WCRP CORDEX
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D1: Third Pole Environment: high resolution simulation/reanalysis & its implication /application

Convection-permitting modeling over the Tibetan Plateau

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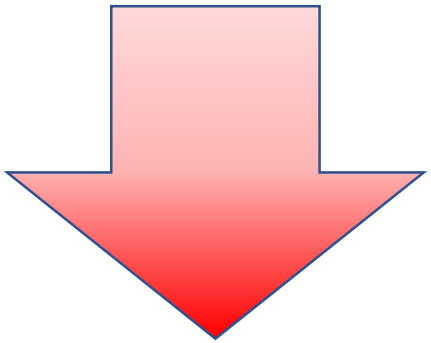
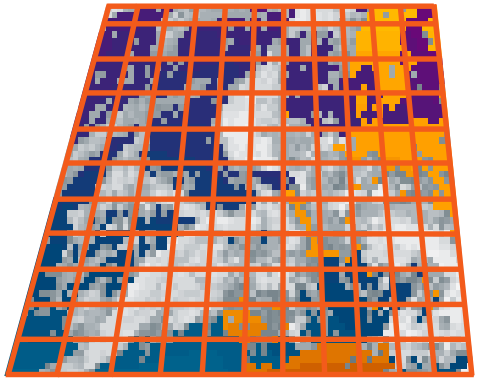
Research succession

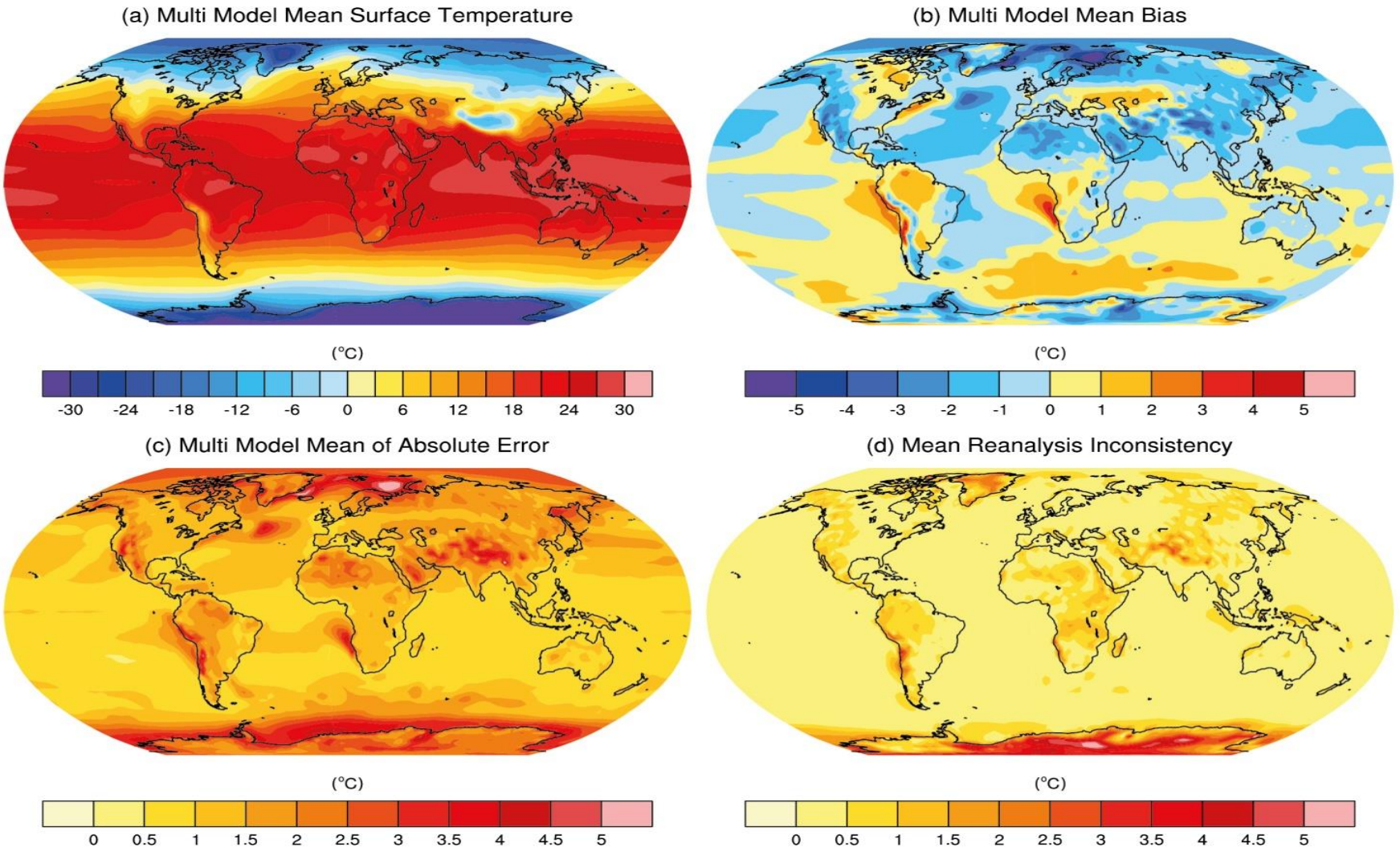
Dynamical downscaling over the Tibet





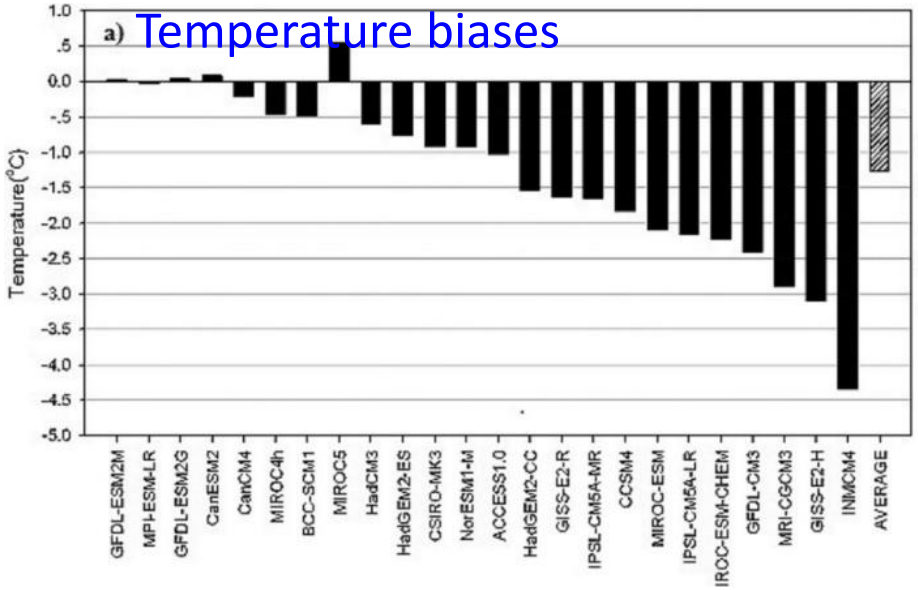
Convention-permitting modeling over the Tibet

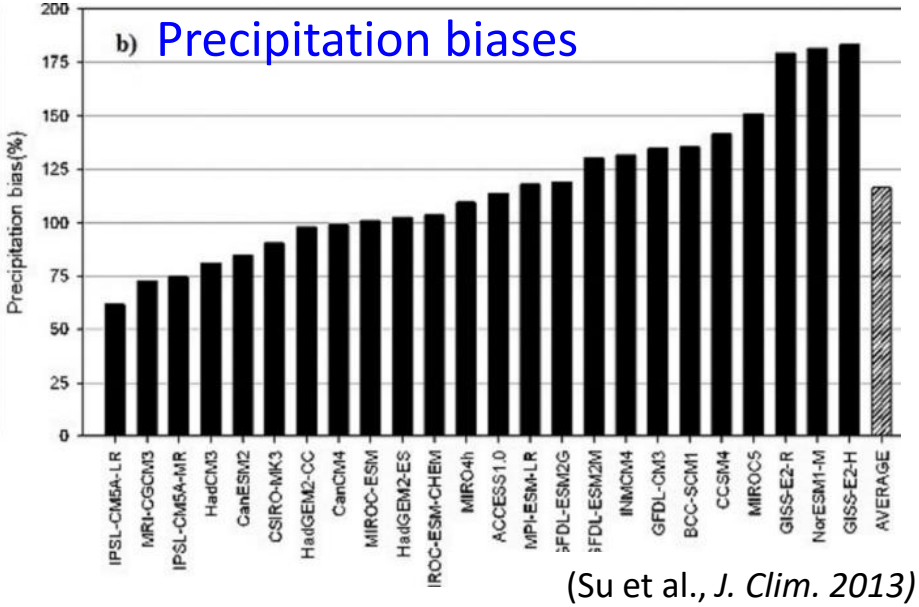
Information from IPCC ensembles



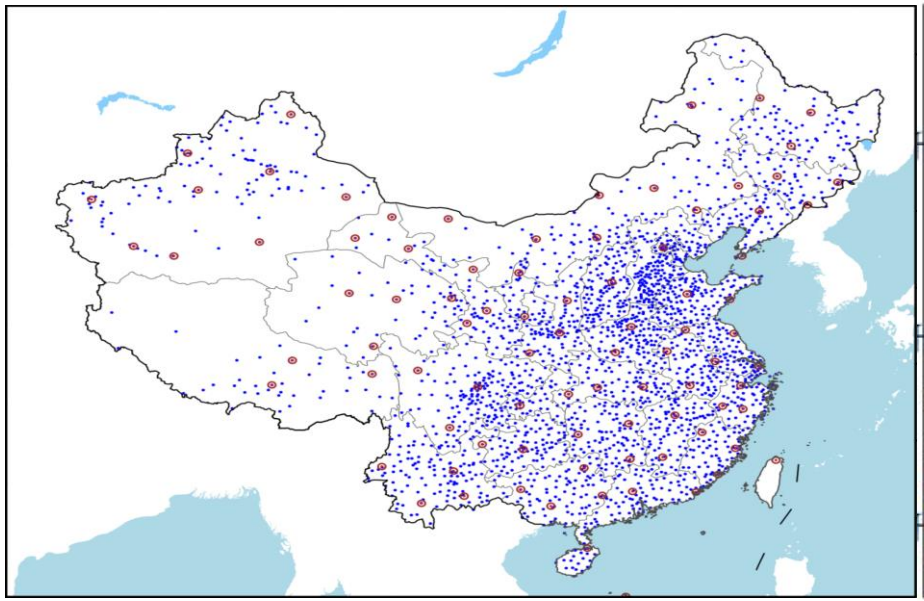
(IPCC 2013)

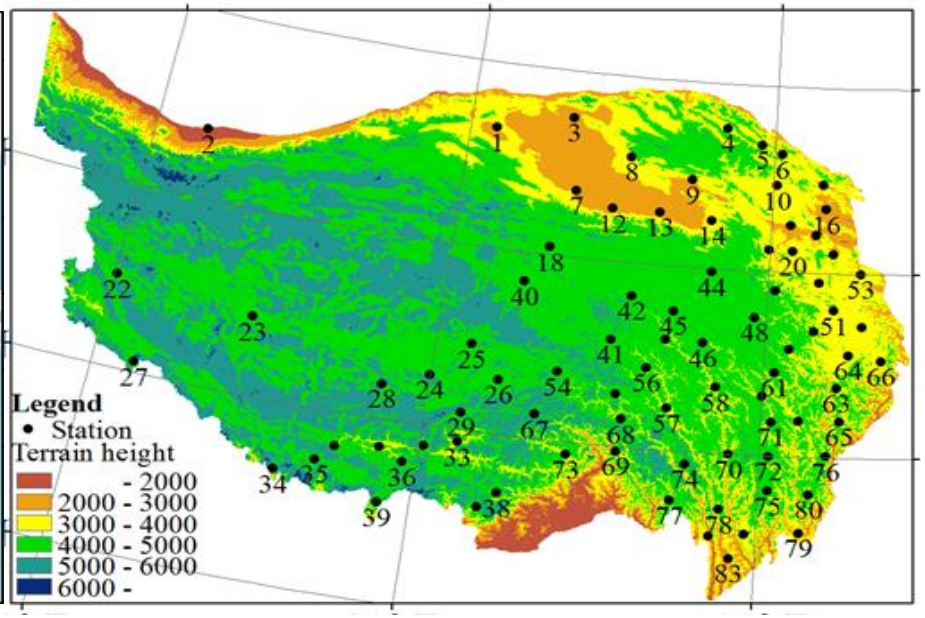
In the Tibet





(Su et al., *J. Clim. 2013)*





Dynamical downscaling over the Tibet

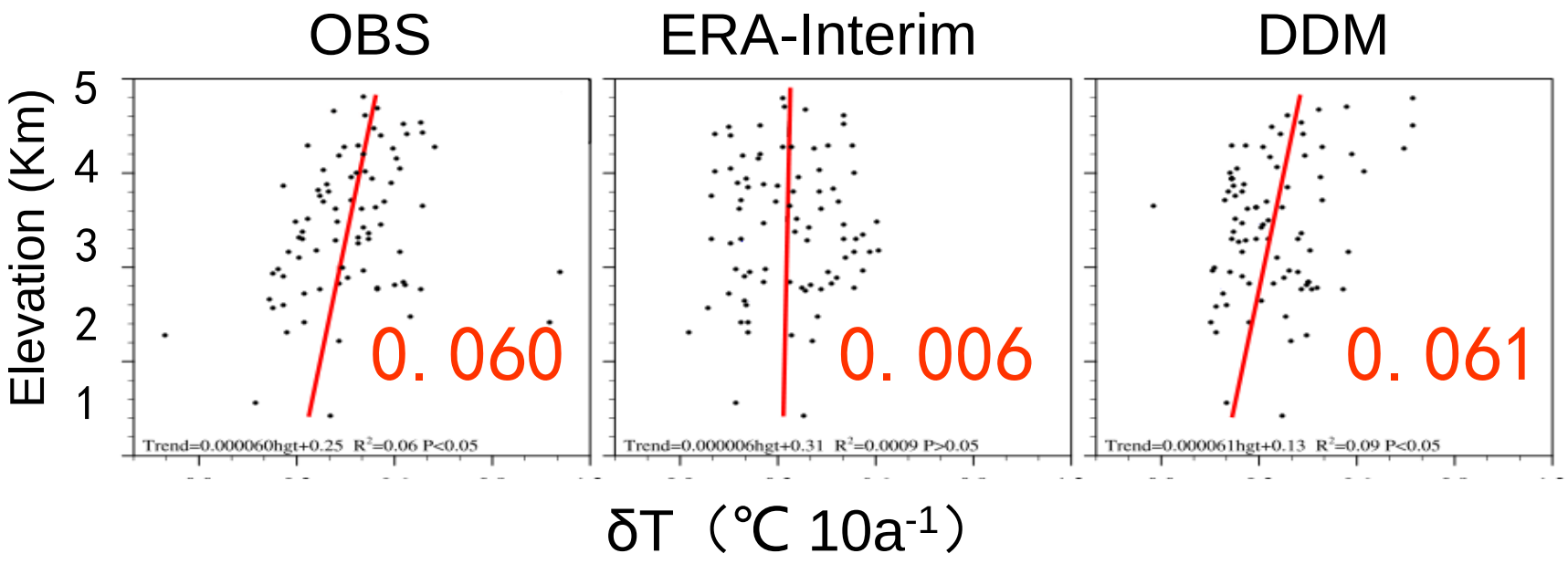
Better reproduce Elevation-dependent warming

- WRF

Horizontal resolution
30km

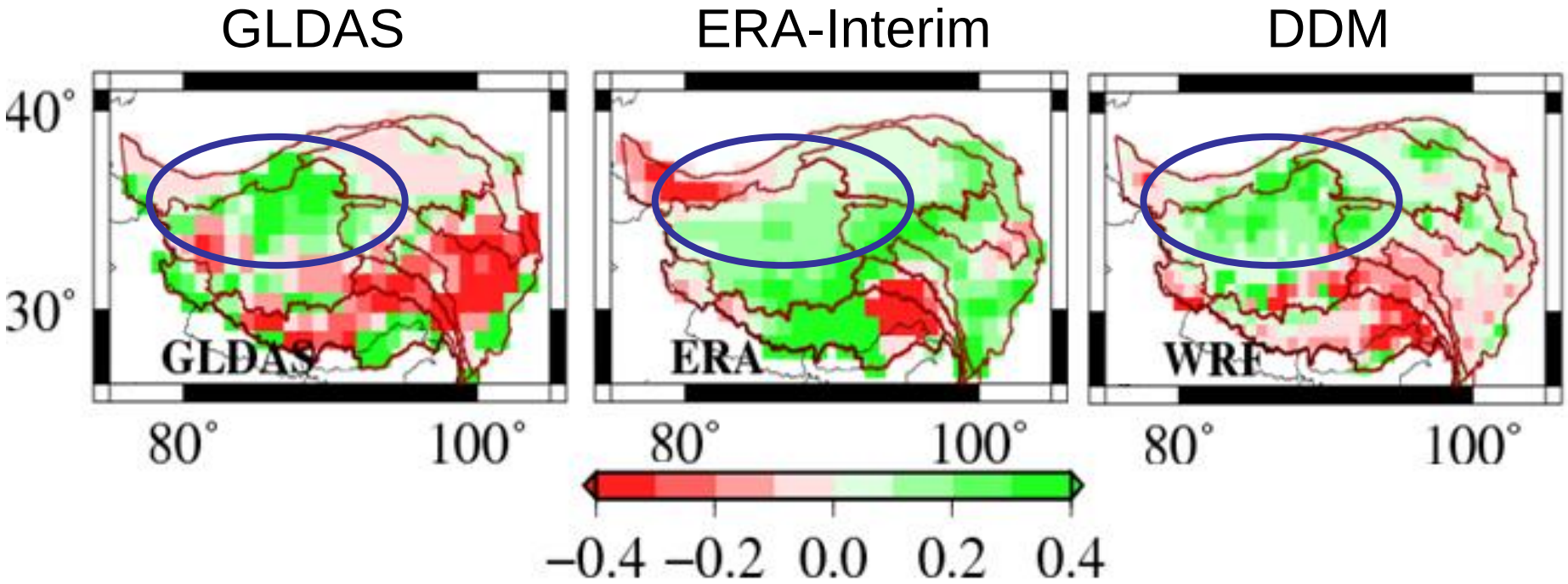
33 years（1979-2011）

- Optimal combination of parameterization
- Best initialization and boundary
- Improved land surface model



(Gao et al., *J. Clim.* 2015a)

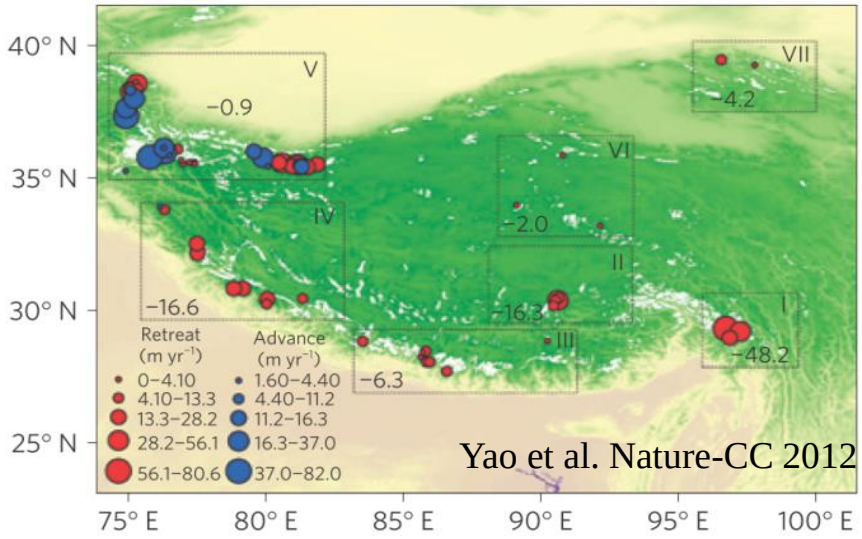
Better simulate contrast changes between northwestern and southeastern TP in P-E



(Gao et al., *J. Clim.* 2015b)

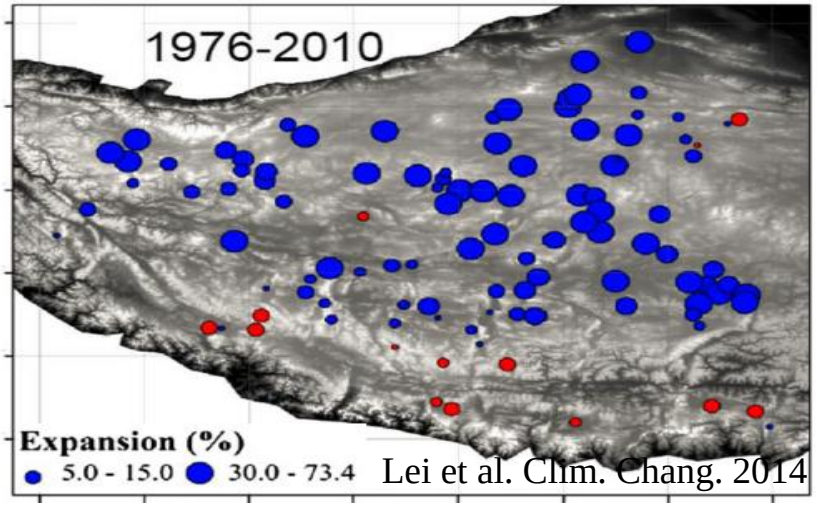
Consistent with other environmental changes

Glacier



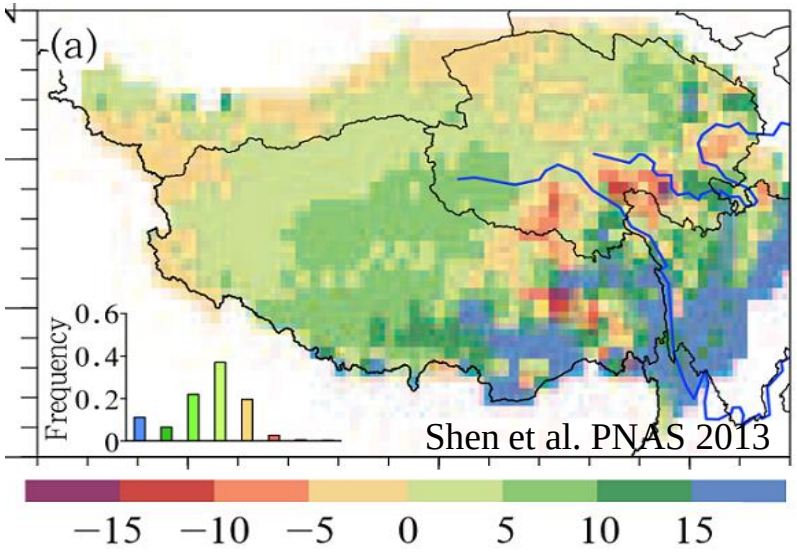
Yao et al. Nature-CC 2012

Lakes



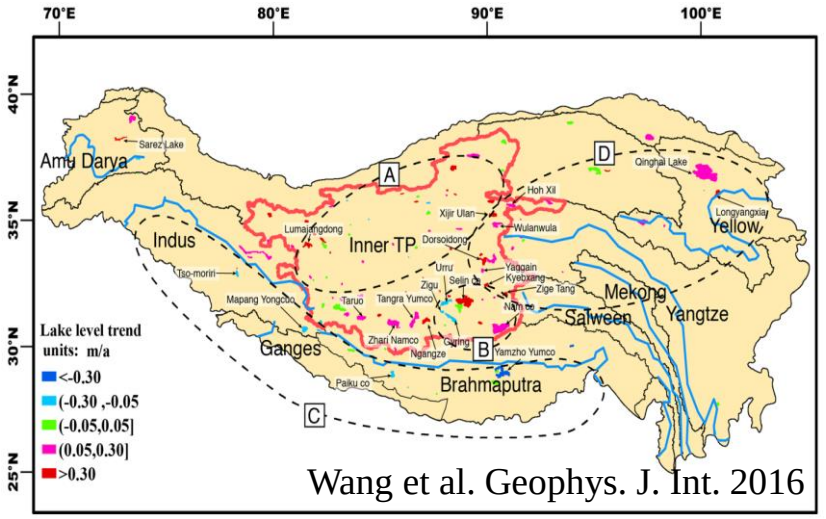
Lei et al. Clim. Chang. 2014

Vegetation



Shen et al. PNAS 2013

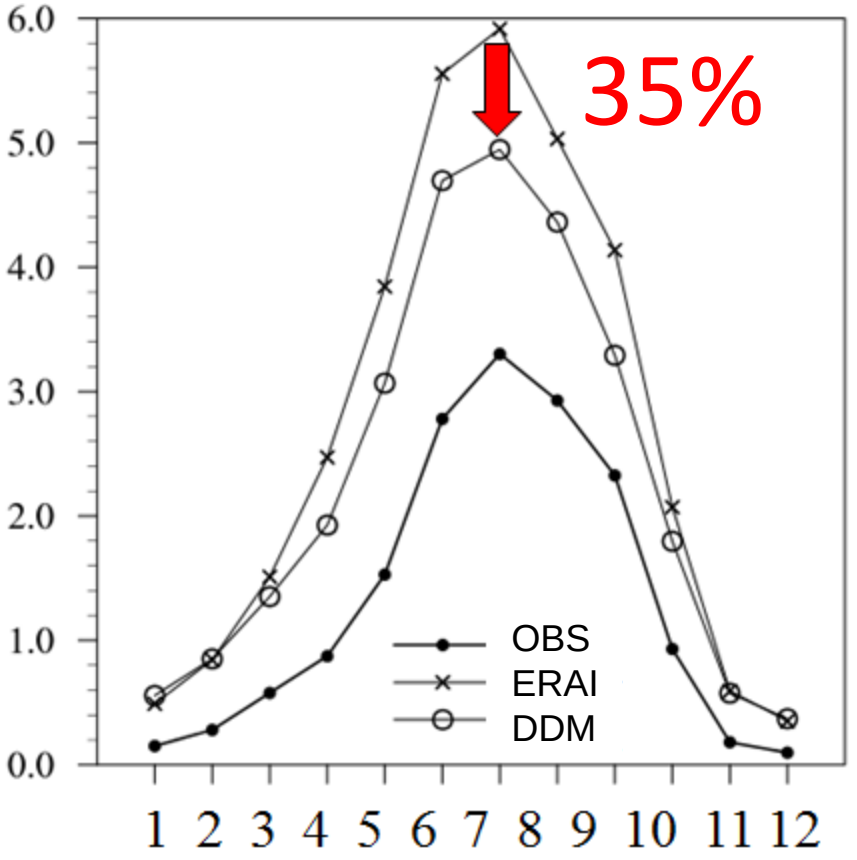
GRACE



Wang et al. Geophys. J. Int. 2016

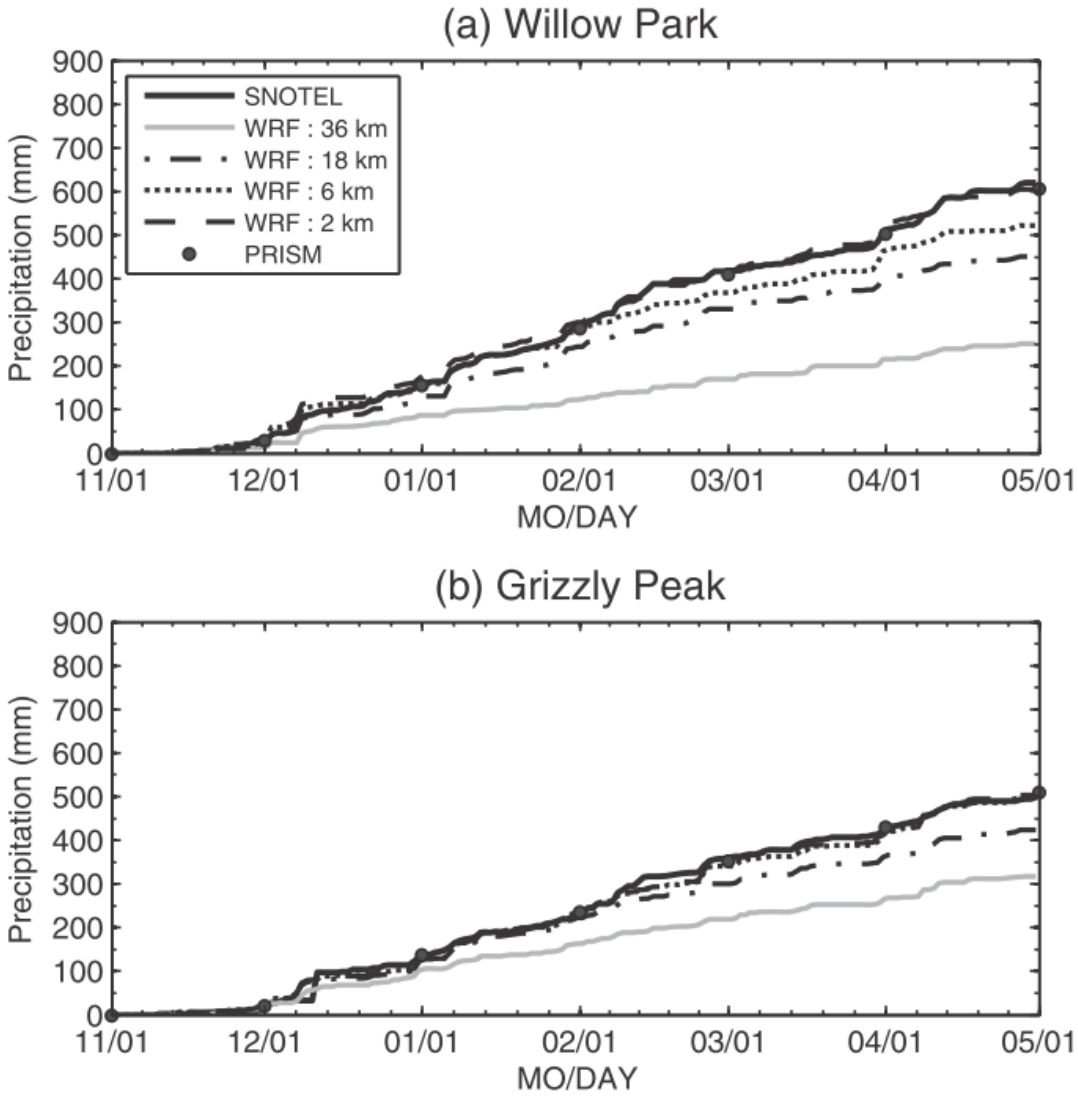
Add values and limitations in precipitation

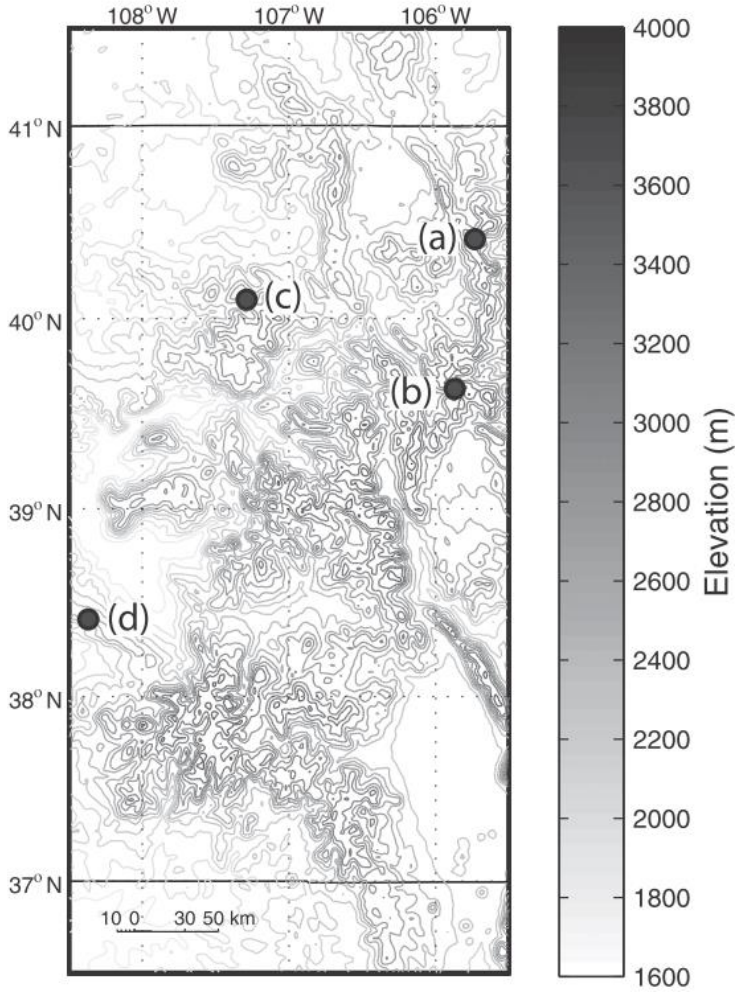
The overestimation of precipitation in reanalysis is reduced by 35% in DDM, however still exists.



Gao et al., *J. Clim.* 2015a

CPS in the world





Rasmmusen et al. *J. Clim.* 2011

Bruintjes et al. 1994; Gaudet and Cotton 1998; Colle et al. 2000, 2005, 2008; Garvert et al. 2007; others…

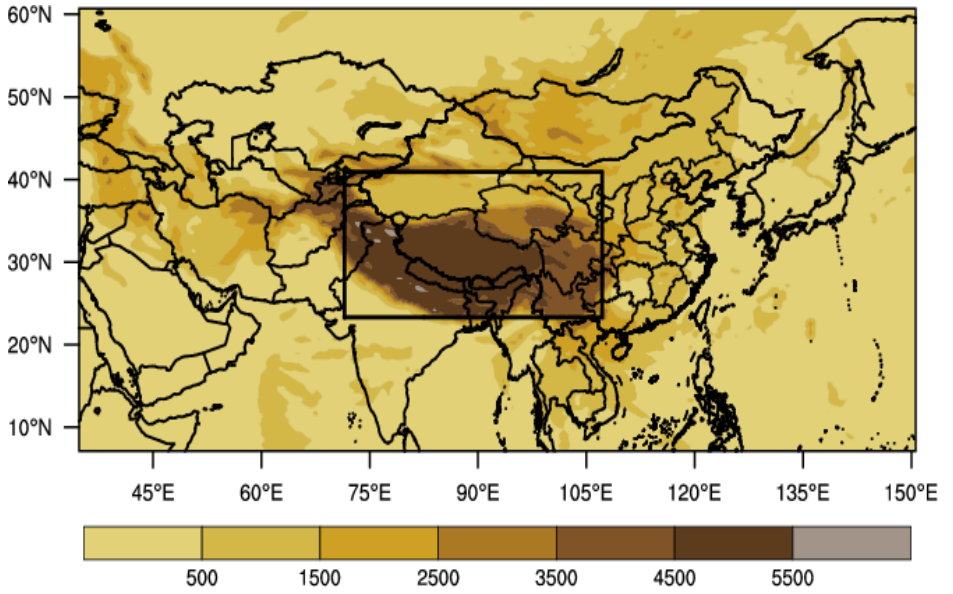
CPS in the Tibet

- WRF

  Horizontal resolution 28km

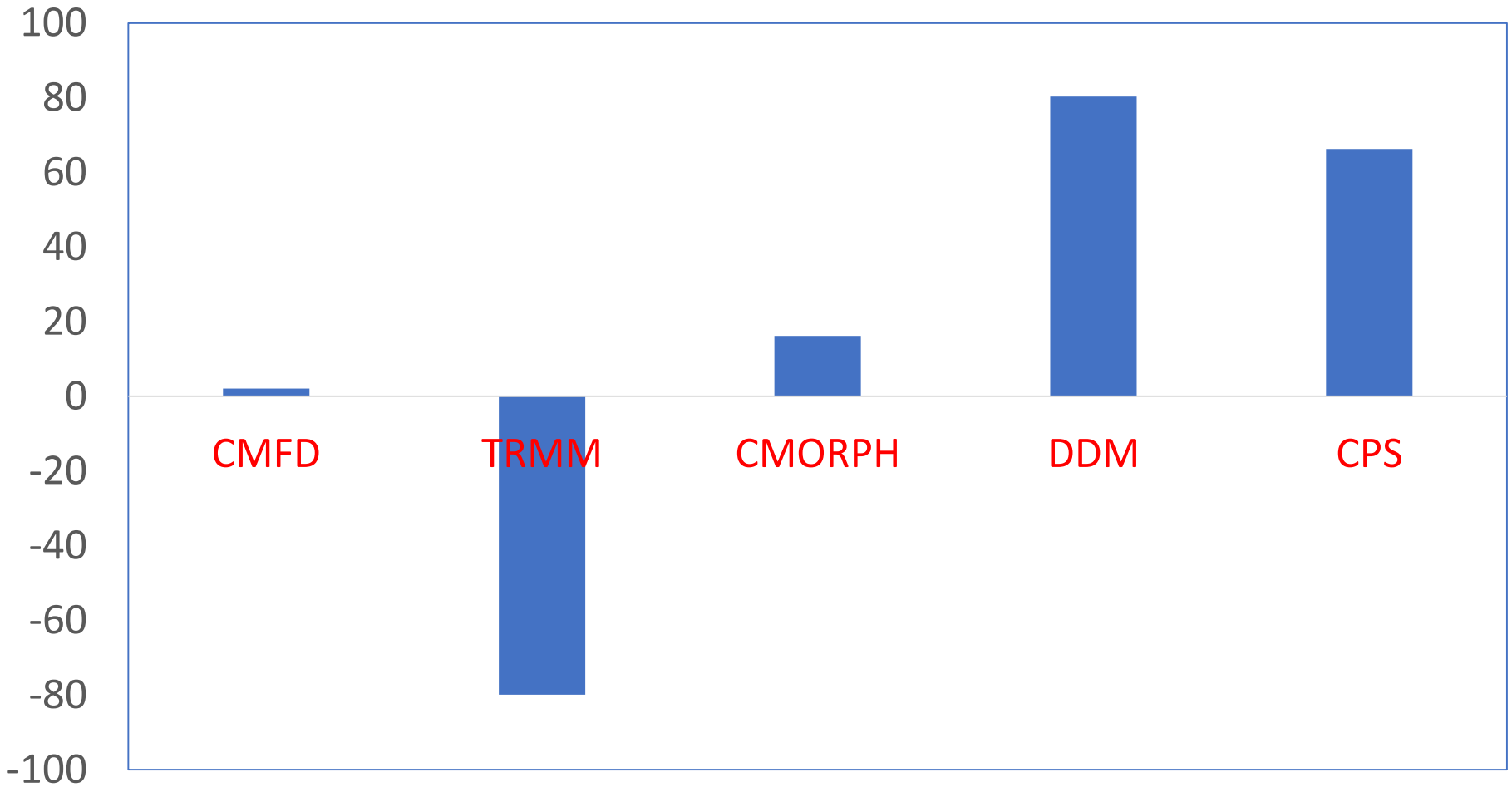
  nesting 4km

  Nov 1st 2013-May 31st 2014

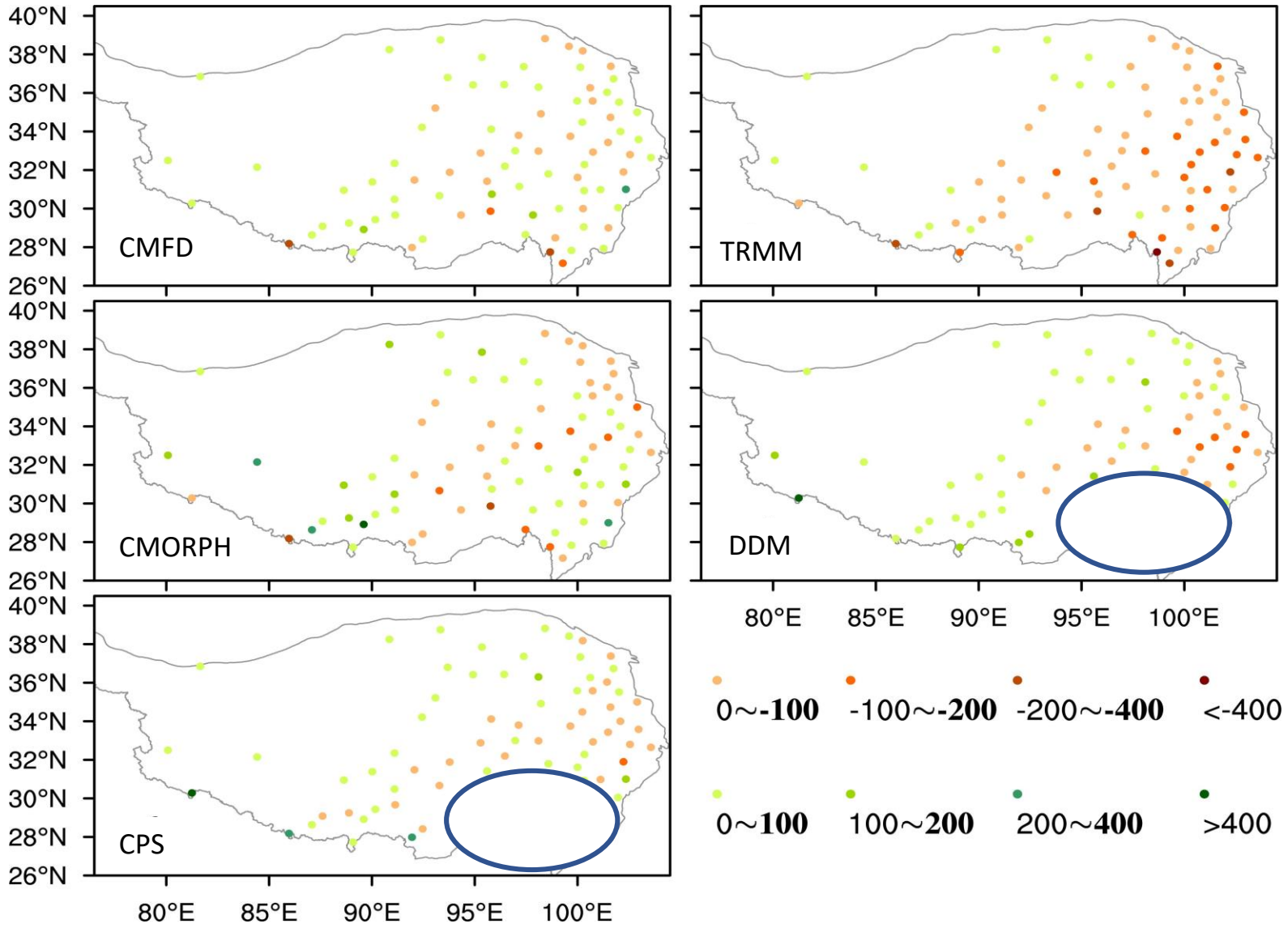


- CAM shortwave scheme and longwave scheme (Collins et al. 2004)
- The WRF Single-Moment 6-class (WSM6)
- Kain–Fritsch convection scheme (Kain, 2004)
- Yonsei University PBL scheme (Hong and Pan 1996)
- Noah LSM (Chen and Dudhia 2001)

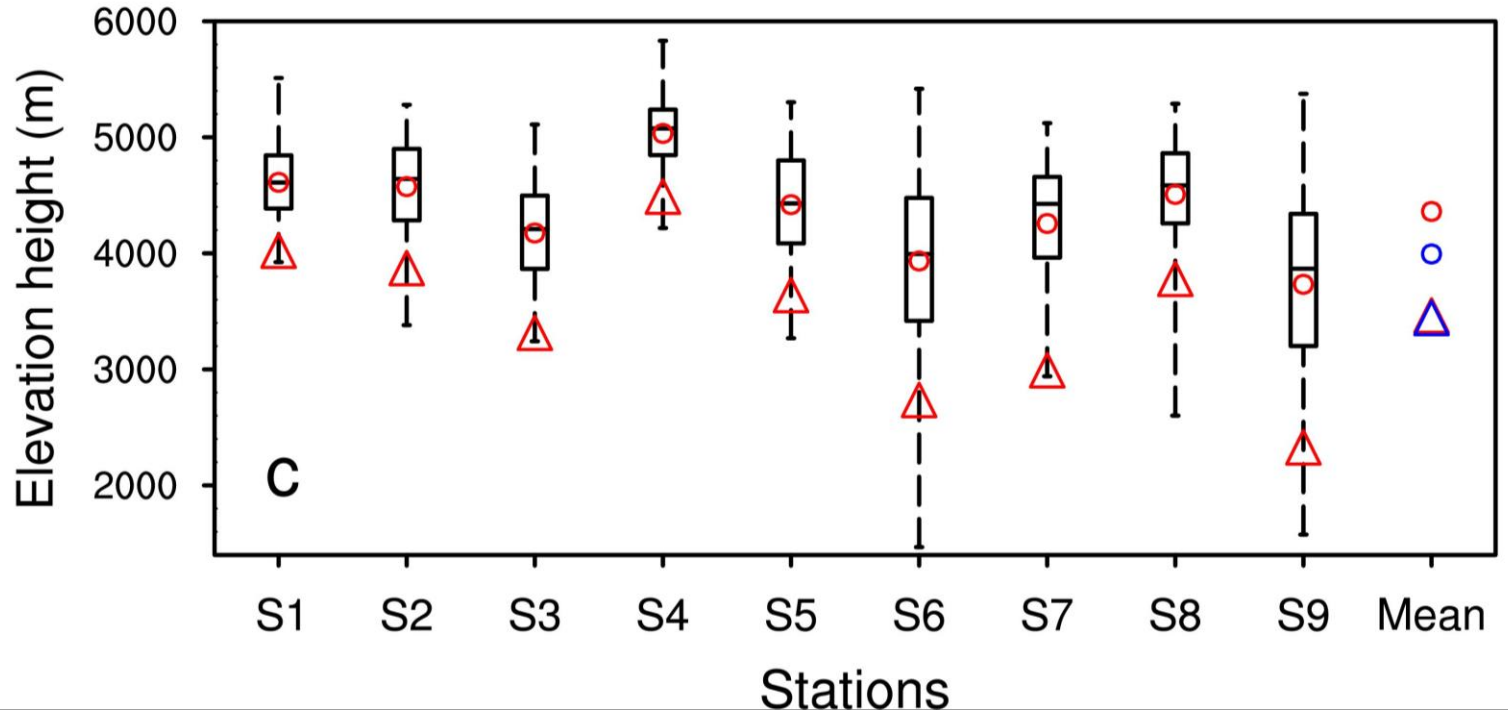
Precipitation biases averaged over stations



Distribution of accumulation precipitation biases compared to CMA station records



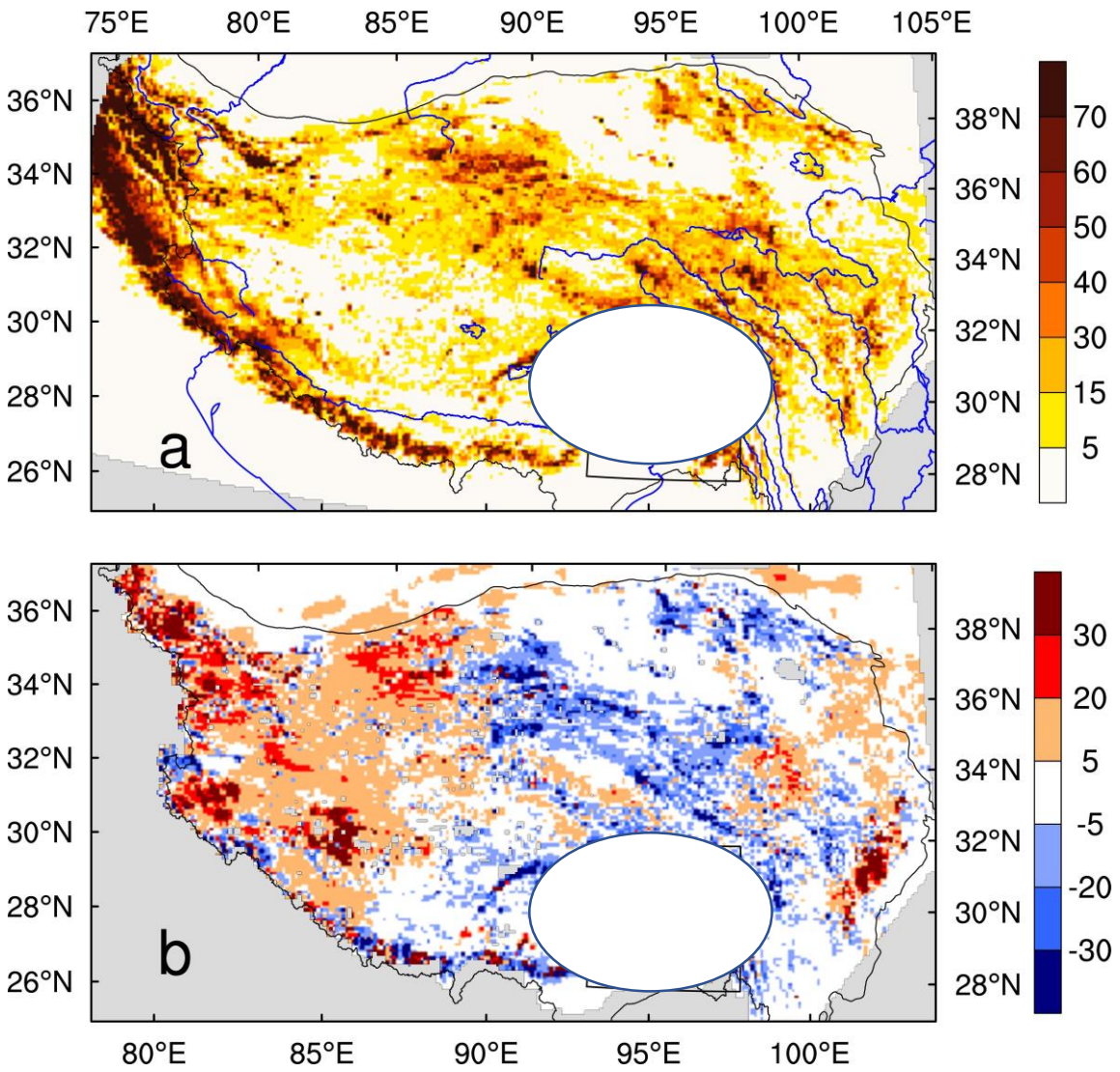
Topography differences between 4km grid cells and stations in the Brahmaputra Grand Canyon



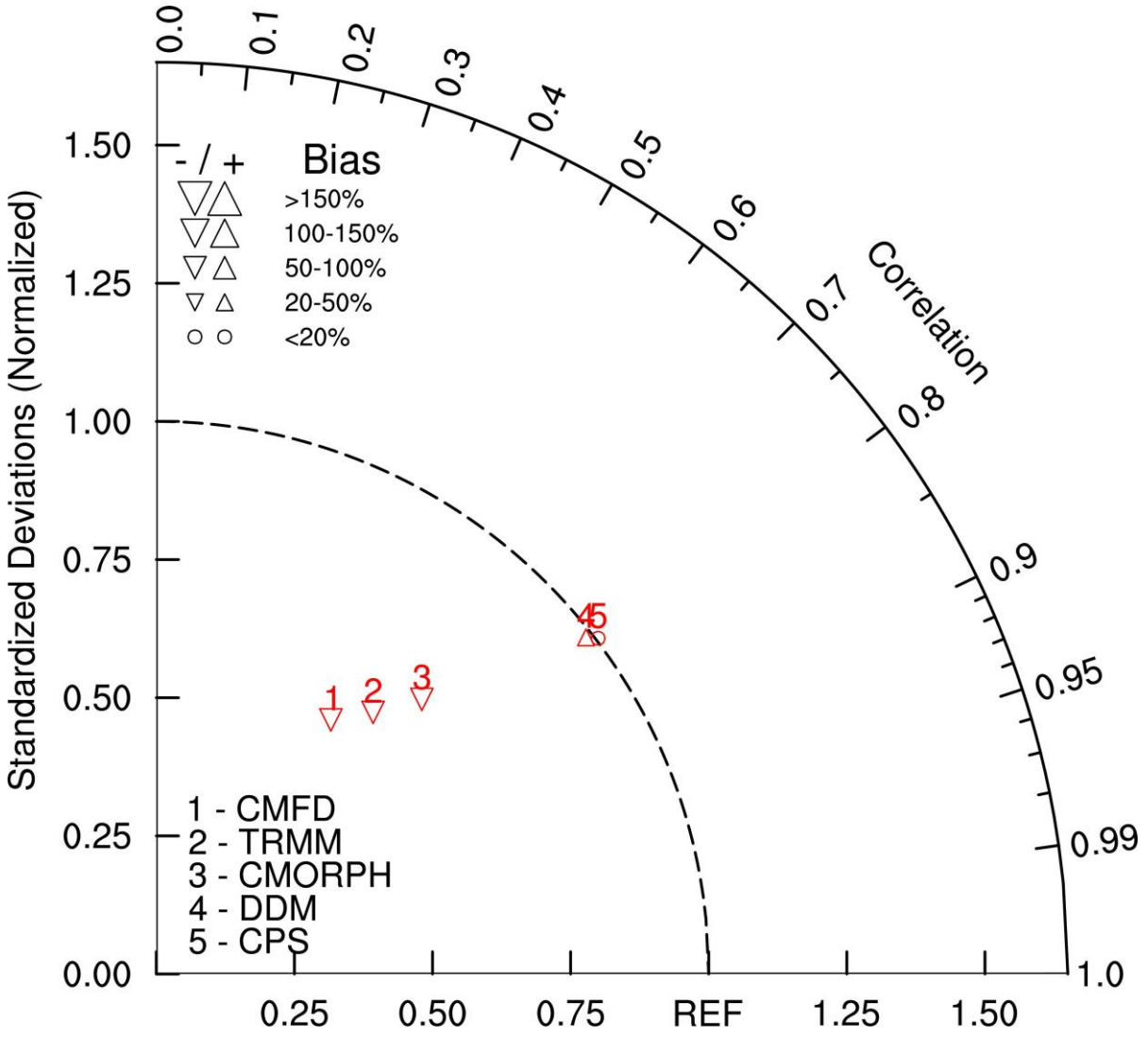
Noah-MP simulated snow cover fraction

MODIS

Noah-MP
driven by CMFD
underestimates
SCF

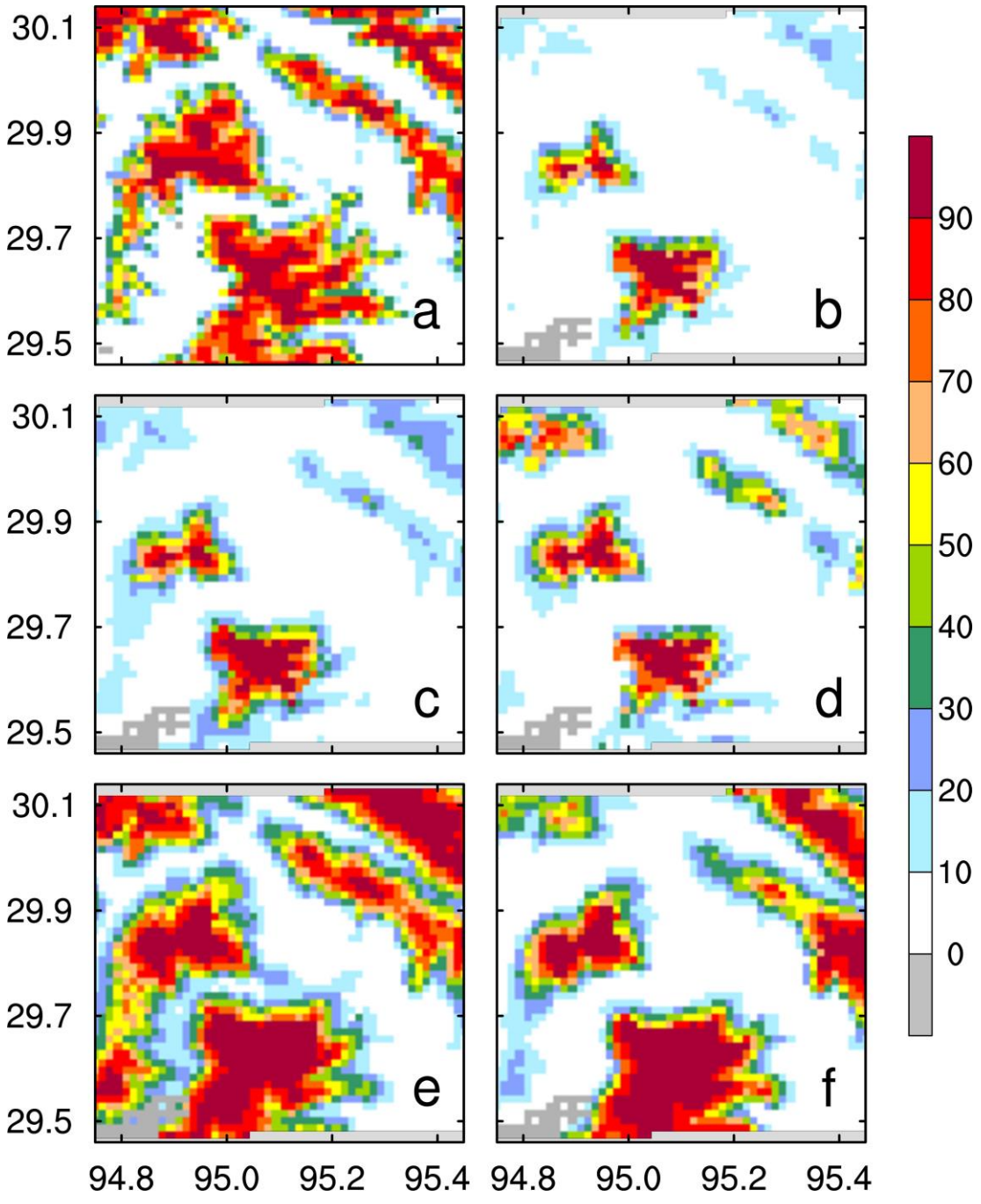


Taylor diagram of SCF simulations driven by multi precipitation datasets



Spatial distribution of snow cover fraction

a) MODIS
Noah-MP runs driven by precipitation of
b) CMFD
c) TRMM
d) CMORPH
e) DDM
f) CPS



Summary

- Five precipitation datasets show great uncertainties in the TP compared to CMA station records.
- Noah-MP run driven by the merged precipitation datasets substantially underestimates snow cover fraction in the central and eastern TP, in particularly, in the Brahmaputra Grand Canyon.
- Simulated snow cover fraction driven by DDM and CFS precipitation agree MODIS snow cover fraction much better than the three merged precipitation driven runs.