



# CEOP-AEGIS



Coordinated Asia-European long-term Observing system of Qinghai–Tibet Plateau hydro-meteorological processes and the Asian-monsoon system with Ground satellite Image data and numerical Simulations

Kick off Meeting: Beijing, May 1<sup>st</sup> 2008  
[www.ceop-aegis.org](http://www.ceop-aegis.org)

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EU 7<sup>th</sup> Framework Program ENVIRONMENT - Improving observing systems for water resource management

2nd CEOP - Geneva, Sept. 15 - 17 2008

# CEOP – AEGIS Participants



<i>Participant organization name</i>	<i>Local contact</i>	<i>Country</i>
Université Louis Pasteur LSIIT ULP	Massimo Menenti	France
International Institute for Geo-information science and Earth Observation ITC	Bob Su	The Netherlands
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University of Bayreuth UBT	Thomas Foken	Germany
Alterra - Wageningen University and Research Centre	Li Jia	The Netherlands
University of Valencia UVEG	José Sobrino	Spain
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China Meteorological Administration CMA – Beijing	Liping Liu	China
Beijing Normal University BNU – Beijing	Li Xiaowen	China
National Institute of Hydrology NIH - Rorkee	K.D.Sharma	India
University of Tsukuba – UNITSUK	Kenichi Ueno	Japan
WaterWatch	Wim Bastiaanssen	The Netherlands
Cold and Arid Regions Environmental and Engineering Research Institute CAREERI–Lanzhou, Gansu	Wang Jian	China
University of Ferrara	Federico Porcù	Italy
Institute of Geographical Sciences and Natural Resources Research IGSNRR CAS – Beijing	Liu Changming	China
Institute for Remote Sensing Applications IRSA CAS – Beijing	Liu Qinhua	China
Future Water	Walter van Immerzeel	The Netherlands

# Water resources, hydrometeorology and Asian Monsoon

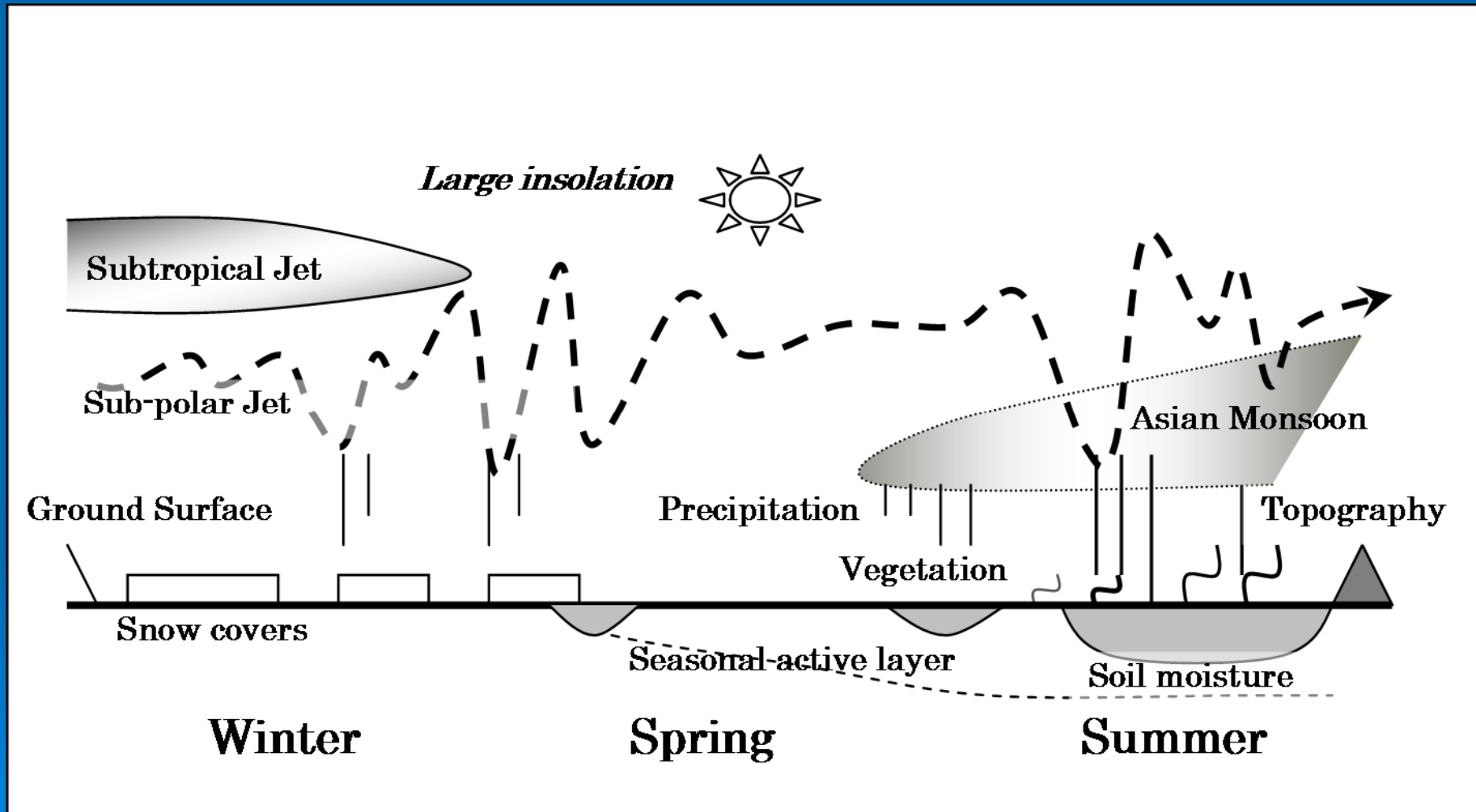


## ➤ Qinghai Tibet Plateau :

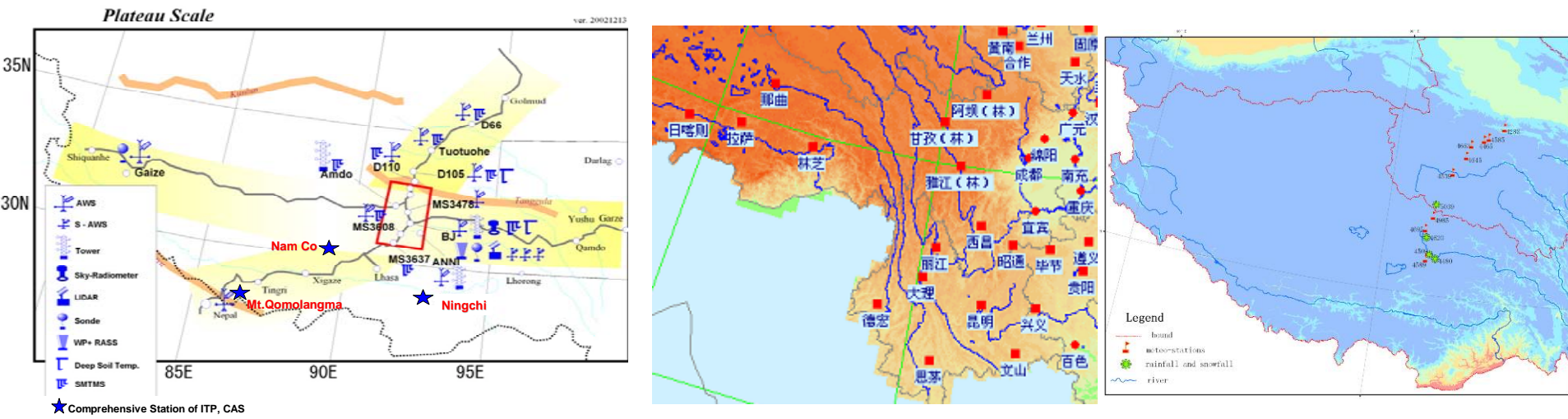
- Headwater area of seven major rivers in SE Asia
- Regulating area for the climate of China and of the Eastern Hemisphere as a whole
- Exerts profound thermal and dynamical influences on the onset, maintenance, and withdrawal of the monsoon



# Tibet Plateau Land Surface Processes and Asian Monsoon



# Existing ground network



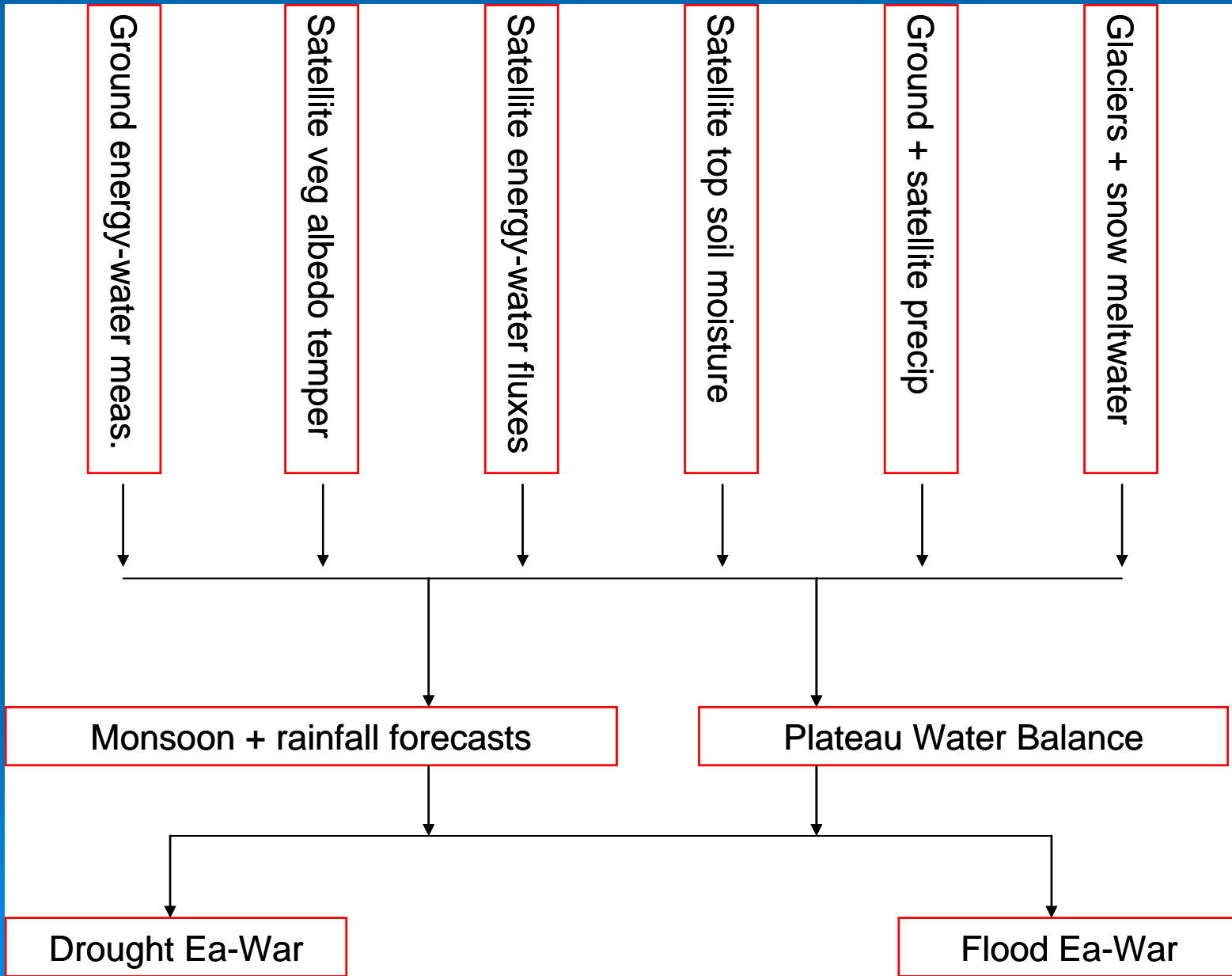
- Qinghai–Tibet Plateau: Location map of hydro-meteorological observatories (left), rain-radars (middle) and nivological stations (green dots, right)

➤ Estimates of the Plateau water balance rely on sparse and scarce observations

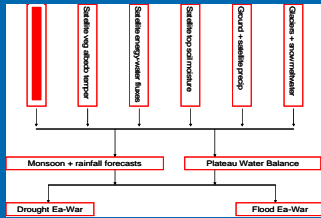
# CEOP-AEGIS Objectives

- Construct an observing system to determine and monitor the water yield of the Plateau
  - Incorporate existing ground measurements and current / future satellites
  - Requires estimating snowfall, rainfall, evapotranspiration and changes in soil moisture
- Monitor the evolution of surface conditions and analyze the linkage with convective activity, precipitation events and the Asian Monsoon
  - Monitor snow, vegetation and surface fluxes as precursors of intense precipitation towards improving forecasts of (extreme) precipitations in SE Asia.

# Interrelation of project technical elements

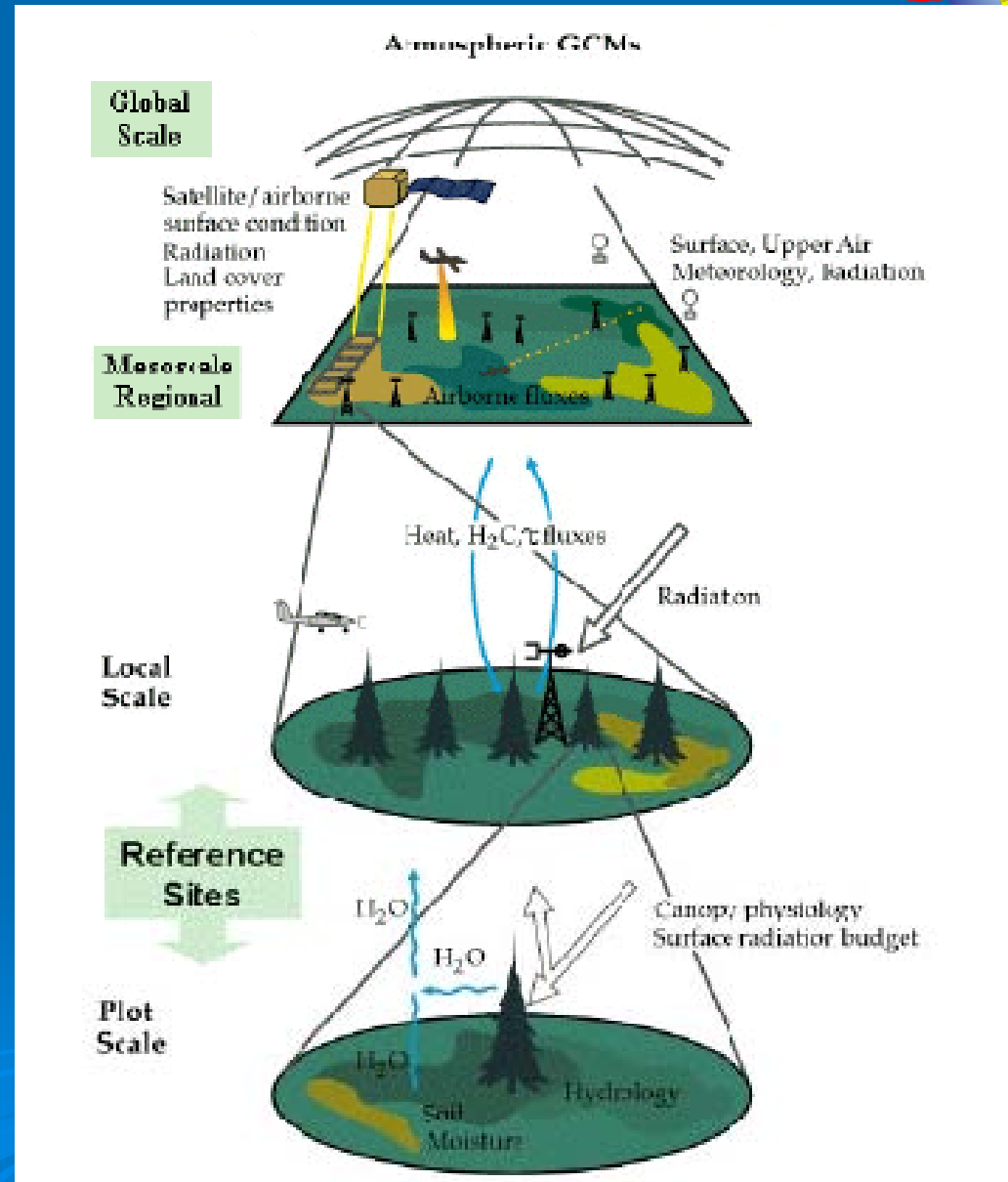


# Measurements at multiple resolutions



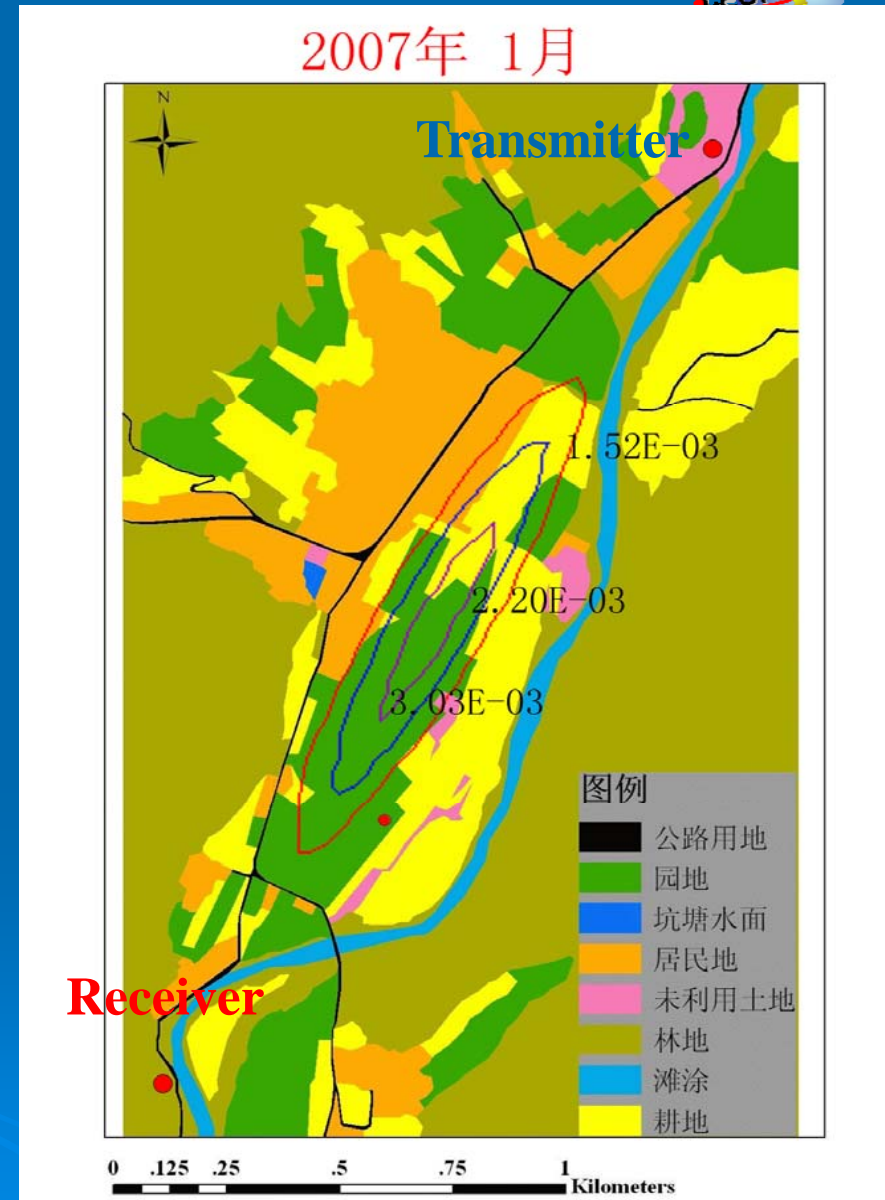
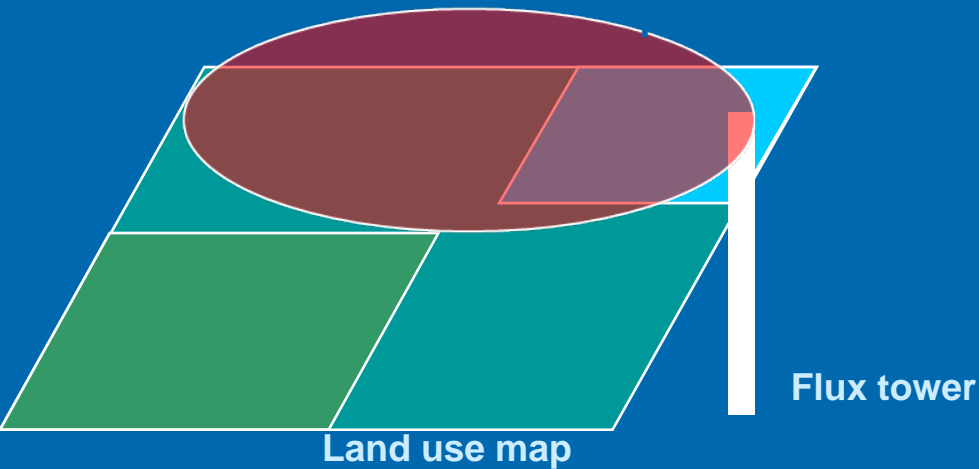
## The challenges:

- matching the resolution of measurements and the inherent space and time scale of processes
- matching the nature of feasible observations and the variables defined by models





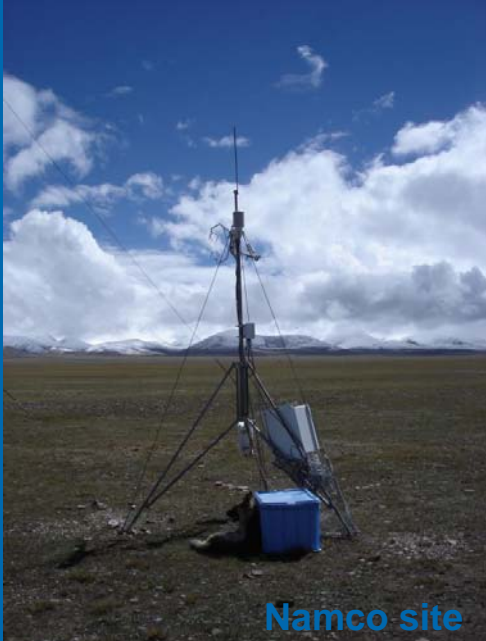
# Eddy covariance, scintillometers and footprints



Monthly variation of LAS  
flux contribution area

(8:00am -17:00pm Jan – Dec, 2007)

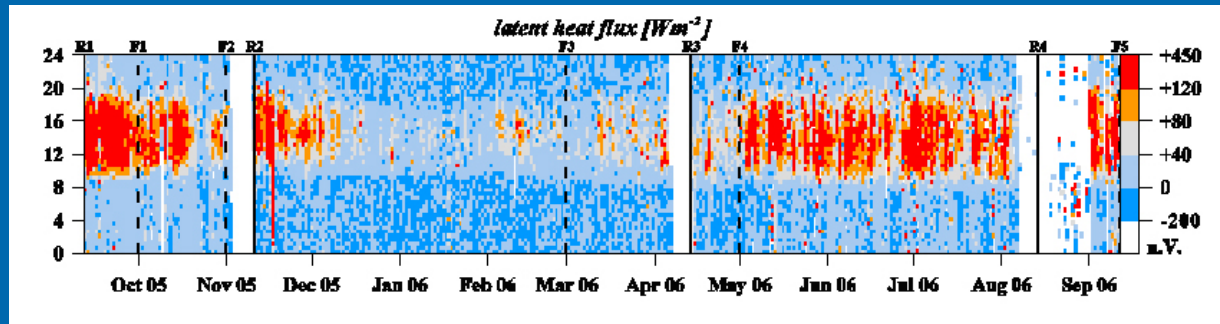
# Previous work: Analysis of data quality of Tibetan energy balance measurements



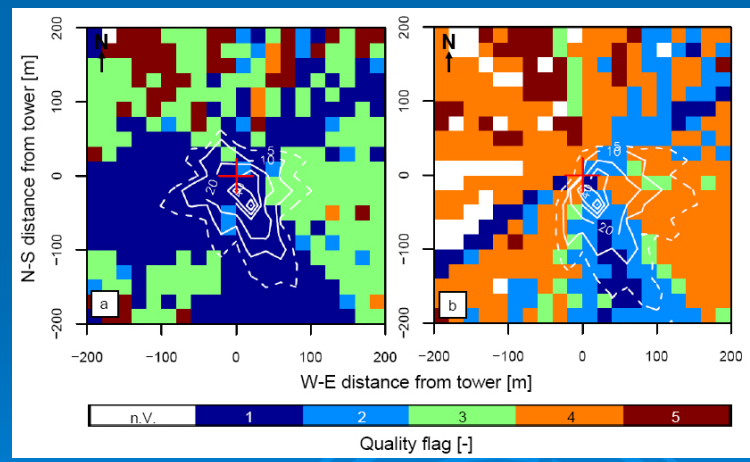
Namco site



New Everest site

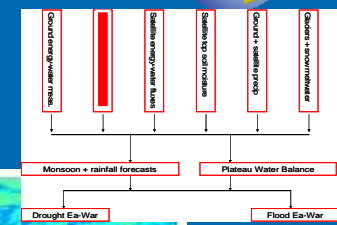


footprint

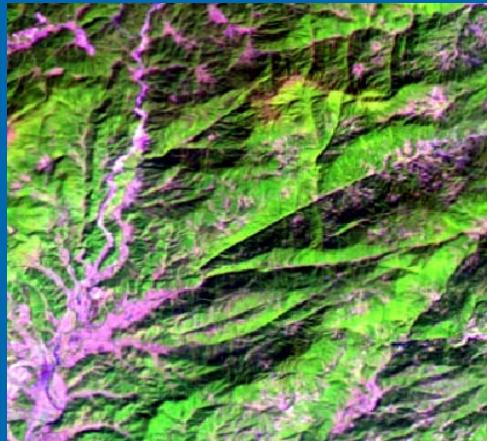


Metzger et al., Adv. Earth Sci. 21 (2006) 1260-1267

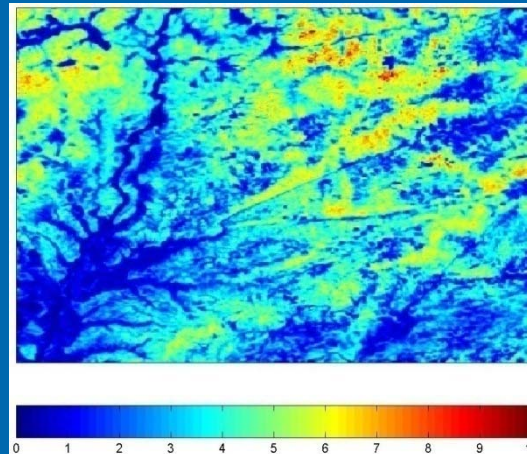
# Retrieval of surface variables with a family of multi-spectral imaging radiometers



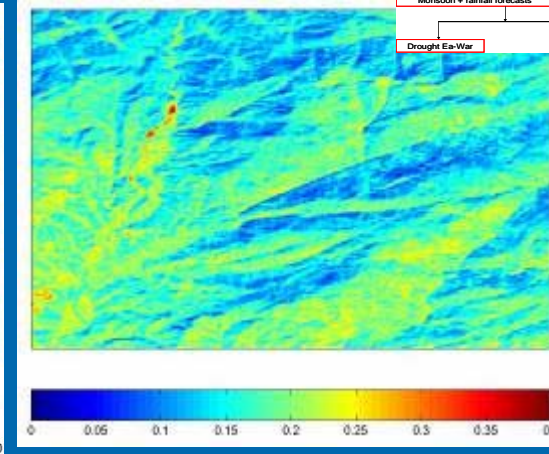
## 1) High resolution RS data, e.g. LANDSAT/TM



Reflectance of Landsat/TM

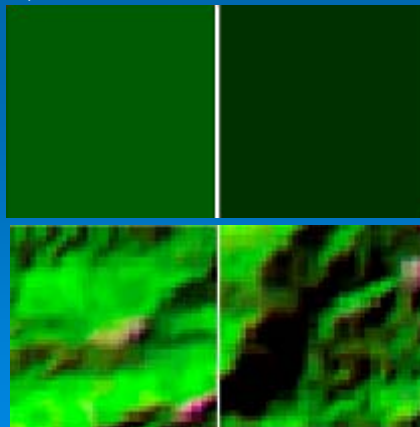


LAI of Landsat/TM

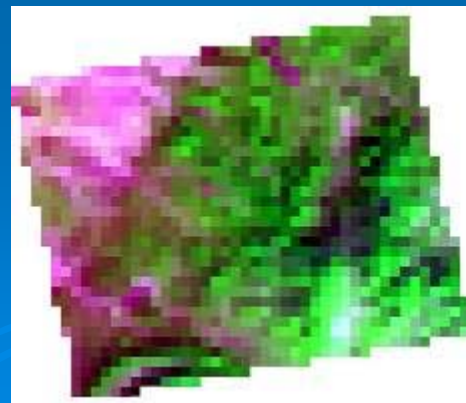


Albedo of Landsat/TM

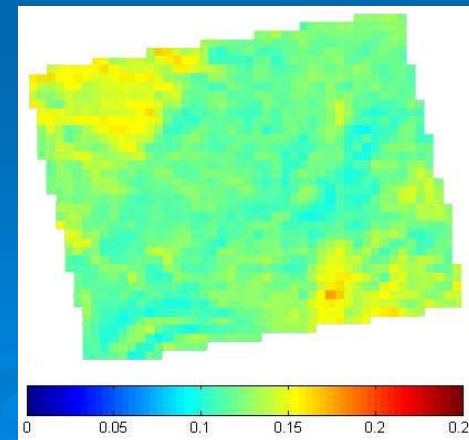
## 2) Low resolution RS data, e.g. MODIS or AVHRR



Sub-topography in low resolution pixel



MODIS 1km reflectance  
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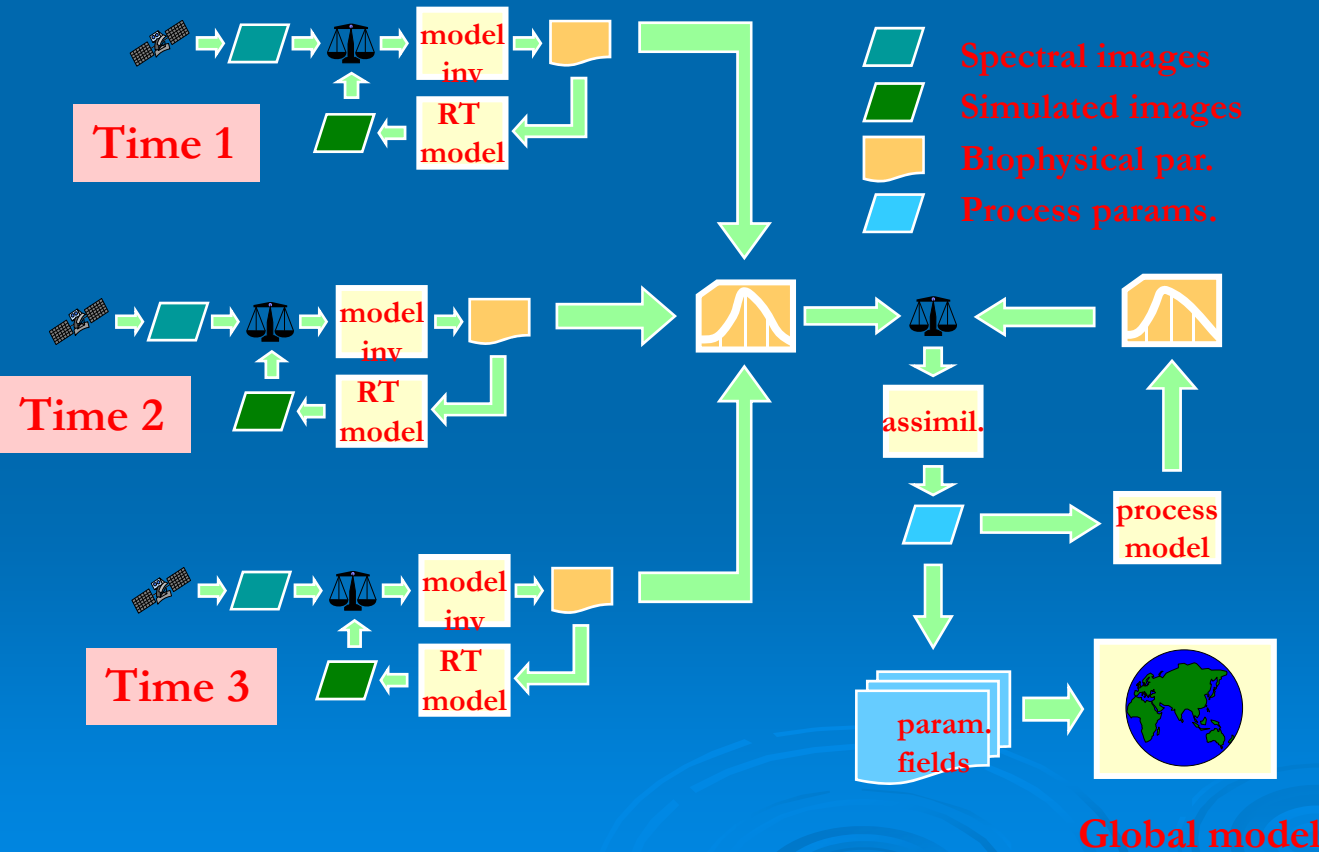


MODIS 1km albedo

# Generic inversion of spectro-directional radiometric data

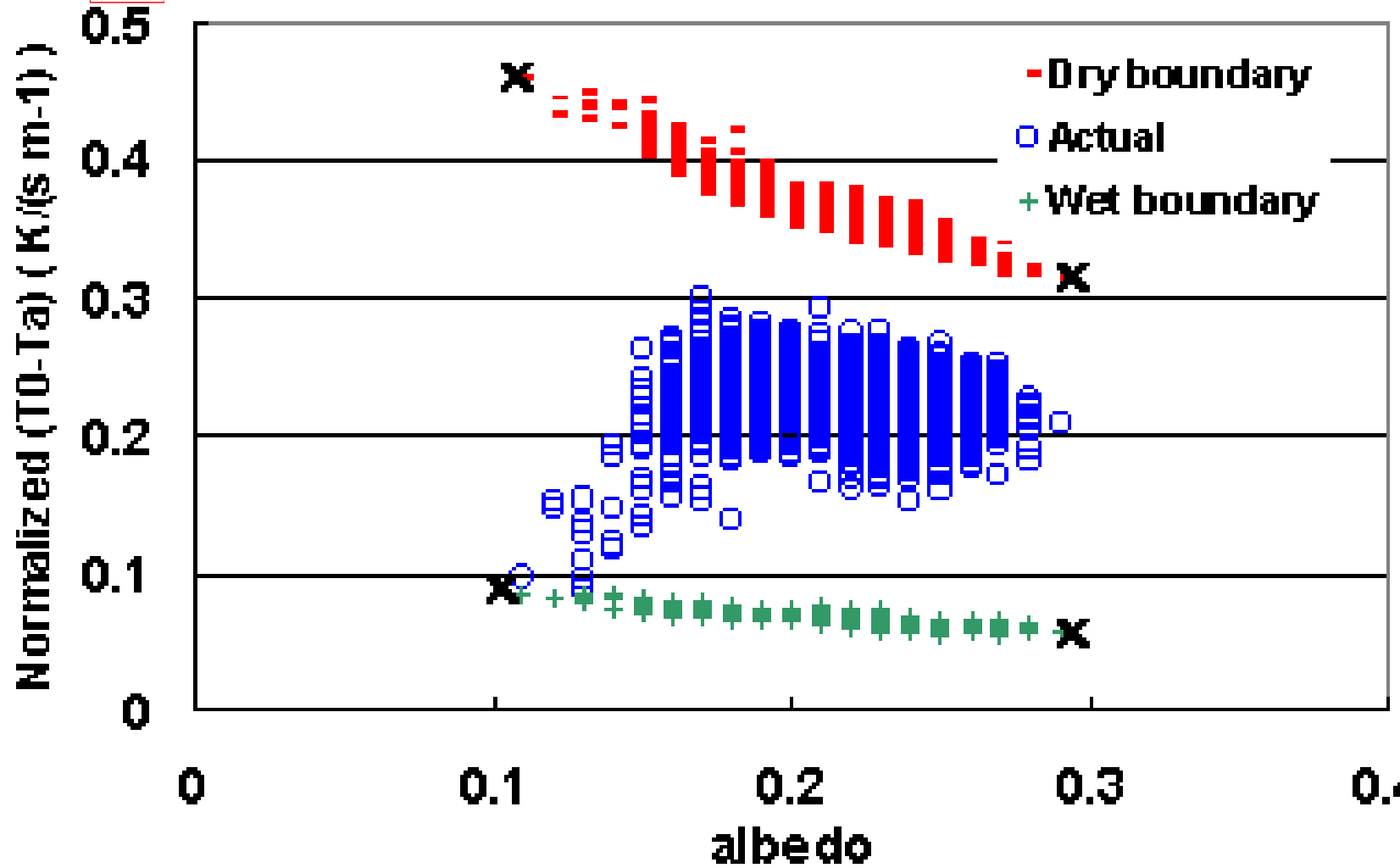
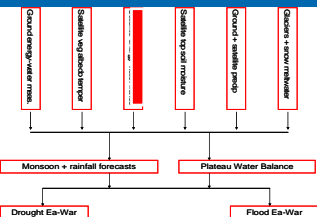


Modelling radiative transfer + biosphere processes to assimilate radiometric data with varying spectral coverage and sampling

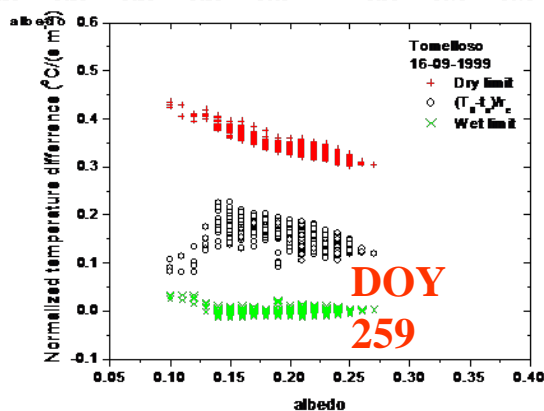
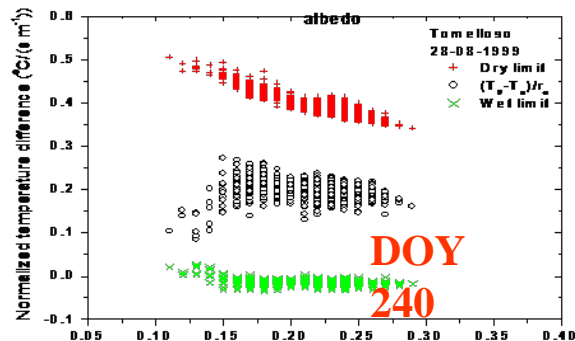
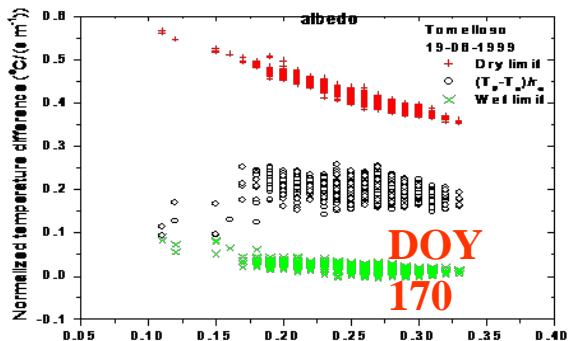
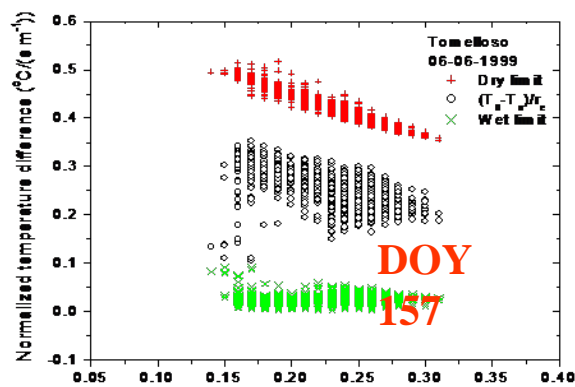
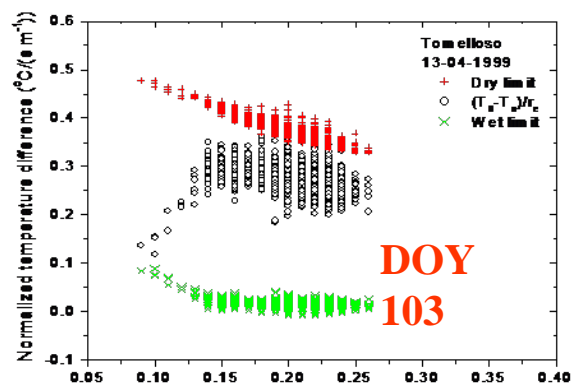


- Assumptions on canopy structure are unavoidable when taking view and illumination geometry into account.
- Independent measurements of canopy height and plant spacing can potentially improve accuracy and generality of algorithms

# Surface Energy Balance Index: dry and wet reference states



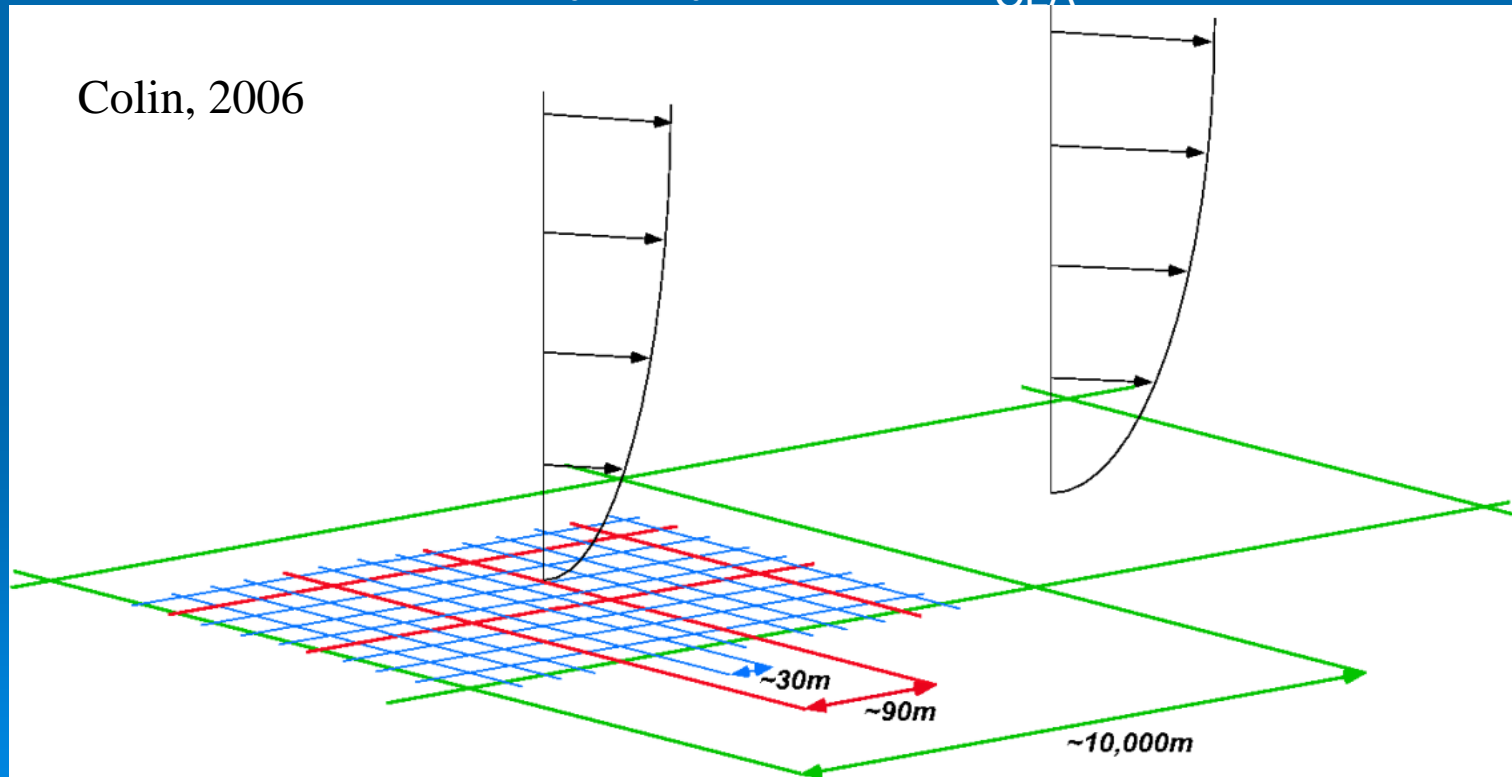
# Monitoring land surface state



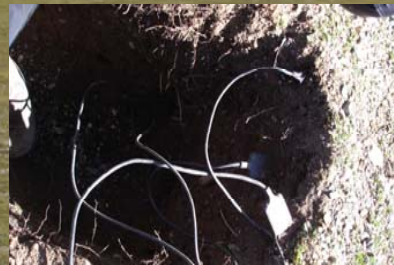
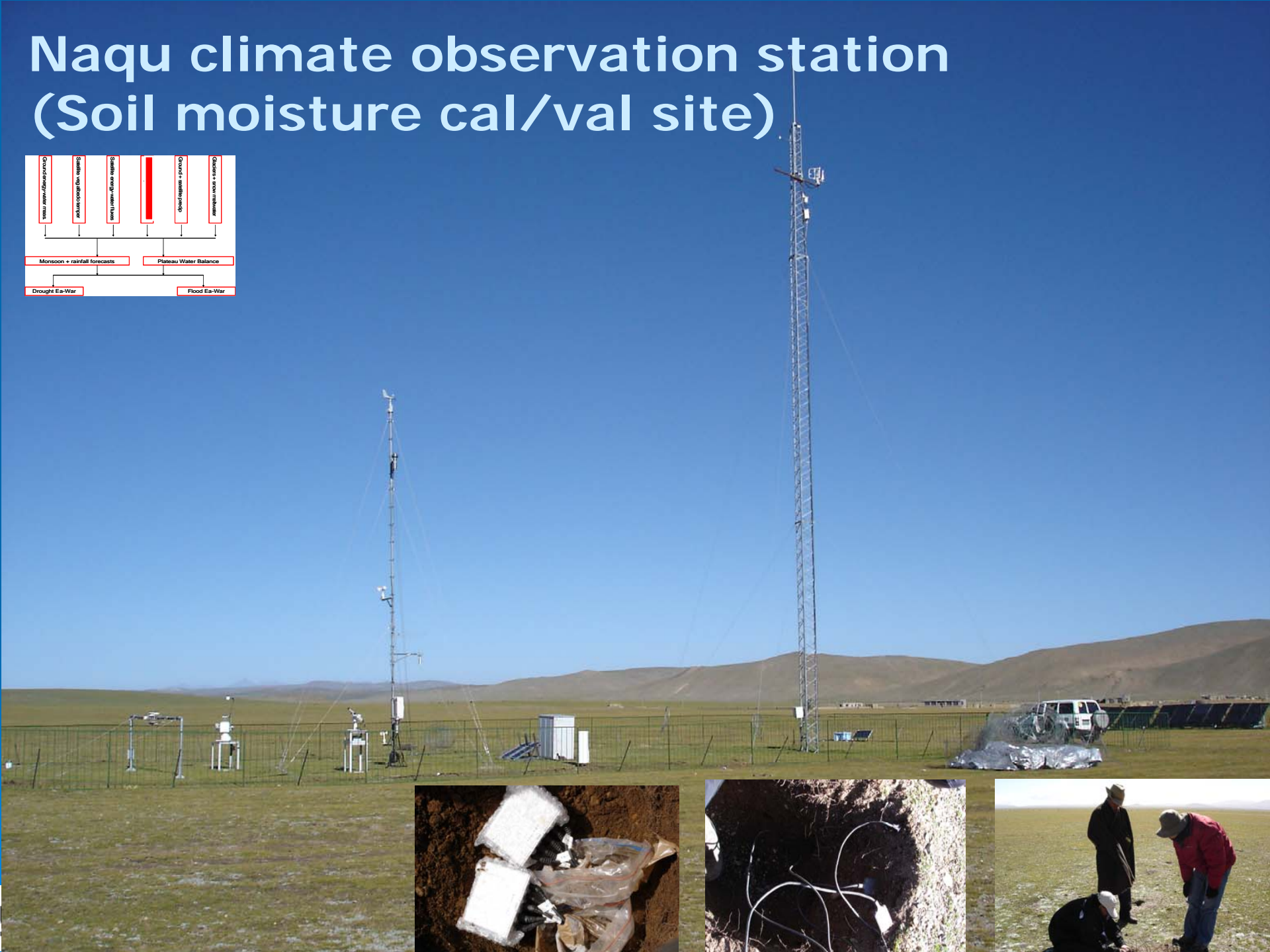
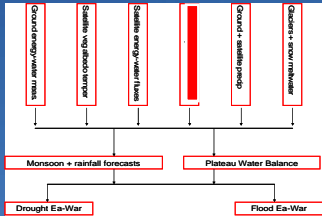
# MSSEBS : a multi-scale approach



- MSSEBS : Multi-Scale Surface Energy Balance System
- Grid size depends on inherent spatial scales of land surface and CBL: Surface properties:  $\sim 30\text{m}$
- Convective Boundary Layer :  $\sim 10 \cdot h_{CLA}$



# Naqu climate observation station (Soil moisture cal/val site)

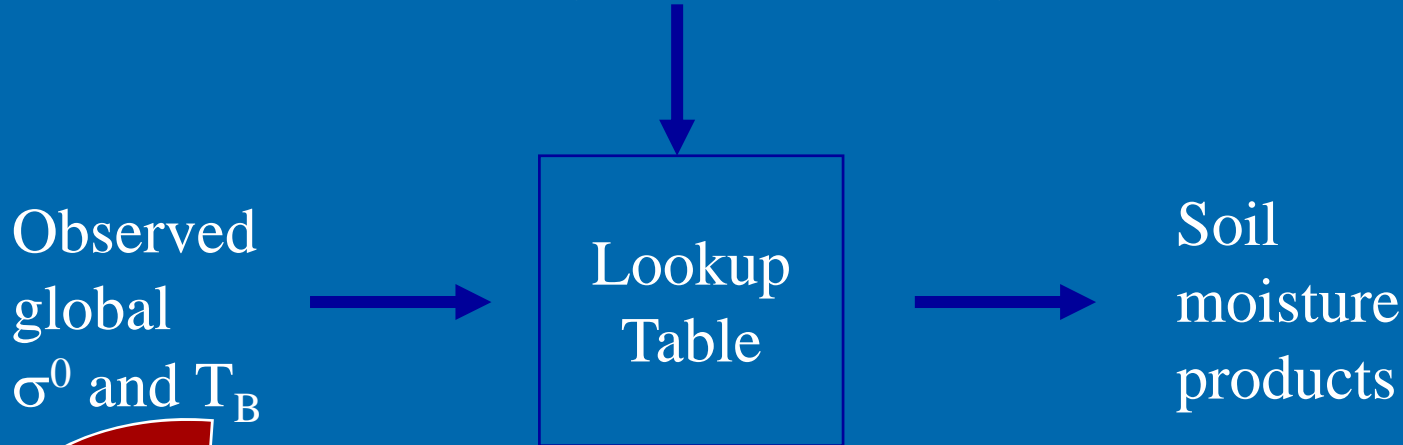




# Model Inversion

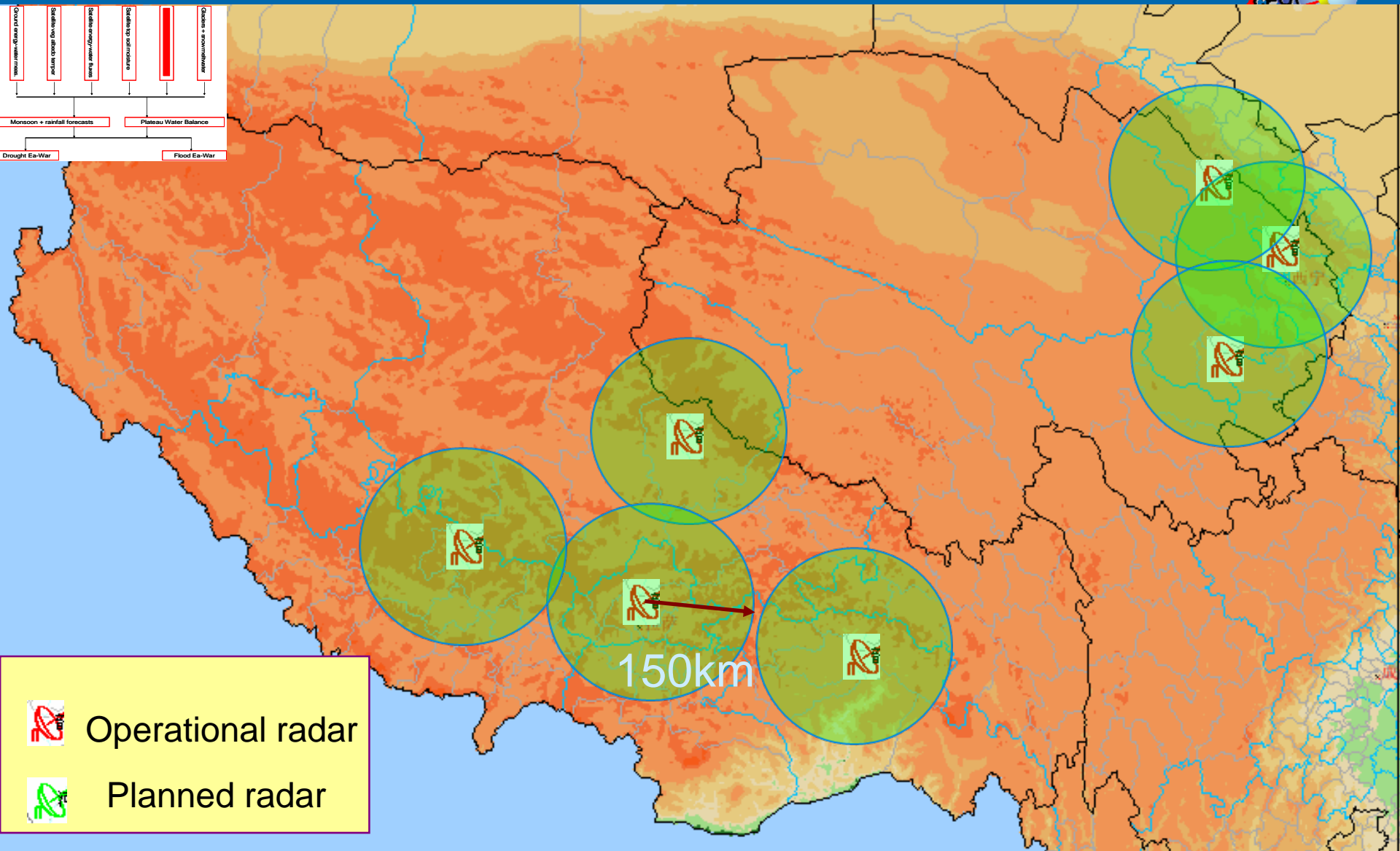
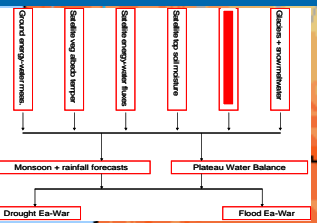




Simulation database obtained by running the developed model for a wide range of soil and vegetation parameters



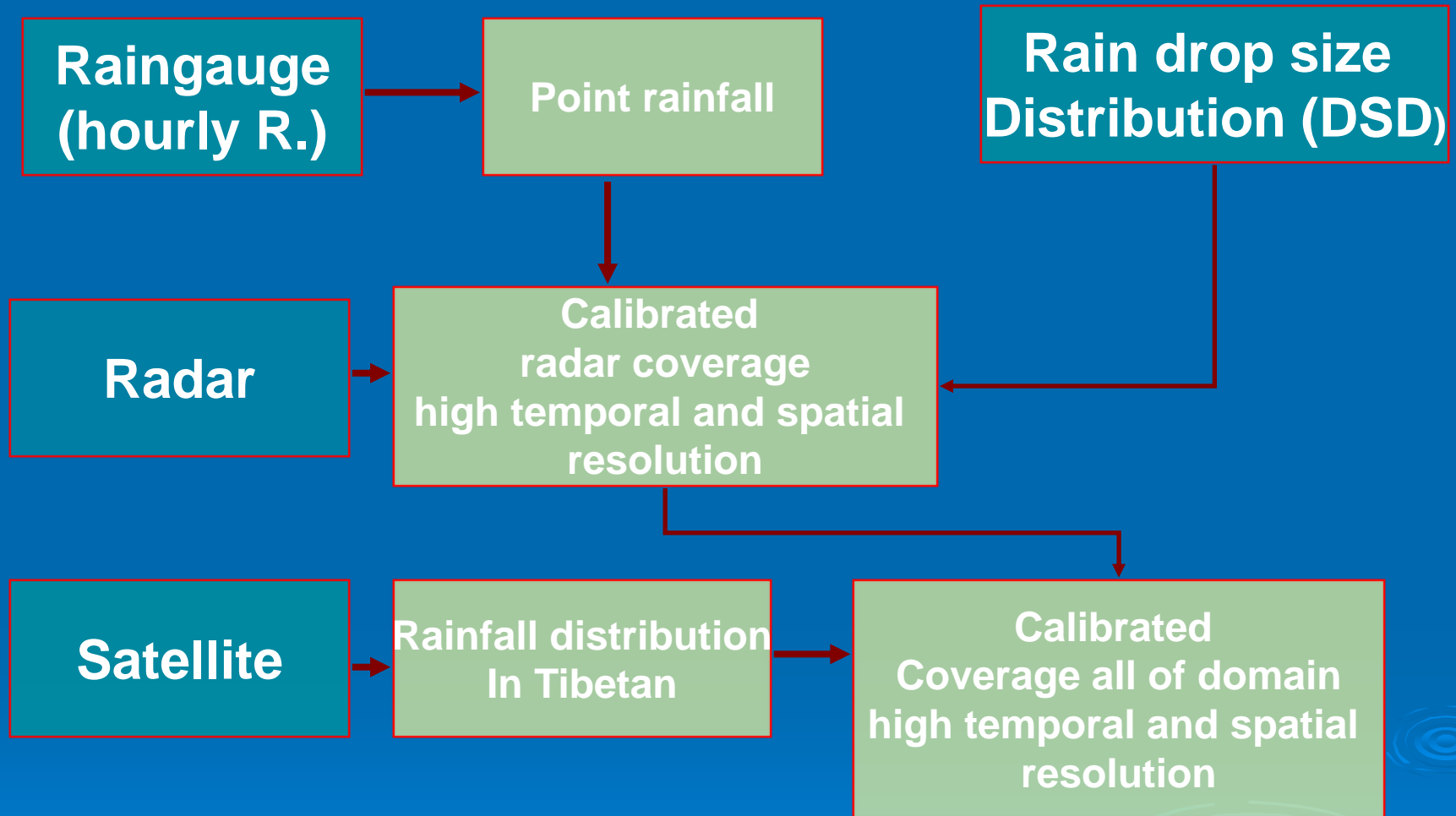
SENSOR NAME	ACQUIS. TIME	FREQ. (GHz)	RES. (km)	REV. TIME
AMSR-E AQUA	2002 – now	6.9, 10.6, etc.	56, 38, etc.	4
MIRAS SMOS	from 2008	1.4	35	1-3
WSC ERS-1/2	1991 – now	5.3	50	3-4
ASCAT METOP	2006 – now	5.255	25-50	1-2

# C band Doppler radar network in Qinghai and Tibetan Plateau



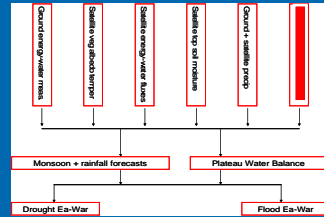
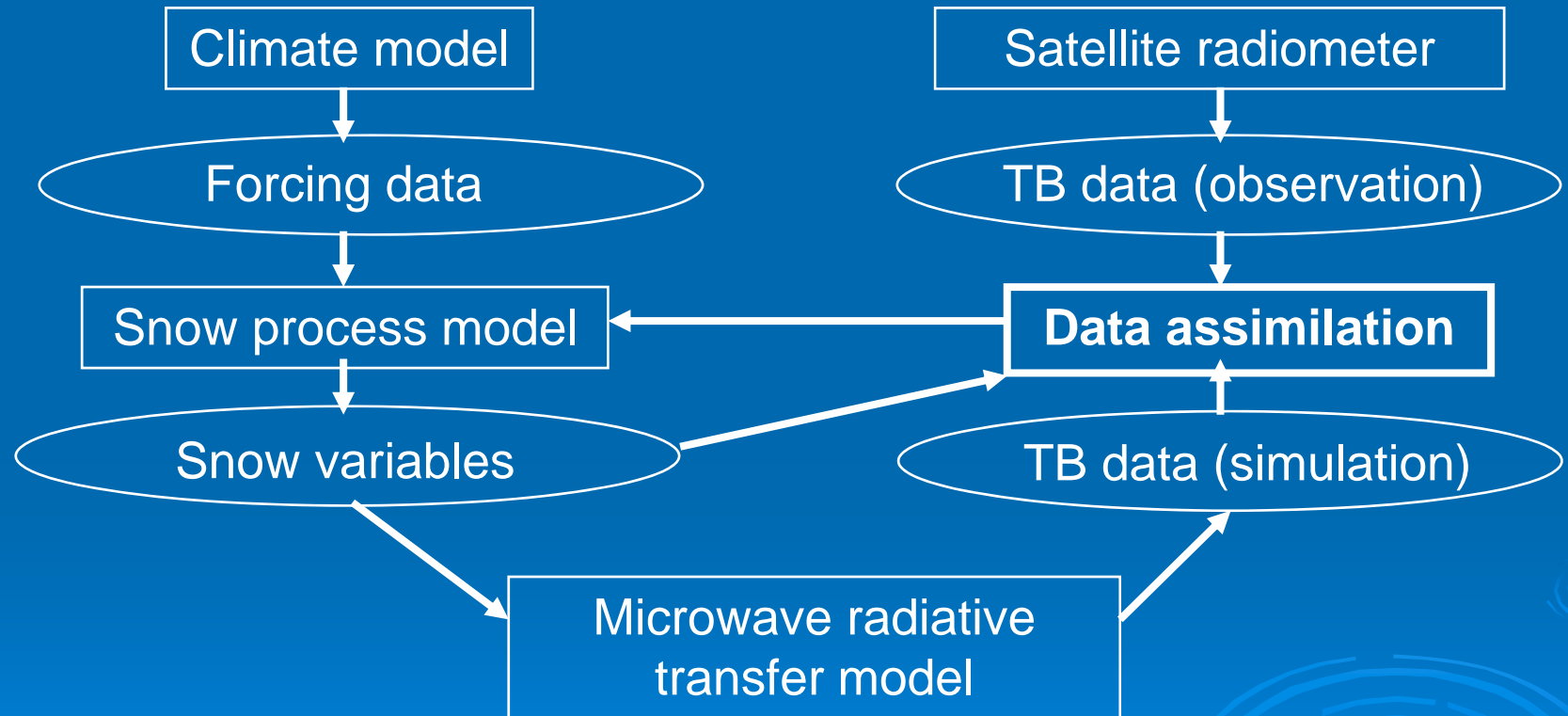
 Operational radar  
 Planned radar

# Raingauges, rainradars and satellites

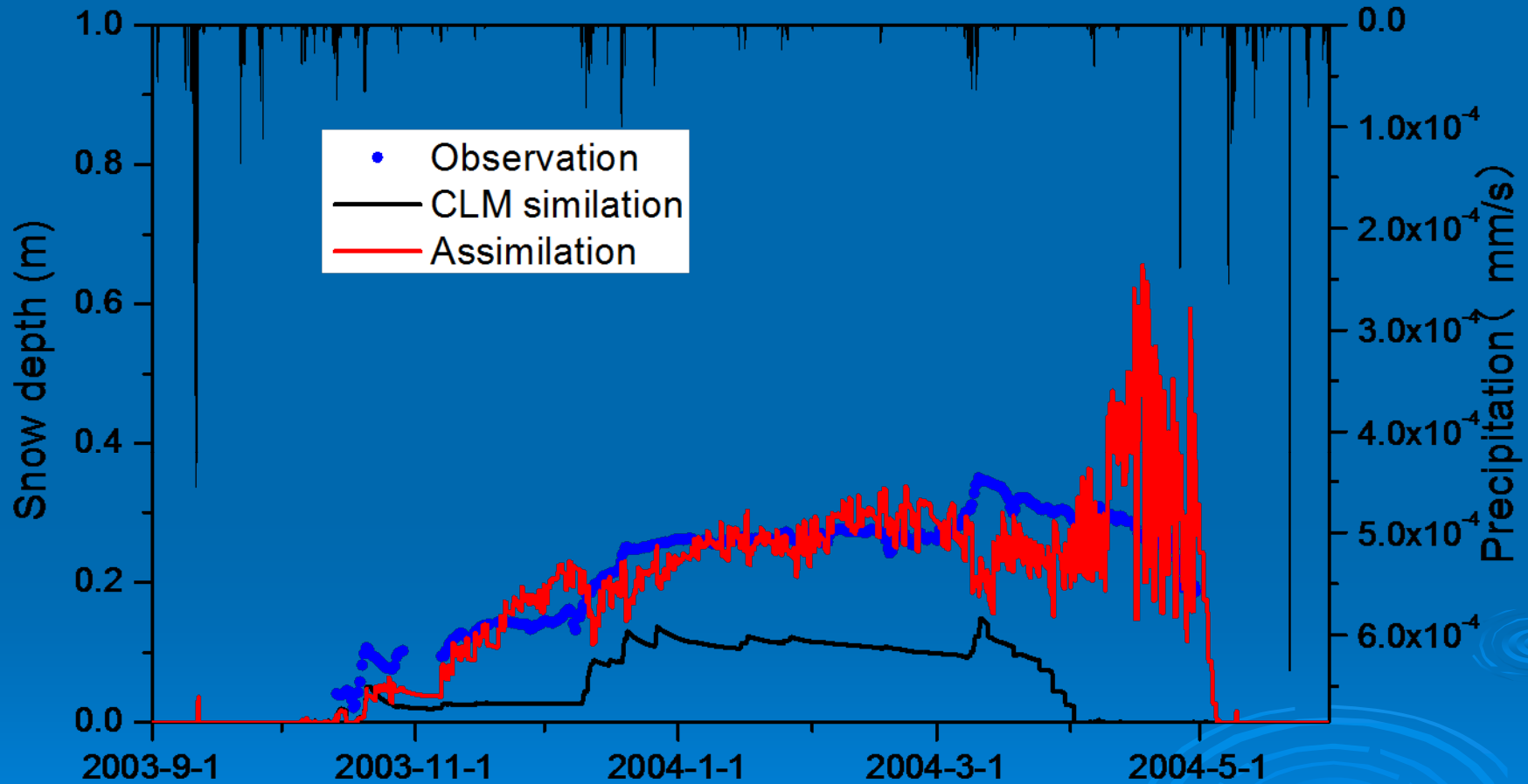


QPE with raingauge, DSD, radar, satellite

## Flow chart of snow data assimilation system



## Assimilation results



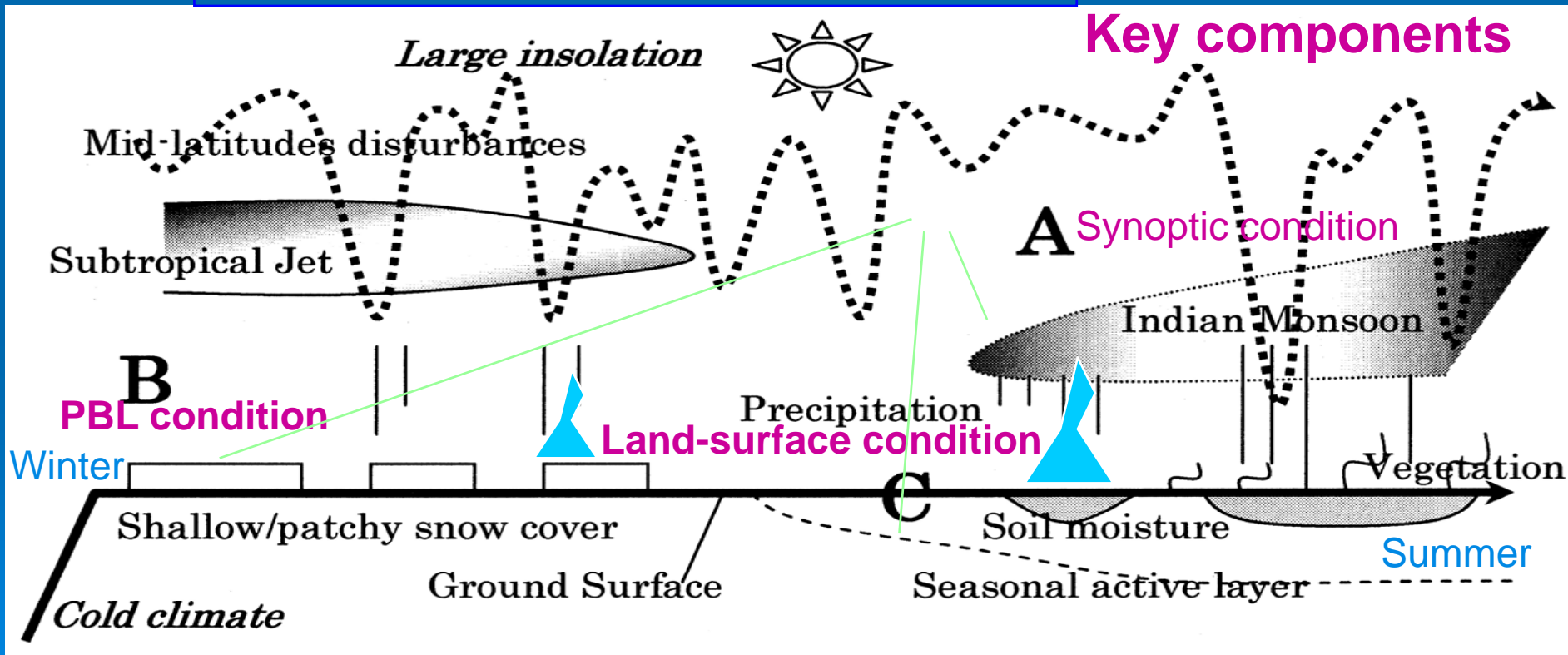
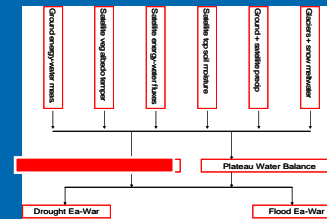
(a)

# Background on land-atmosphere interaction



## Important functions

- Interactions among meso-synoptic scales
- Seasonal changes of the background
- Intra-seasonal variability of monsoon
- Diurnal change of convections



## Importance of seasonal progress

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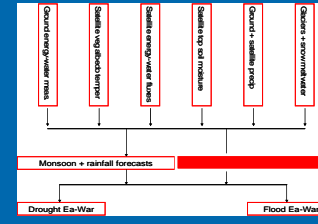
# CMA NWP system GRAPES\_30km → GRAPES\_15km



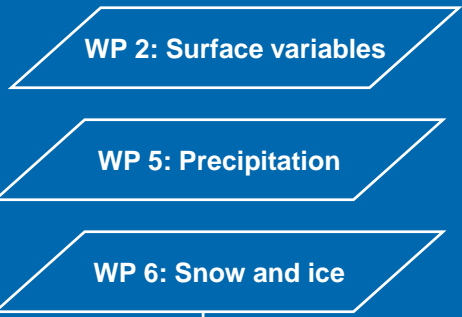
Jian SUN Xueshun SHEN Dehui CHEN Jishan XUE  
*State Key Laboratory of Severe Weather*  
*Chinese Academy of Meteorological Sciences*

- **Implement complex physics scheme**
  - **Land surface:** RUC, NOAH, SSIB(?)
  - Microphysics: WSM, CAMS
  - PBL: YSU, CAMS
- **Tuning the vertical coordinate and the temperature reference profile**
- **Improve performance on super-computer**
  - Accelerating solver of Helmholtz equation by GCR, MG

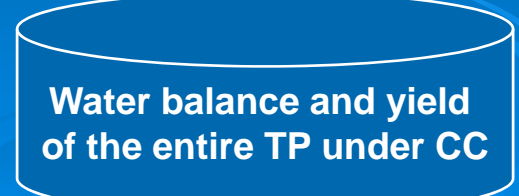
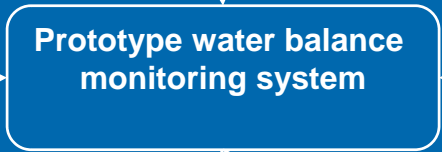
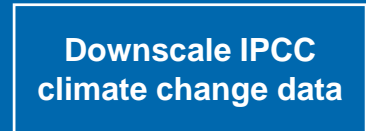
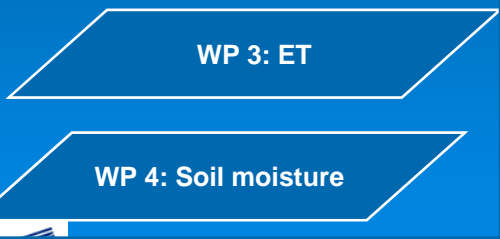
# Water Balance Model Qinghai – Tibet Plateau



## Model forcing

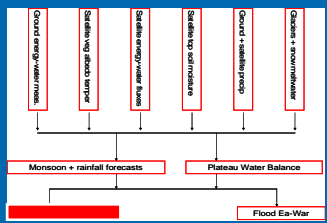
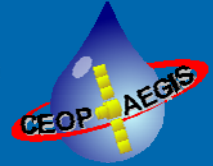


## Model calibration

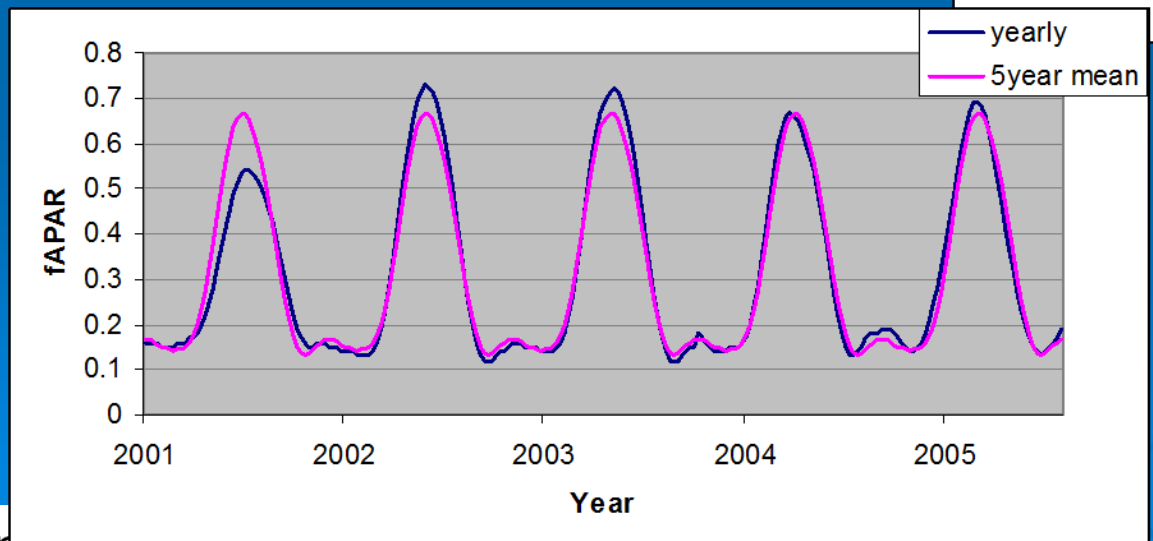
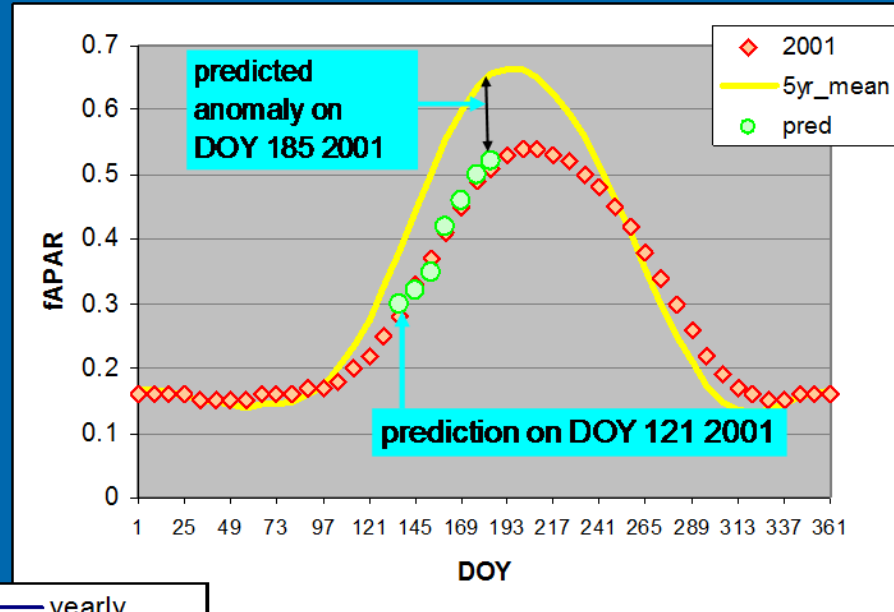




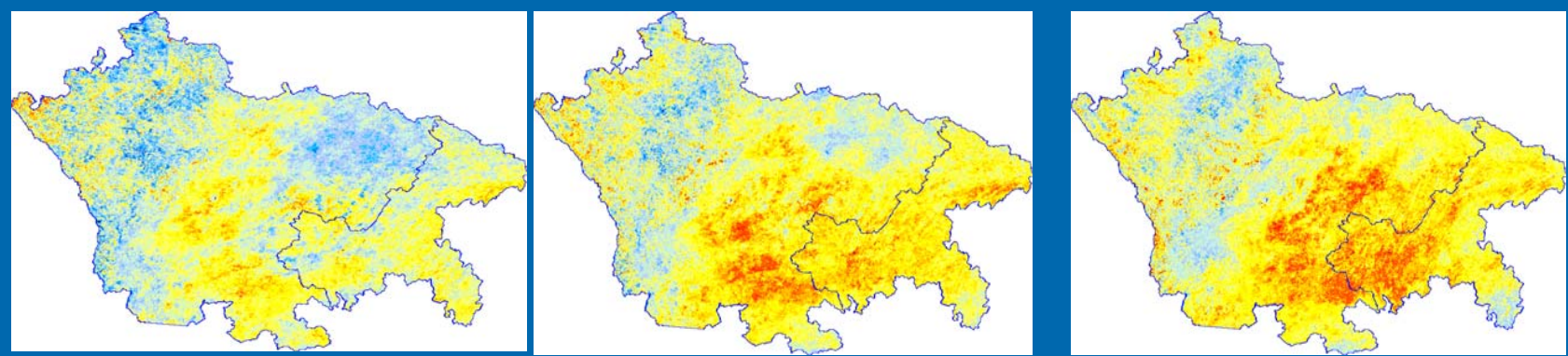
# Early warning and prediction of drought events



**Prediction:** through modeling of time series by Fourier series, wavelets, Markov chains, etc. **per pixel** over entire country.



# LST anomaly Sichuan-Chongqing 2006 drought



May

June

July

August

September





**Thank you!**

Contact

[www.ceop-aegis.org](http://www.ceop-aegis.org)

poster on show