An auto-calibration system to assimilate AMSR data into a land surface model for estimating soil moisture and surface energy budget

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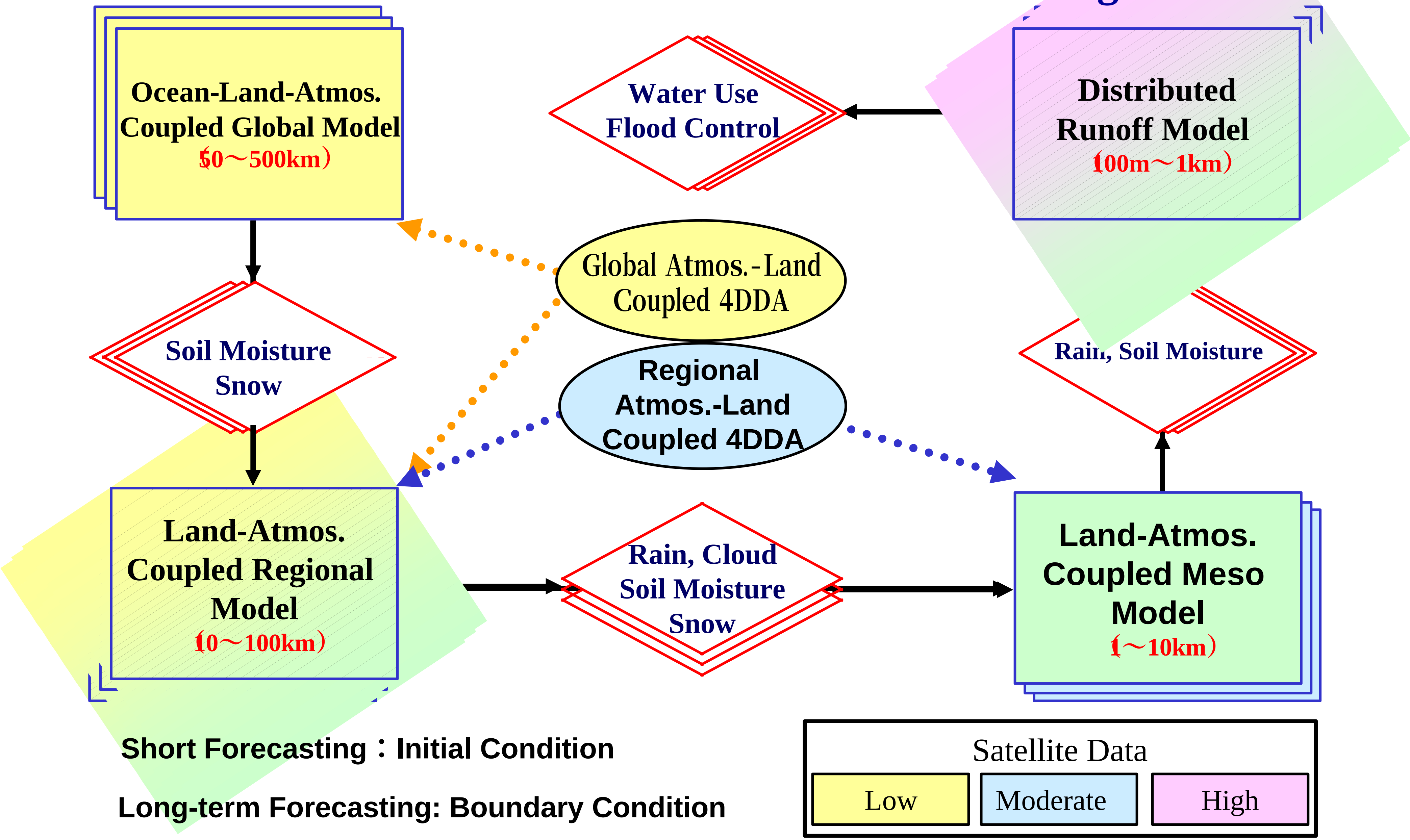
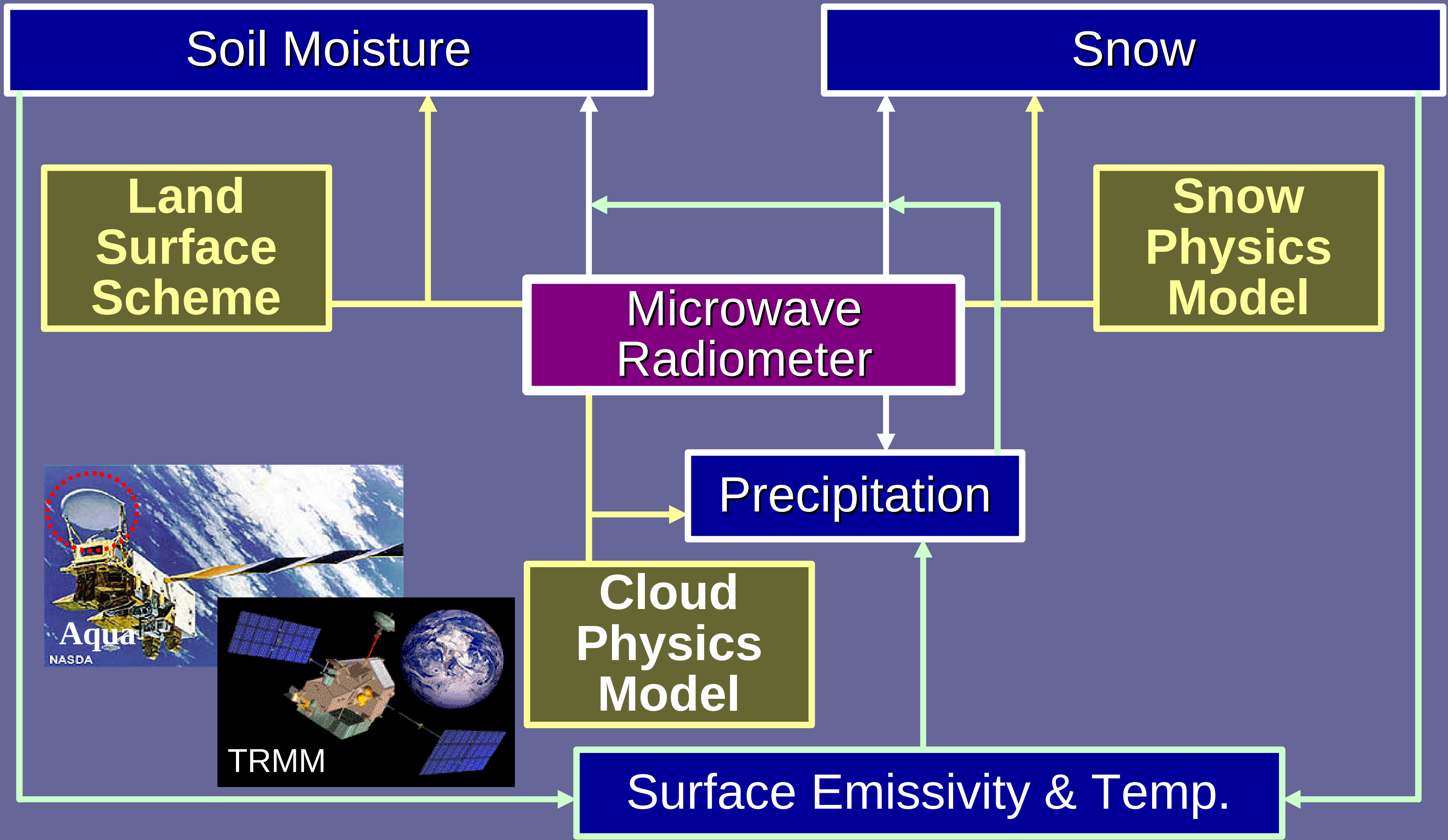
Global ⇔ Regional-Meso ⇔ Basin

Satellite Data Assimilation and Down-scaling

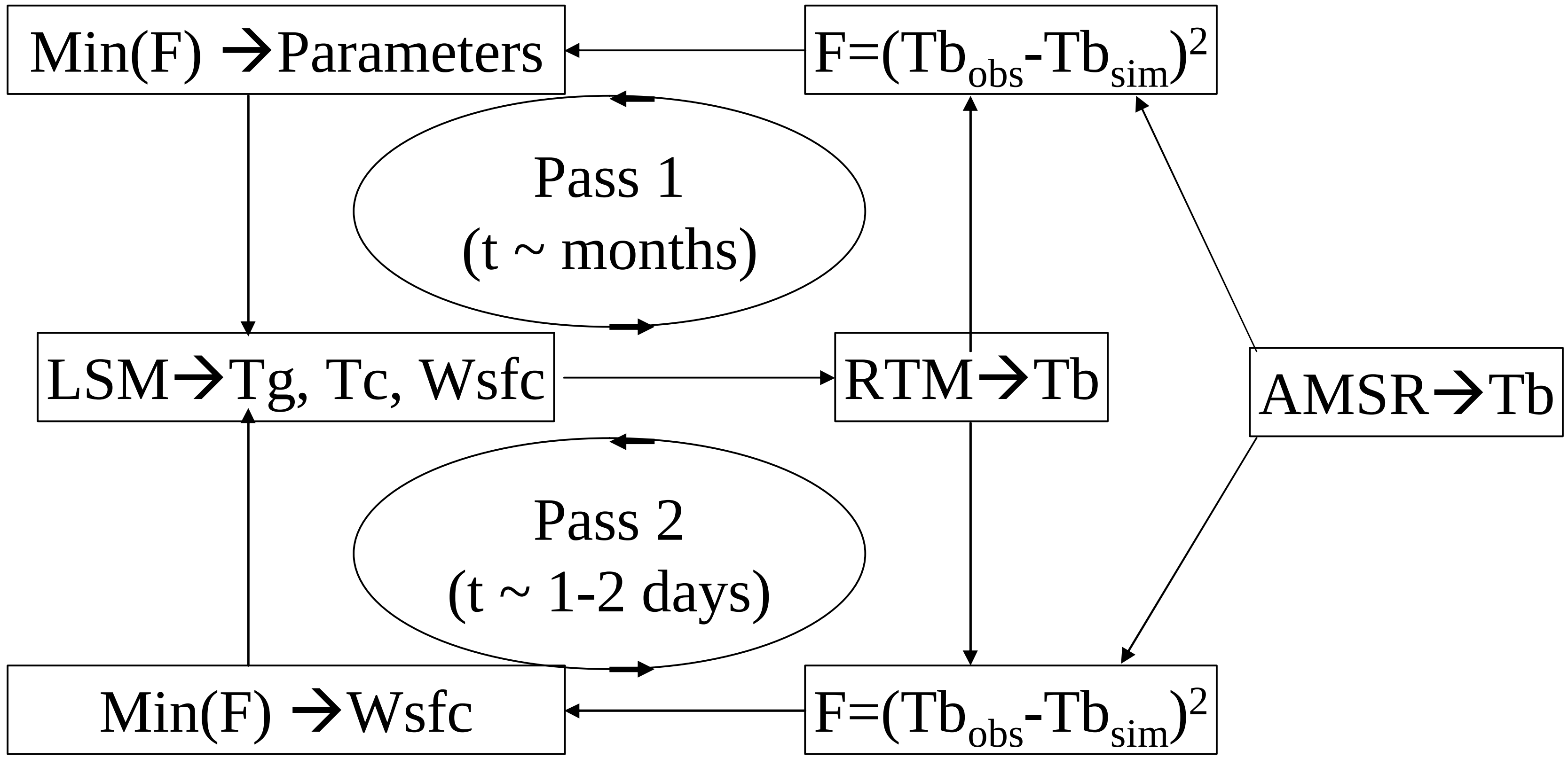


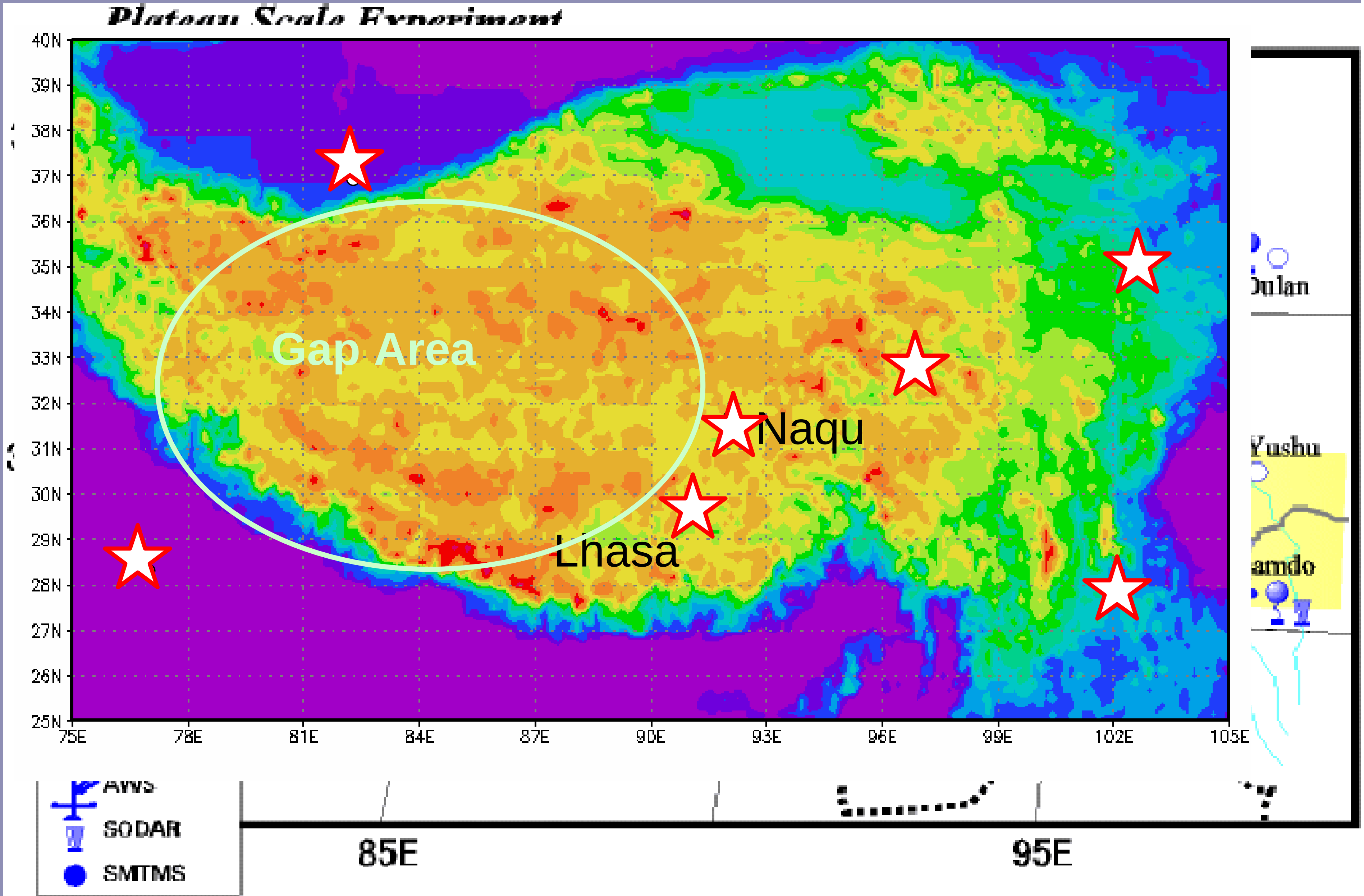
Four Dimensional Data Assimilation



Two-pass LDAS-UT

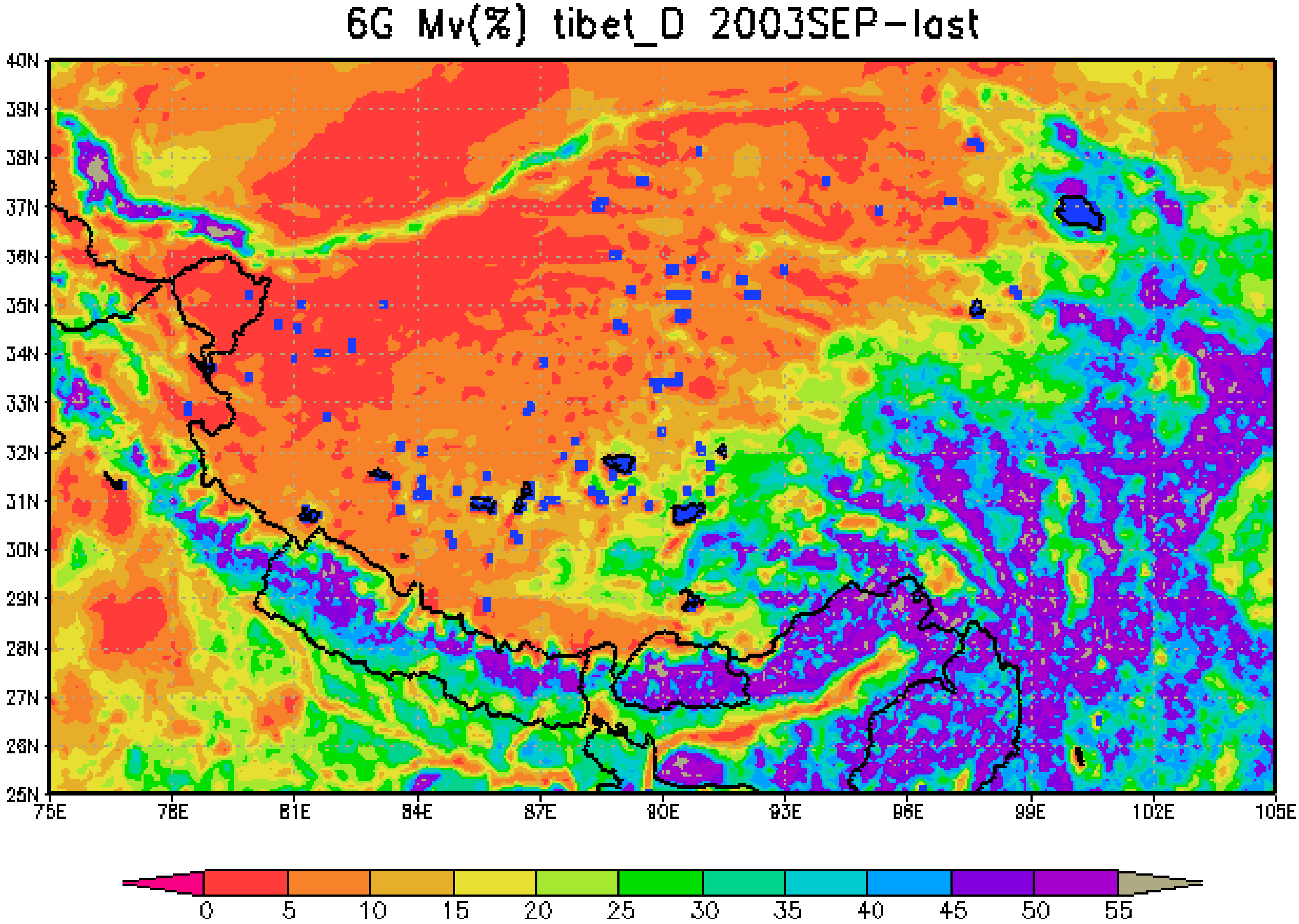
soil texture, porosity: LSM
surface roughness: RTM





Plateau Scale Experiment
Gap Area
Naqu
Lhasa
Dulan
Yushu
amdo
40N
39N
38N
37N
36N
35N
34N
33N
32N
31N
30N
29N
28N
27N
26N
25N
75E
78E
81E
84E
87E
90E
93E
96E
99E
102E
105E
AWS
SODAR
SMTMS
85E
95E

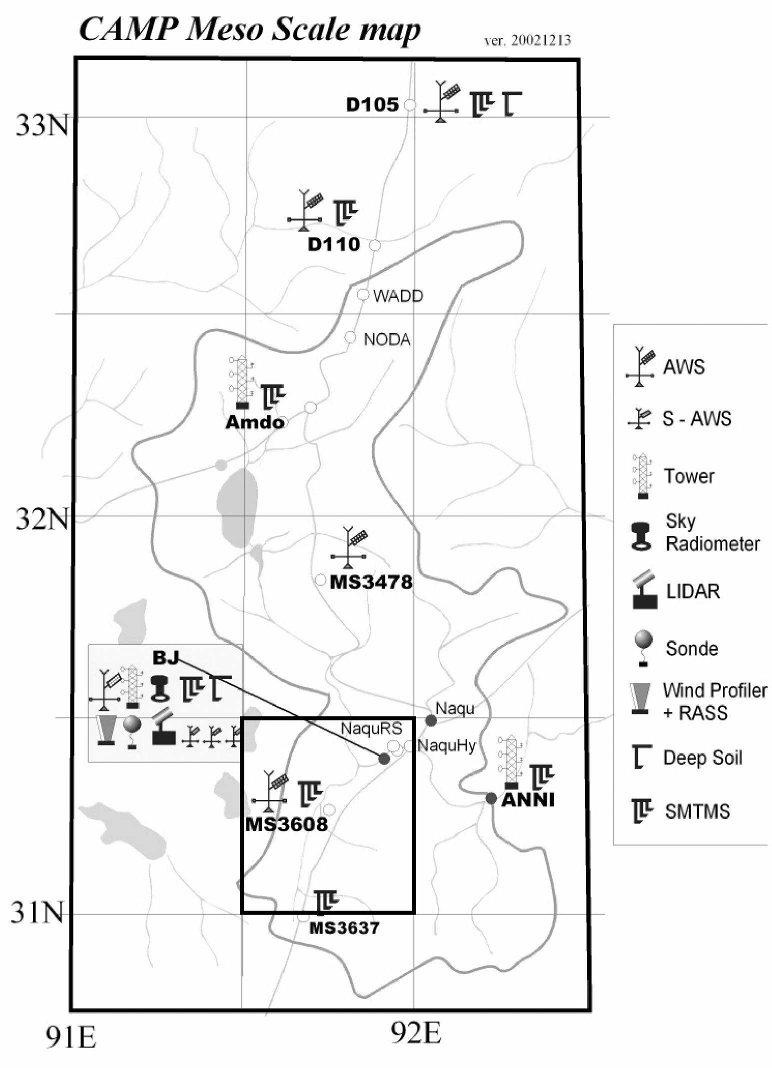
Seasonal Variation of the Soil Moisture in the Tibetan Plateu



Input data→ Easy application in any region

- LDAS-UT grid size: 0.5 degree
- Forcing
  - GPCP precipitation: 1 degree
  - ISCCP radiation: 2.5 degree
  - NCEP reanalysis: 1.5 degree
- Leaf area index: MODIS 0.25 degree 8-day product
- Microwave Tb: AMSR 0.5 degree 6.9 and 19.7 GHz

First application: A case at CEOP Tibet site



Items	Station (depth)
Precipitation	BJ
Radiation	BJ
Surface	BJ, MS3608
temperature	S-AWS1, S-AWS3
Near-surface	BJ, MS3608 (4cm)
soil moisture	S-AWS1, S-AWS3 (0-5 cm)
	SSMTMS (0-3 cm)
Turbulent fluxes	BJ (3m, 20m)

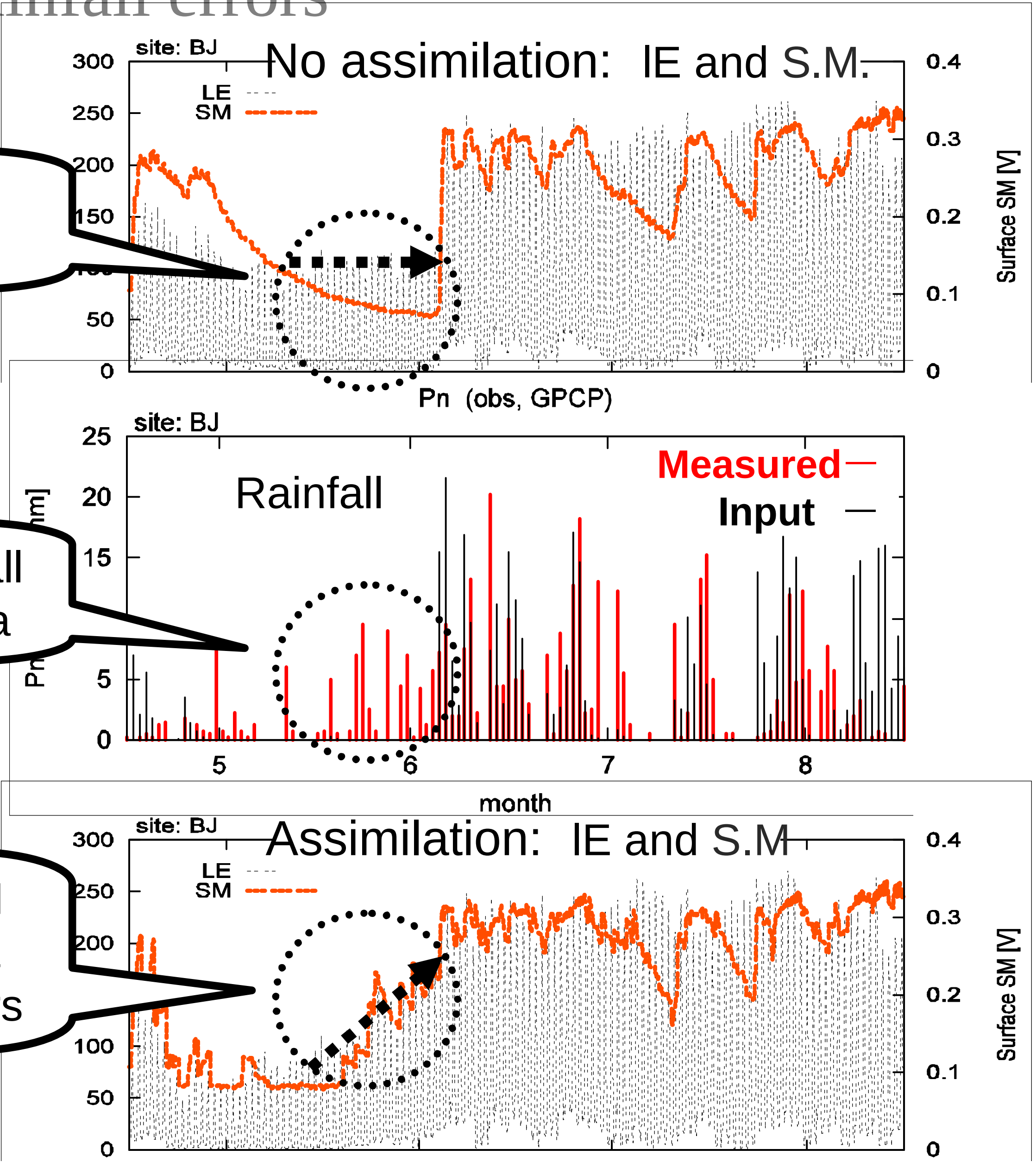
Comparisons between Assimilation and No assimilation

- Contamination of rainfall errors

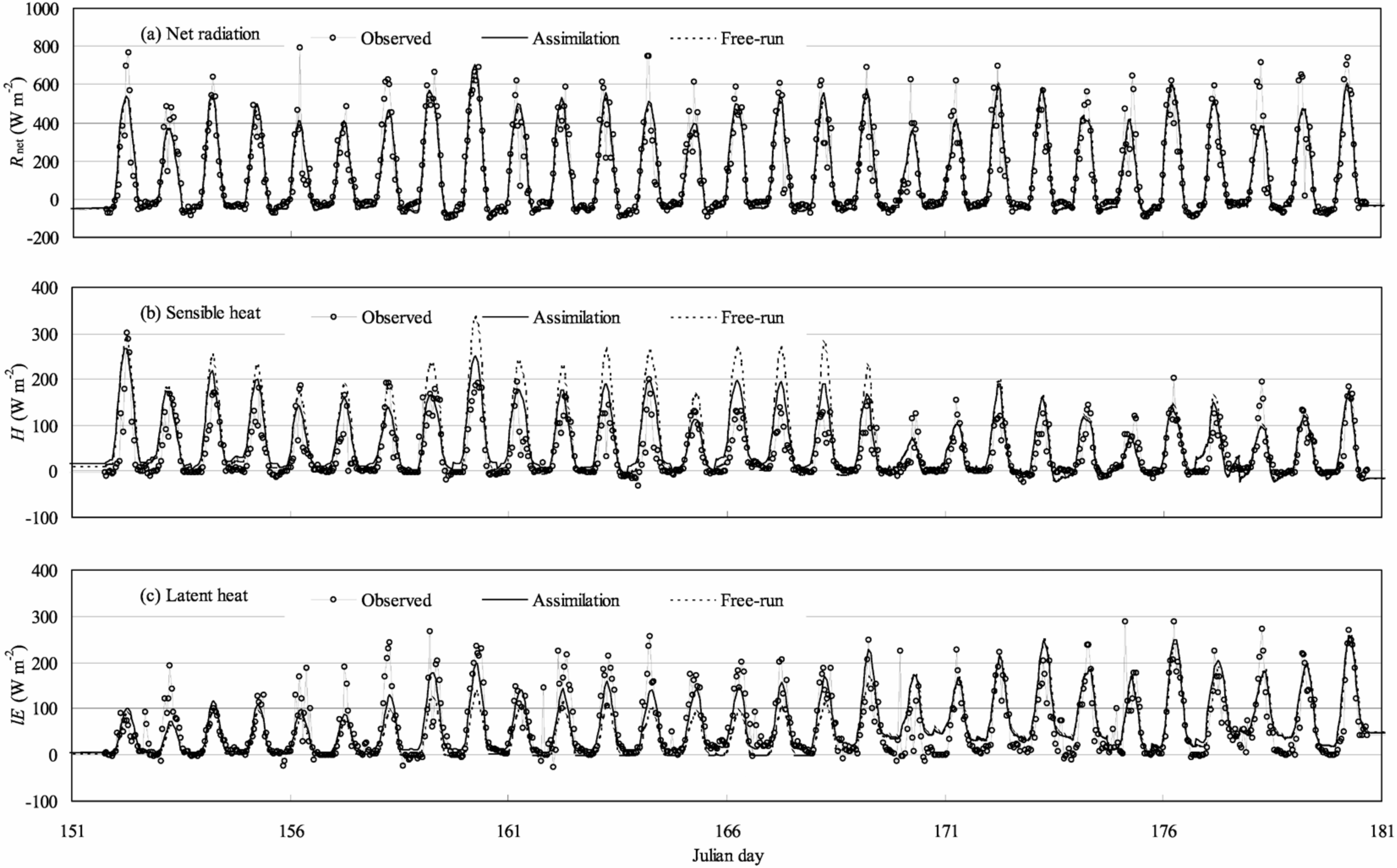
No assimilation: No increase of S.M and lE

Before June, observed rainfall is not available in GPCP data

Assimilation: Increase of S.M and lE → Assimilation is not very sensitive to rainfall errors



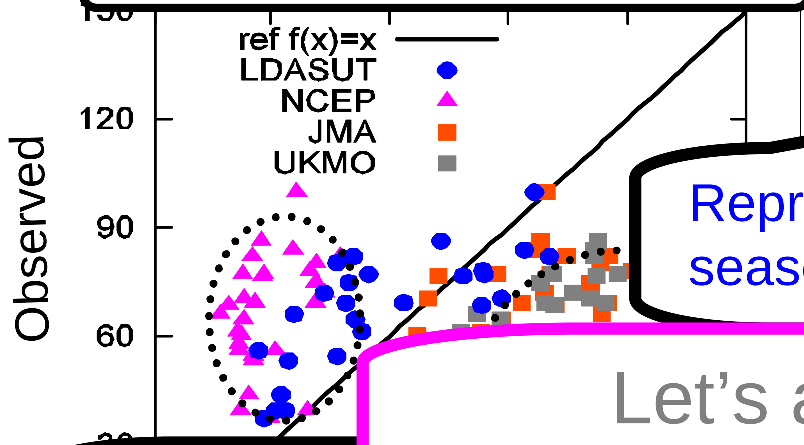
Surface energy budget



Compare with GCMs

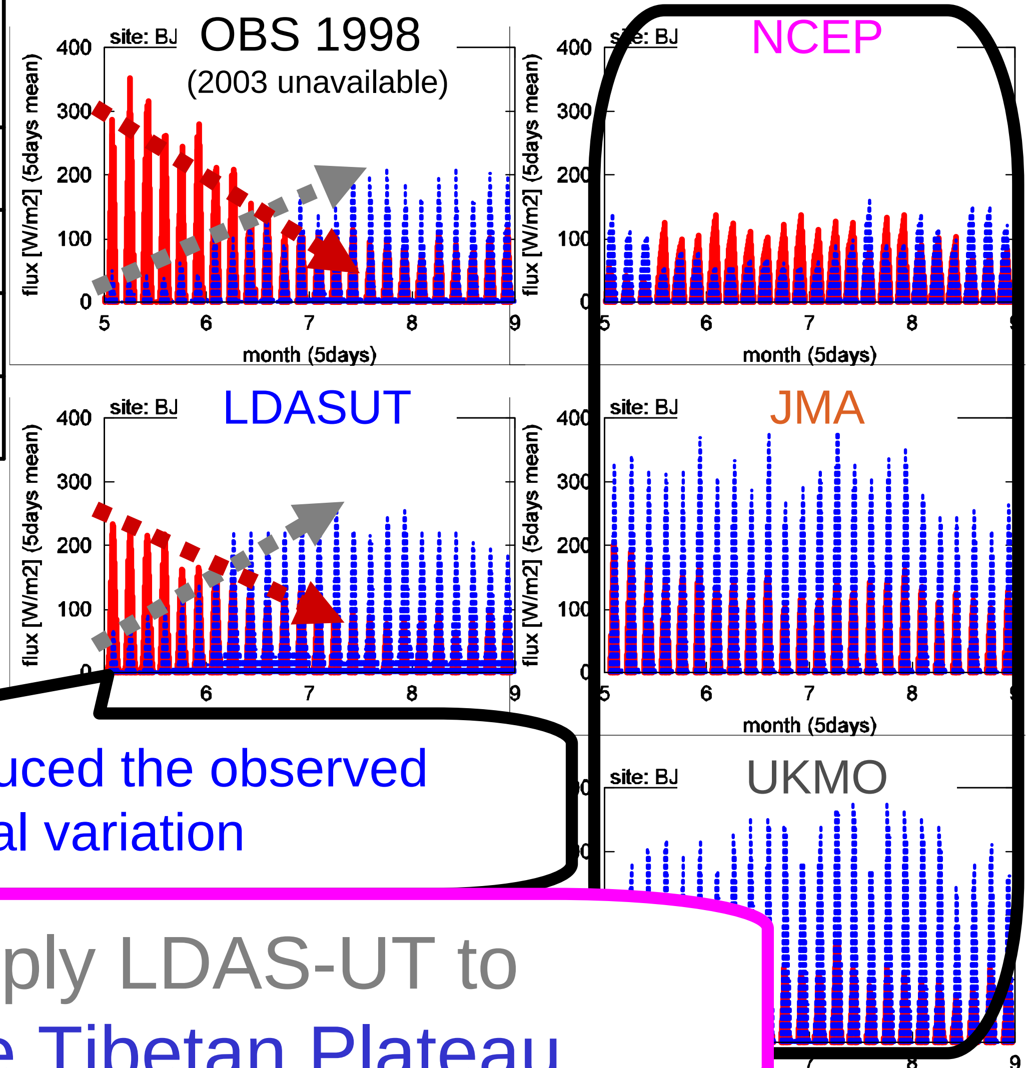
	H RMSE [W/m²]	LE RMSE [W/m²]
LDASUT	32.0	42.5
NCEP	40.2	68.4
JMA	32.3	79.8
UKMO	35.3	80.1

LE daily-mean (June)



GCMS over-p
⇔ LDASUT predicted much better

Flux variation (May~September)
Sensible (H) —
Latent(LE) —

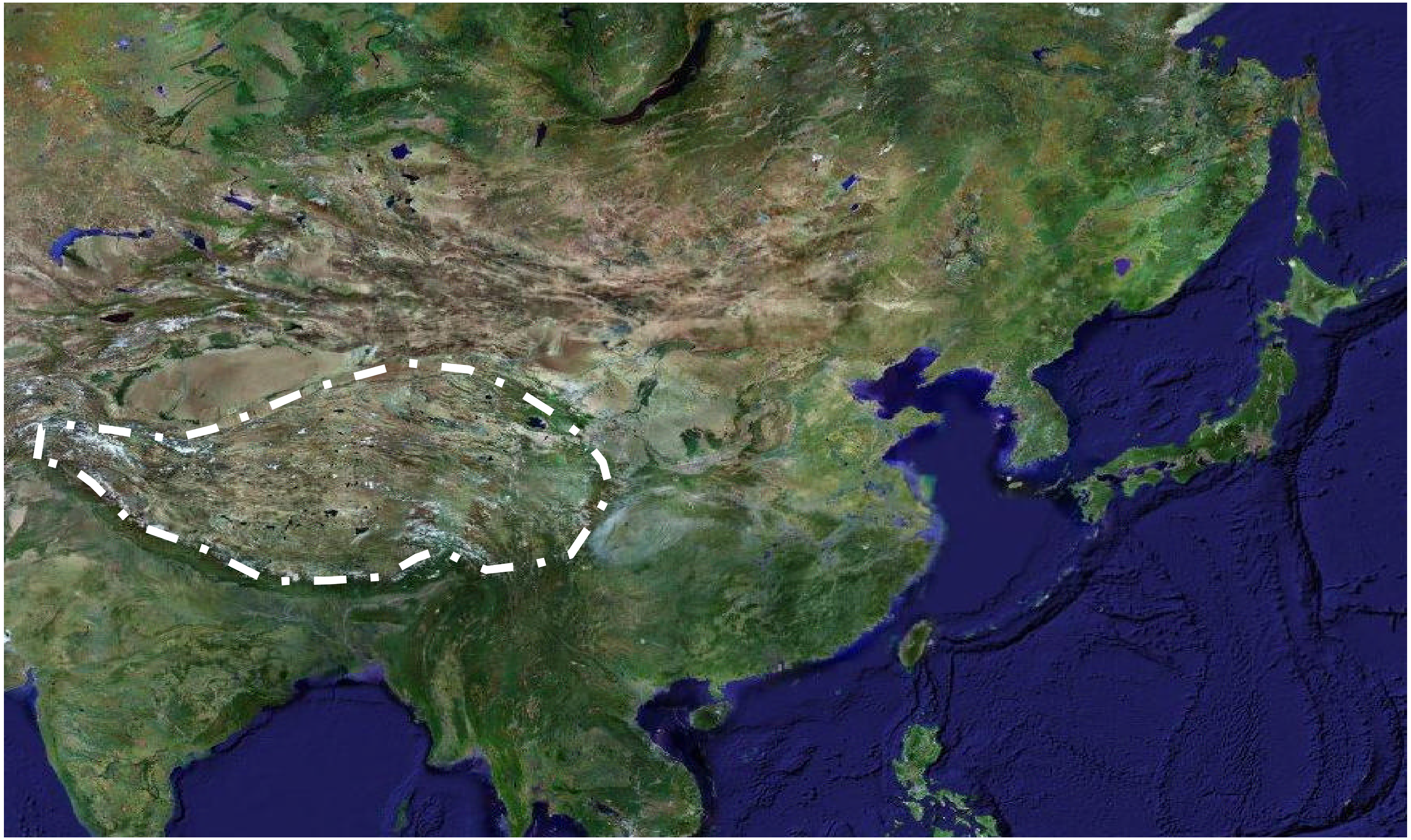


Reproduced the observed seasonal variation

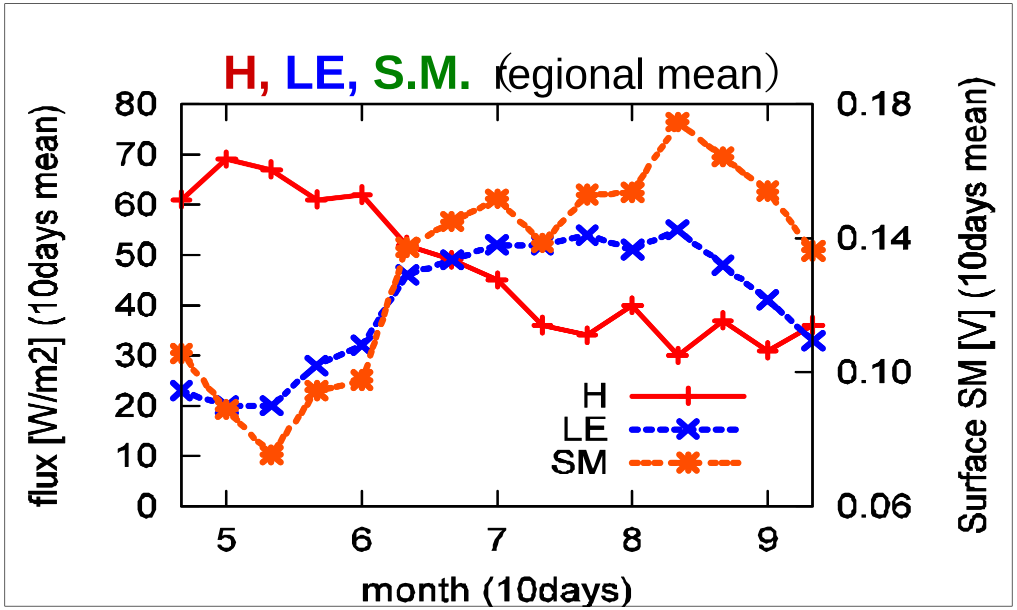
No seasonal variation

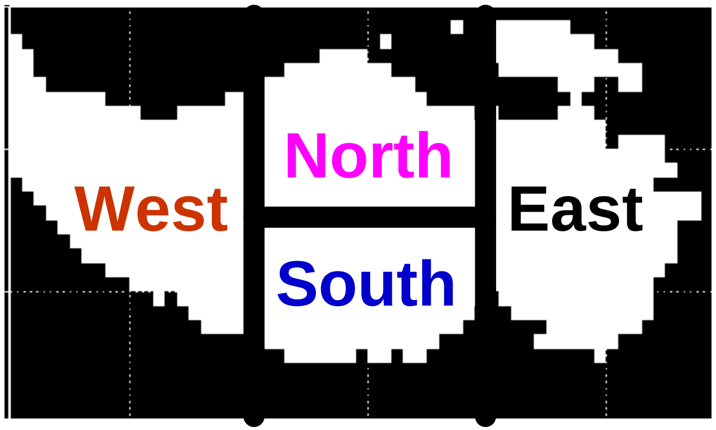
Let's apply LDAS-UT to
the whole Tibetan Plateau

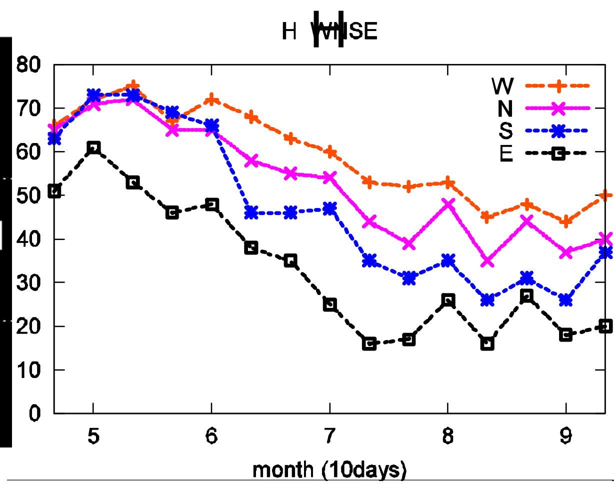
Application to the Tibetan Plateau 2003

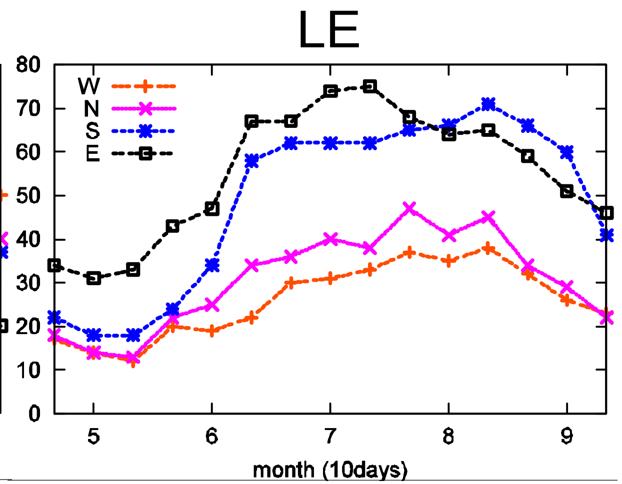


Seasonality of TP-mean fluxes and S.M.



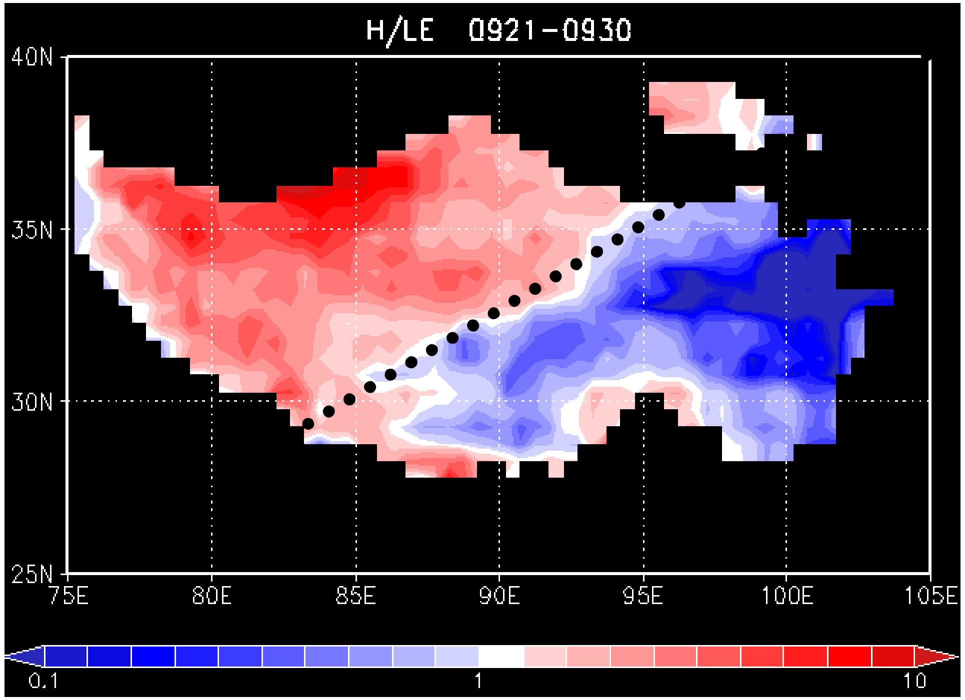




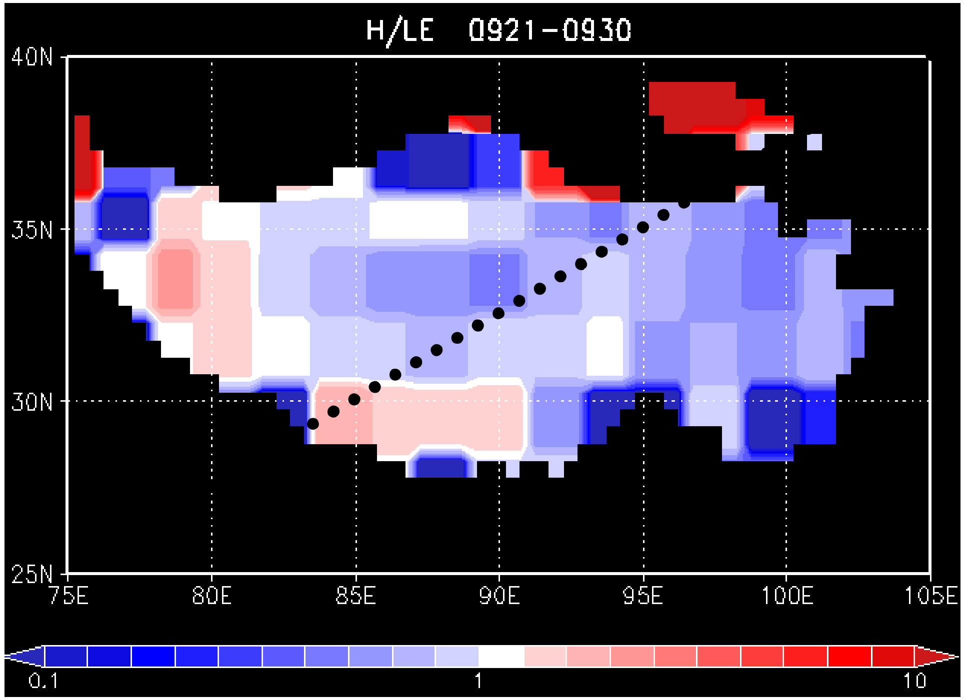


Seasonality of distributed Bowen ratio

LDASUT



NCEP



LDAS Seasonality: May~Mid June, H > lE; Mid June~Aug; lE>H

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