Water and Energy Budget Study (WEBS)

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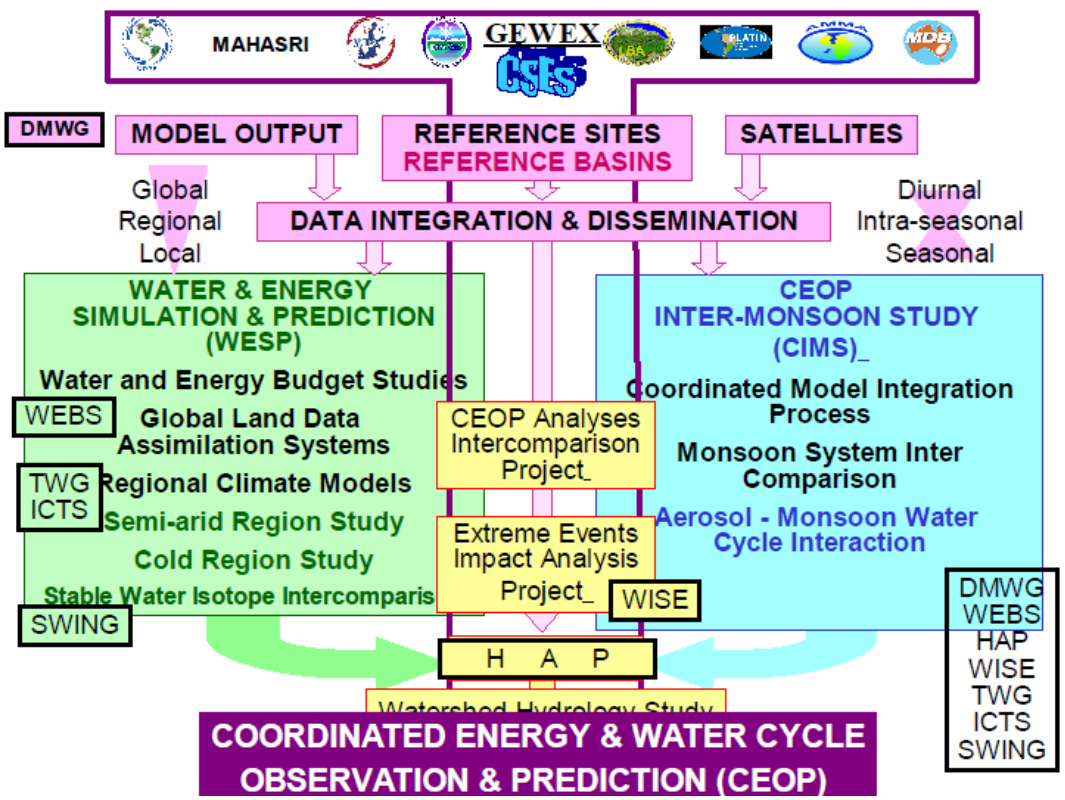


Objectives

- Determine and understand average values and temporal variability for components of the water and energy cycles
- Identify systematic errors and uncertainty of various types of water and energy data (in situ, model, satellite, etc.)
- Identify the variability of water and energy budget of regional hydroclimate phenomena with particular attention to
  - Extreme events
  - Hydroclimate hot spot

WEBS actions proposed by ECPC

- Evaluate global water cycle using model intercomparison and parameterization sensitivity experiments (Objective #2, #3)
  - Land-surface, convective, and boundary layer schemes
  - Diurnal → Interannual variability
- Identify and focus on regions where water cycle simulation has trouble (Objective #3)
  - Overlap with semi-arid and cold region studies
  - Identify remotely-sensed datasets that will be useful
- Examine the vertical profiles of water cycle exchanges throughout column and their temporal variability (Objective #3)

WEBS actions proposed by UT

- Global and regional CEOP inter-comparison study → Objectives #2 and #3
  - Identify model deficiencies in simulating diurnal, seasonal, and annual precipitation pattern and water and energy budget (2007-2008)
  - Evaluate satellite products of precipitation and radiation (2007-2009)
  - Compare diurnal cycle of precipitation between TRMM/PR and in situ data (2007-2009).
- Regional hydroclimate hotspot studies in Tibet → Objectives #1 and #2
  - Produce Tibet 10-year soil moisture and surface energy budget by LDAS-UT (2007-2008)
  - Analyze Tibet atmospheric heating and its relation with extreme events in East Asia (2008-2010)
  - Integrated study on Tibet water and energy cycle using model data, satellite data and LDAS-UT (2007-2008)

Highlights

- Evaluate satellite radiation and precipitation products
  - Fix a systematic error in GEWEX-SRB algorithm
- Multi-model inter-comparisons
  - Identify model deficiencies
- Develop flux scheme for bare soil surfaces
  - Improve Tsfc and H simulation
- Develop and validate LDAS-UT
  - Improve estimates of surface energy budget

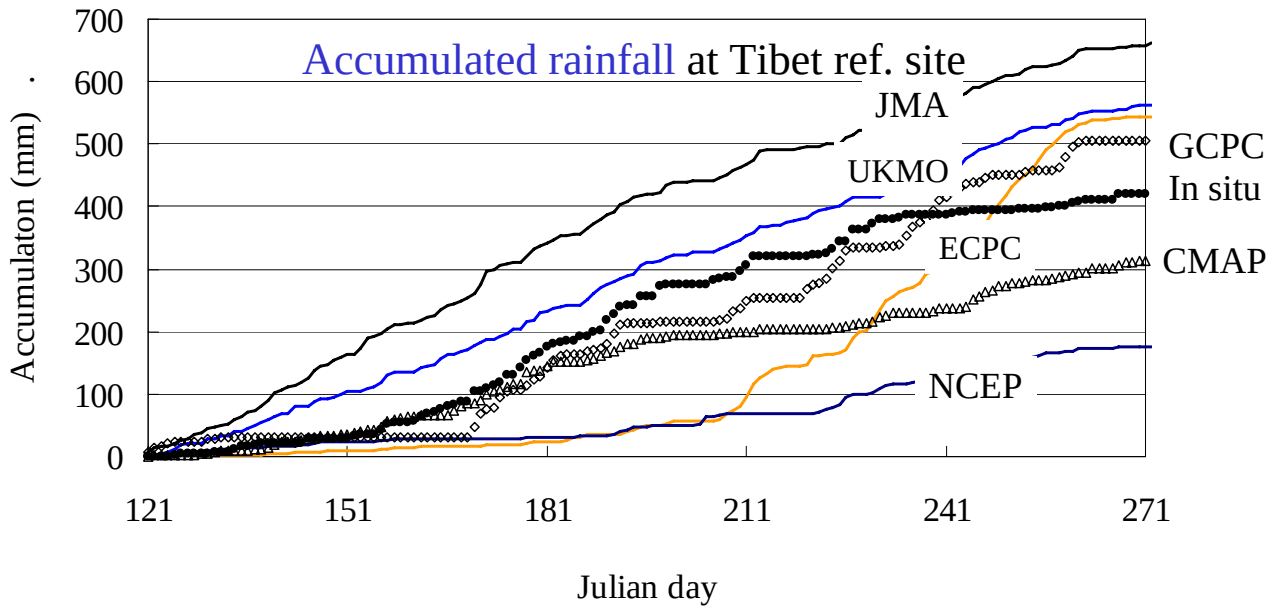
1a. Evaluate ISCCP and GEWEX-SRB radiation (Yang et al., 2006, GRL)

	GEWEX-SRB			
Reference	L95	C06	X06	**Tibet**
SWD MBE	10	-5~-15	-9~28	**-48**
SWD RMSE	25	15~25	22~35	**50**

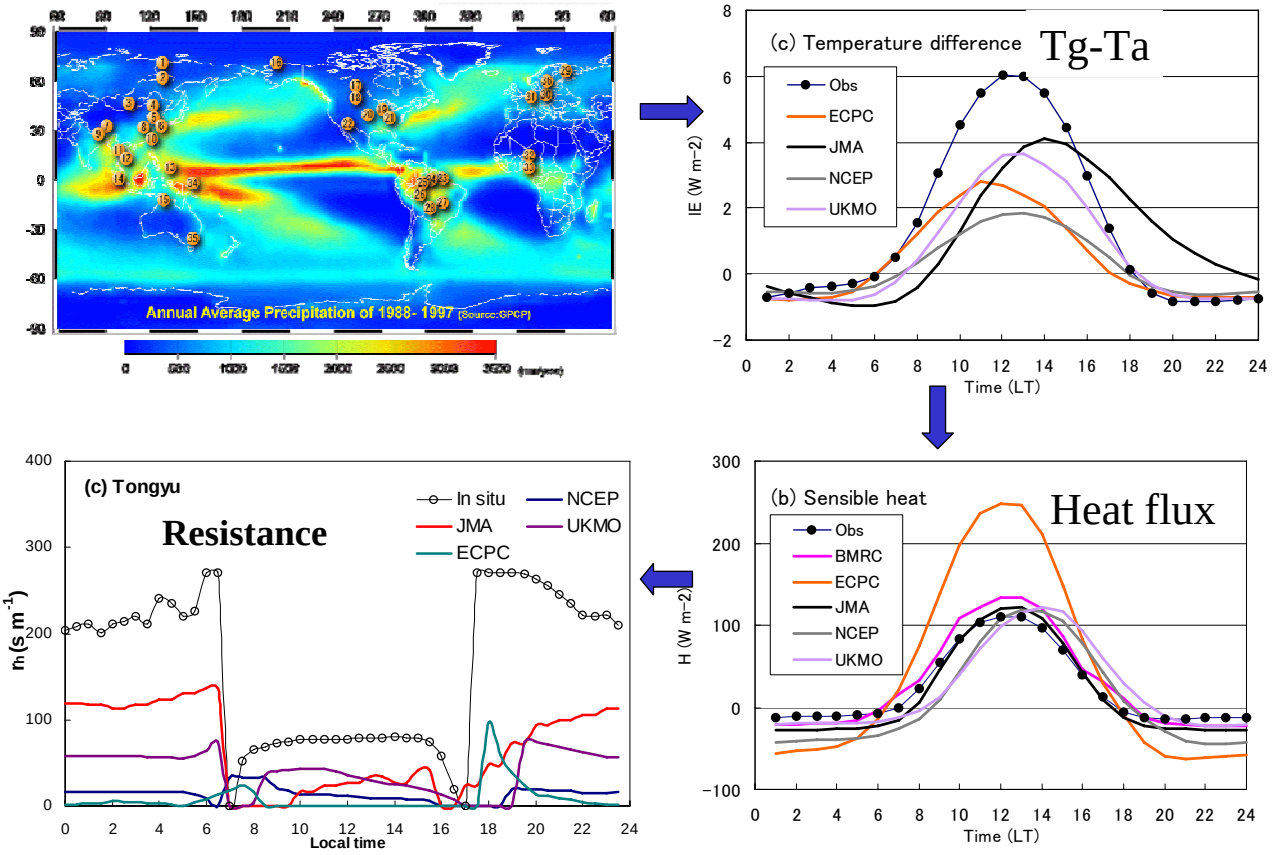
Error (Tibet) >> Error (lowland)

Elevation effects were not accounted for in the SWD product!

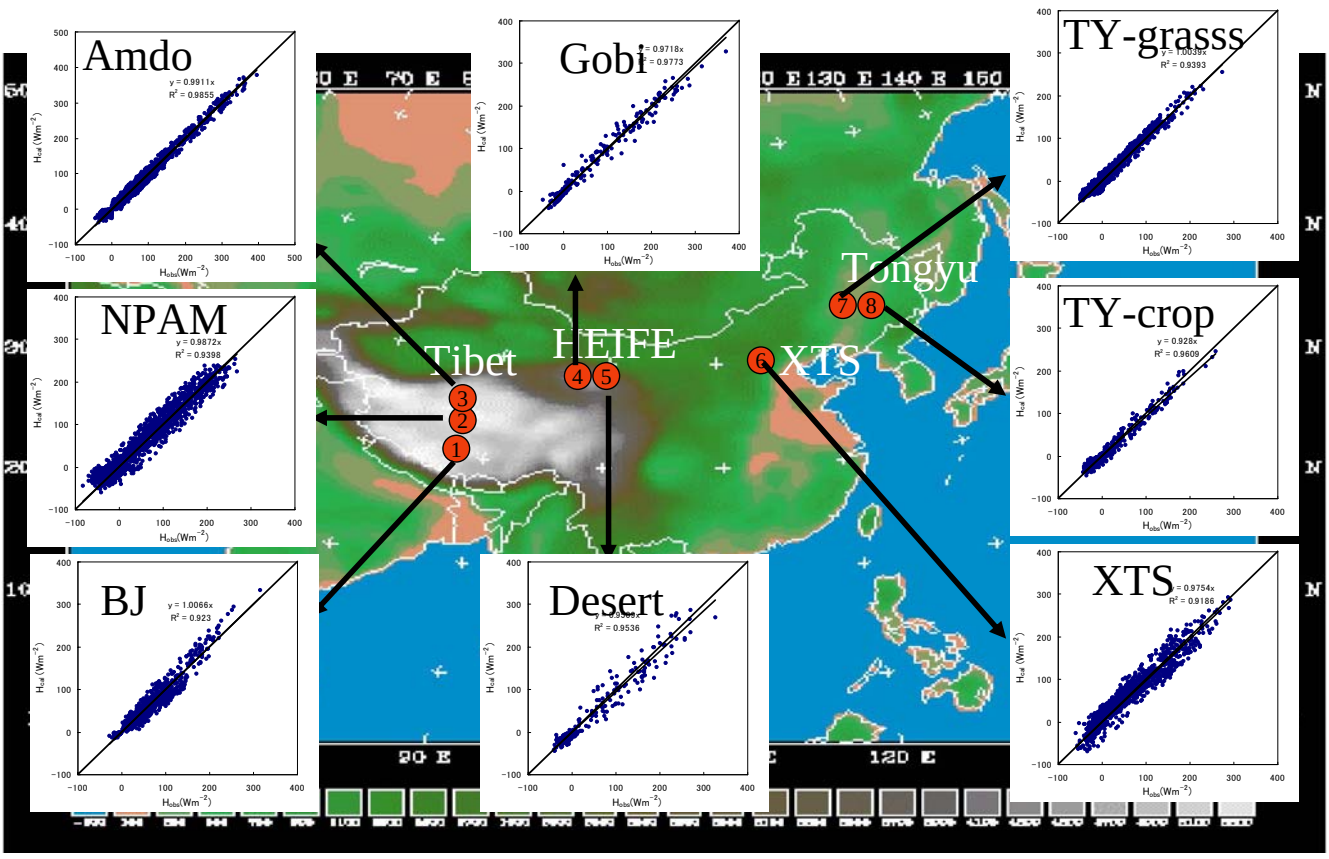
1b. Evaluate satellite and model precipitation



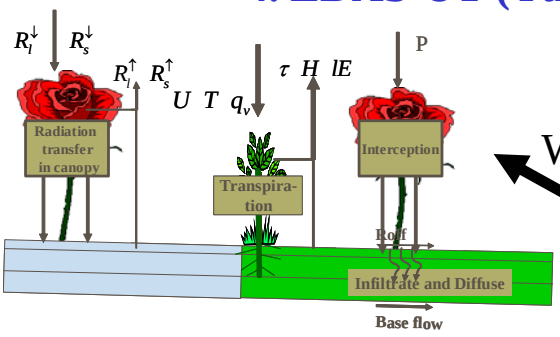
2. CEOP inter-comparison (Yang et al., 2007a, JMSJ CEOP)



3. Heat flux parameterization (submitted to JAMC)



4. LDAS-UT (Yang et al., 2007b, JMSJ CEOP)



Wsfc

Min: cost function
$F(Tb_{obs}-Tb_{sim})$

Revised SiB2 / JMA new SiB

Tb_{obs}

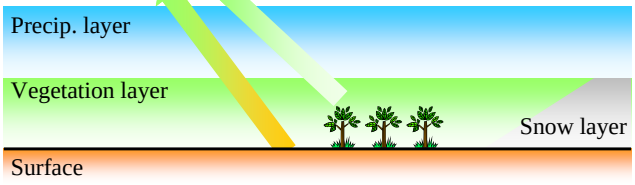
Tb_{sim}

Tg, Tc, Wsfc

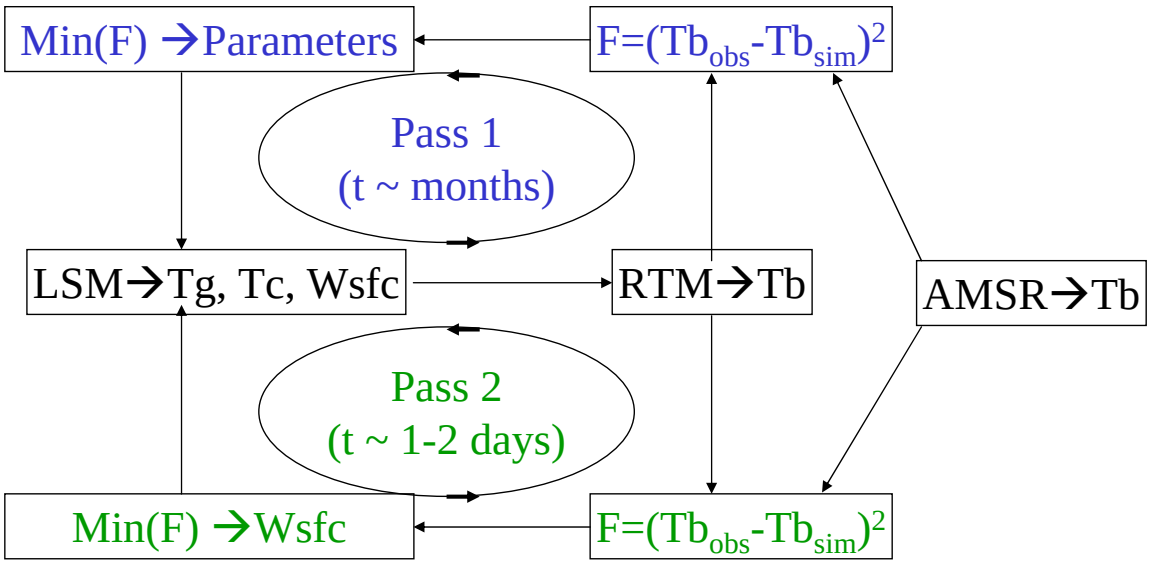
$$T_{bp} = T_g(1-\Gamma_p)\exp(-\tau_c) + T_c(1-\omega)[1-\exp(-\tau_c)][1+\Gamma_p\exp(-\tau_c)],$$

Surface radiation Vegetation emission

Radiative transfer model

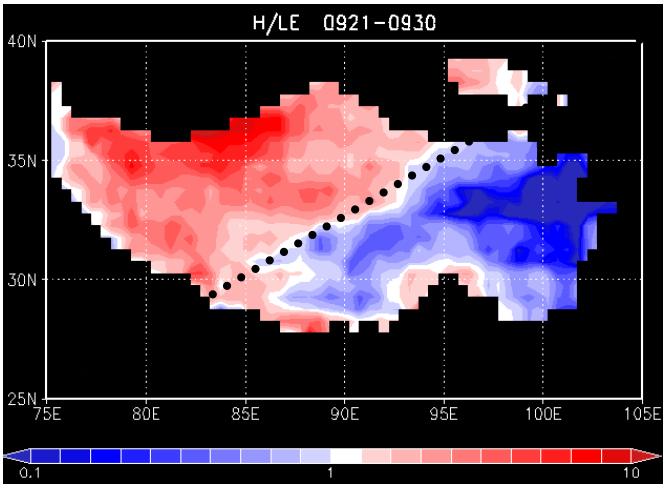


Dual-pass algorithm

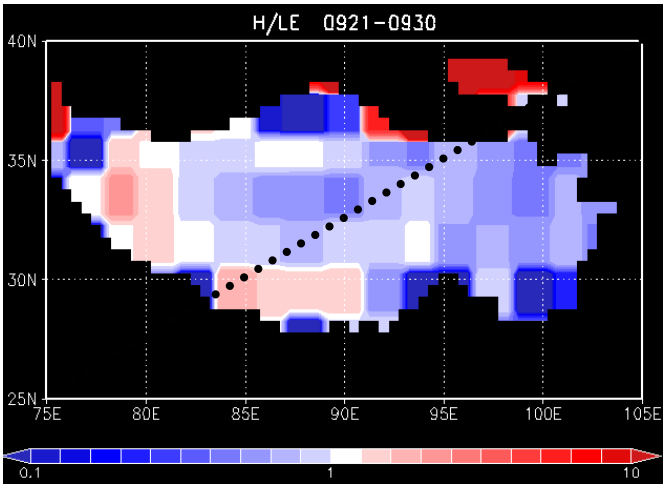


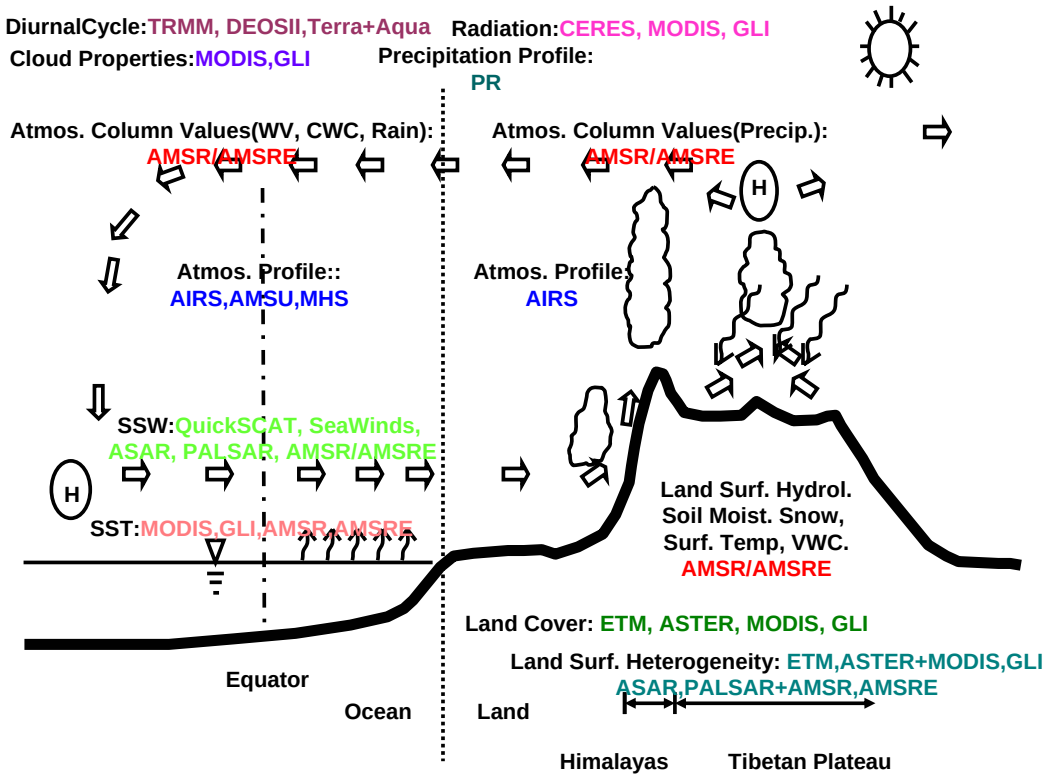
Seasonality of distributed Bowen Ratio (2003)

LDASUT



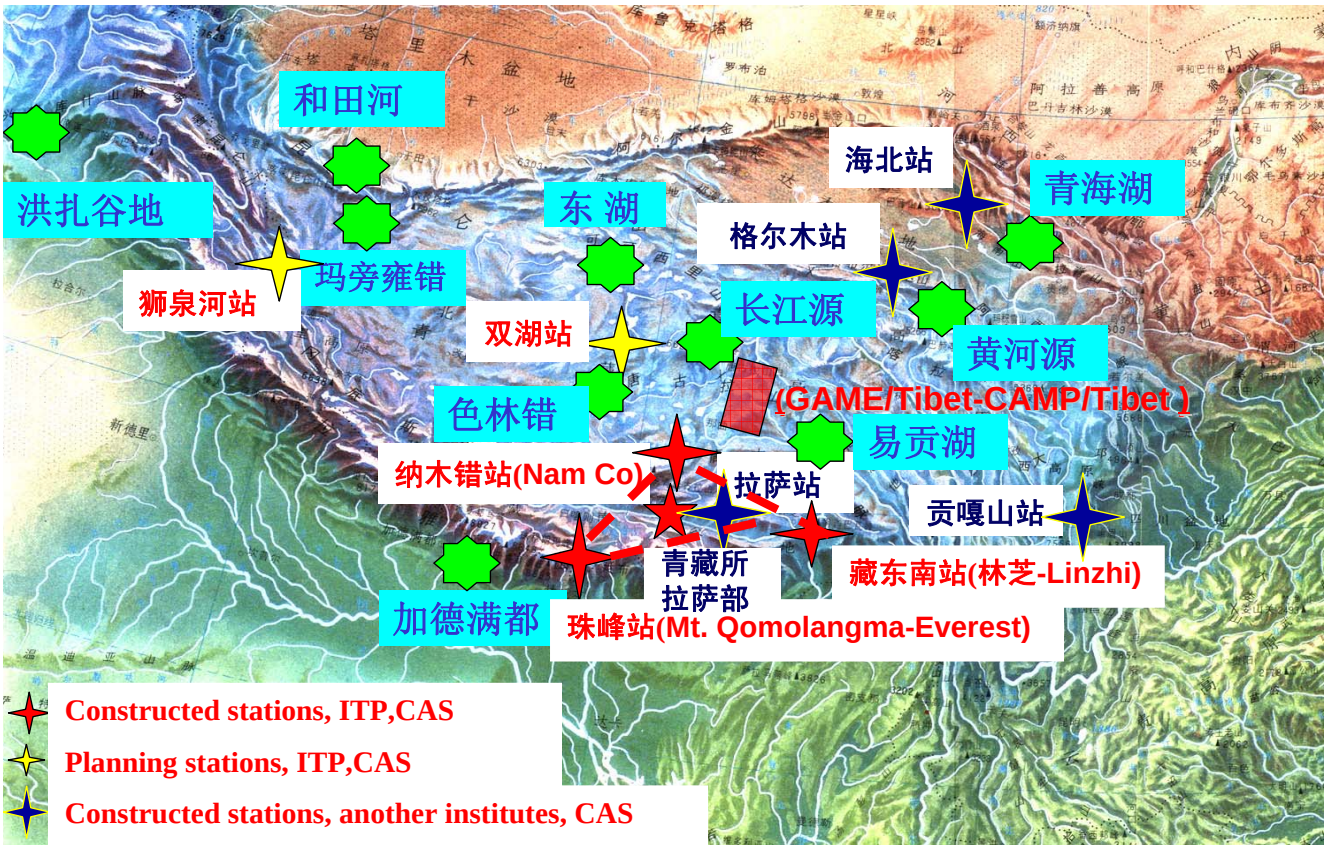
NCEP



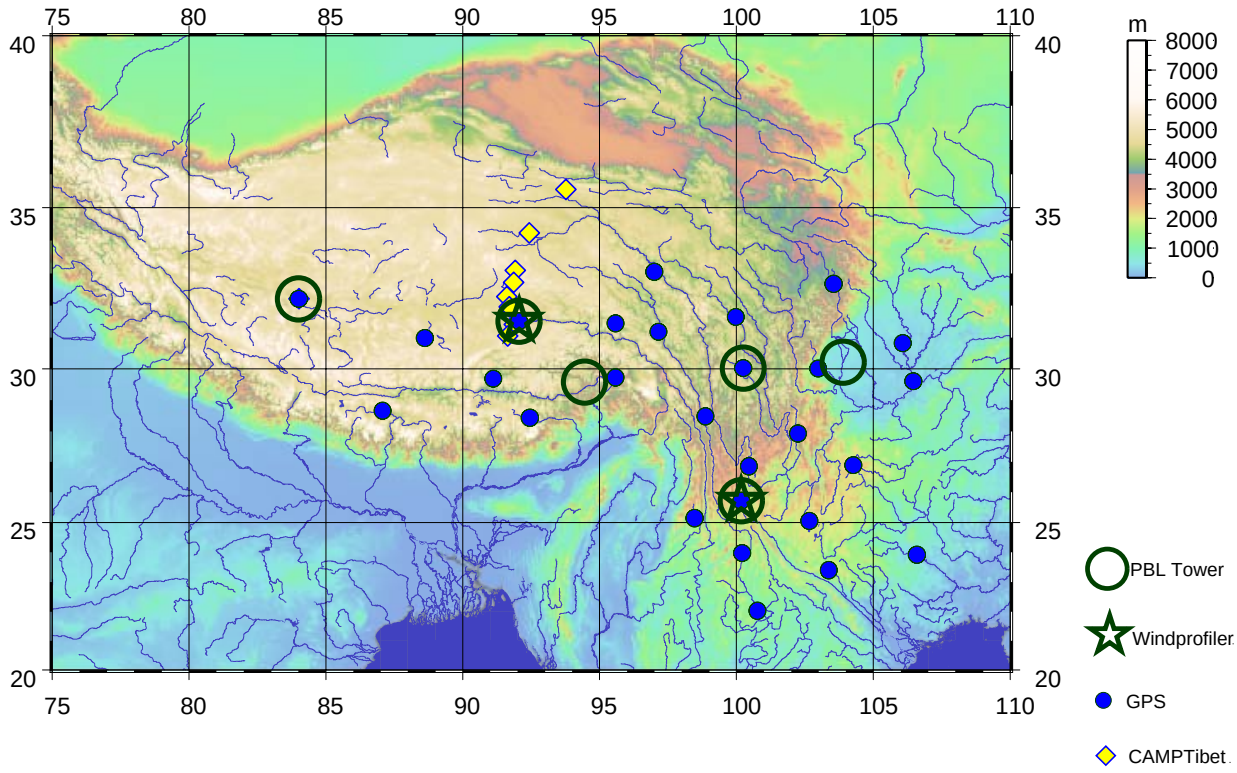


Tibetan Observation and Research Platform (TORP), Inst. Tibetan Plateau Res.

9 comprehensive observation and study stations and 10 observational sites will be constructed by Chinese Academy of Sciences (CAS) in the coming years



China-Japan Cooperative Project On Weather Disaster Reduction



Next step

- Produce 10-year (1998-2007) soil moisture and surface energy budget for Tibet (2007-2008)
- Analyze Tibet atmospheric heating and its interannual variability (2008-2010)
- Integrated study on Tibet water and energy cycle using model data, satellite data and LDAS-UT (2007-2008)
- Relation between Tibet heating anomaly and extreme events in East Asia (1998 Yangtze river flood; 2006 S.W. China drought and heatwave) (2010-2012)

Summary

- CEOP provides a golden opportunity to WEBS, which is able to address GEWEX objectives
  - Data quality issue
  - Advanced understanding of water and energy cycle
  - Identification of model deficiencies and improvement of parameterization schemes