Seasonal variation of the surface wind forecast performance of the 3km-grid WRF-RTFDDA forecasting system over China.
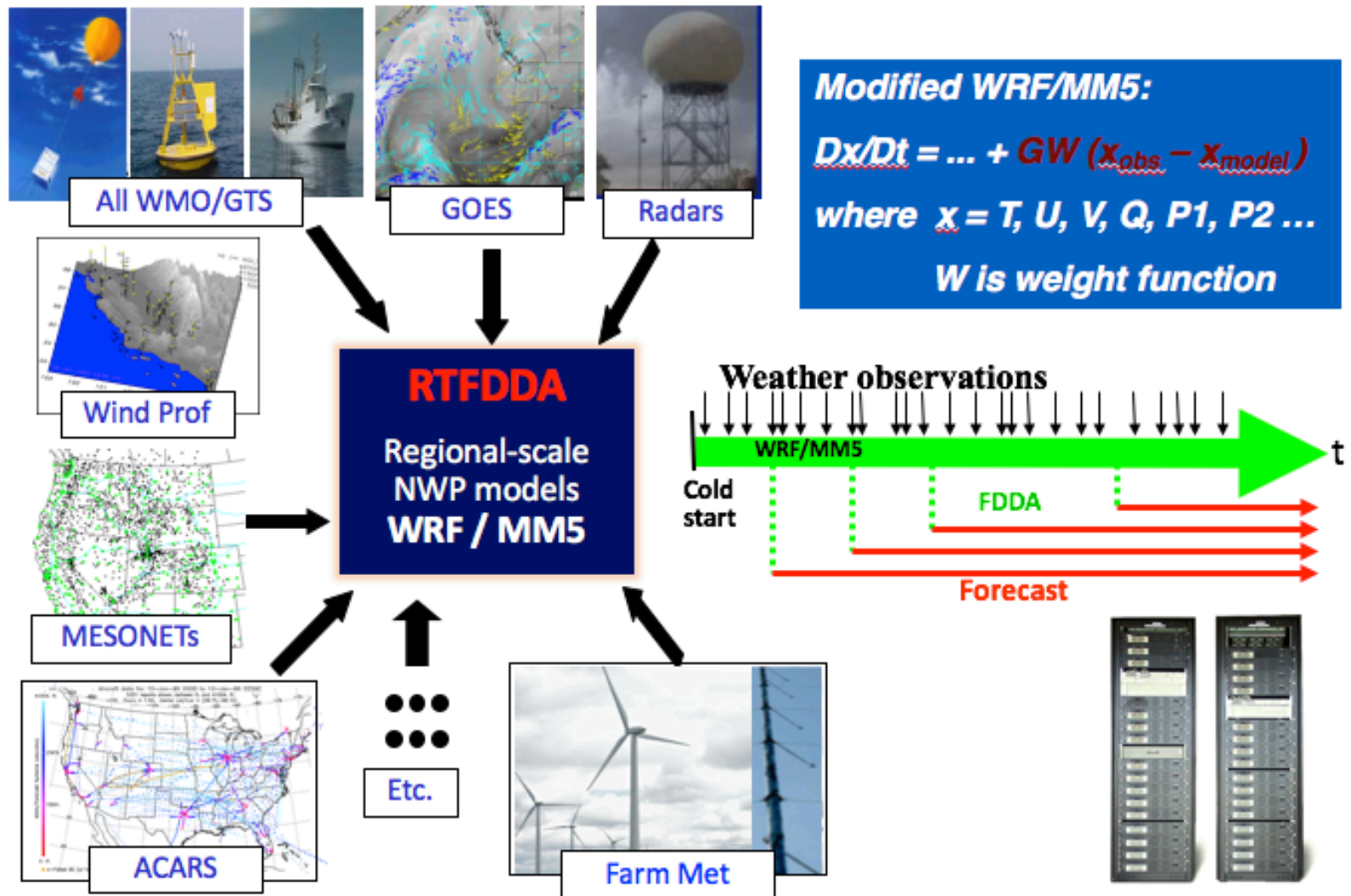
Linlin Pan [1], *Yubao Liu* [1], *Gregory Roux*[1], *Will Cheng* [1], *Yuewei Liu*[1], *Ju Hu*[2], *Shuanglong Jin* [2], *and Shuanglei Feng*[2]

[1]NCAR/Research Application Laboratory, Boulder, CO
[2]China Electric Power Research Institute, Beijing, China

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

Real-time four dimensional data assimilation (RTFDDA)

Modified WRF/MM5:

$$Dx/Dt = \ldots + GW(x_{obs} - x_{model})$$

where $\underline{x} = T, U, V, Q, P1, P2 \ldots$

W is weight function

Model domain
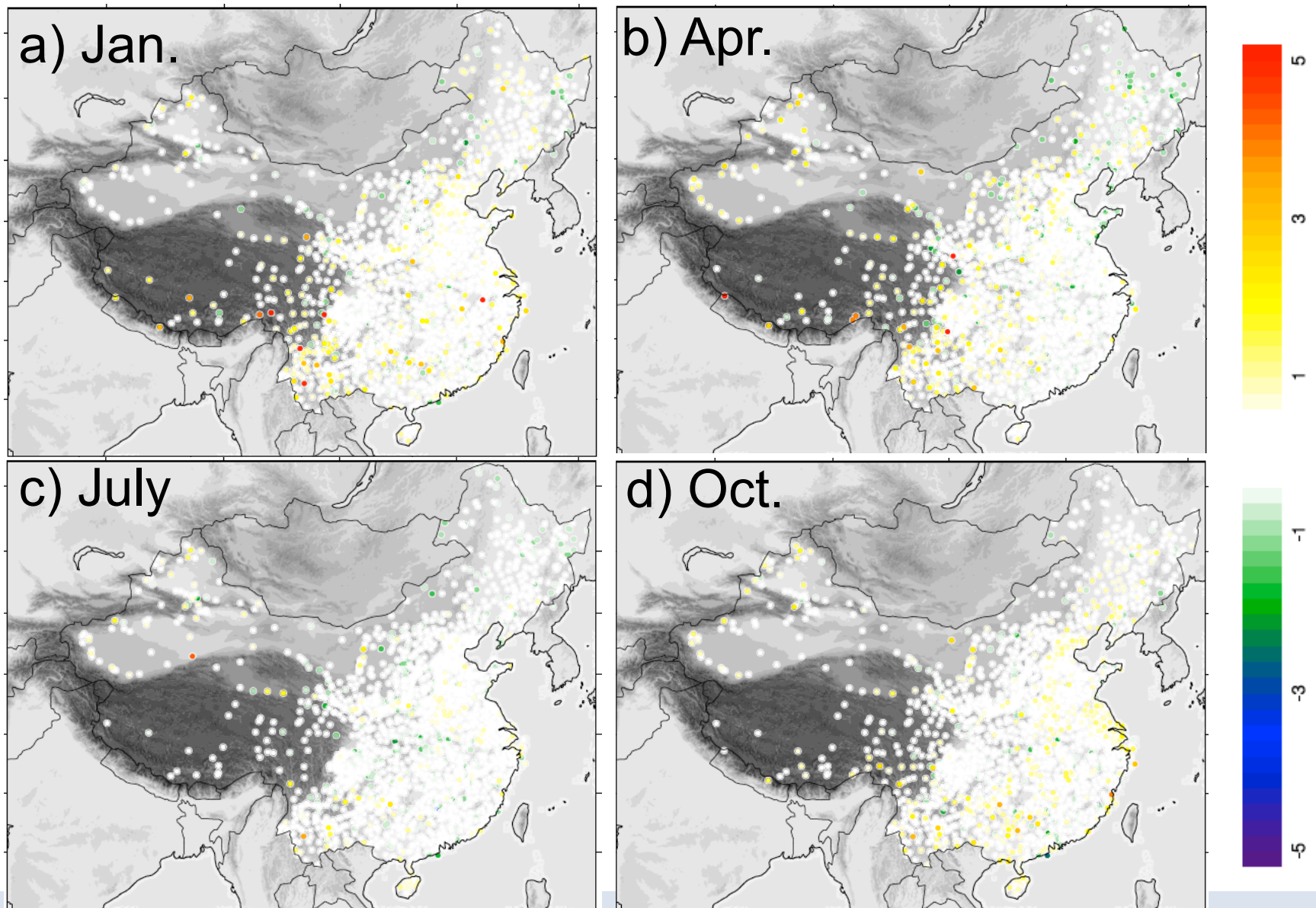

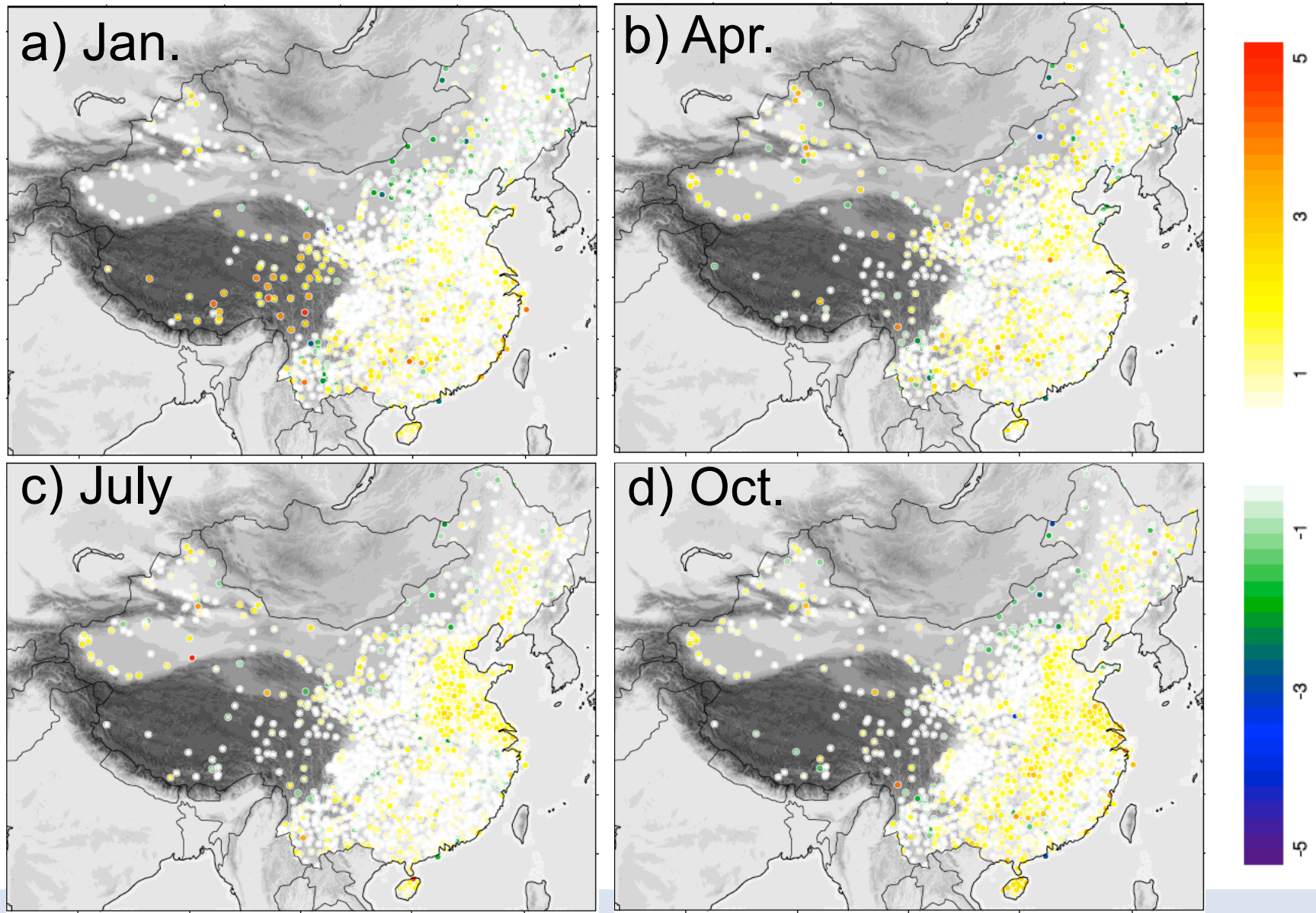GMTED2010 30-arc-second topography height   meters MSL
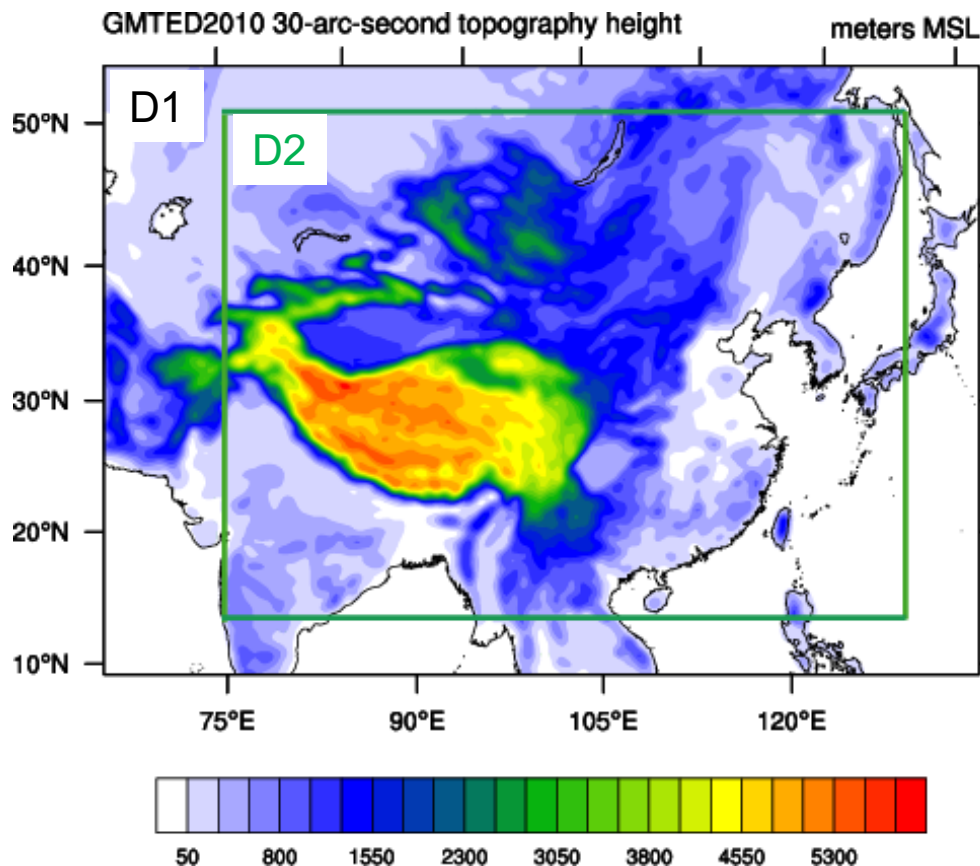
- WRF3.8.1
- 2 domains
  (15km, 651x483
  3km, 1830x1395)
- Thompson Microphysics
- RRTMG Longwave
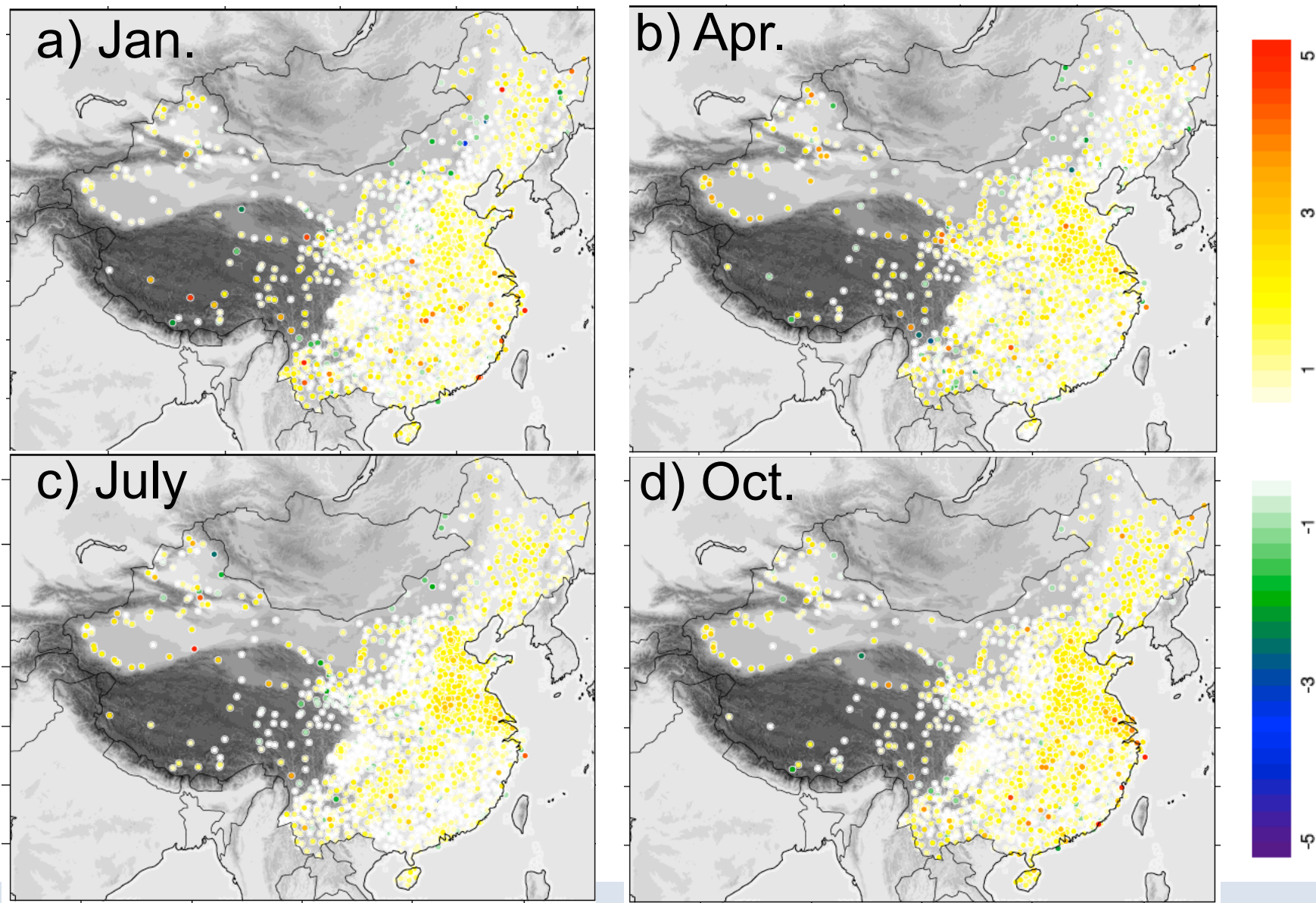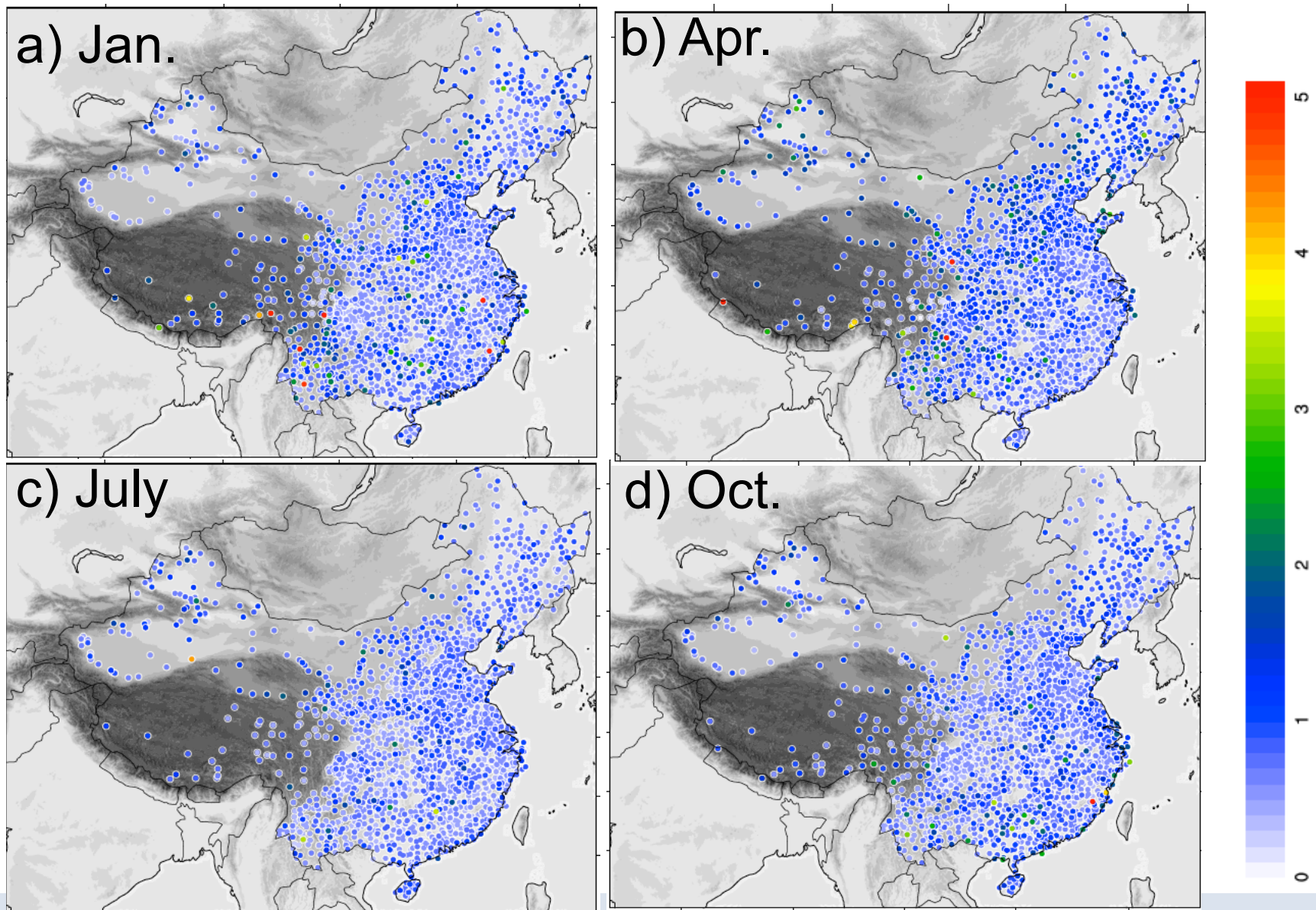- RRTMG Shortwave
- Modified YSU PBL
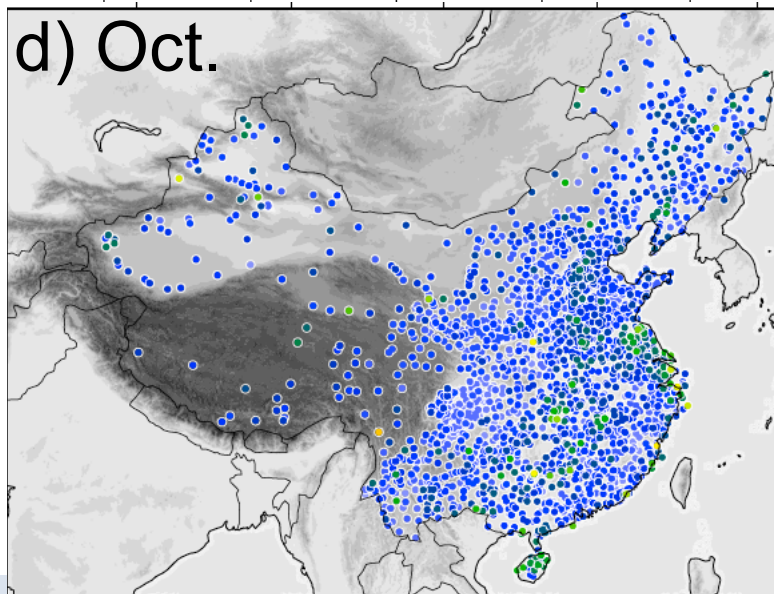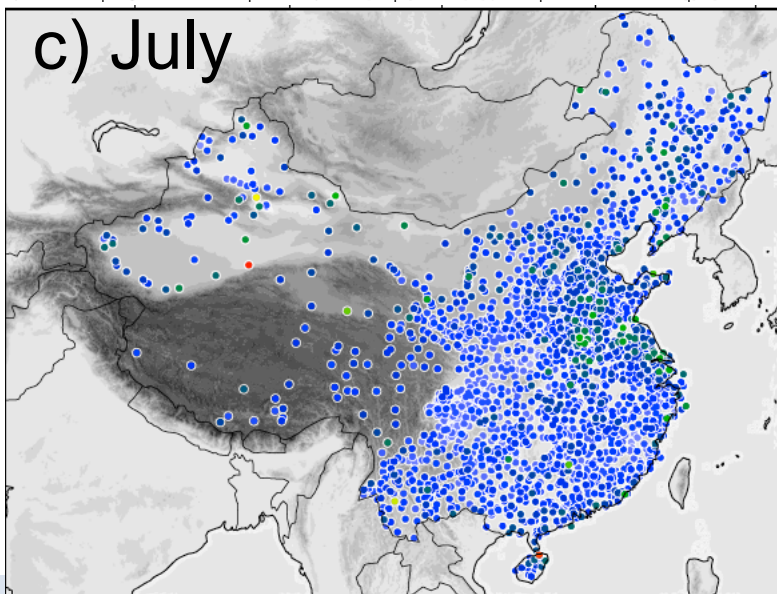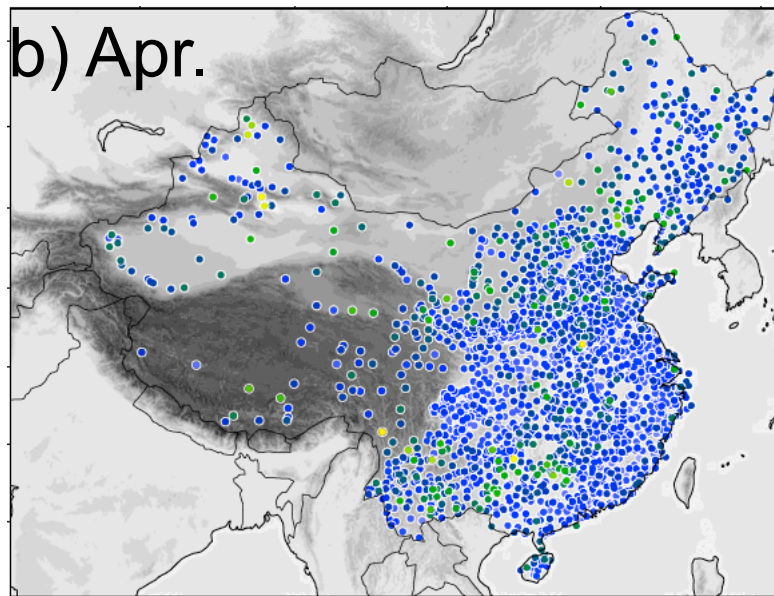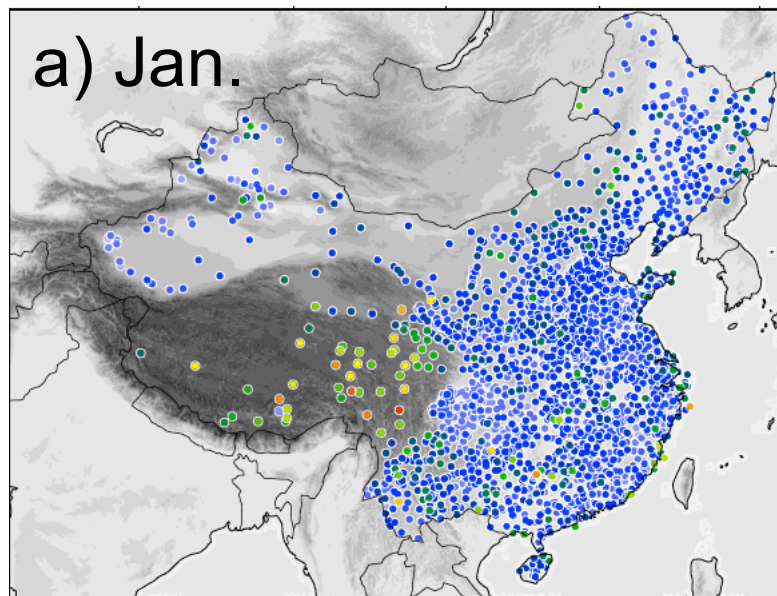- Noah land surface model
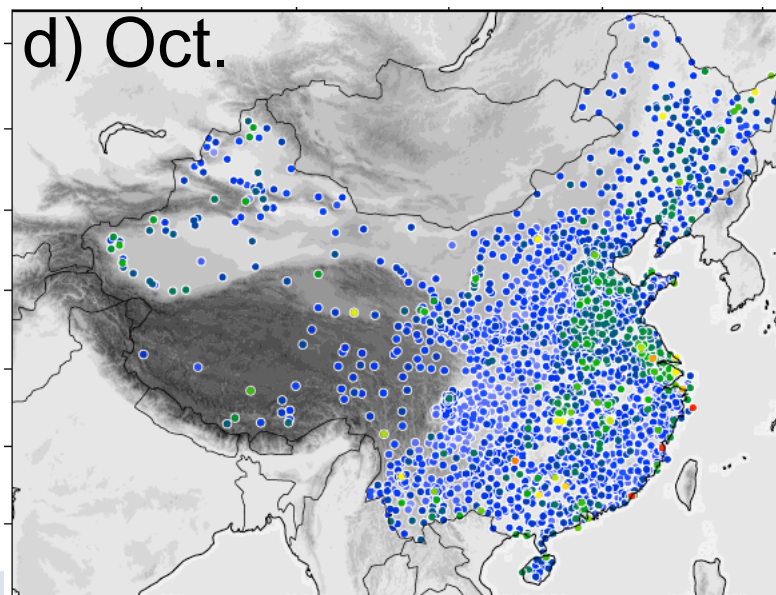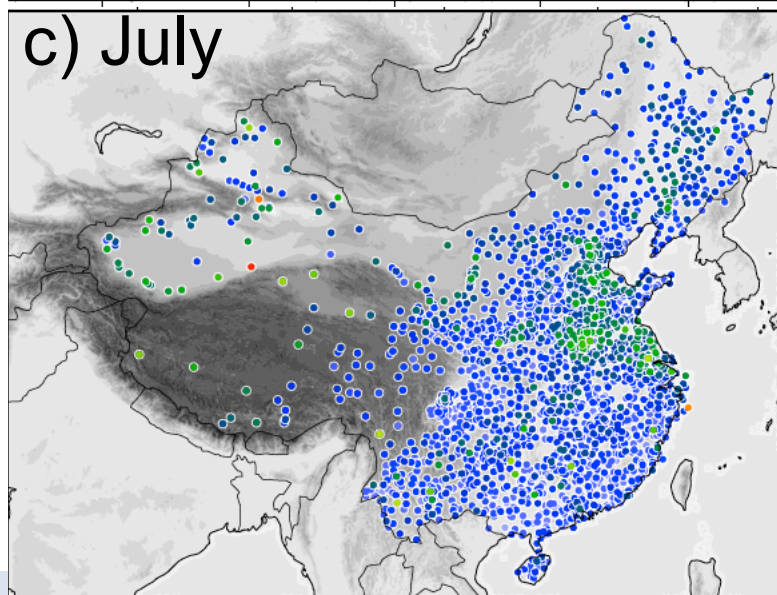
SPD bias for analysis at 00Z

SPD bias for 6h FCST at 06Z

SPD bias for 12h FCST at 12Z

SPD MAE for analysis at 00Z
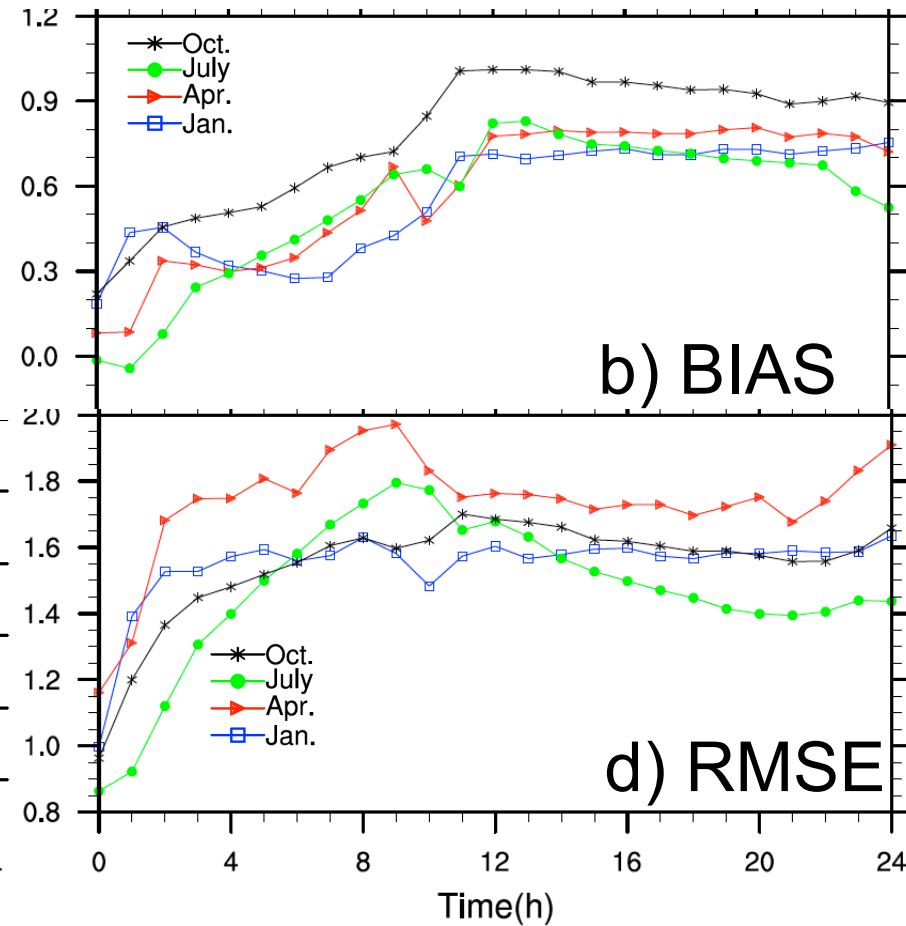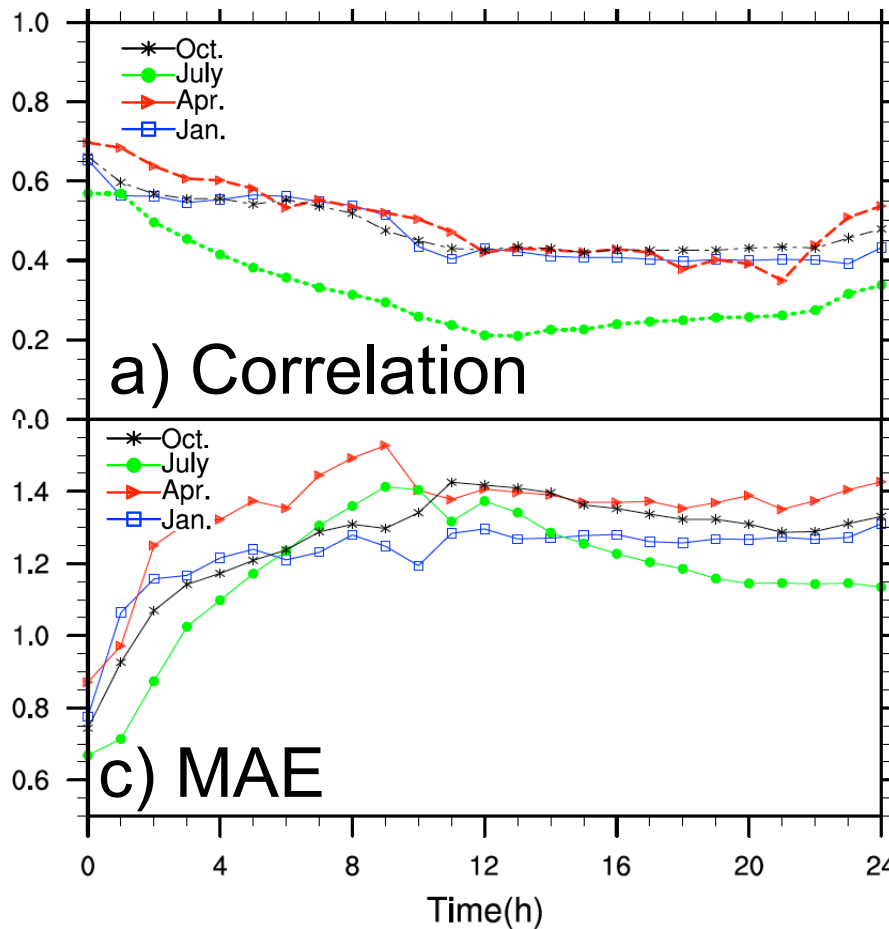

a) Jan.

b) Apr.

c) July

d) Oct.

SPD MAE for 6h FCST at 06Z

SPD MAE for 12h FCST at 12Z
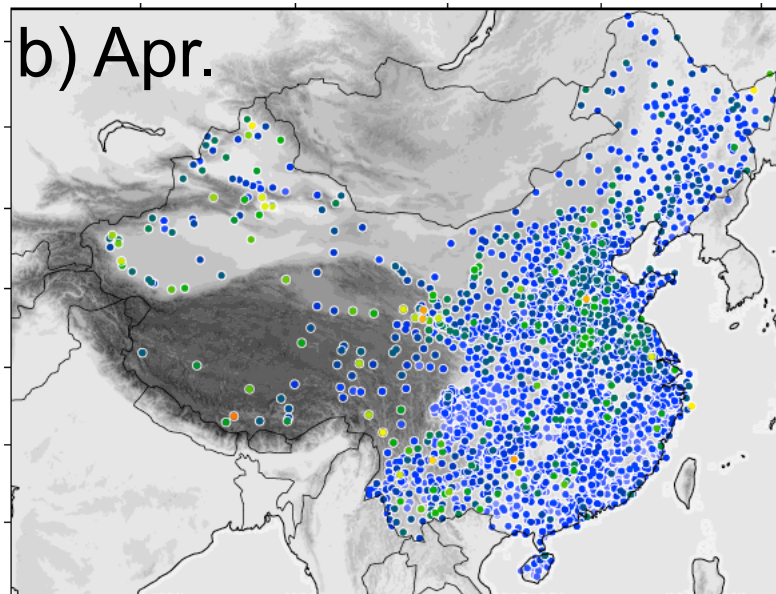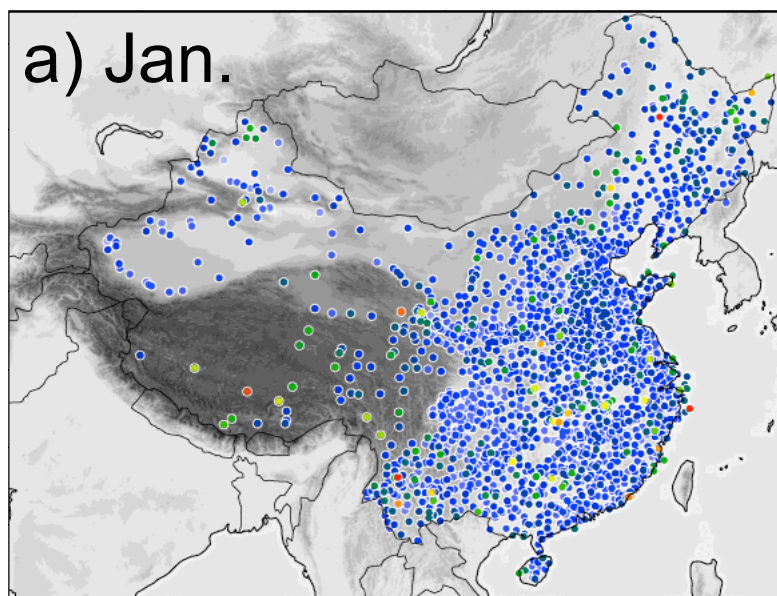
Domain average statistics

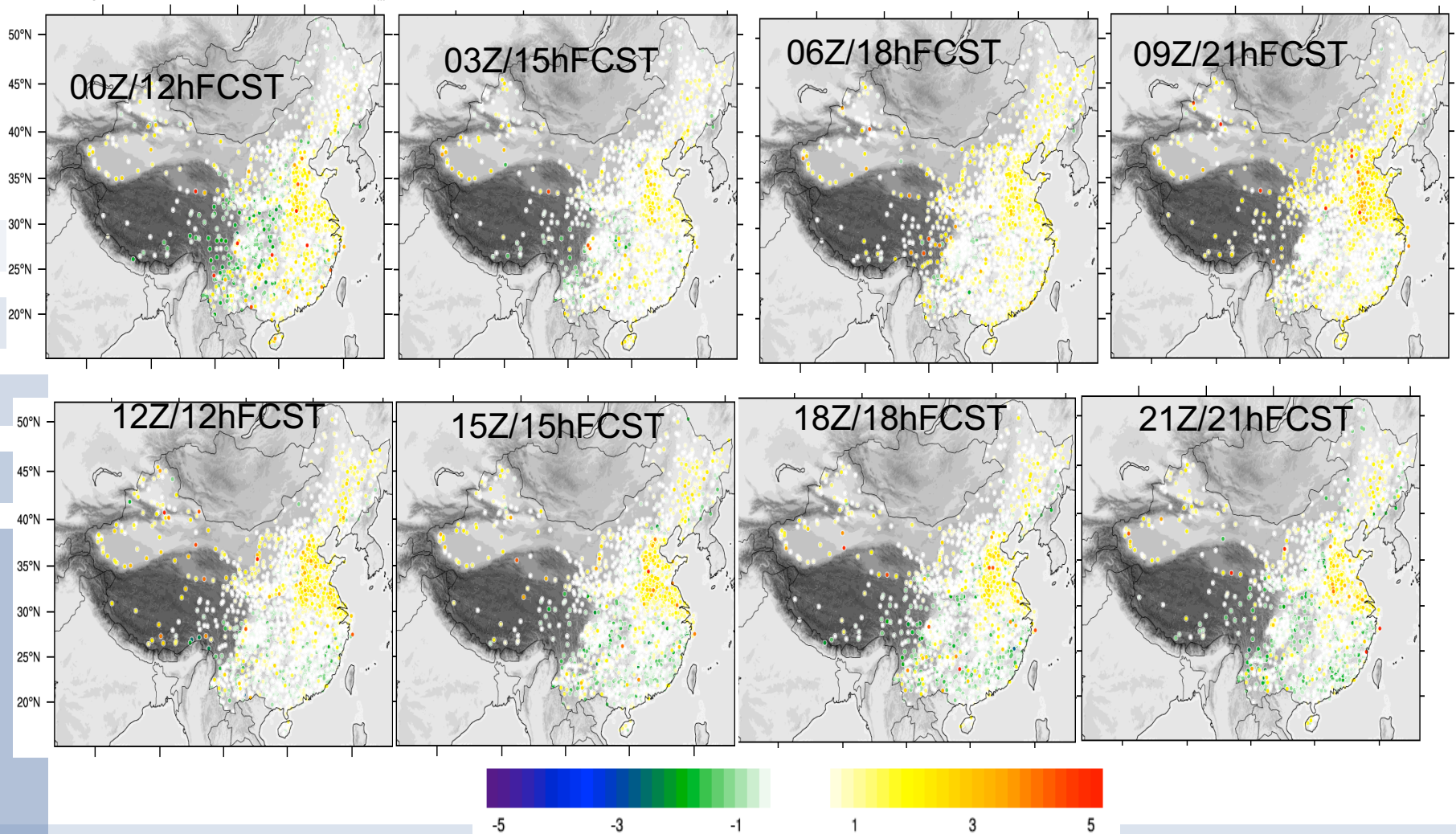# BIAS variation with wind speeds

$0m/s<WS_{obs}\leq 1m/s$

0Z cycle bias average for 12hr fcst (0m/s<ws<1m/s)
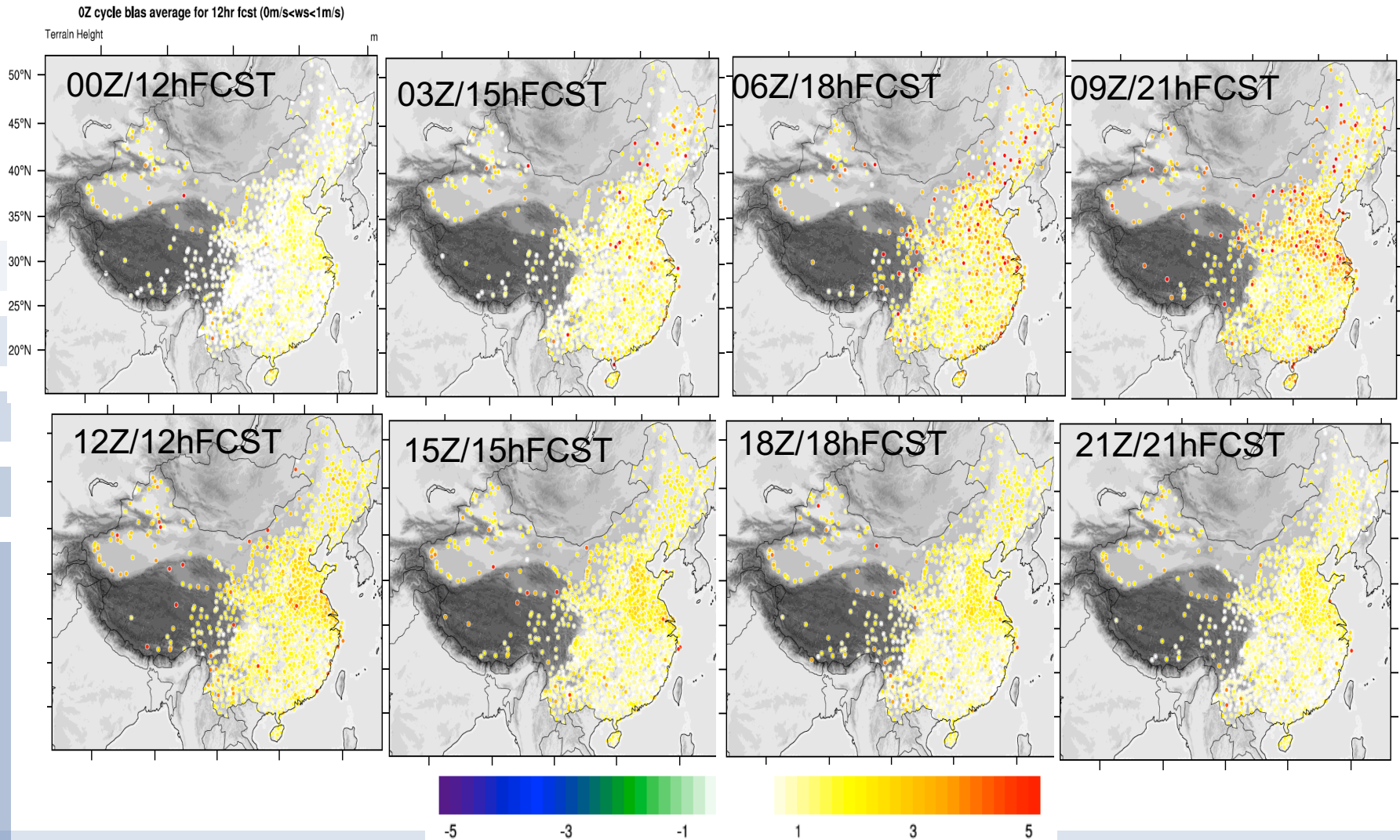
Terrain Height

2m/s<WS$_{obs}$≤ 3m/s

0Z cycle bias average for 12hr fcst (2m/s<ws<3m/s)

Terrain Height

3m/s<WS$_{obs}$ ≤ 4m/s
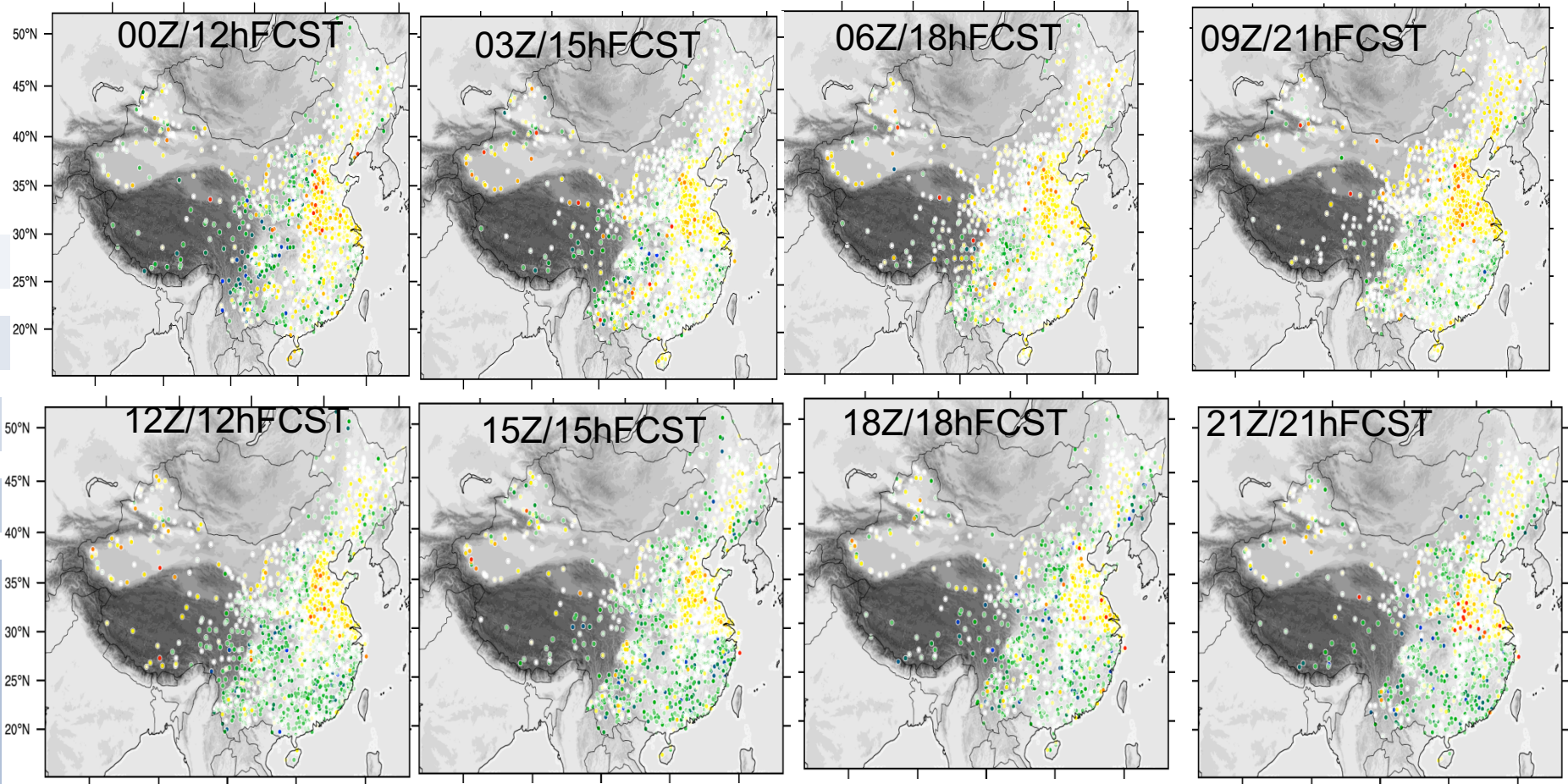
5m/s<WS$_{obs}$ ≤ 6m/s

0Z cycle bias average for 12hr fcst (5m/s<ws<6m/s)

Terrain Height
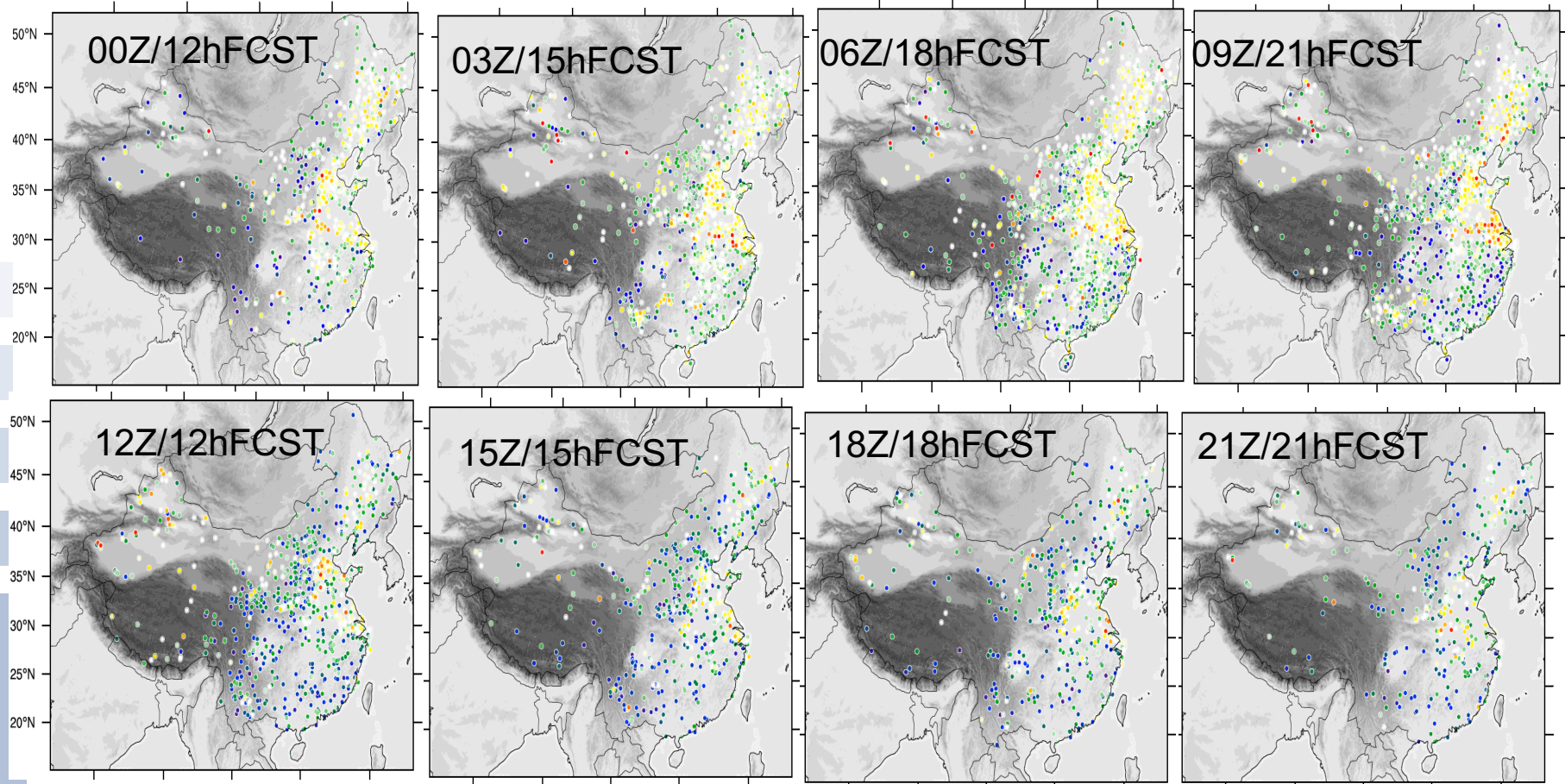
00Z/12hFCST
03Z/15hFCST
06Z/18hFCST
09Z/21hFCST

12Z/12hFCST
15Z/15hFCST
18Z/18hFCST
21Z/21hFCST

$7m/s < WS_{obs} \leq 8m/s$
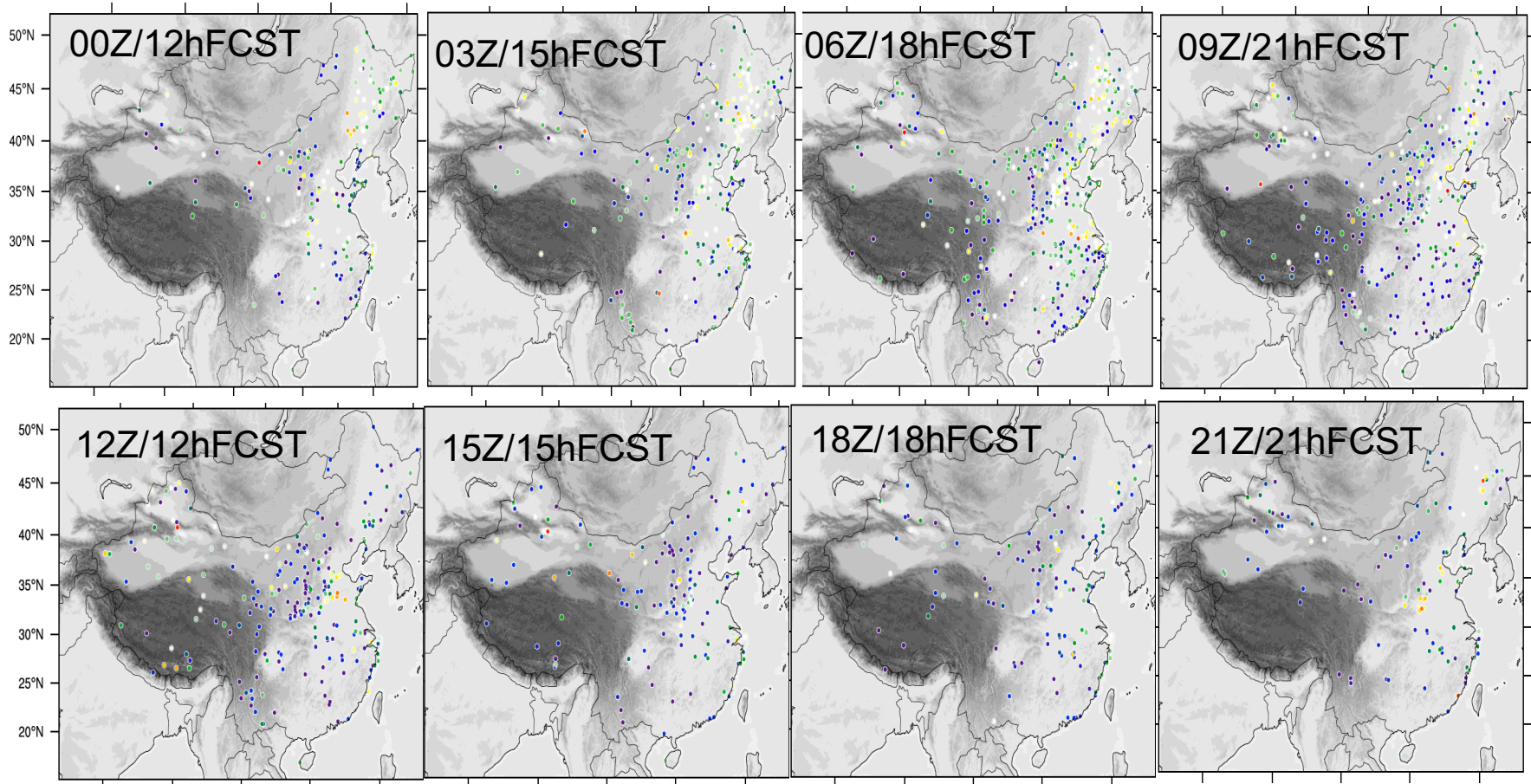
8<WS$_{obs}$ ≤ 9m/s
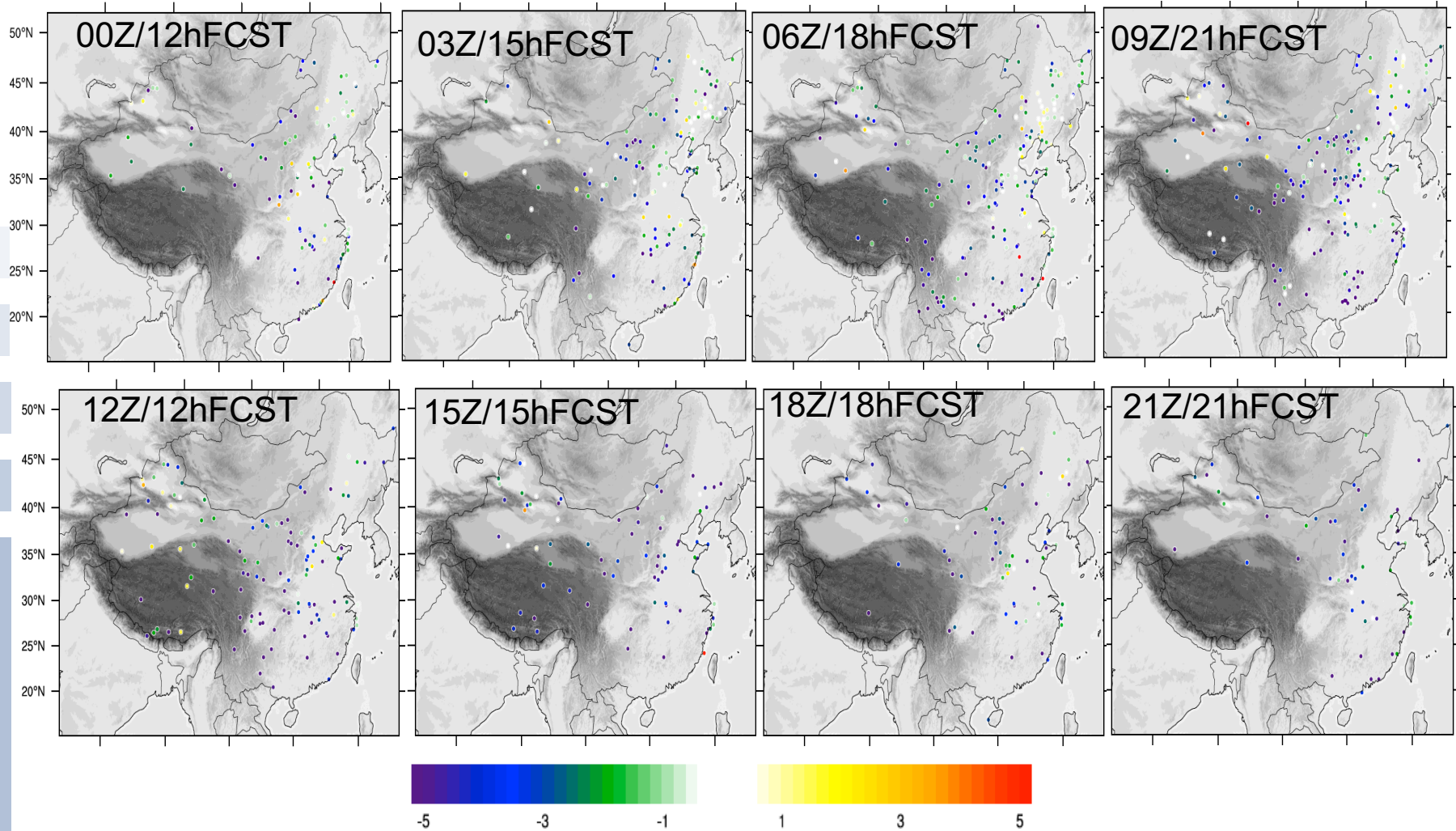
0Z cycle bias average for 12hr fcst (8m/s<ws<9m/s)

Terrain Height   m

00Z/12hFCST   03Z/15hFCST   06Z/18hFCST   09Z/21hFCST

12Z/12hFCST   15Z/15hFCST   18Z/18hFCST   21Z/21hFCST
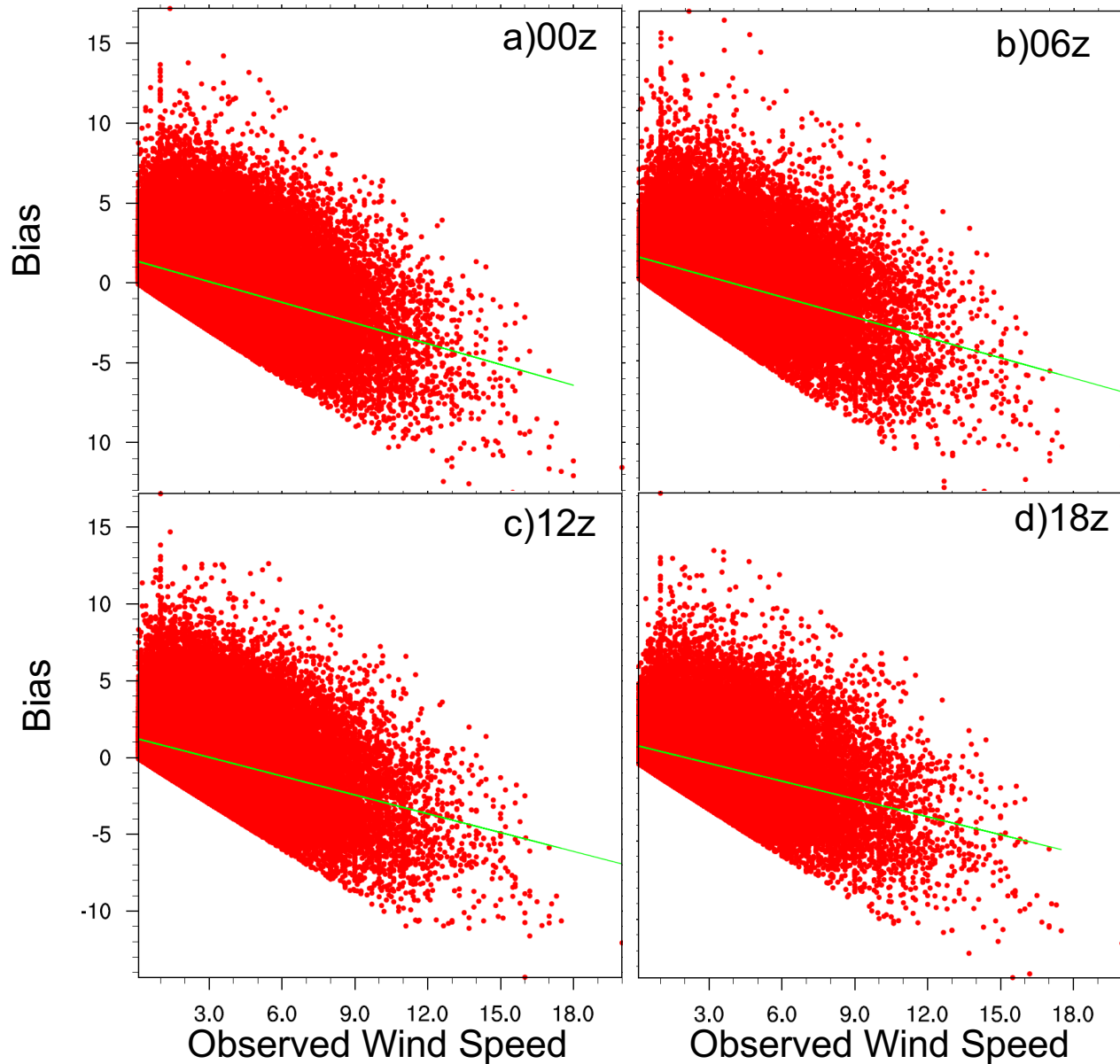
-5   -3   -1   1   3   5
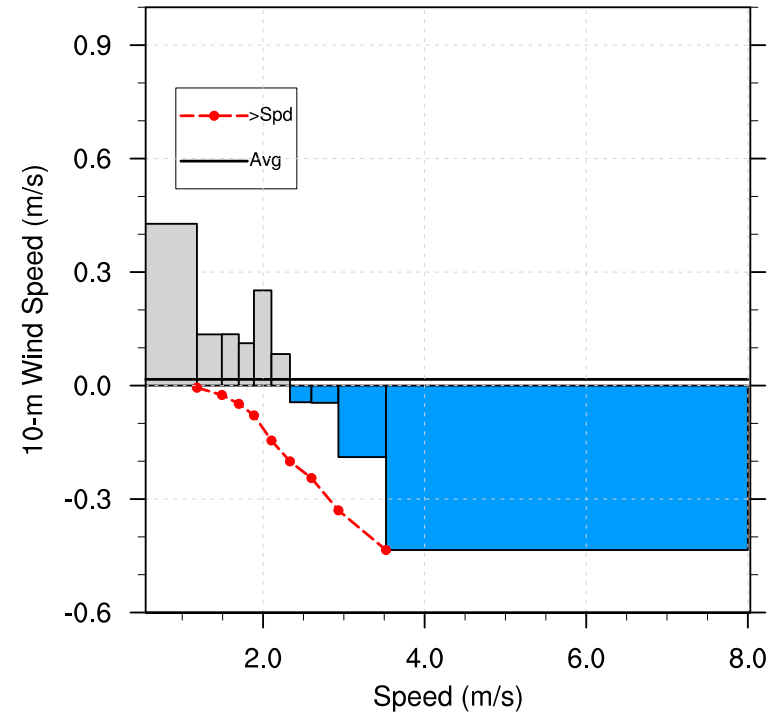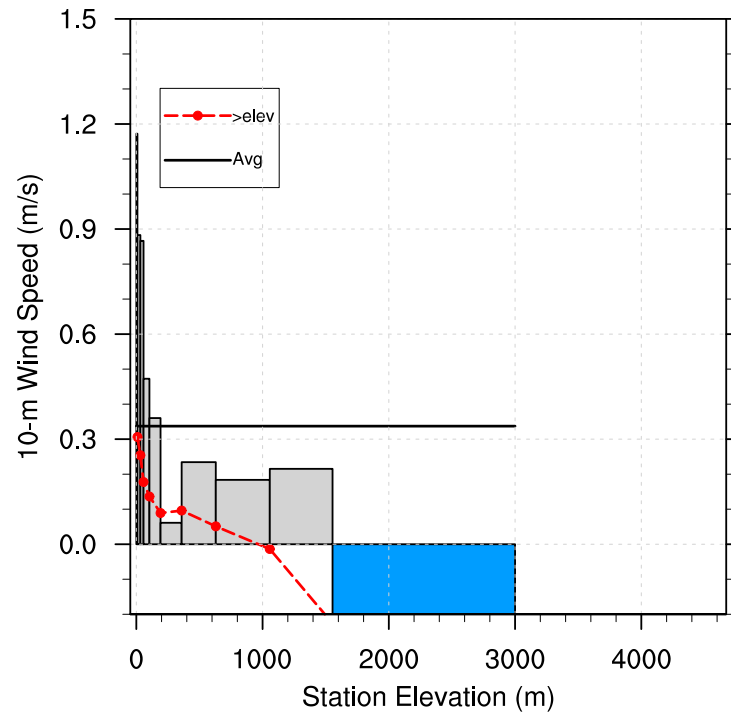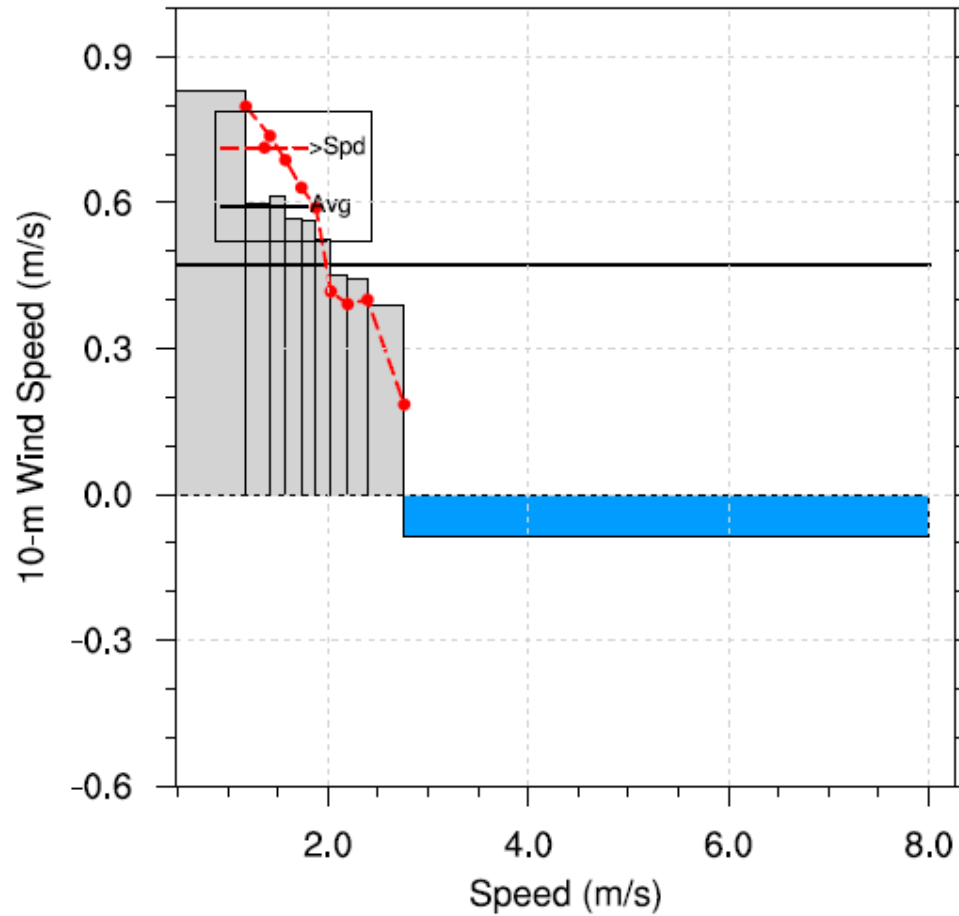
WSobs>6m/s
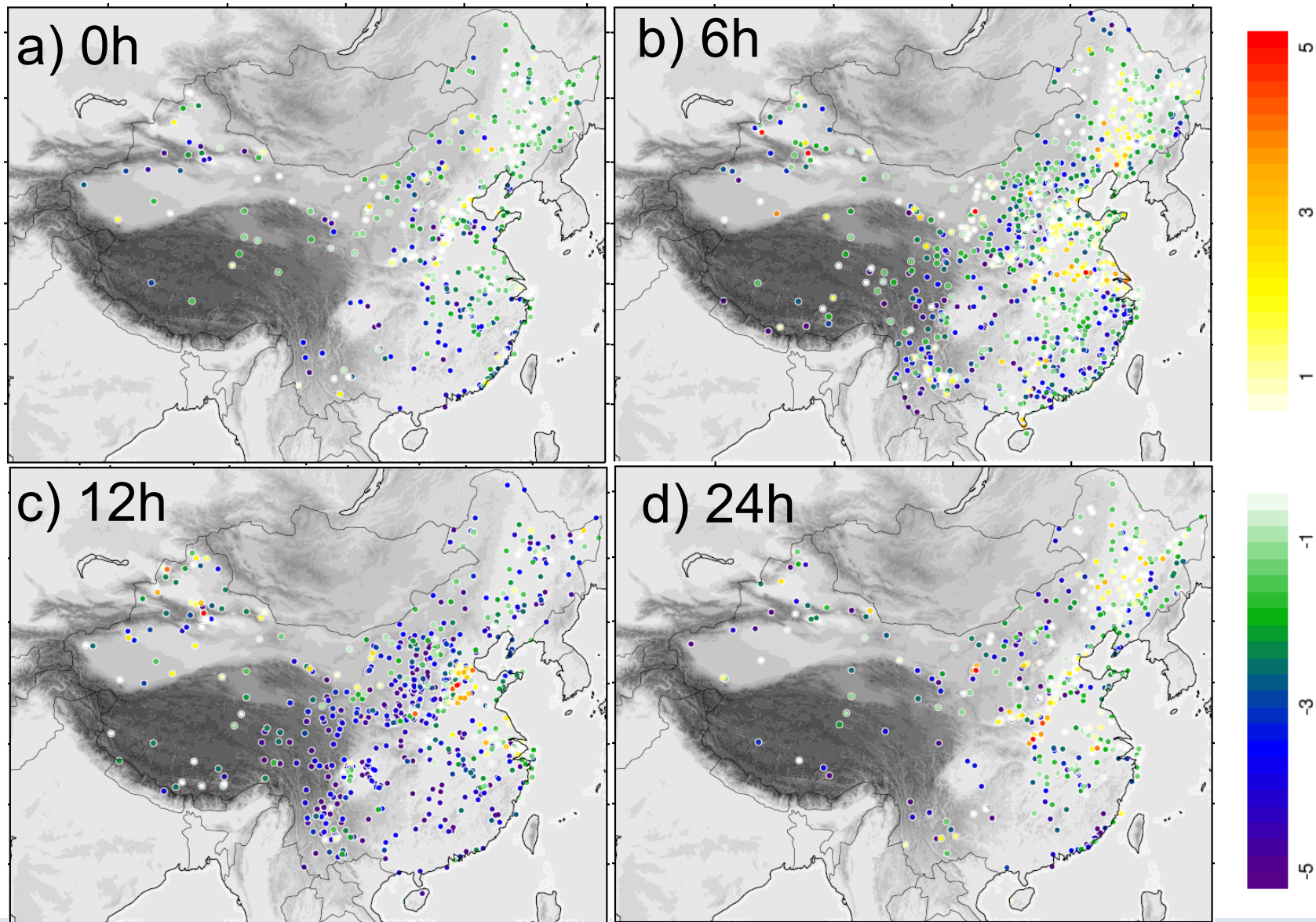
WSmod>6m/s
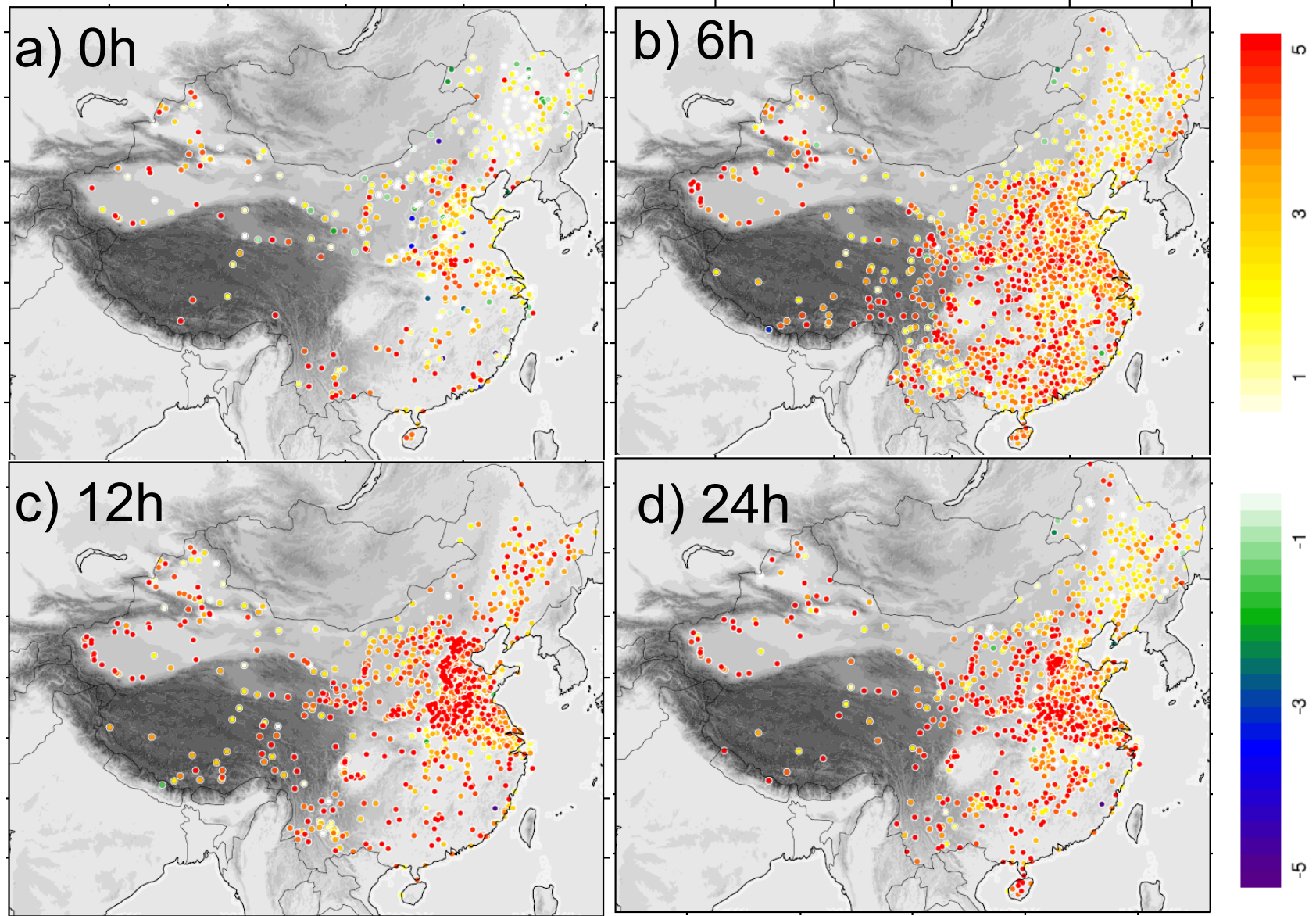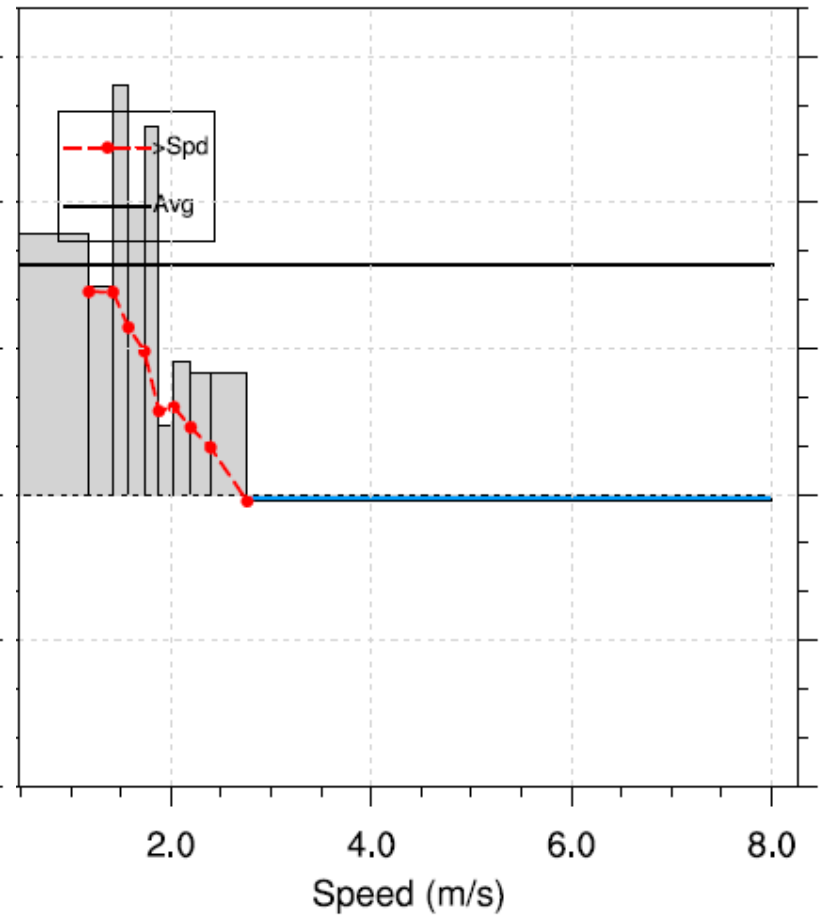
Bias changes with observed wind speed

BIAS vs height and speed

Different regions

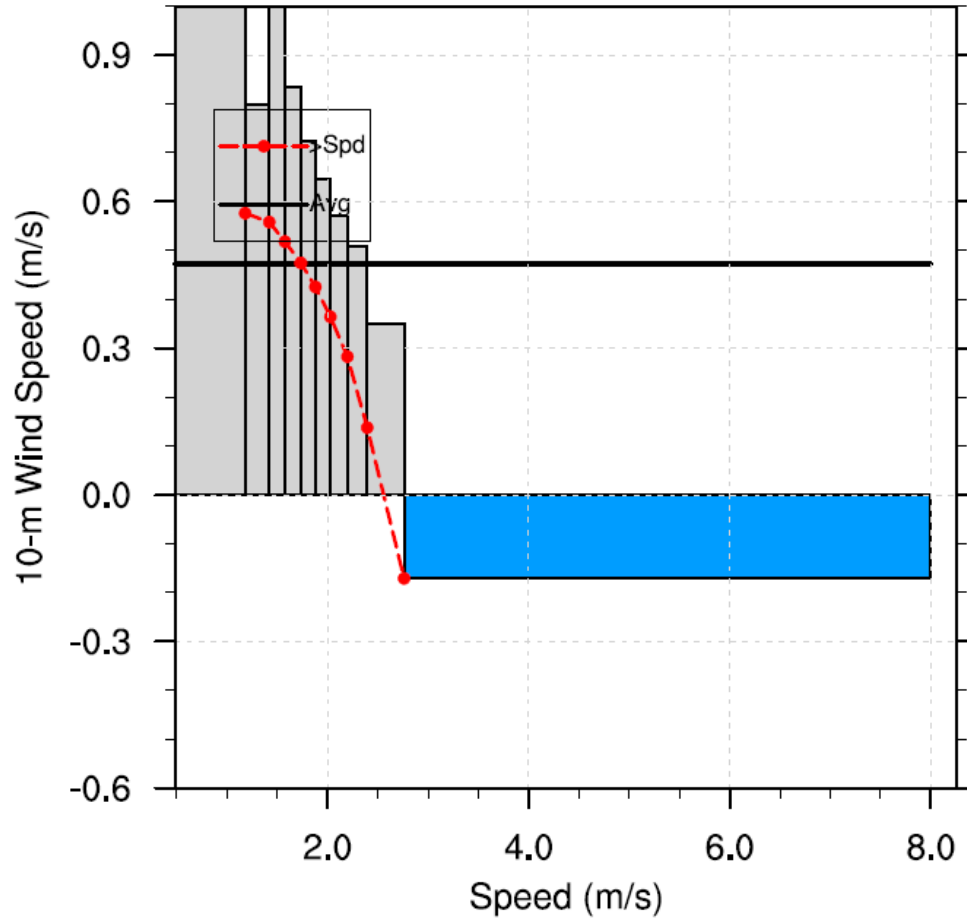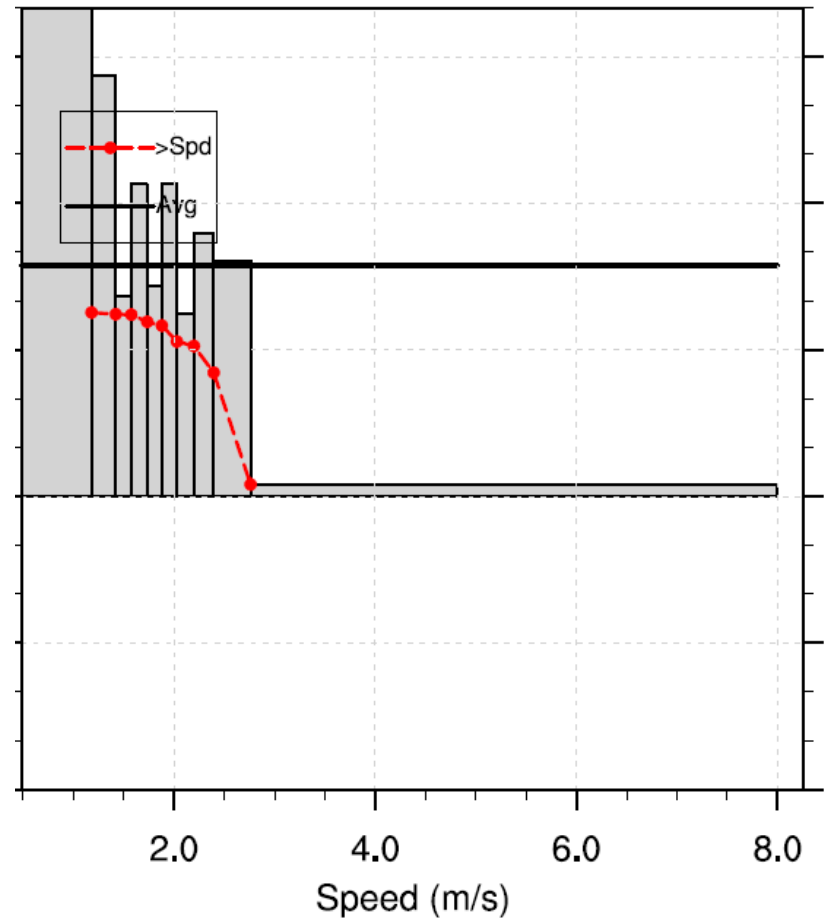Xinjiang　　　　　　Xizhang-Qinghai

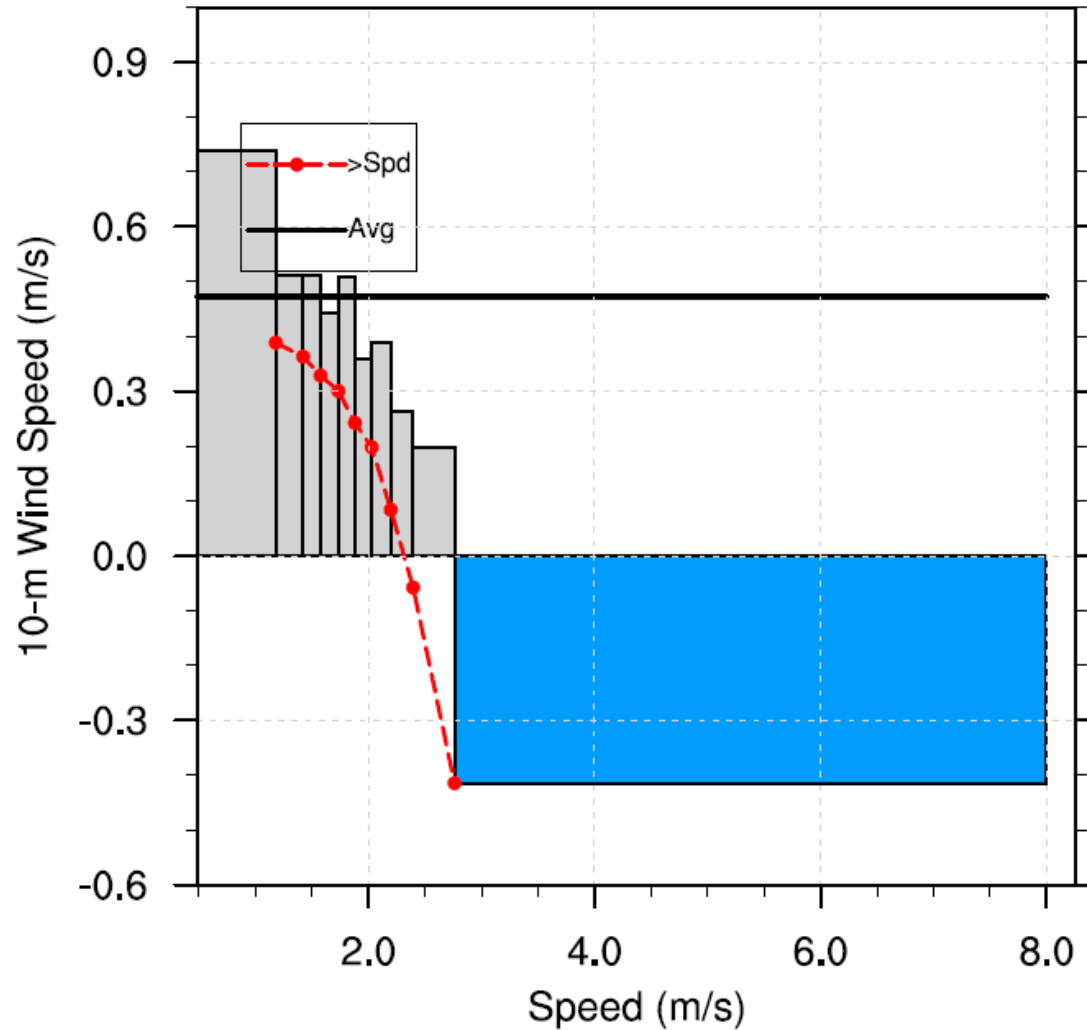# Different regions

Huabei   Dongbei

Different regions

Huadongnan

Summary

- The wind bias varies obviously with seasons. It has the largest diurnal changes in summer.

- WRF tends to have positive bias for weak winds and negative bias for high winds.

- WRF performances varies geographically. It has positive bias for lower topography regions, and negative bias for high topography areas.

- Some underprediction of strong winds may due to the spatiotemporal phase errors.