

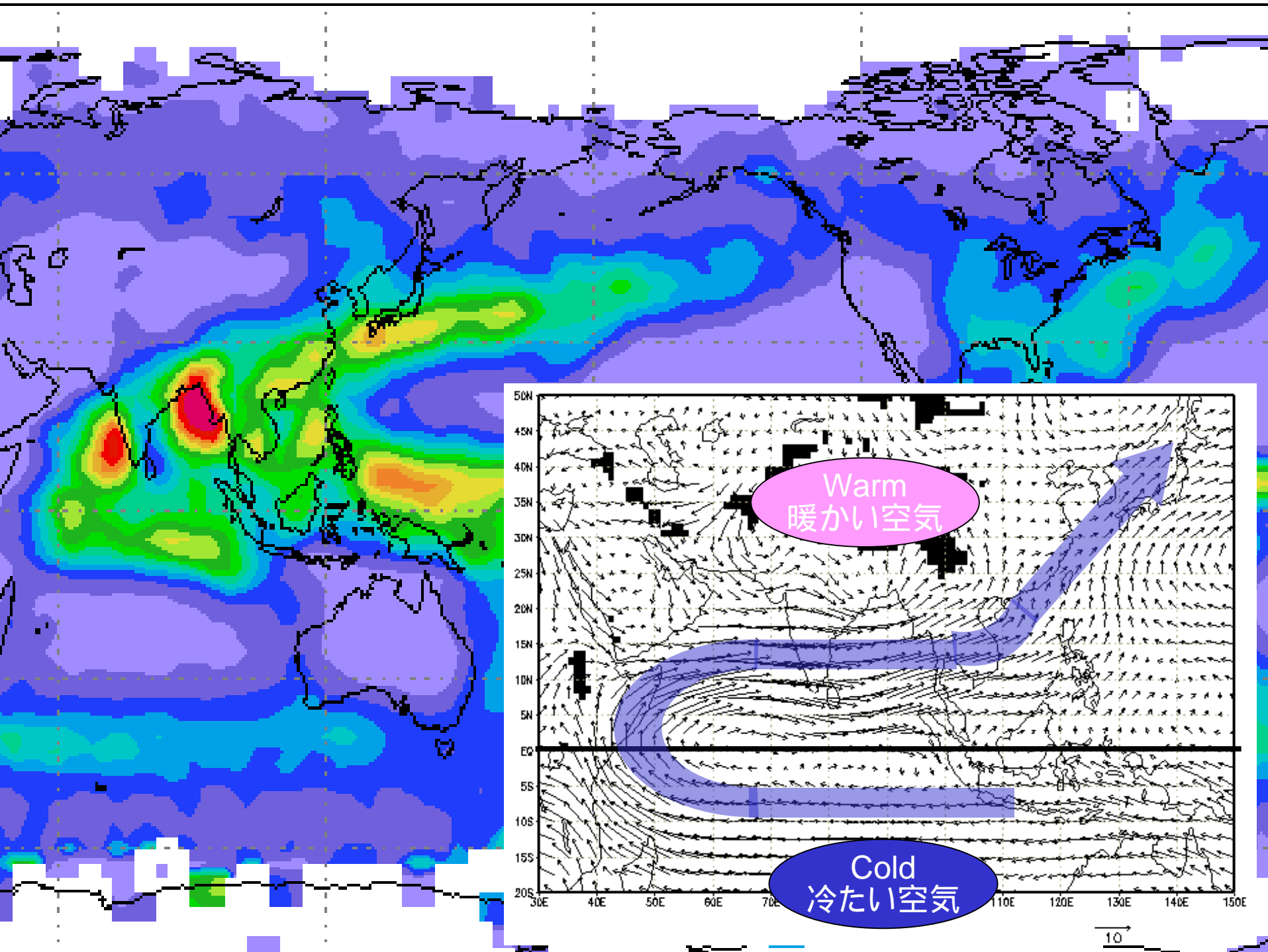


# A Challenge by GEOSS/AWCI to Flood Disaster Reduction in Asia アジアにおける洪水被害軽減への挑戦

Toshio Koike  
小池俊雄

Earth Observation Data Integration and Fusion  
Research Initiative (EDITORIA), The University of Tokyo  
東京大学地球観測データ統合連携研究機構

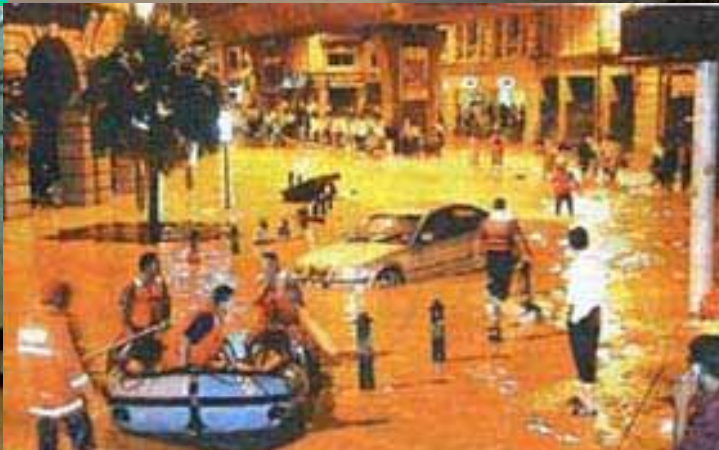
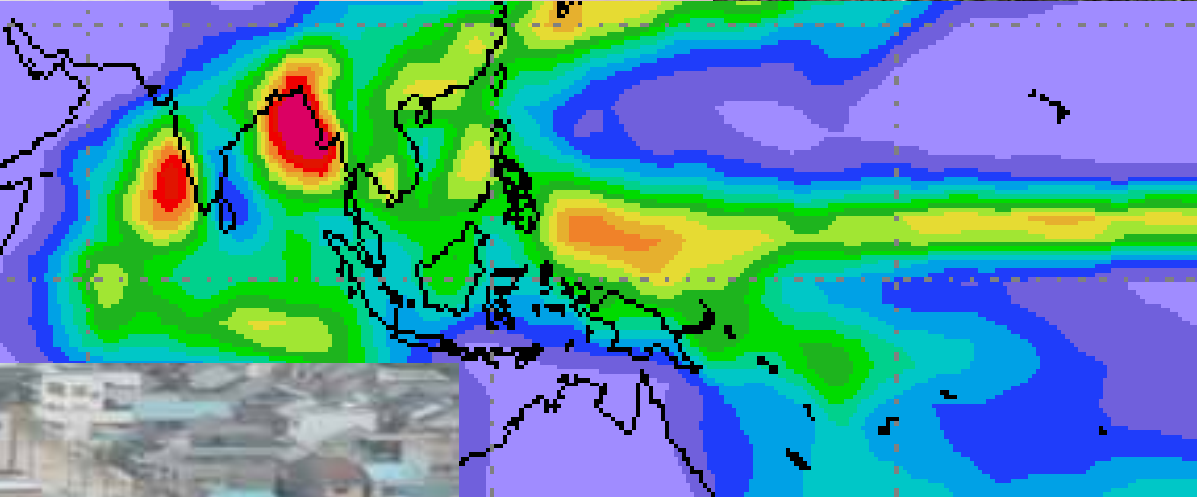
The 2nd Asia Water Cycle Symposium, Tokyo, January 9-10, 2007  
第2回アジア水循環シンポジウム, 東京, 2007年1月9-10日



Warm  
暖かい空気

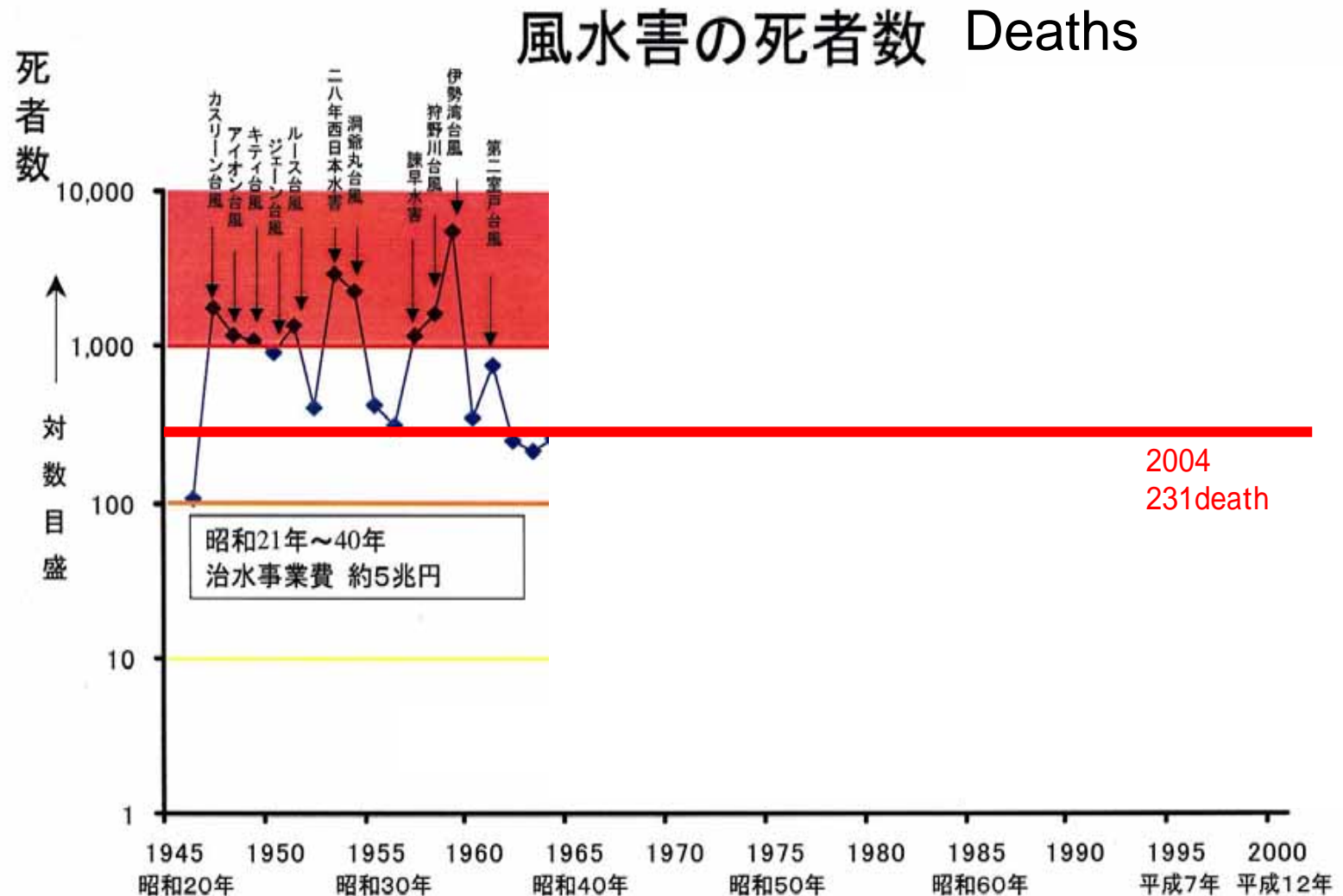
Cold  
冷たい空気

10



# 風水害 (日本)

## Floods/Storms in Japan



# 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

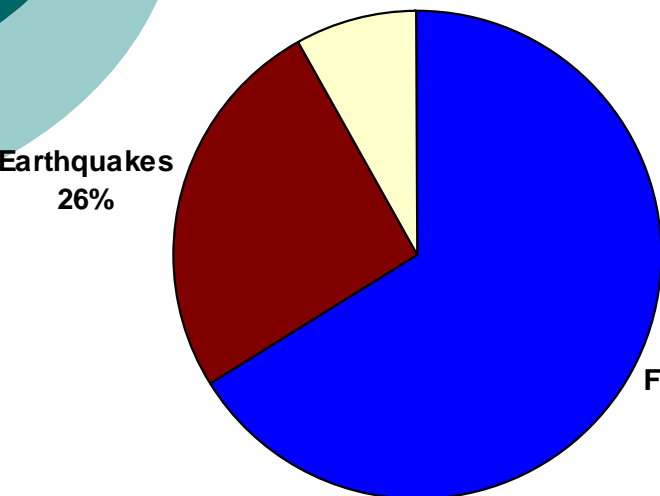
Year	地名Location	死者数Deaths
1991	バングラディシュ Bangladesh	139,000
1991	フィリピン Philippines	6,000
1991	中国 淮河 Huai River, China	2,900
1998	中国 長江 Yangtze River, China	3,000
1998	インド, バングラディシュ India and Bangladesh	2,425

# 風水害 (世界)

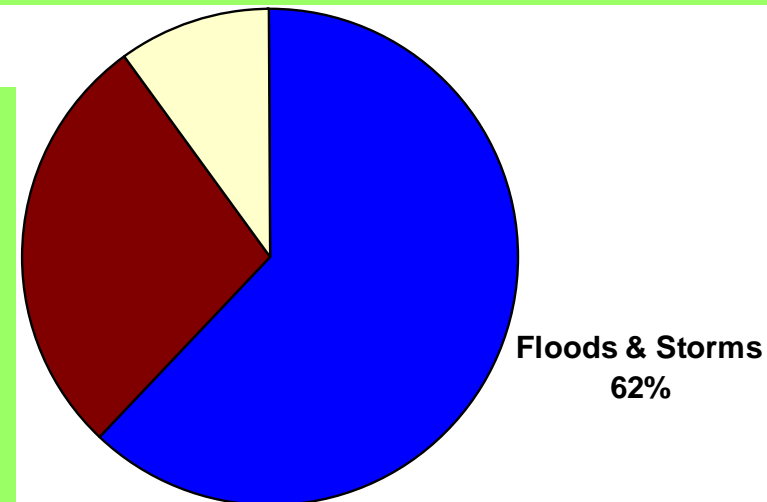
## Floods/Storms & Water Scarcity in the World

'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**.

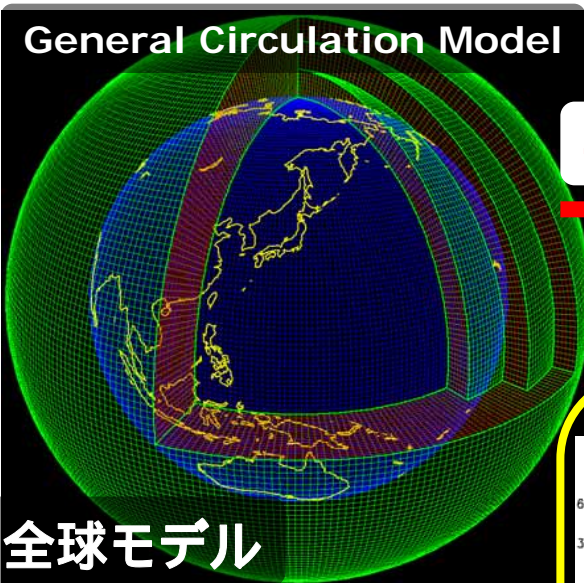


死者数:  
390,000

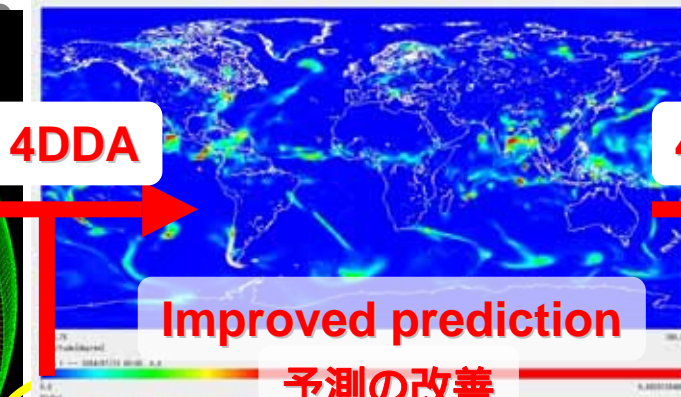


経済被害:  
\$700 billion

General Circulation Model



全球モデル

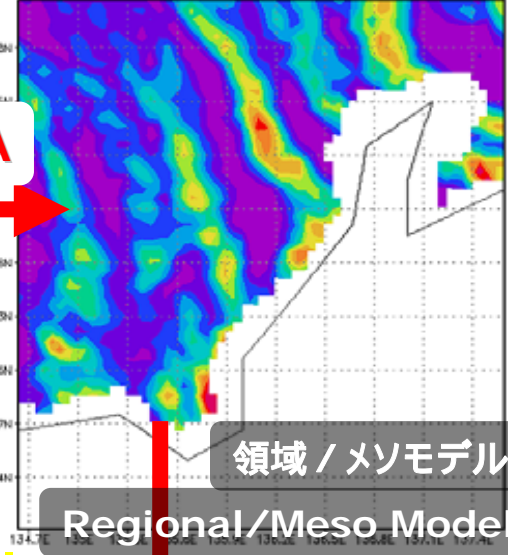


4DDA

4DDA

Improved prediction

予測の改善



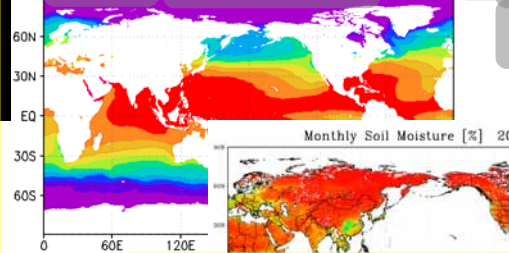
領域 / メソモデル

Regional/Meso Model

衛星 Satellite

地上観測データ

In-situ data



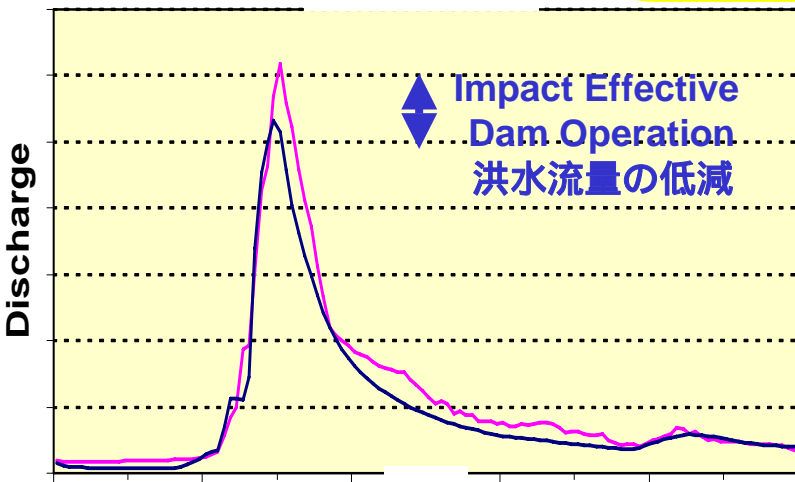
Monthly Soil Moisture [%]



Centralized Data System

データ統合化システム

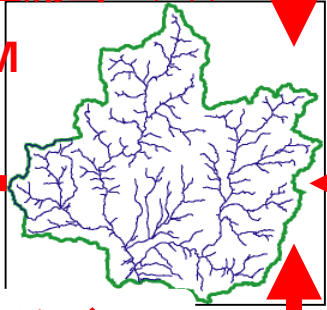
River Discharge



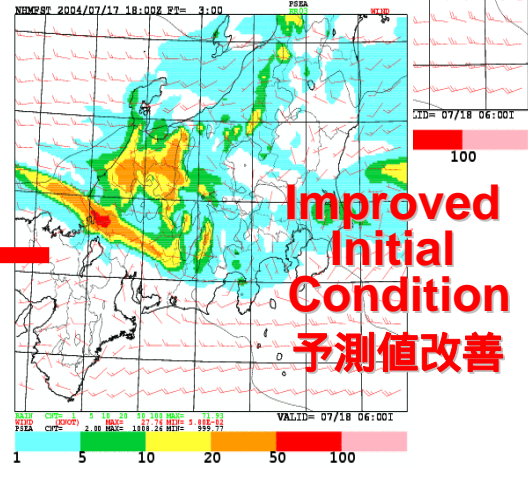
Impact Effective Dam Operation 洪水流量の低減

分布型流出モデル

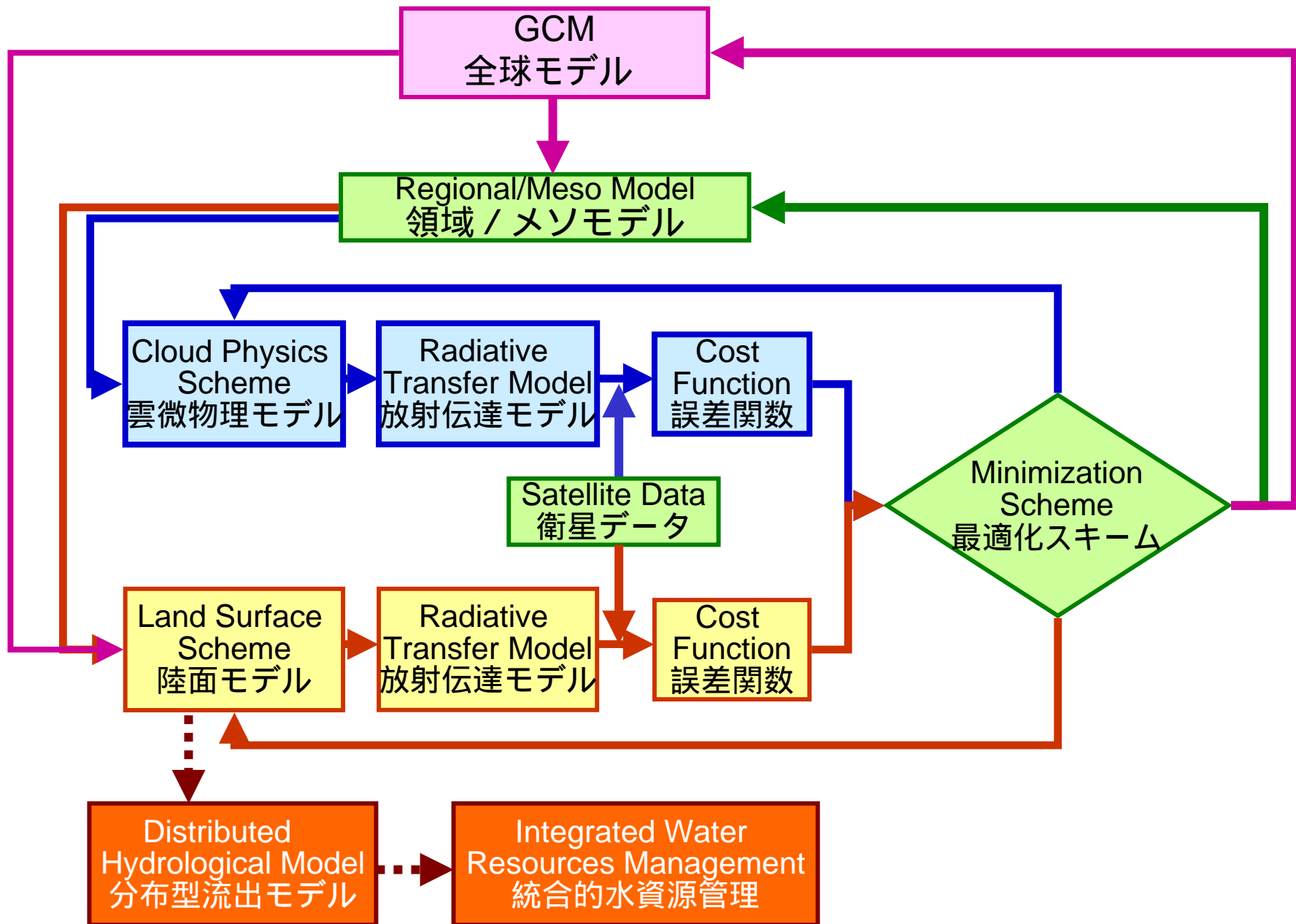
DHM



社会経済データ Socio-Economic Data



Improved Initial Condition 予測値改善





GCM  
全球モデル

**Forcing**  
**モデル入力**

降水・日射・気温  
湿度・風速など

Land Surface  
Scheme  
陸面モデル

Radiative  
Transfer Model  
放射伝達モデル

Satellite Data  
衛星データ

Cost  
Function  
誤差関数

Minimization  
Scheme  
最適化スキーム

**LDAS**

**陸面データ同化**

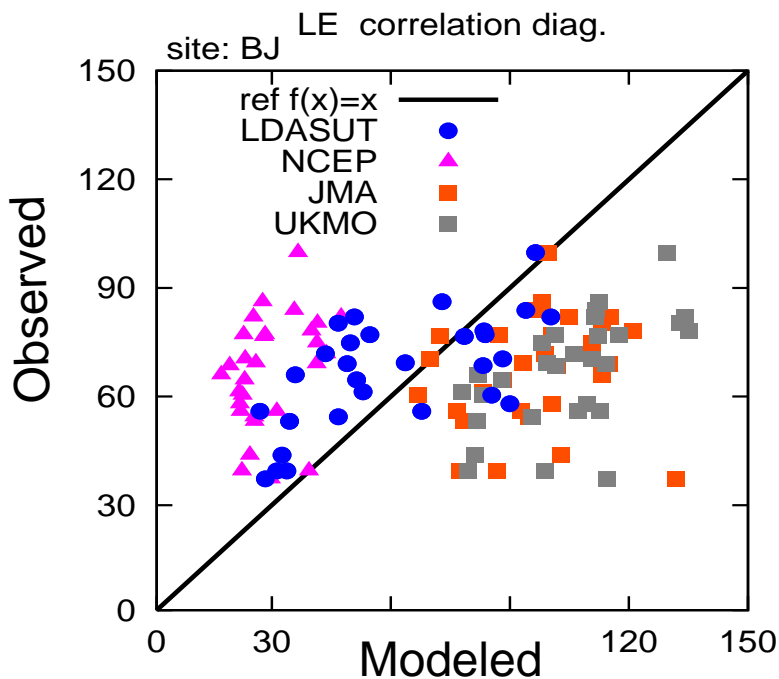
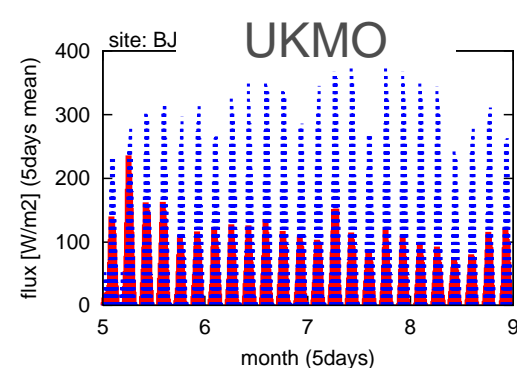
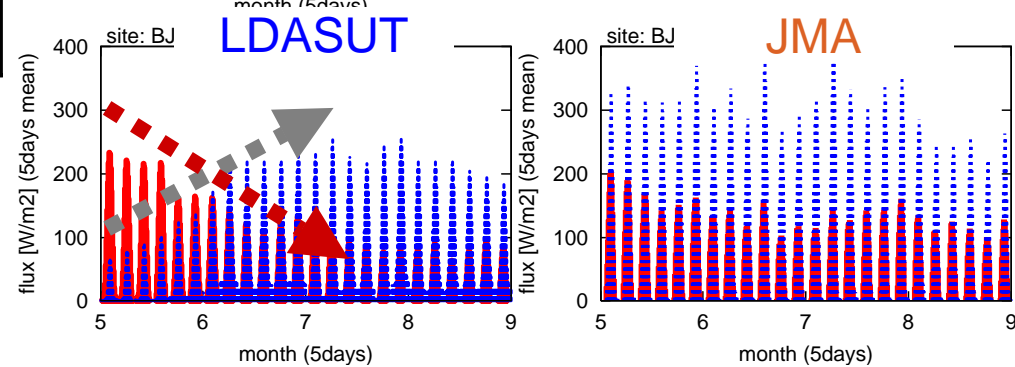
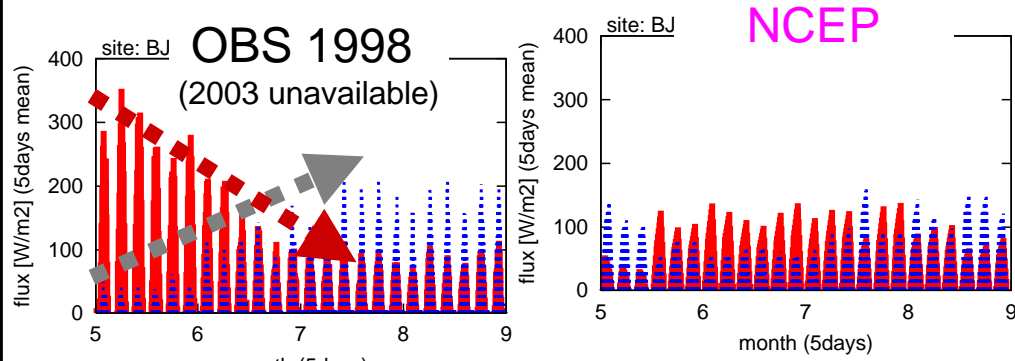
# LDASUT- GCMs

LE daily-mean ( June)6月の月平均潜熱

Seasonal variation 季節変化  
( May - September)(5-9月)

(H) -  
(LE)

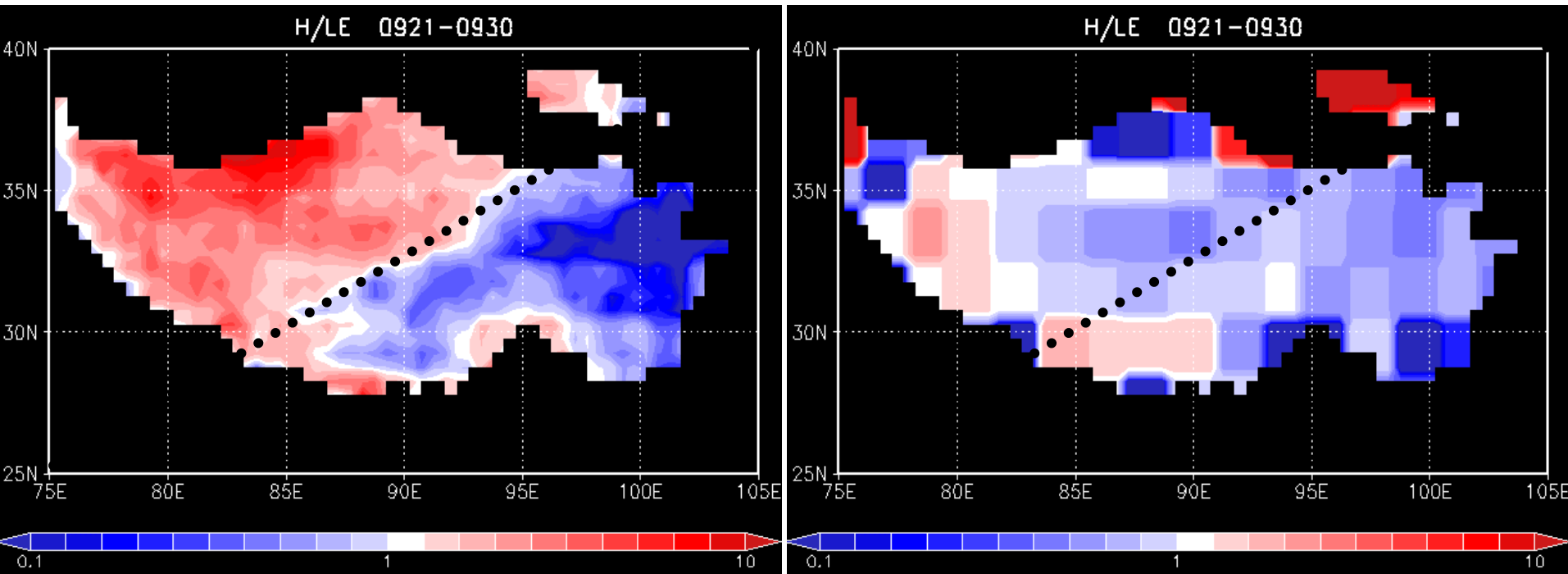
[W/m <sup>2</sup> ]	<b>H</b> RMSE 顕熱誤差	<b>LE</b> RMSE 潜熱誤差
<b>LDASUT</b>	<b>32.0</b>	<b>42.5</b>
<b>NCEP</b>	<b>40.2</b>	<b>68.4</b>
<b>JMA</b>	<b>32.3</b>	<b>79.8</b>
<b>UKMO</b>	<b>35.3</b>	<b>80.1</b>



# Seasonality of distributed Bowen Ratio: Sensible Heat Flux/Latent Heat Flux チベット高原におけるボーエン比(顕熱/潜熱)の季節分布

LDASUT

NCEP



LDAS Seasonality: May~Mid June,  $H > 1E$ ; Mid June~Aug;  $1E > H$

LDAS Regionality: H is dominant in N.W. TP,  $1E$  is dominant in S.E. TP

GCM  
全球モデル

## Land surface impacts on prediction

予測における陸面の効果

Satellite Data  
衛星データ

Land Surface  
Scheme  
陸面モデル

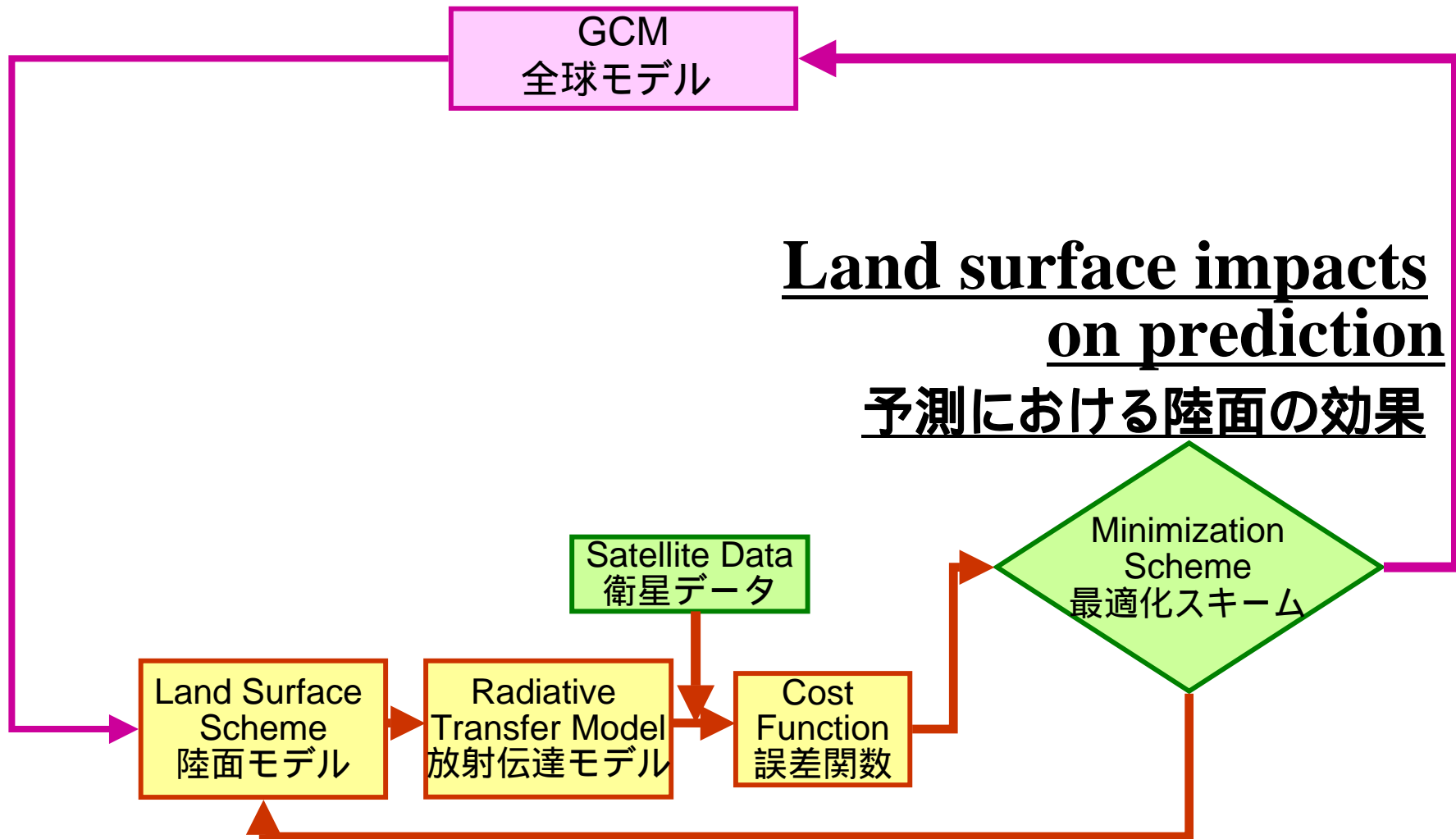
Radiative  
Transfer Model  
放射伝達モデル

Cost  
Function  
誤差関数

Minimization  
Scheme  
最適化スキーム

LDAS

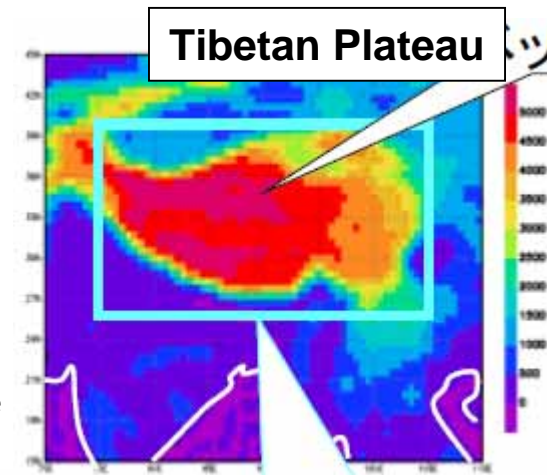
陸面データ同化



# Impacts of the Tibet surface conditions on the GCM prediction

(チベット高原が予測に及ぼす影響)

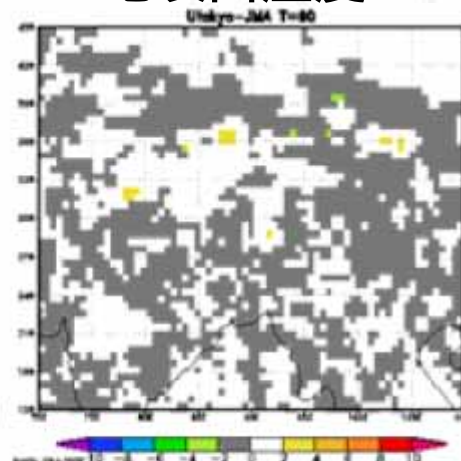
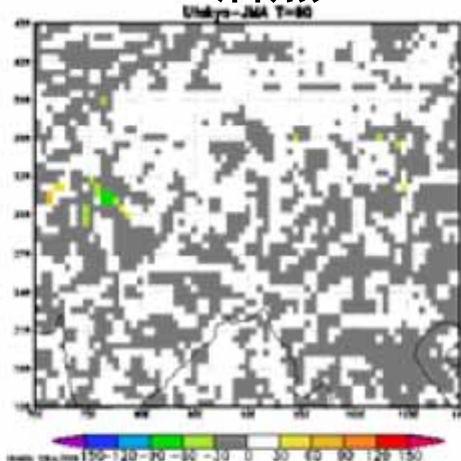
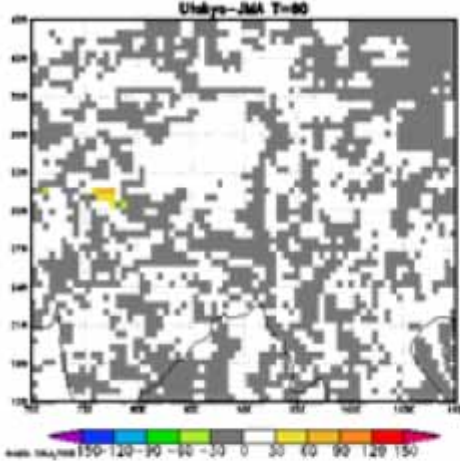
(UT-JMA Cooperative Research/東大 - 気象庁共同研究)



sensible  
heat flux  
顕熱

latent  
heat flux  
潜熱

surface  
Temperature  
地表面温度



Use the assimilation product as the initial Condition (データ同化の結果を予測に利用)

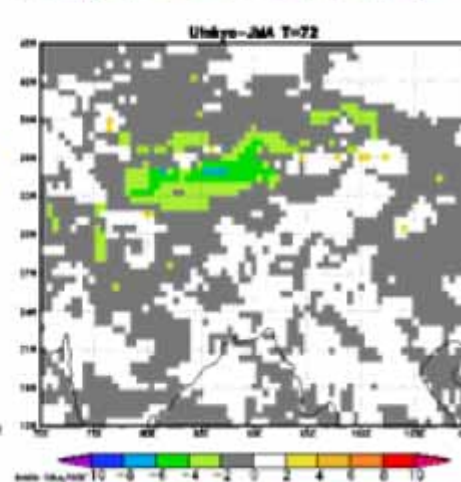
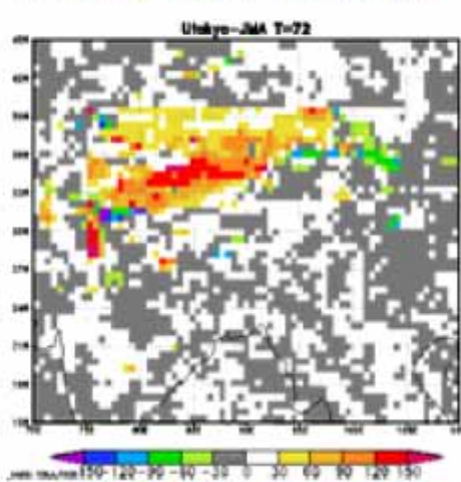
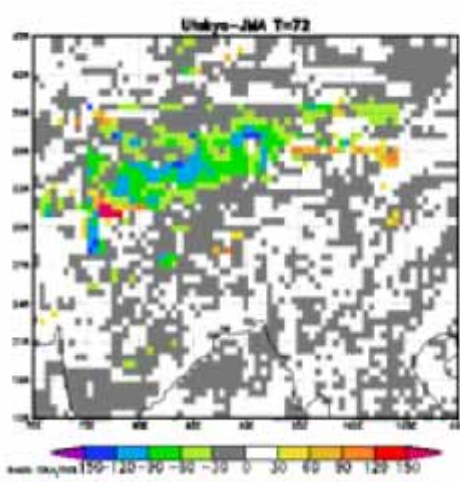
Nighttime (夜間)

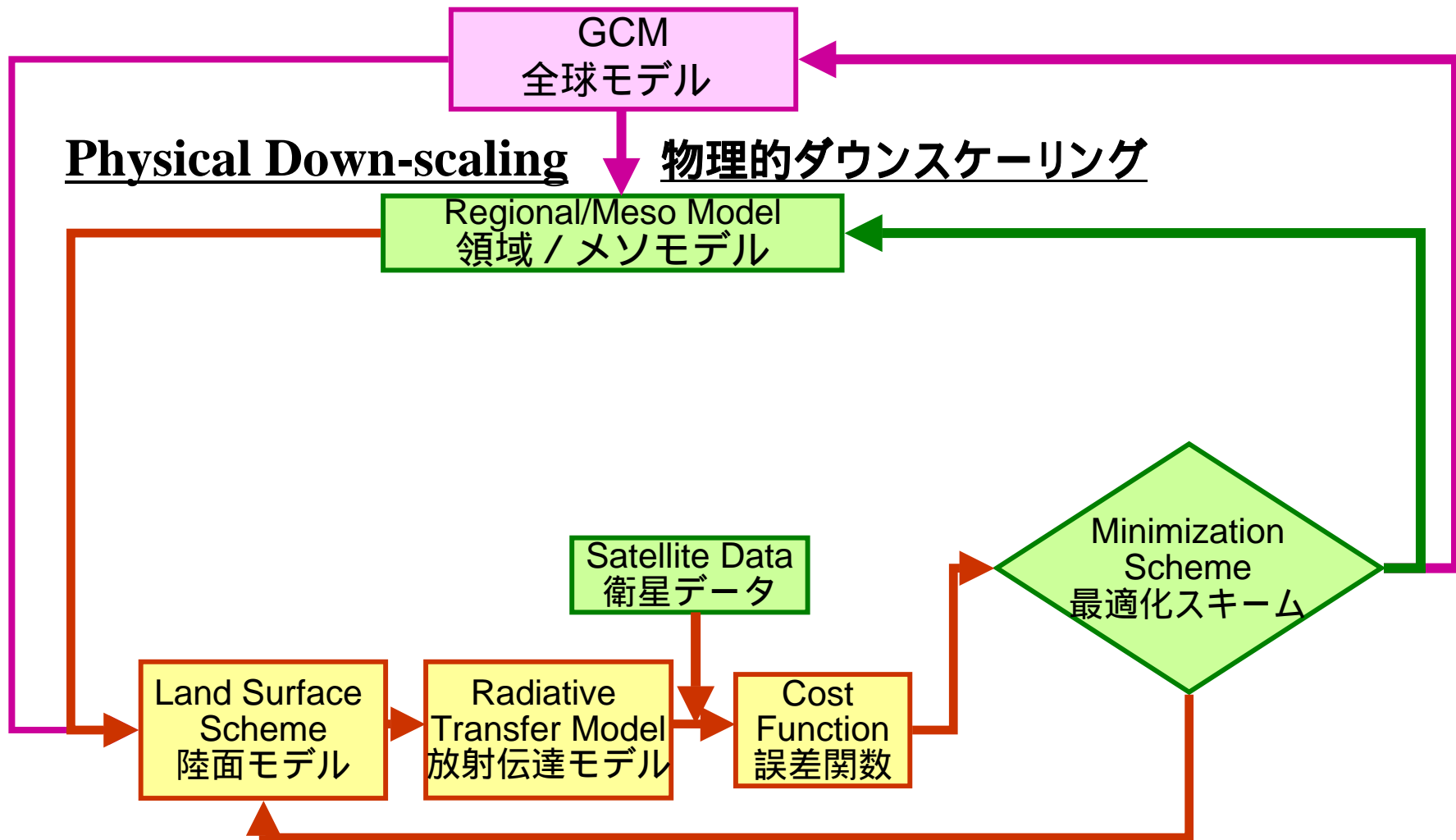


Three days later  
3日後の予測値



Daytime (日中)





**LDAS**  
**陸面データ同化**

# Impacts of LDAS on Weather Forecasting

## 陸面データ同化の気象予測における影響評価

### No Assimilation Case

#### 陸面データ同化なし

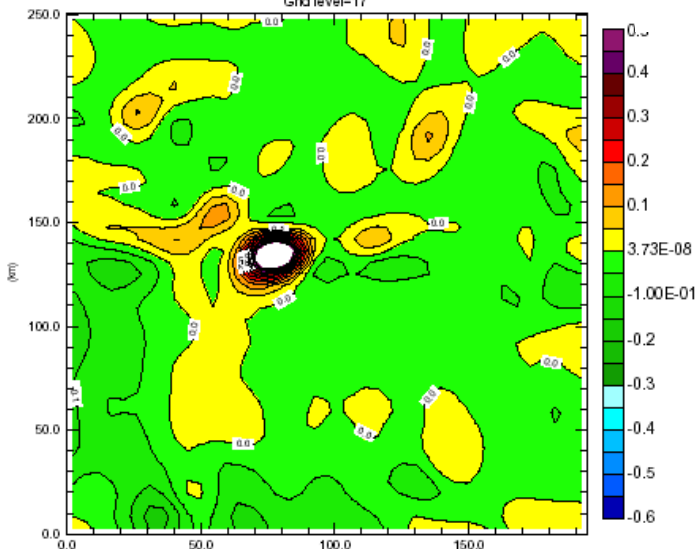
3-D Run No Ldas case

Vertical Wind

Boundary and initial atmospheric condition are from Game Reanalysis ver 1.5

12:00LT Fri 3 Jul 1998 t=21600.0 s (6:00:00)

Grid level=17

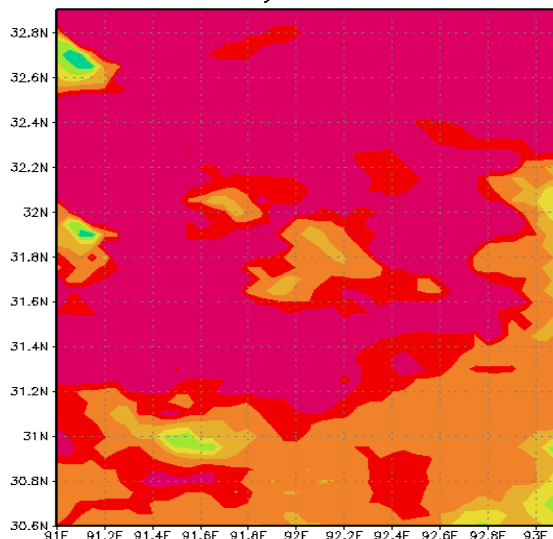


Vertical Wind field

w (m/s, shaded/contour)

Min=-.173 Max=0.839 Inc=0.500E-01

GMS5 Ic Convective Index  
1998 July 3 at t= 12LT



GMS IR1-based  
convective Index  
静止衛星による  
対流指標

### Assimilation Case

#### 陸面データ同化あり

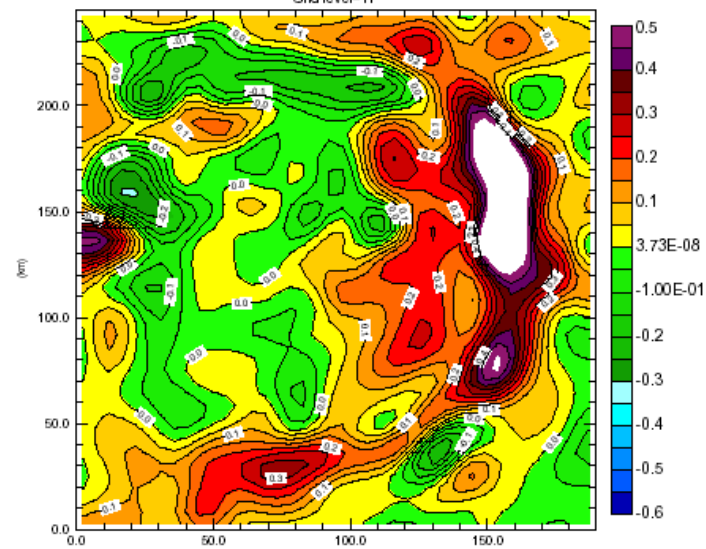
3-D Run Using a Variational LDAS scheme for soil moisture initialization

Vertical wind

Boundary and initial atmospheric condition are from Game Reanalysis ver 1.5

12:00LT Fri 3 Jul 1998 t=21600.0 s (6:00:00)

Grid level=17

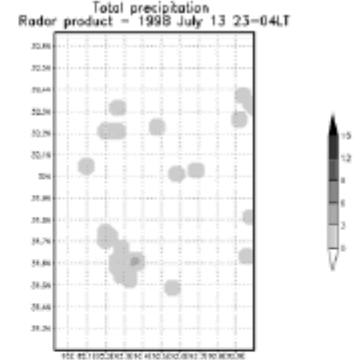
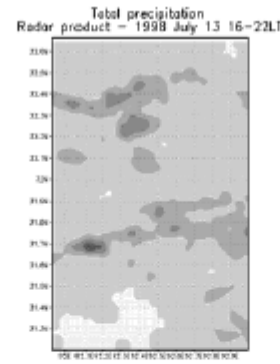
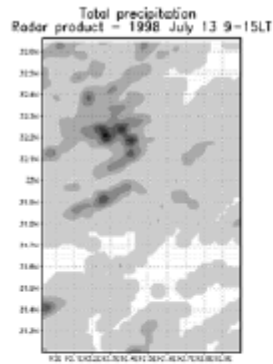


Vertical Wind field

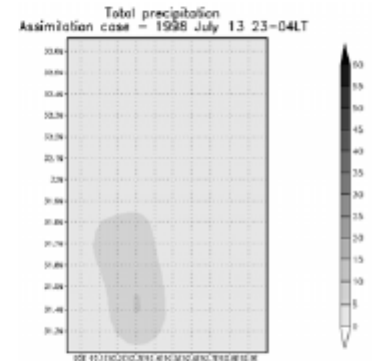
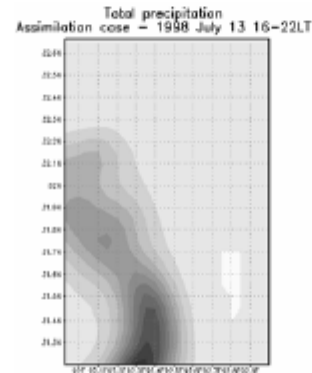
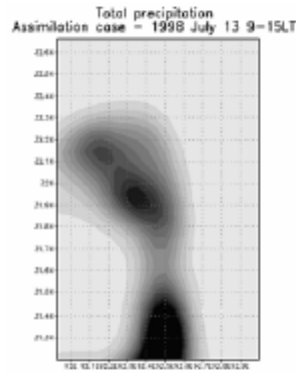
w (m/s, shaded/contour)

Min=-.309 Max=0.944 Inc=0.500E-01

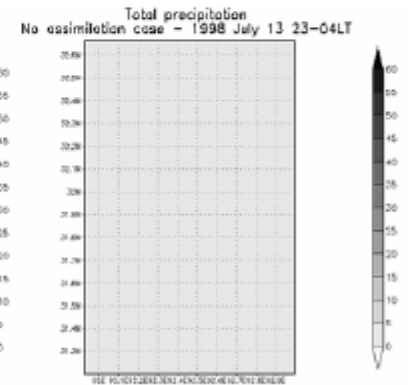
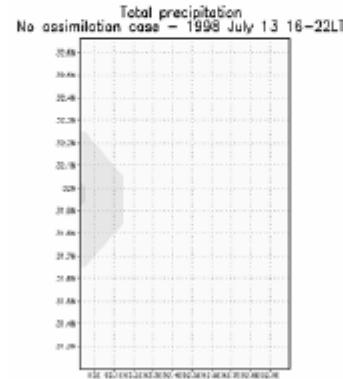
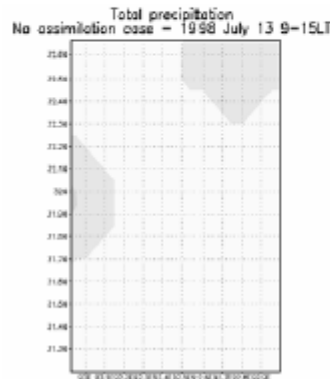
# Radar at BJ レーダ観測雨域



# Assimilation Case 陸面データ同化あり



# No Assimilation Case 陸面データ同化なし



**Impacts of LDAS  
On Prediction of Diurnal  
Variation of Rainfall  
降雨の日周変化予測に対  
する陸面データ同化の影響**

9-15

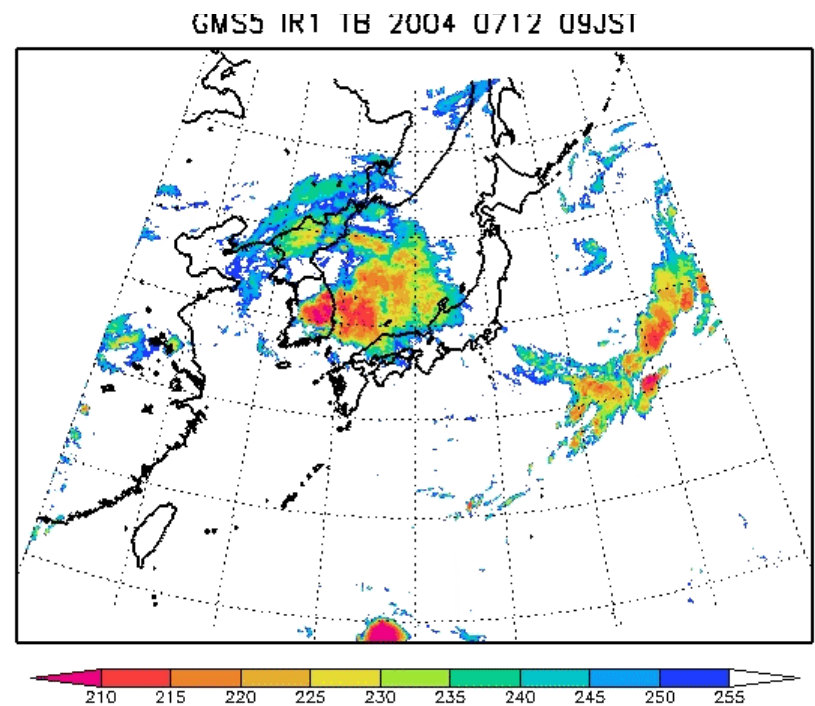
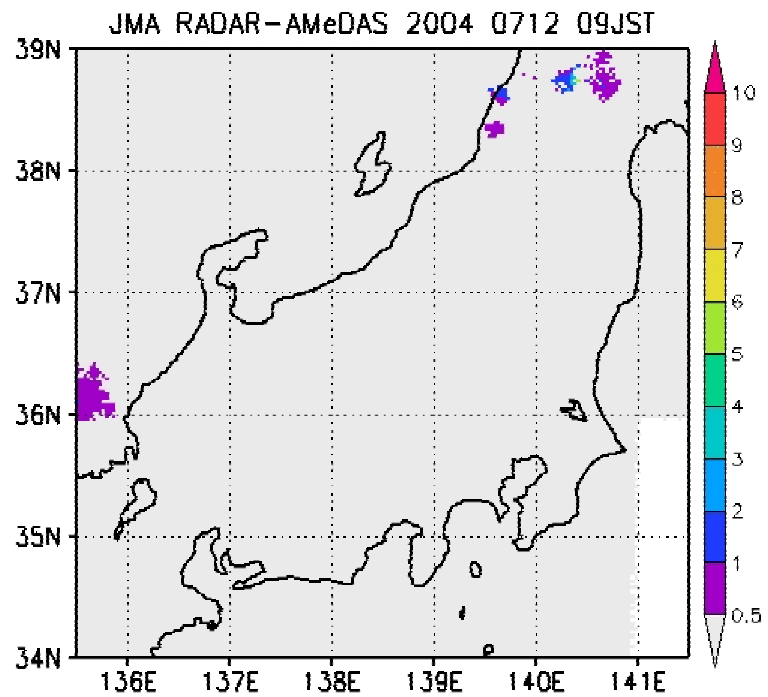
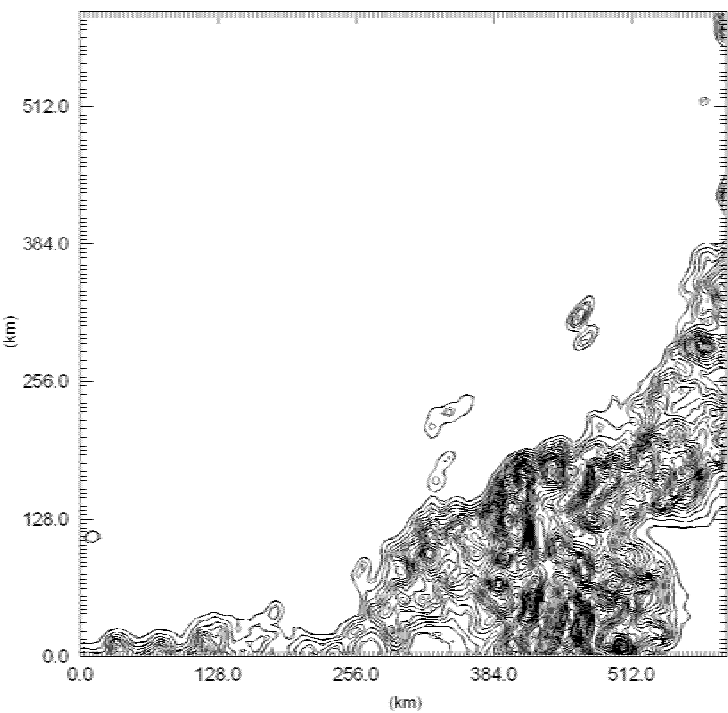
16-22

23-04



# NIGATA EXTREME FLOOD EVENT July 12 ~ 13, 2004

00:00Z Mon 12 Jul 2004 T=0.0 s (0:00:00)



GCM  
全球モデル

Physical Down-scaling ↓ 物理的ダウンスケーリング

Regional/Meso Model  
領域 / メソモデル

Cloud Physics Scheme  
雲微物理モデル

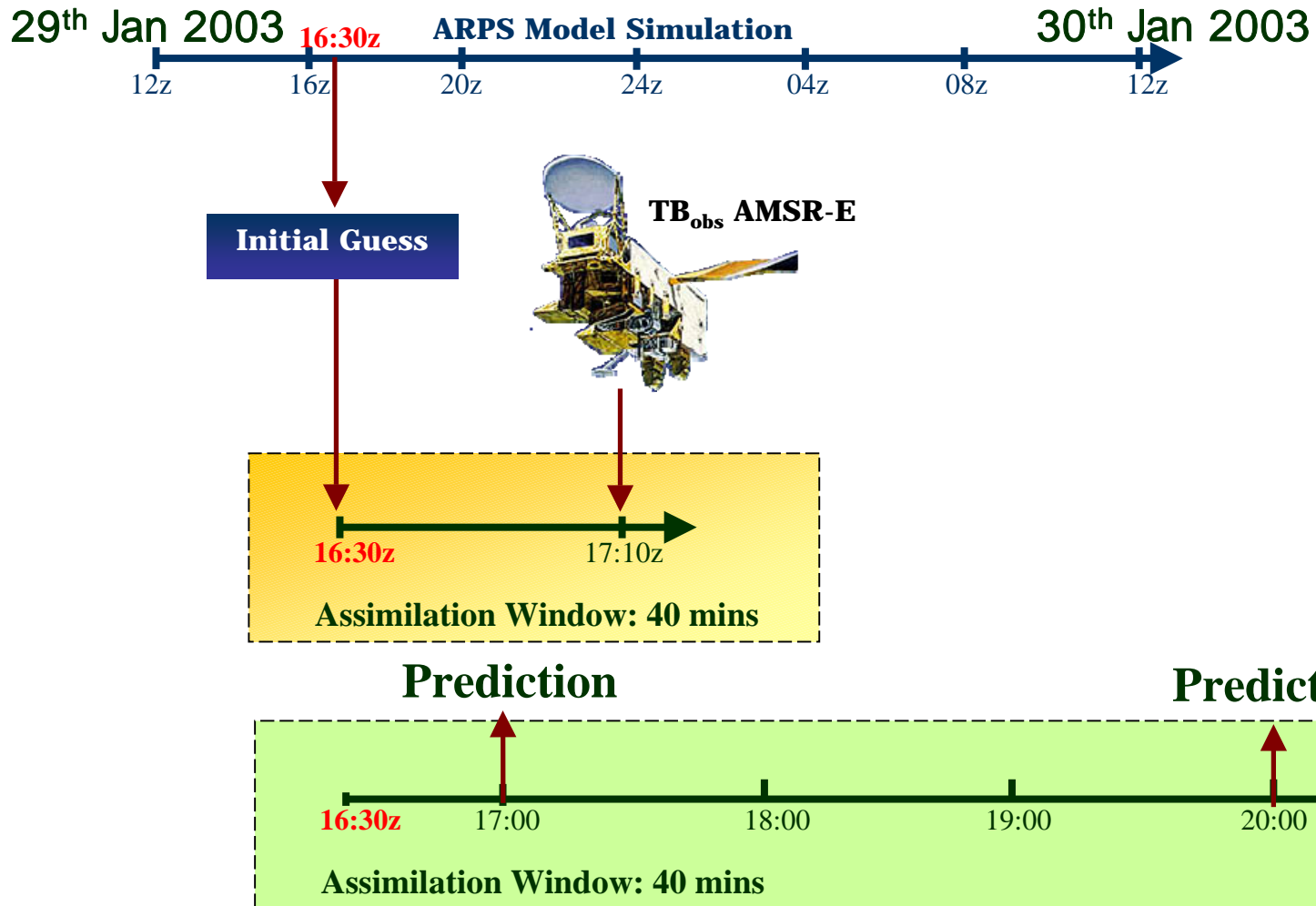
Radiative Transfer Model  
放射伝達モデル

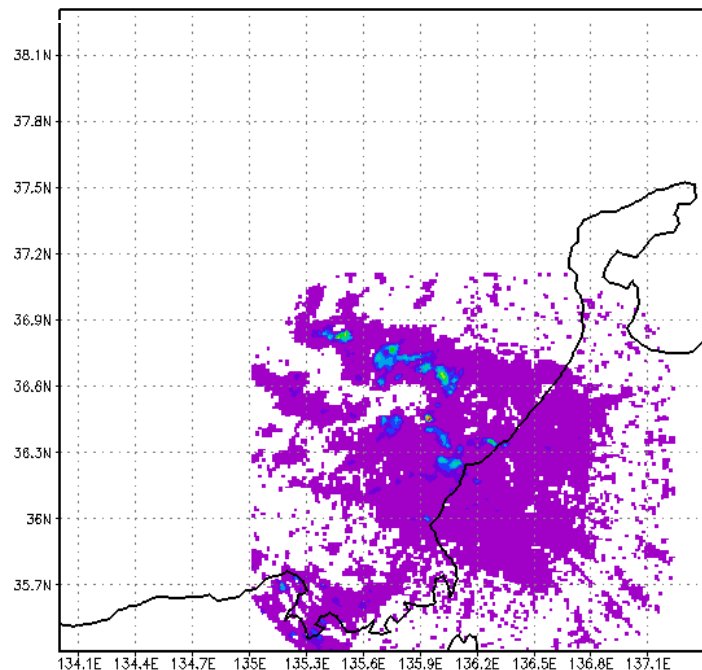
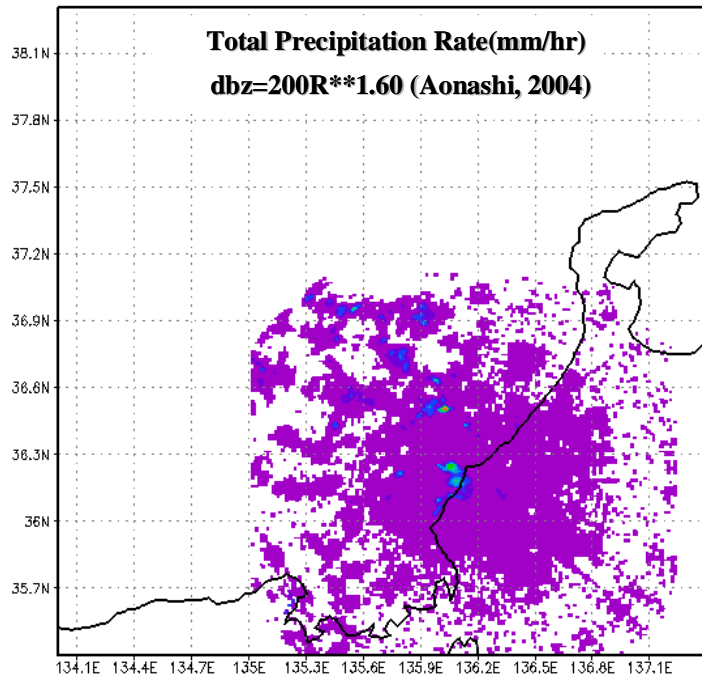
Cost Function  
誤差関数

Satellite Data  
衛星データ

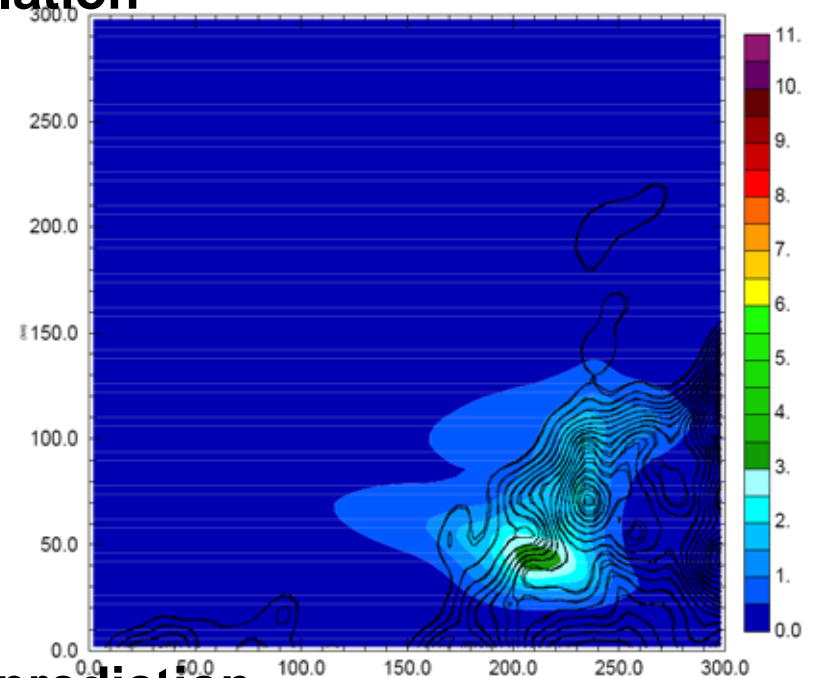
Minimization Scheme  
最適化スキーム

# Practical Approach: システムの適用

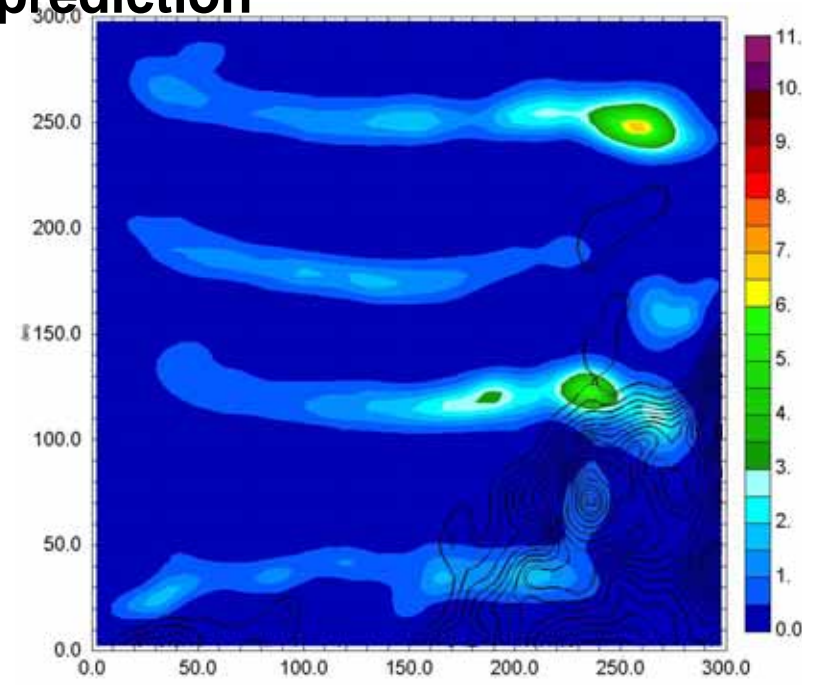


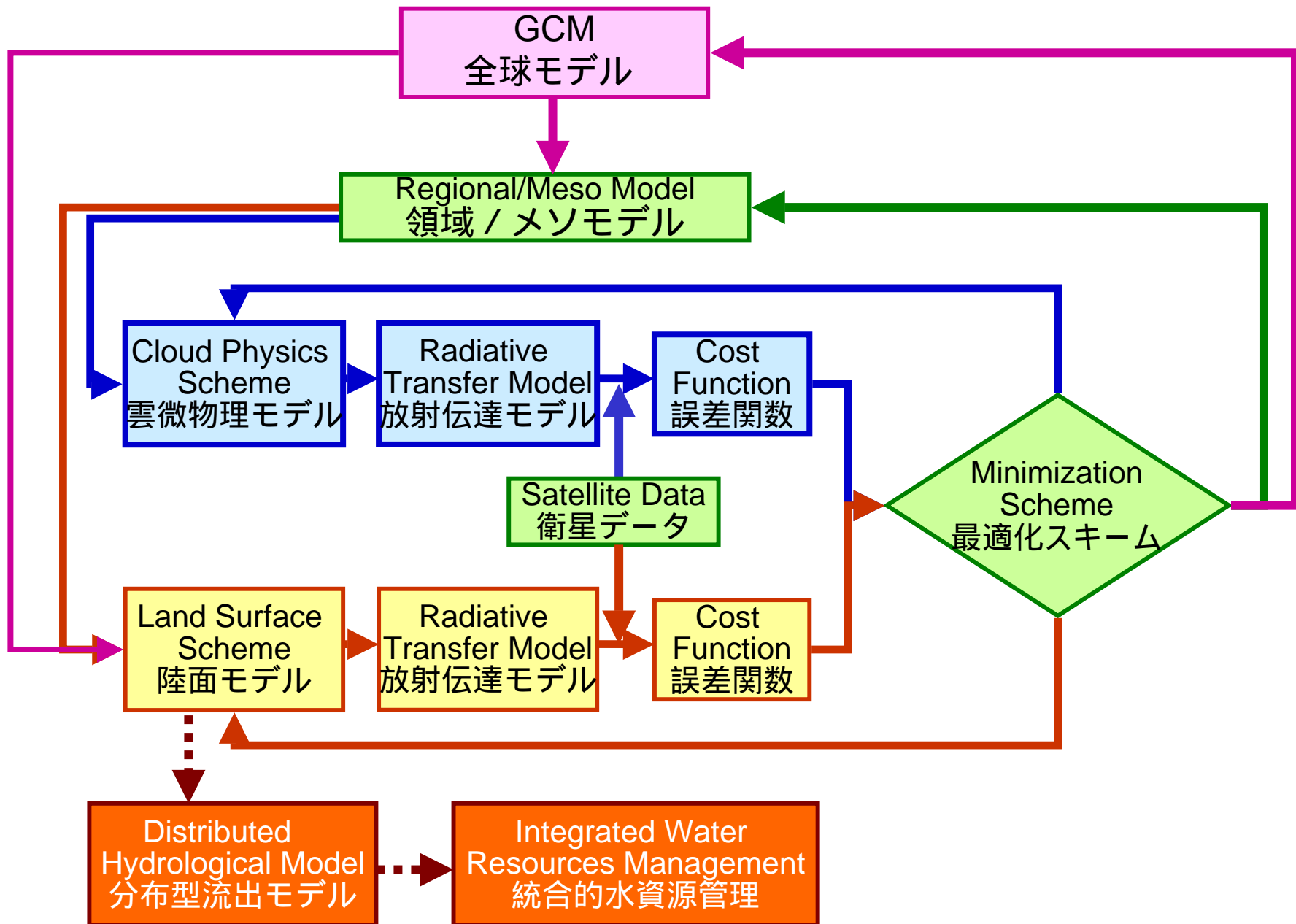


## assimilation



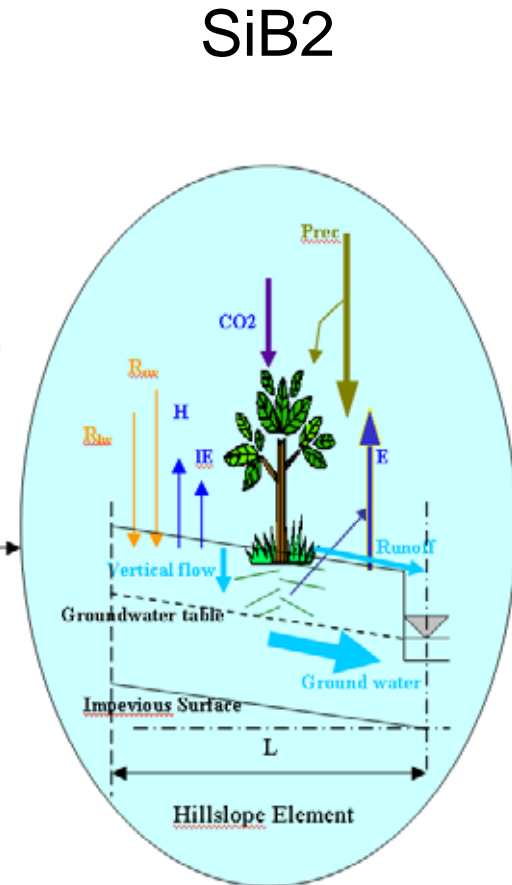
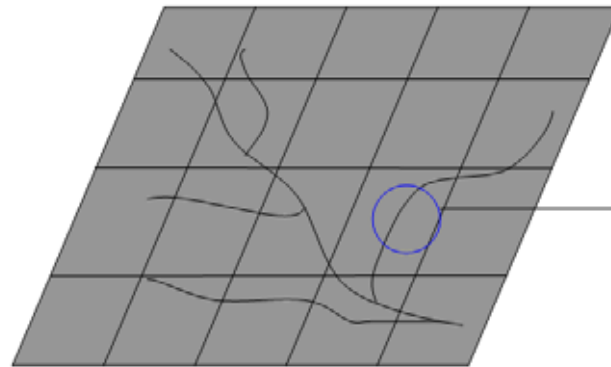
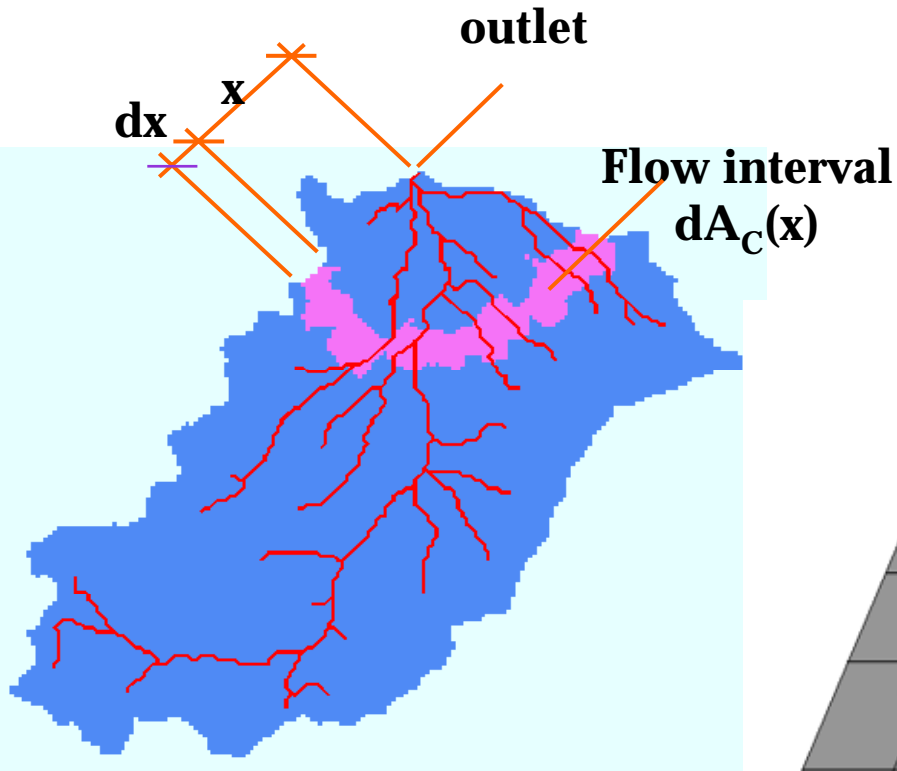
## 3hour prediction





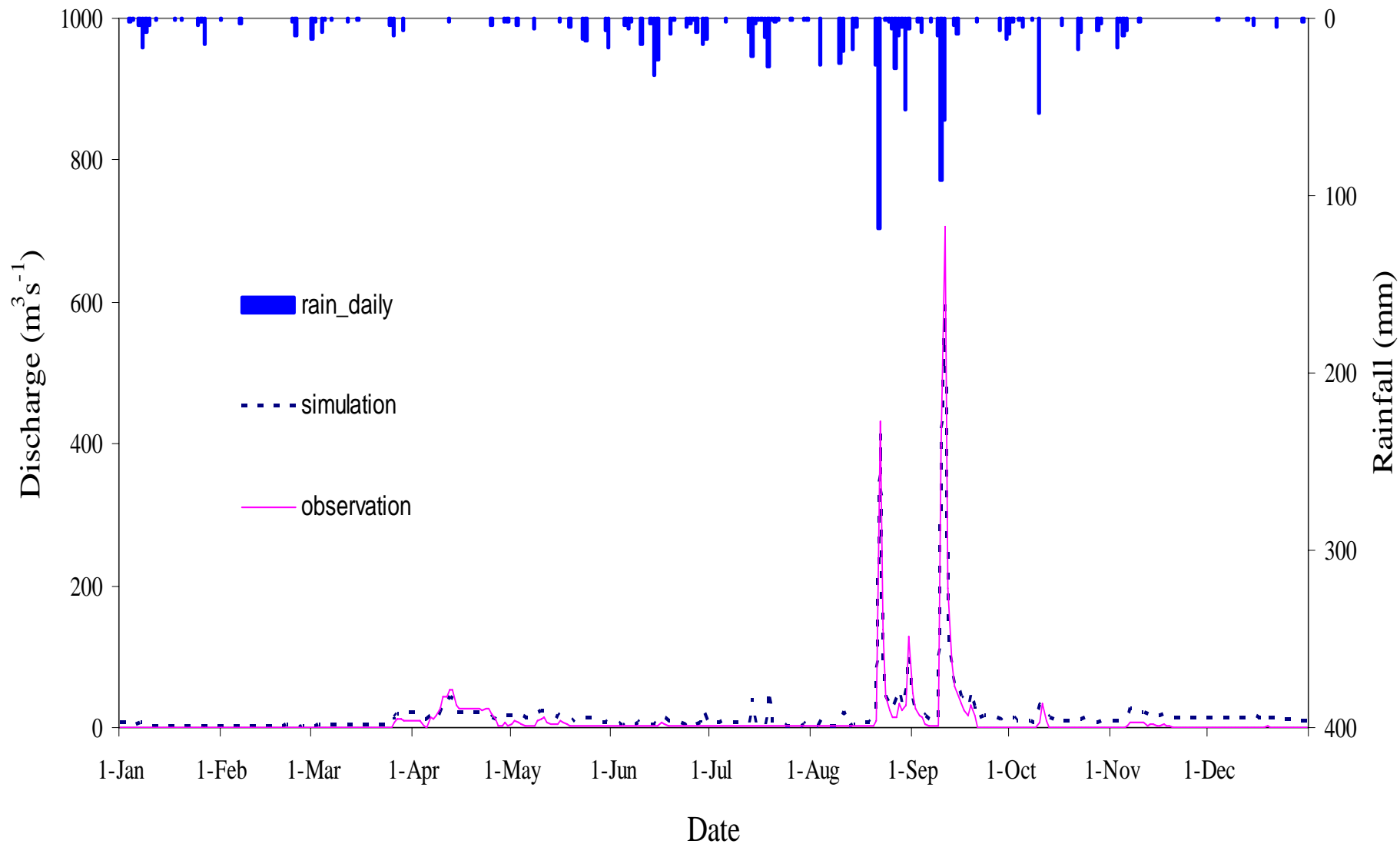
# A Distributed Hydrological Model Coupled with a Land Surface Scheme

## 陸面モデルを含む分布型流出モデル



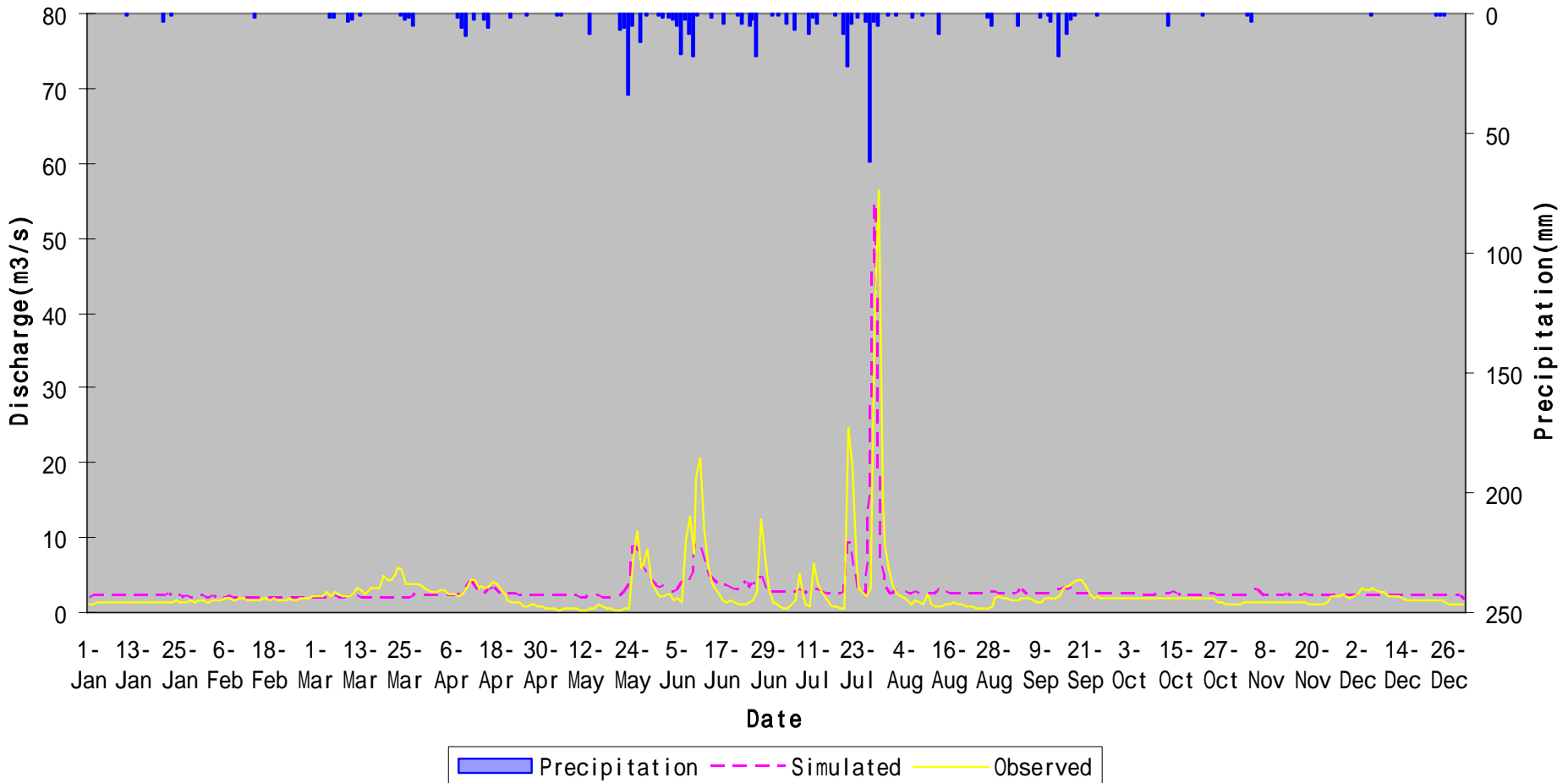
GBHM by D.Yang

# Tone River/利根川



# Yonding River / 永定河

515





# Dam Operation Optimization System by Using Rainfall Forecasting

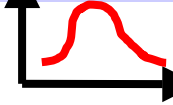
## 予測降雨を用いたダム操作の最適化

Short-term 洪水期

Weather forecast Output  
気象予報出力

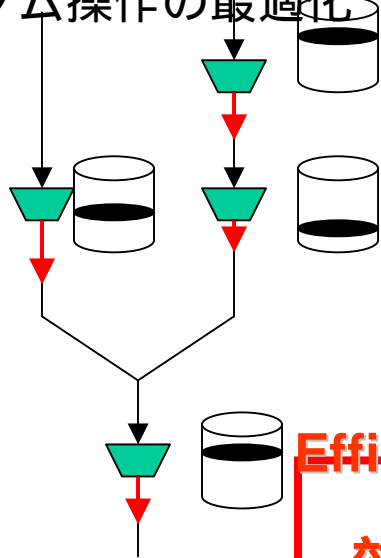
Observed rainfall  
観測降雨

Error Forecast  
誤差の予測



Spatially distributed data  
空間分布データ

Optimization of dam network  
ダム操作の最適化



Potential  
Operational  
Rule  
&  
Weighting  
操作規則の選択

Coupled DHM & Dam Operation  
分布型流出モデルとダム操作の結合

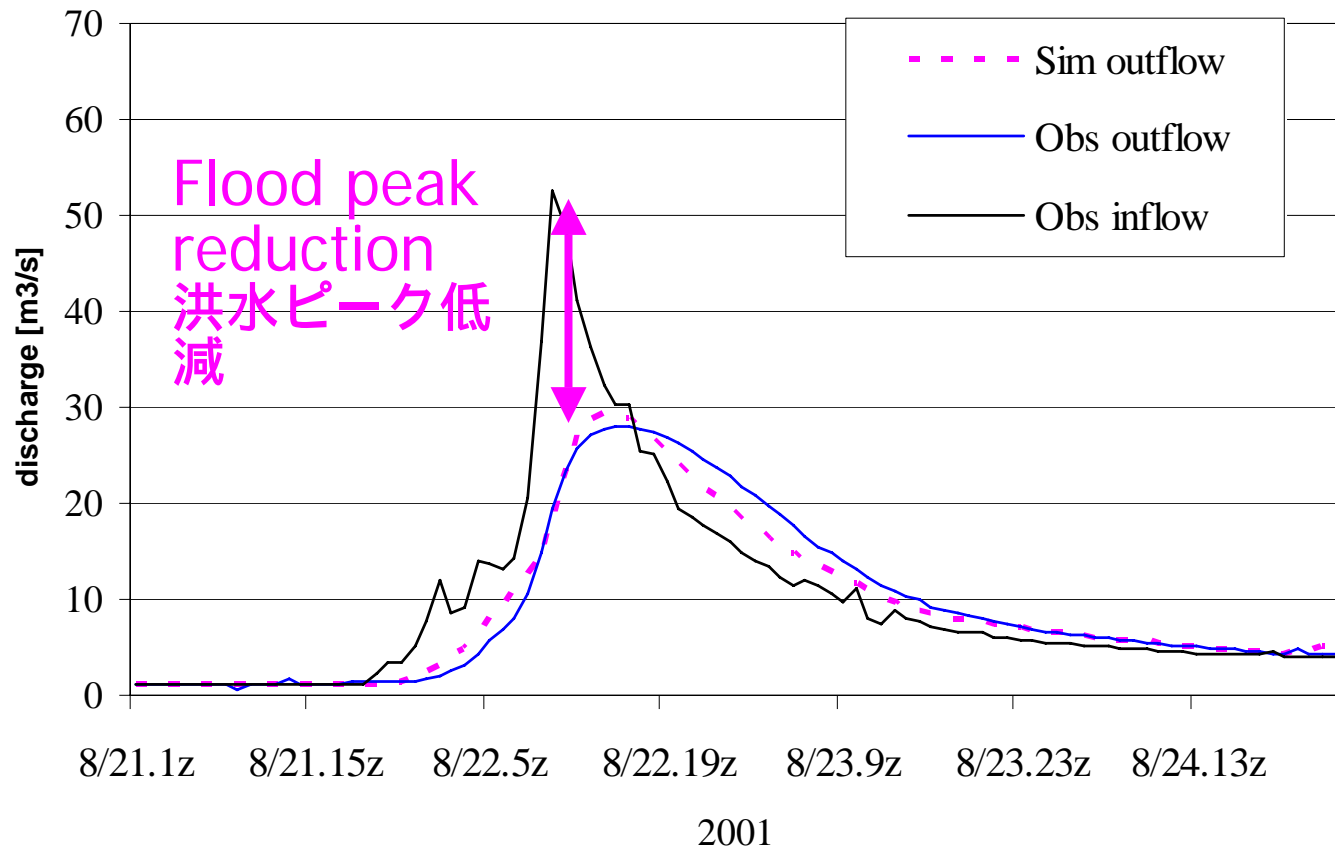
Minimization Scheme  
最適化スキーム

**Efficient water resources  
Management  
効率的・効果的水管理**

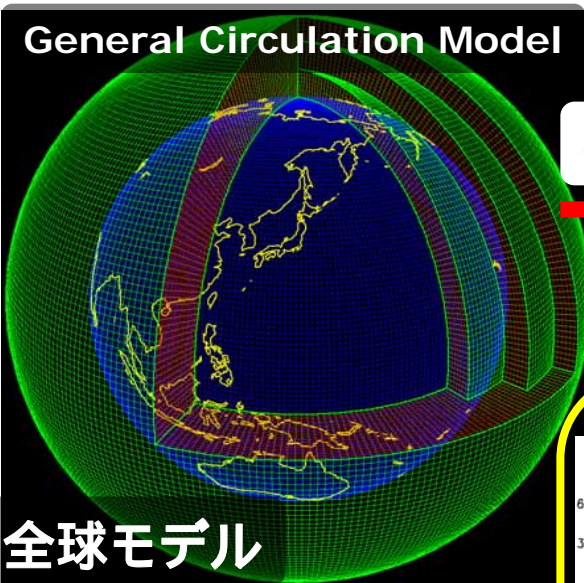
Integrated dam network  
release schedule  
統合的ダムの管理

# Tone River / 利根川

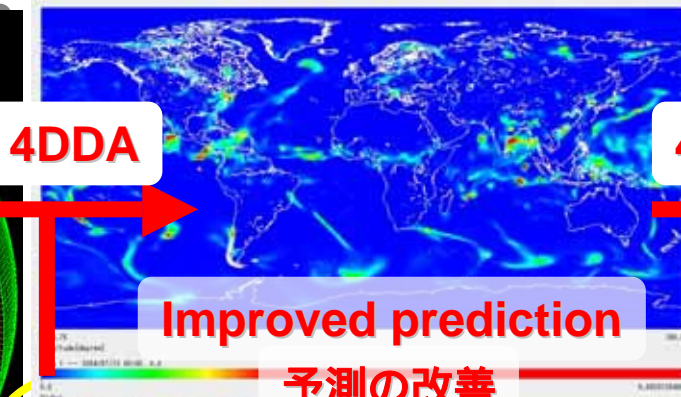
## Using Spatial Radar Data



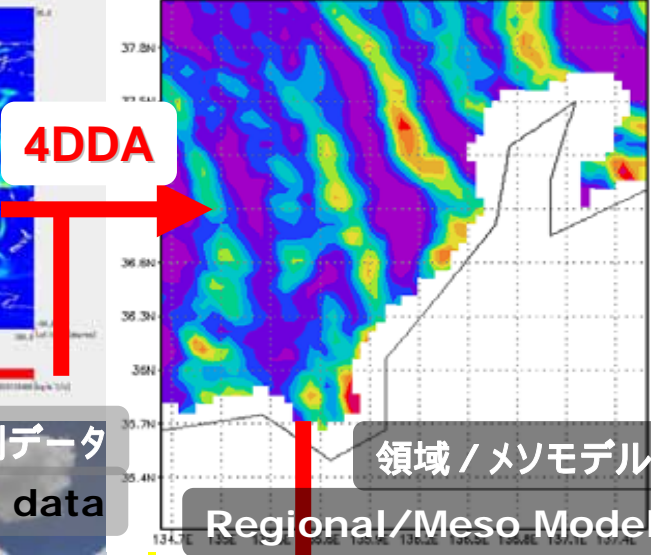
General Circulation Model



全球モデル



4DDA



4DDA

Improved prediction

予測の改善

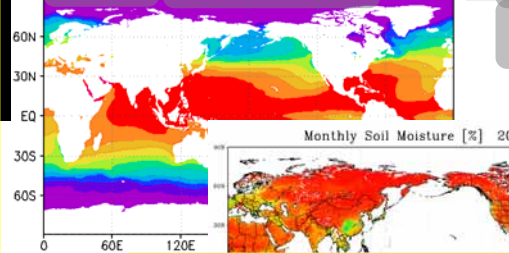
衛星 Satellite

地上観測データ

In-situ data

領域 / メソモデル

Regional/Meso Model



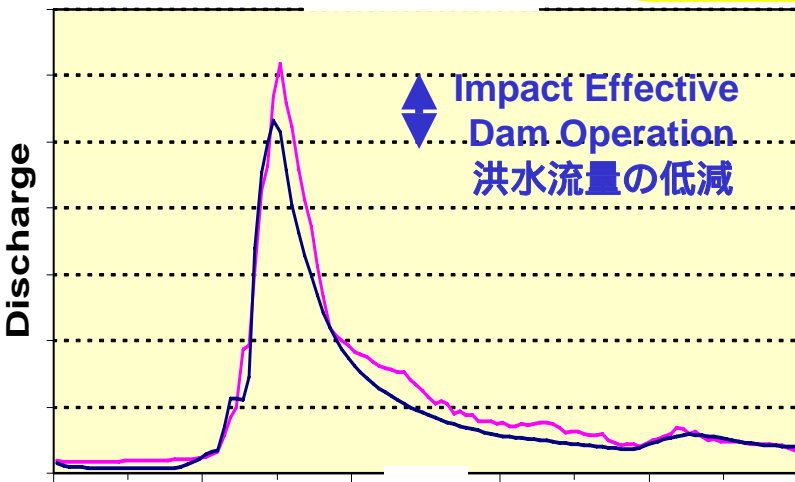
Monthly Soil Moisture [%]



Centralized Data System

データ統合化システム

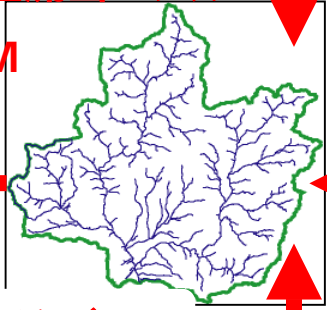
River Discharge



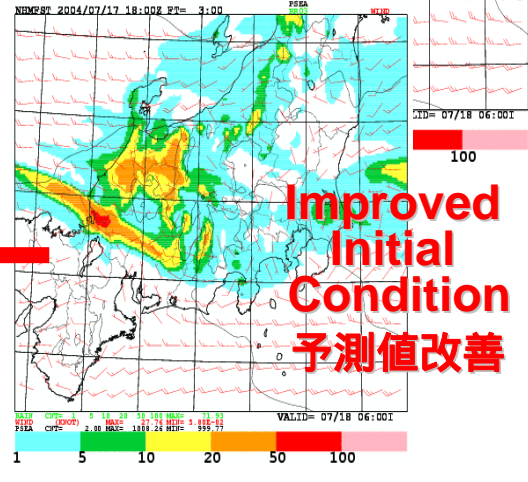
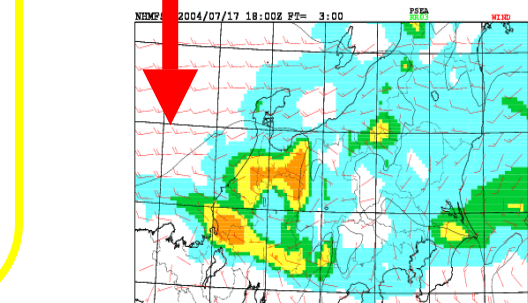
Impact Effective Dam Operation 洪水流量の低減

分布型流出モデル

DHM



社会経済データ Socio-Economic Data



Improved Initial Condition 予測値改善

# GEOSS/Asian Water Cycle Initiative GEOSSアジア水循環イニシャティブ

## Integration and use of earth observation data 地球観測データの統合と利用

Satellite data, global network data, numerical forecasting model, assimilation of data  
衛星データ, 地球観測ネットワークデータ, 数値予測モデルデータ, データ同化プロダクツ

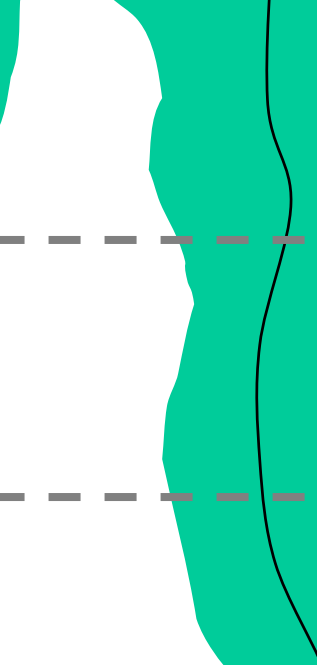
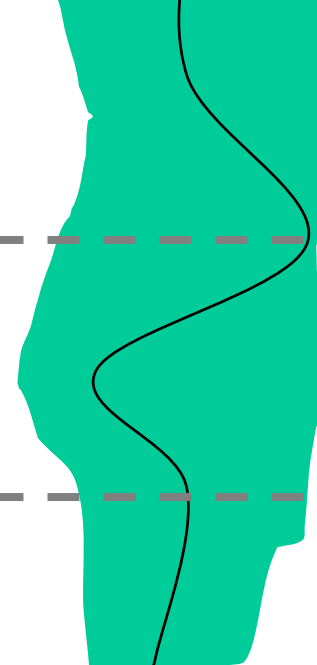
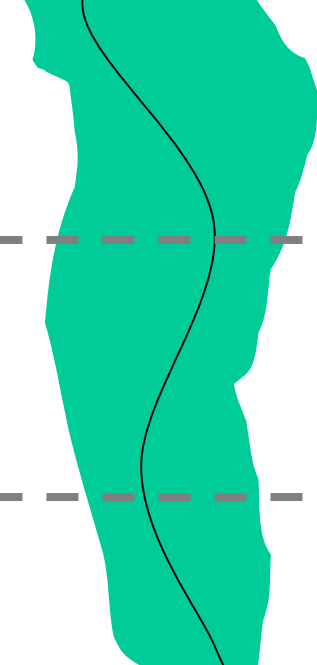
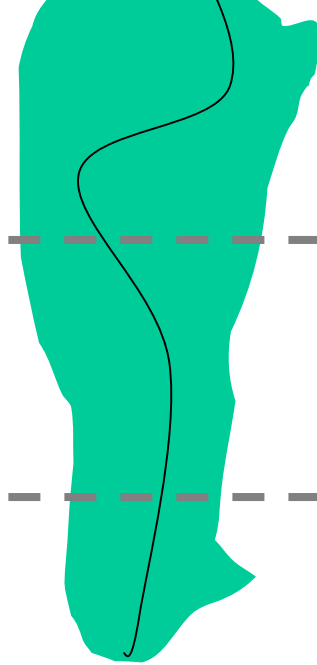
### Regional Area data / information 地域データ・情報

In-situ data  
流域データ

In-situ data  
流域データ

In-situ data  
流域データ

In-situ data  
流域データ



Basin 1

Basin 2

Basin 3

Basin 4

### Capacity Building 能力開発

use of satellite data  
衛星データ利用

\* Space Agencies  
衛星機関

Research obs,  
Modeling and analysis  
研究観測・モデル

\* UNU, universities  
Research Institute,  
国連大学, 研究機関

In-situ observation  
River management  
現場観測・河川管理

\* ICHARM, MRC  
ESCAP, etc.

Common items  
共通事項

# Toward Convergence

