同化システム Land-Atmosphere Data Assimilation System

全球数値気象予報モデル・再解析
GCM Prediction, Re-analysis

衛星による地域データセット
Satellite Regional Products

領域モデル
Regional Model

Land Data Assimilation System 陸面データ同化システム

陸面モデル
Land Surface
Scheme

放射伝達モデル
Radiative
Transfer Model

AMSR-E

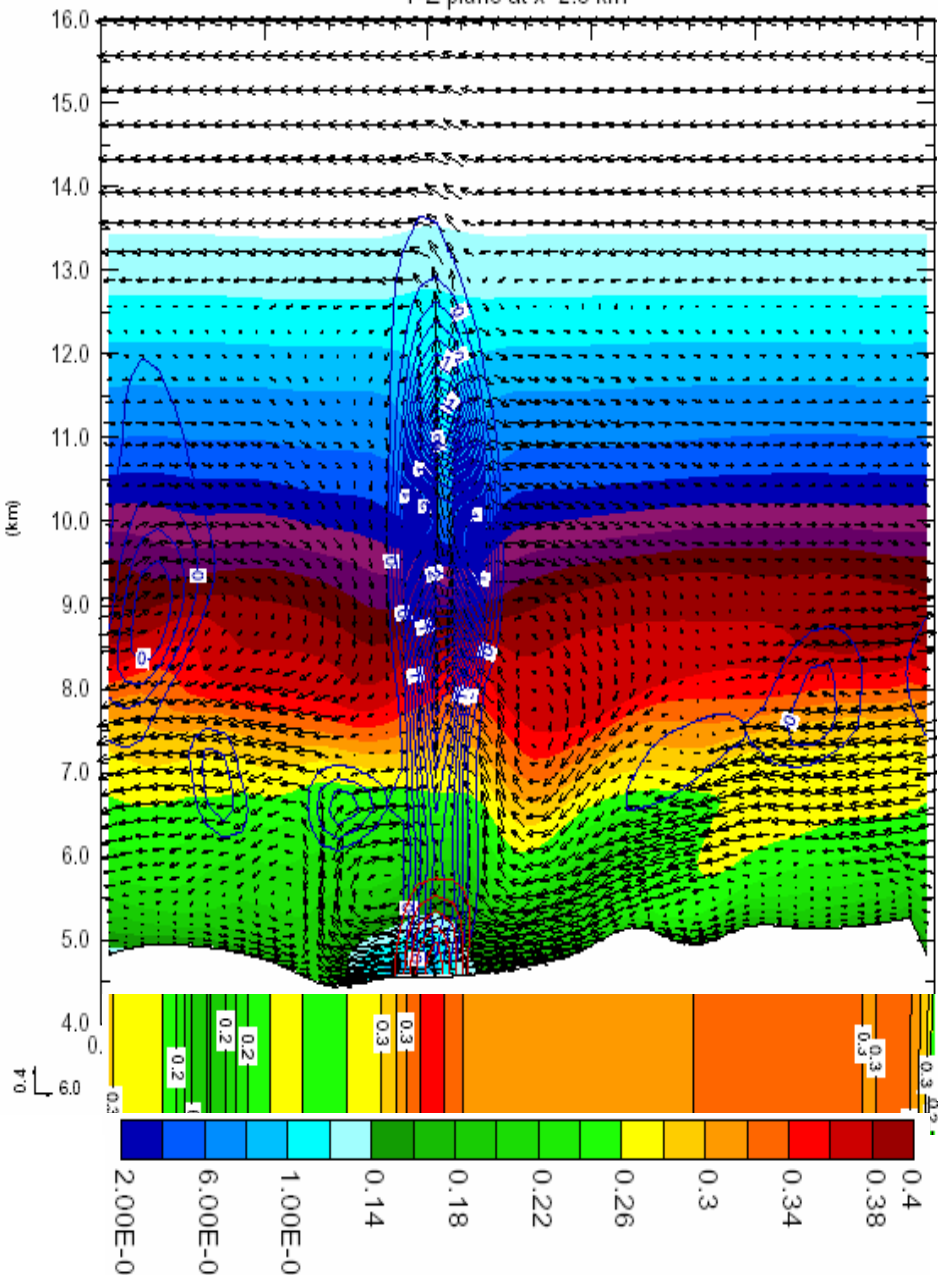
評価関数
Cost Function

最小化手法
Minimization
Scheme

L-A DAS

20:00LT Thu 9 Jul 1998 t=396000.0 s (**:00:00)

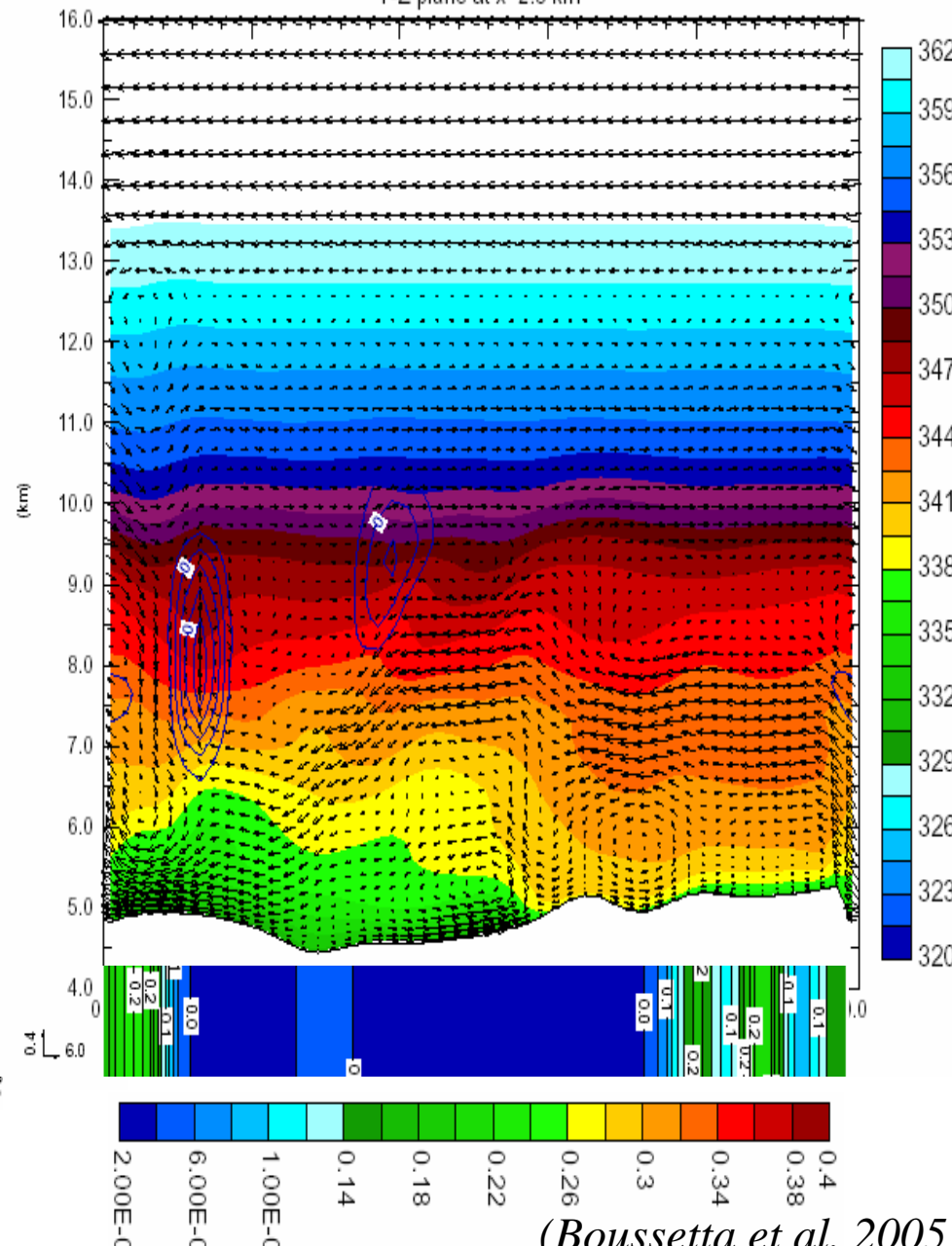
Y-Z plane at x=2.5 km



Only Regional Model

20:00LT Thu 9 Jul 1998 t=396000.0 s (**:00:00)

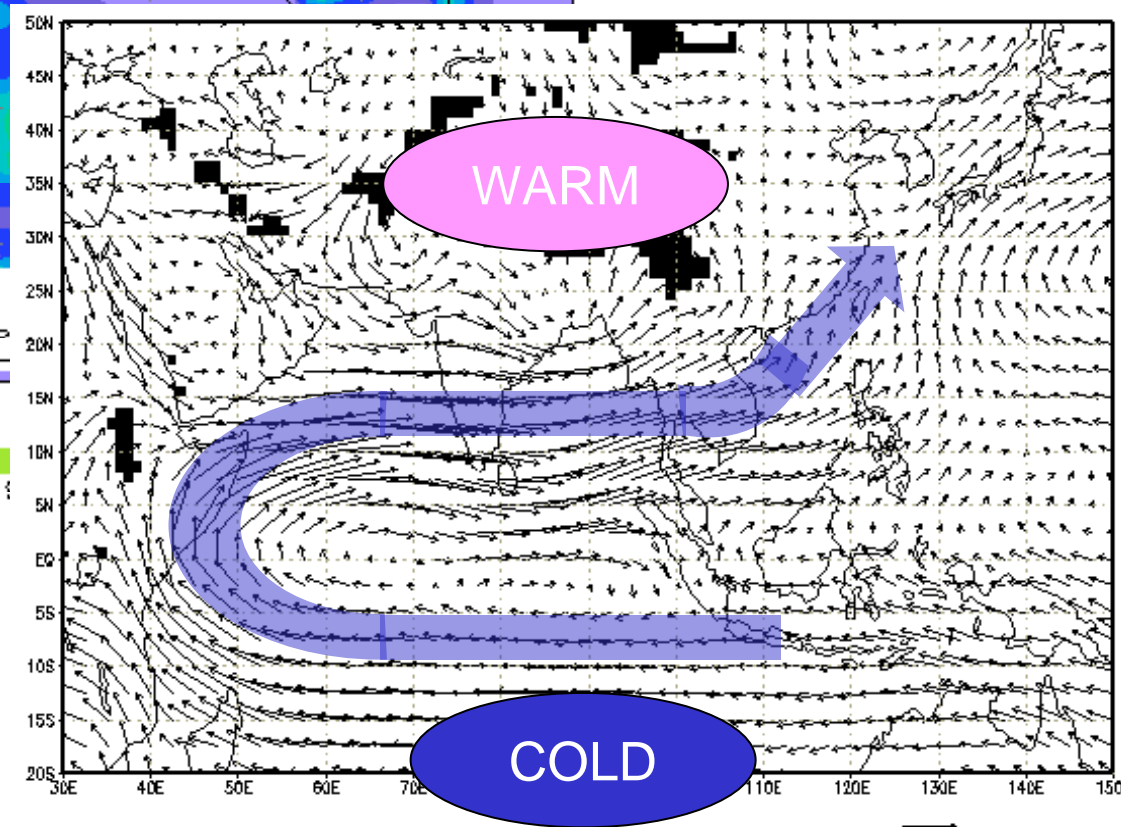
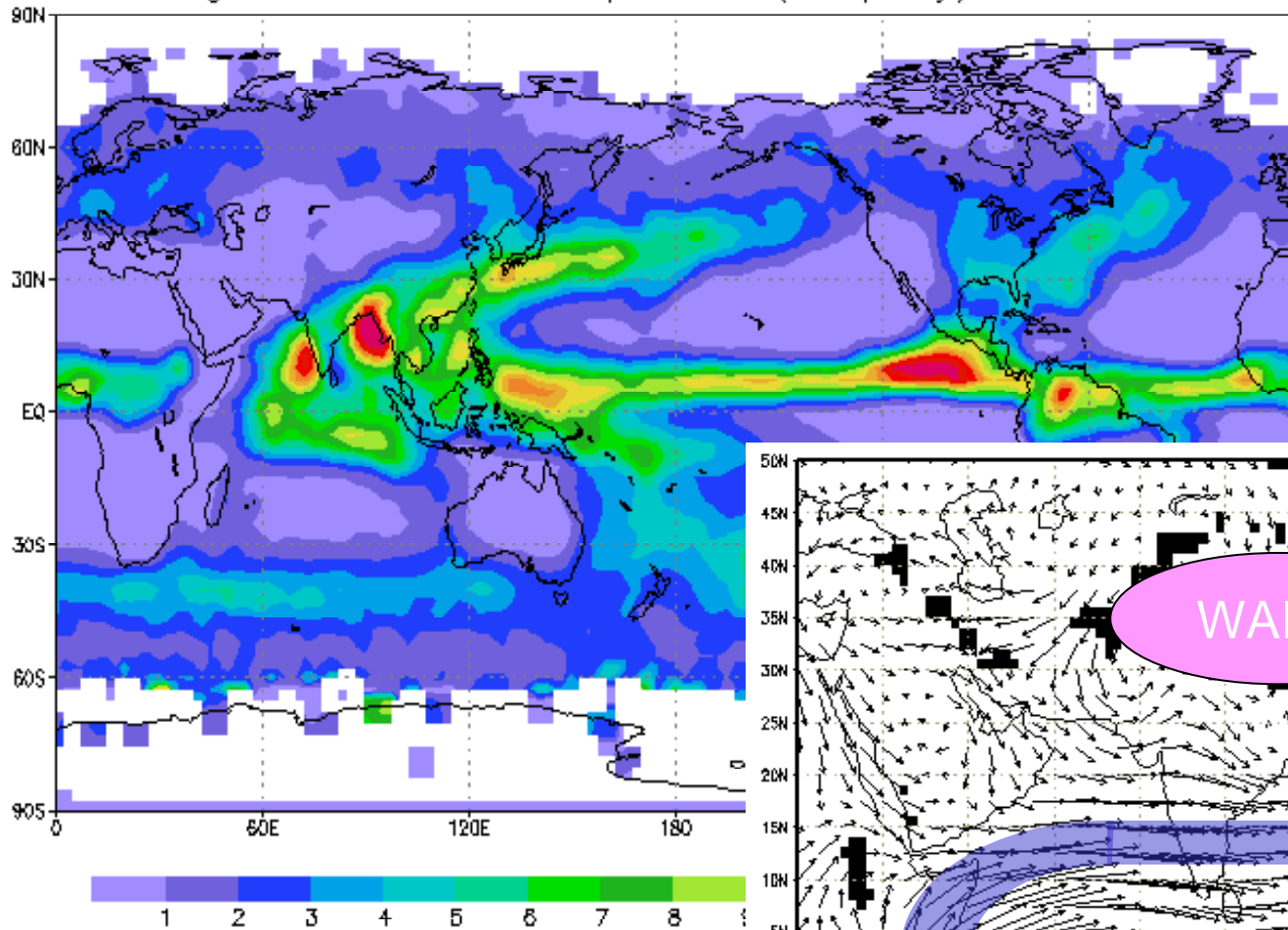
Y-Z plane at x=2.5 km





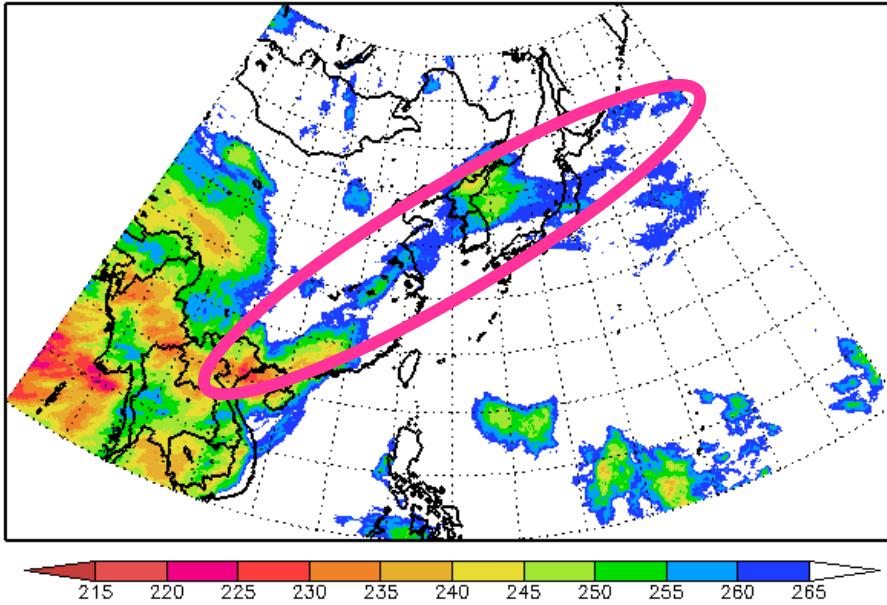
Tangula Pass, Tibet, Aug., 1991

Average June GPCP Precipitation (mm/day) for 1988–96



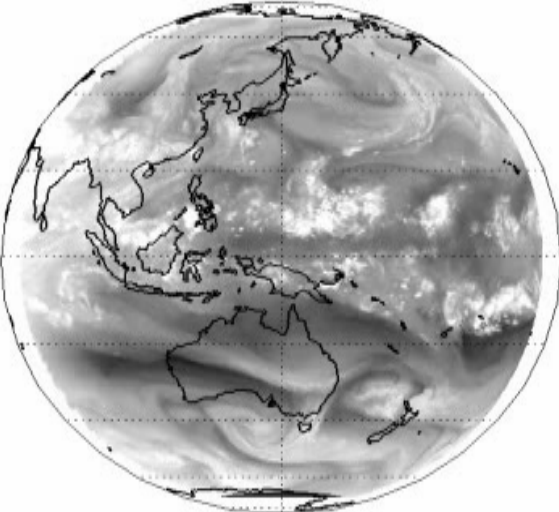
2004年7月新潟豪雨 July 13, 2004 Niigata, JAPAN

GOES9 IR1 TB (2-Day avg.) 2004 0712-0713



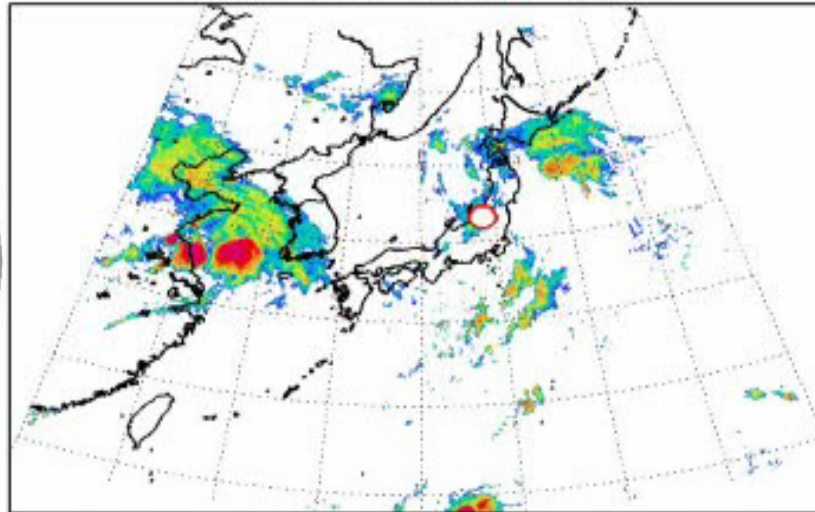
静止気象衛星(水蒸気)
GOES (Water Vapor)

GOES9-IR3 20040709 00UTC



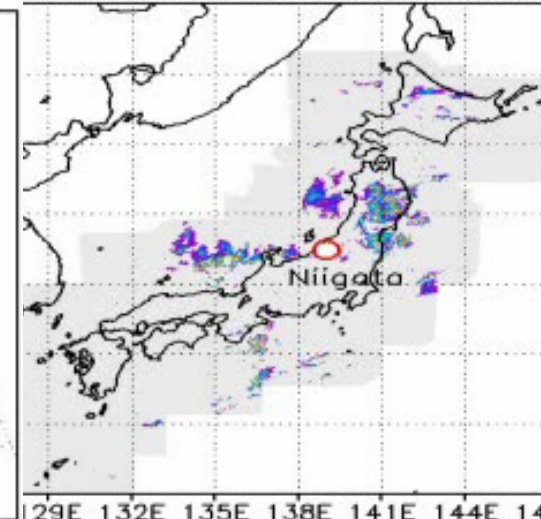
静止気象衛星(雲頂温度)
GOES(Brightness Temp.)

GOES9 IR1 TB 2004 0711 09JST



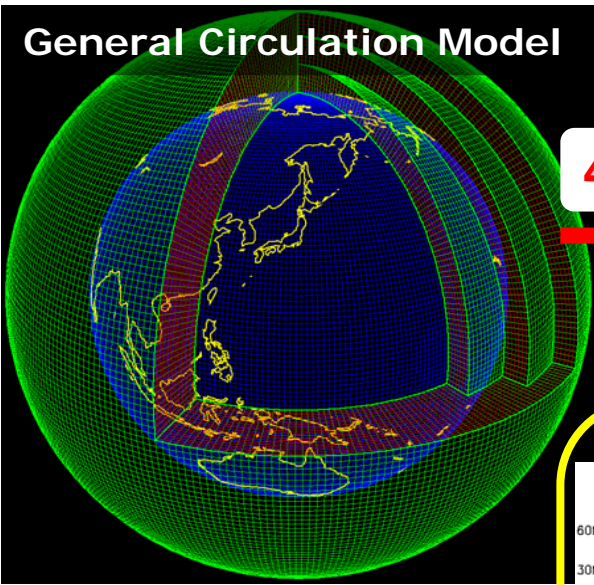
レーダ・アメダス合成データ(降雨)
RADAR-Rain Gauge (Precipitation)

RADAR-AMeDAS 2004 0711 00:30



全球→流域へのダウンスケール: Global to Local

General Circulation Model



4DDA

4DDA

全球予測の改善
Improved prediction

大気初期値の改善
Improved Initial Condition

領域、メソモデル
Regional/Meso Model

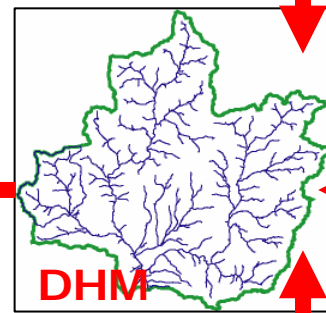
Satellite data

In-situ data

データ統合システム
Data Integration System

River Discharge

Impact Effective Dam Operation
予測情報を用いた
ダム最適操作による
洪水流量の低減



社会経済データ
Socio-Economic Data

豪雨予測の改善
Improved Prediction

