Part 1: Review what has been done & the remaining problems

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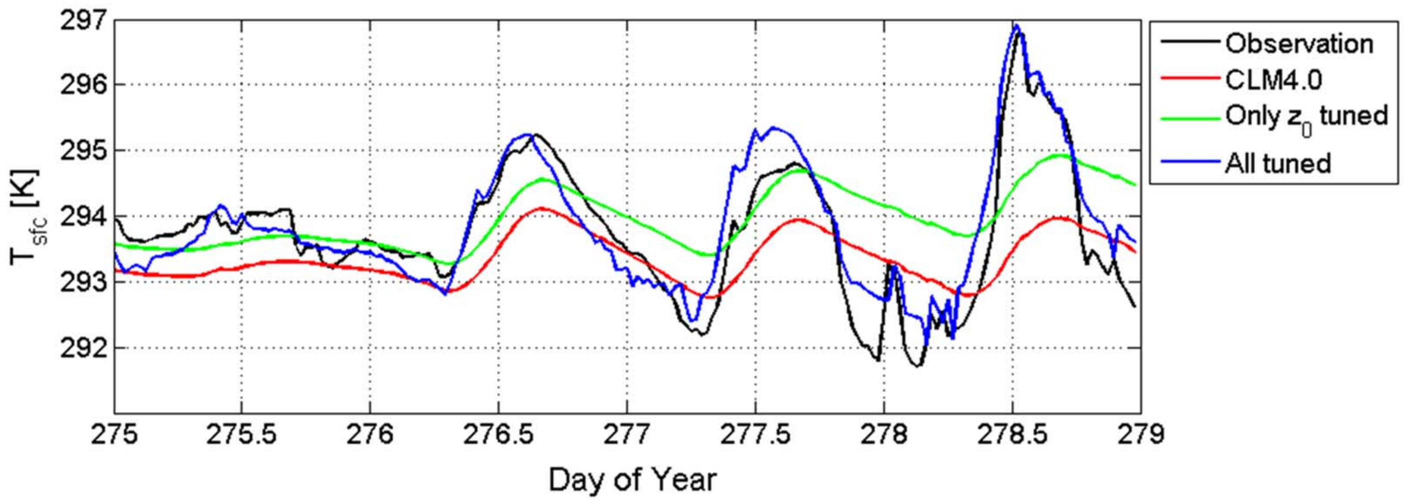
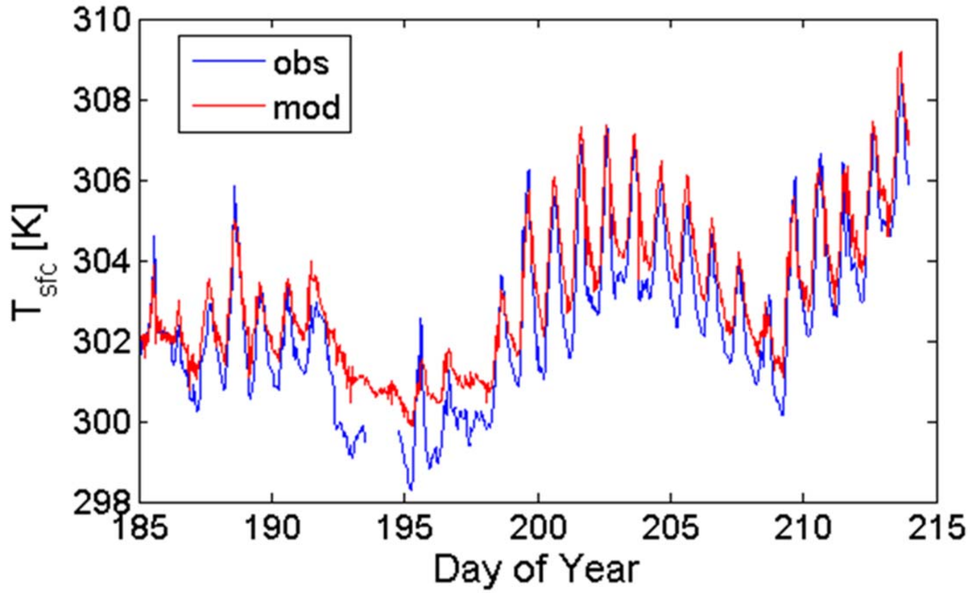
1.1 Tuned parameters

	Taihu specific	CLM4.0 default
Roughness length (z_0)	z_{0m}, z_{0h}, z_{0q} derived from Wei's work in transfer coefficients	$z_{0m}=f(u_*, Depth, Fetch^*)$ for unfrozen lake (if $Fetch$ is available)
Light extinction coefficient (η)	2.21 m^{-1}	η = $1.1925 \cdot Depth^{-0.424}$ (which is 0.89 m^{-1})
Eddy diffusivity (k_e)	0.02 of the default value	enhanced diffusion included



1.2 Remaining problems



Problem 1: not performs well during nighttime and the passage of cold fronts;

Problem 2: extend the evaluation to the 2011 dataset and DPK (大浦口) dataset;

Part 2: Updates on the remaining problems

2.1 Problem 1 (nighttime and cold front situations)

At each time step:

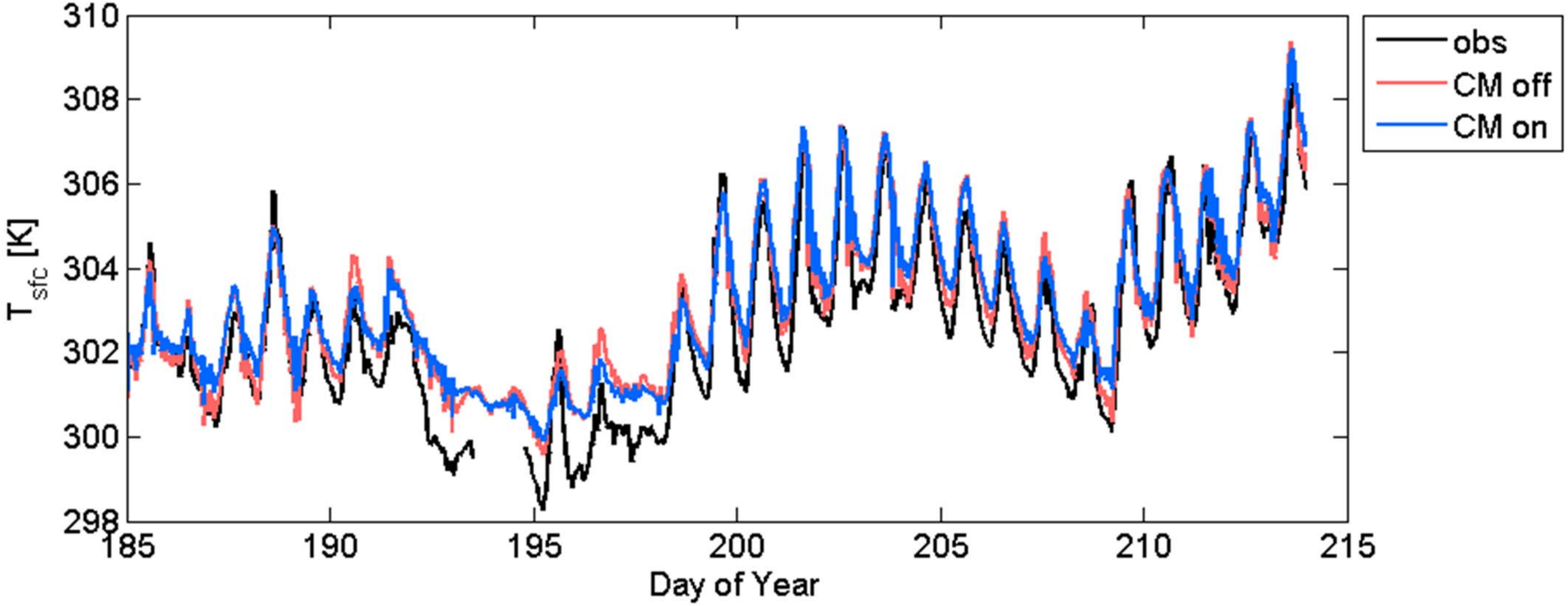
after the calculation of lake T for all the layers

```
if (instability exists between layer i and layer j)
        Ts for all layers between these two layers are
         replaced by the thickness weighted average
end
```

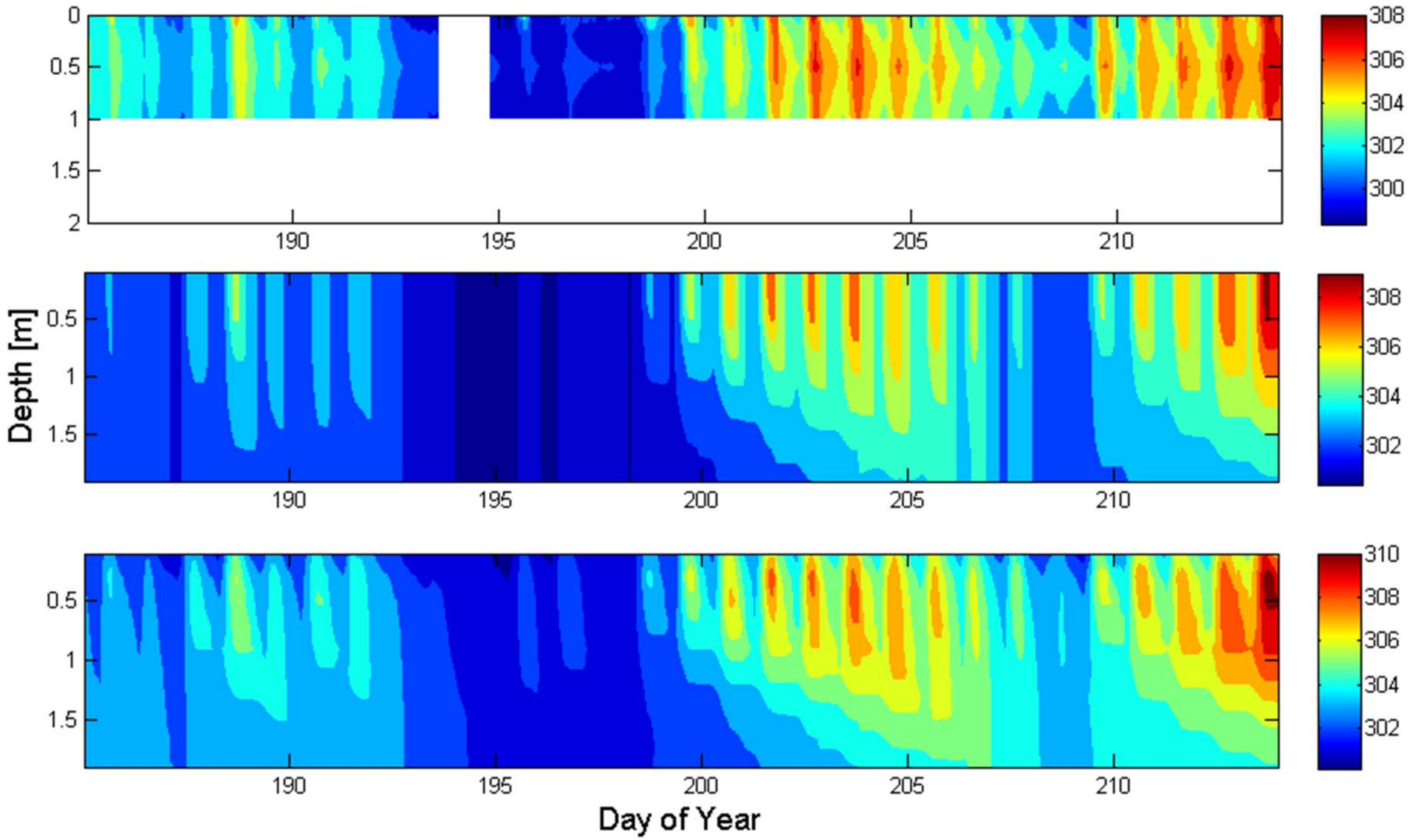
Convective mixing (CM): assume instability removed instantly

During nighttime and the passage of cold front, lake surface is colder than the layers below. Implementing CM thus overestimates Tsfc under these circumstances.

2.1 Problem 1 (nighttime and cold front situations)

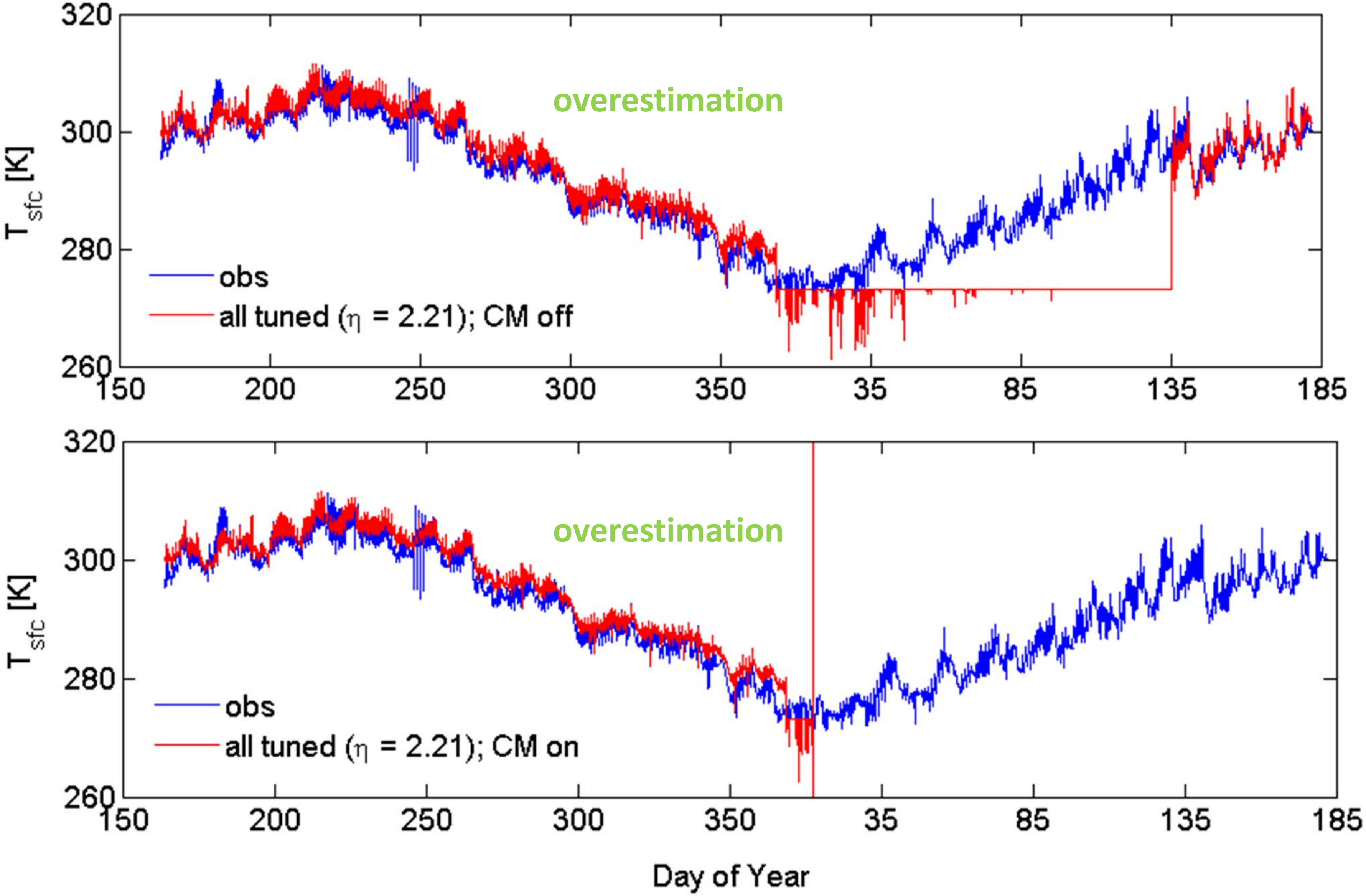


2.1 Problem 1 (nighttime and cold front situations)

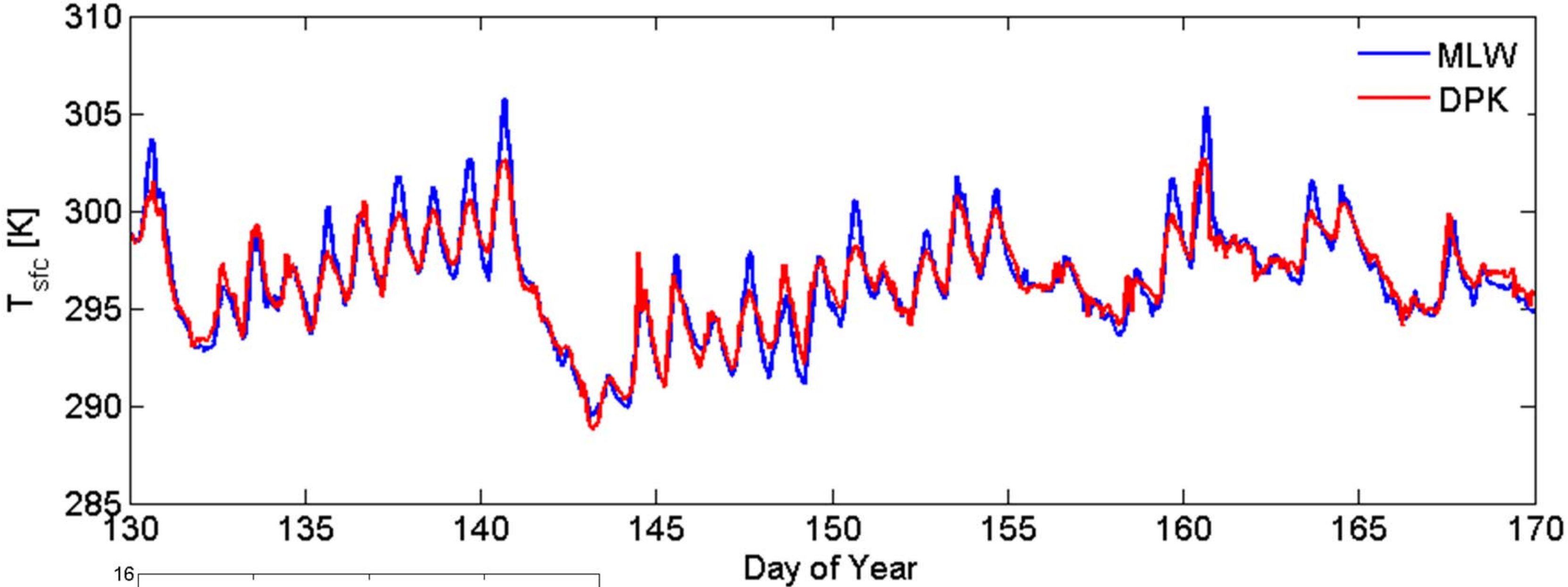


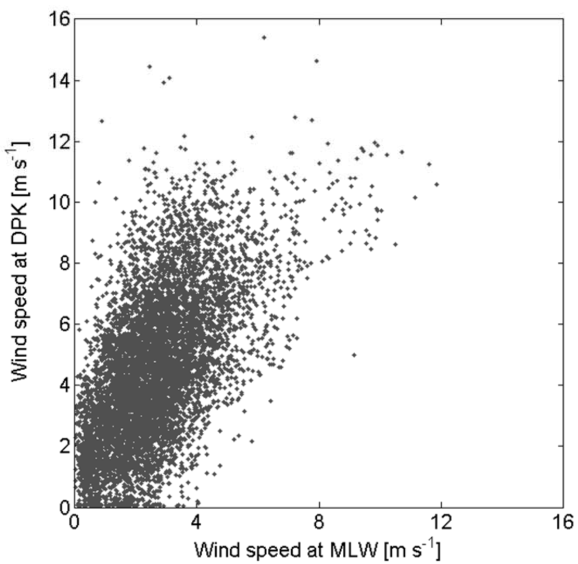
(**Top**): Observation; (**Middle**): CM on; (**Bottom**): CM off

2.2 extend the evaluation to the MLW (梅连湾) 2010-2011 gap-filled dataset



2.2 extend the evaluation to the DPK (大浦口) 2011 dataset

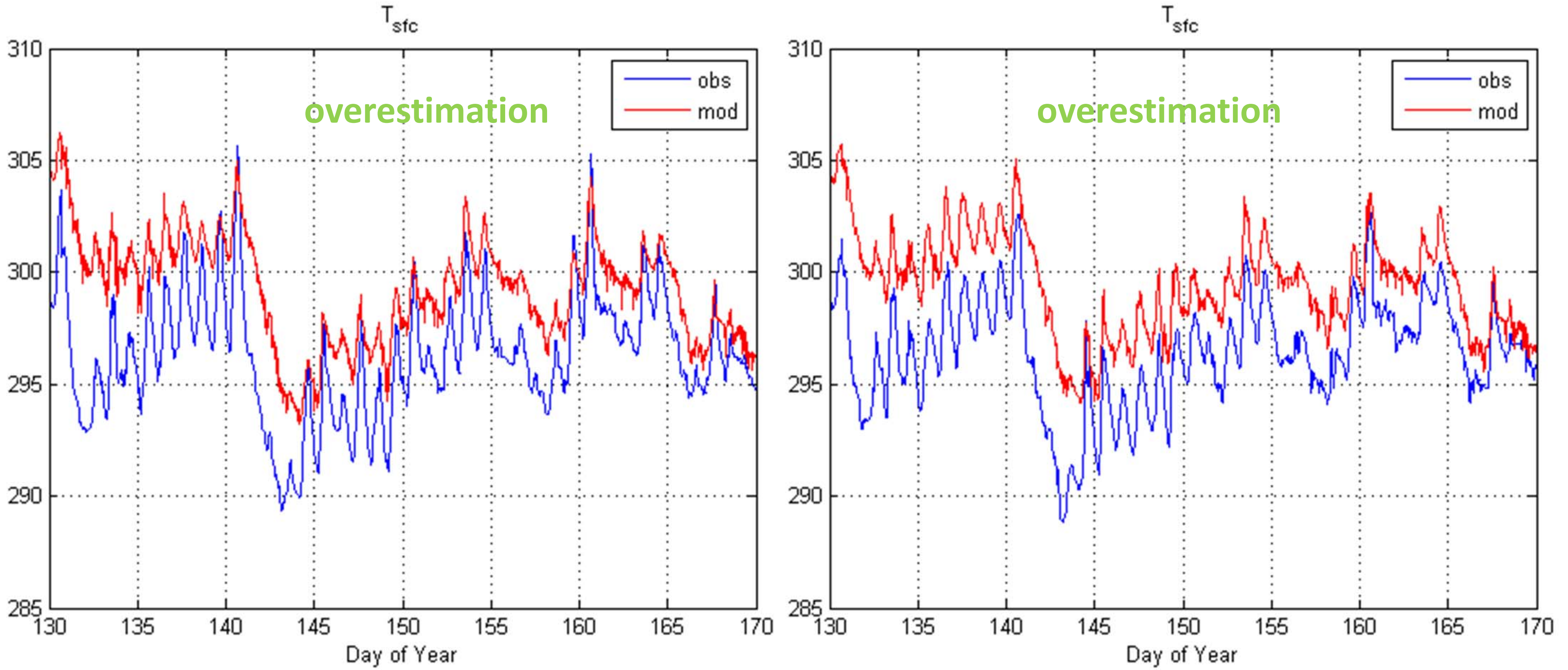




In general:

DPK has higher wind speed and lower daily maximum of Tsfc.

2.2 extend the evaluation to the DPK (大浦口) 2011 dataset



MLW site DPK site

Overestimation observed at both MLW and DPK for most time periods

	Taihu specific	CLM4.0 default
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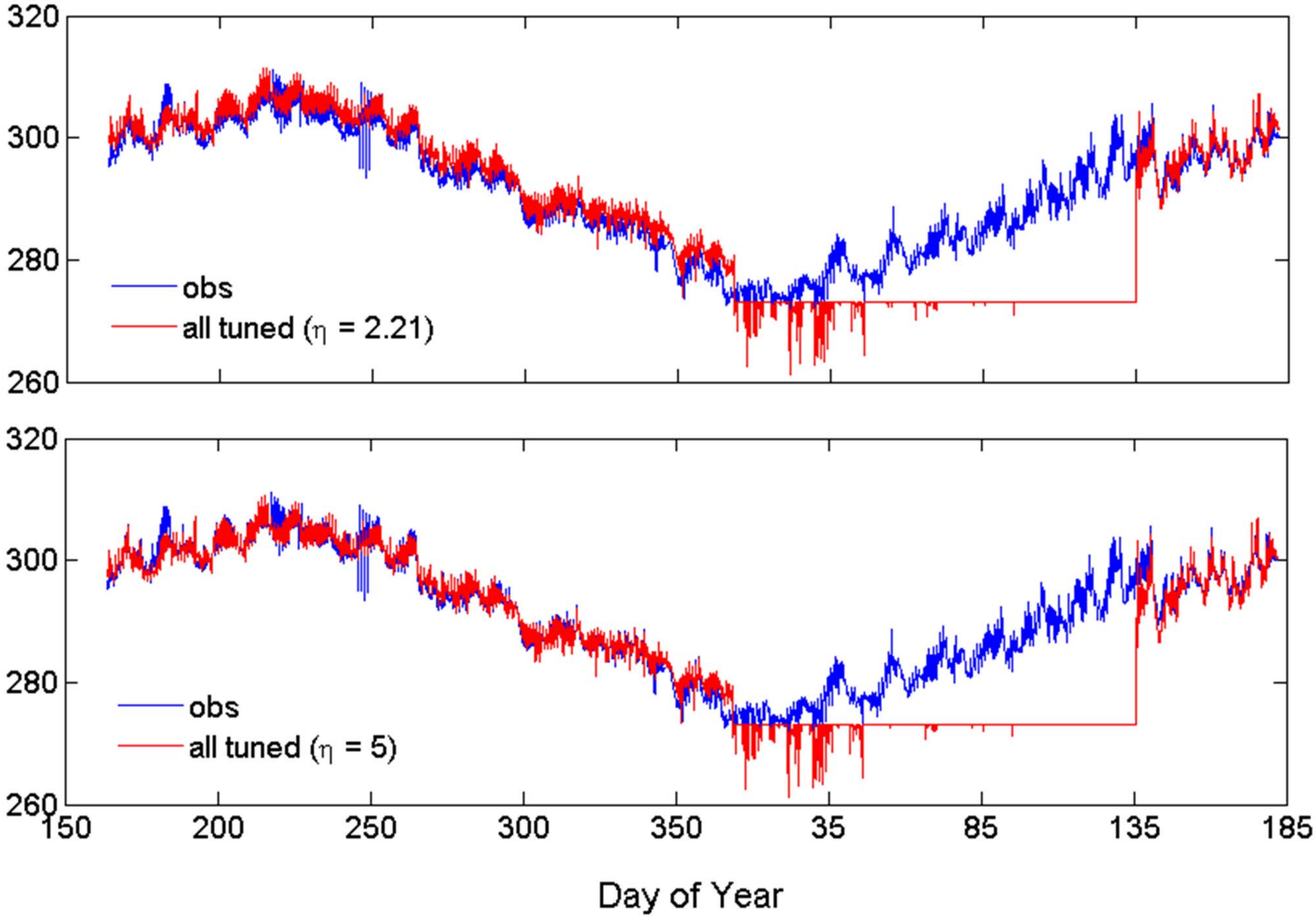
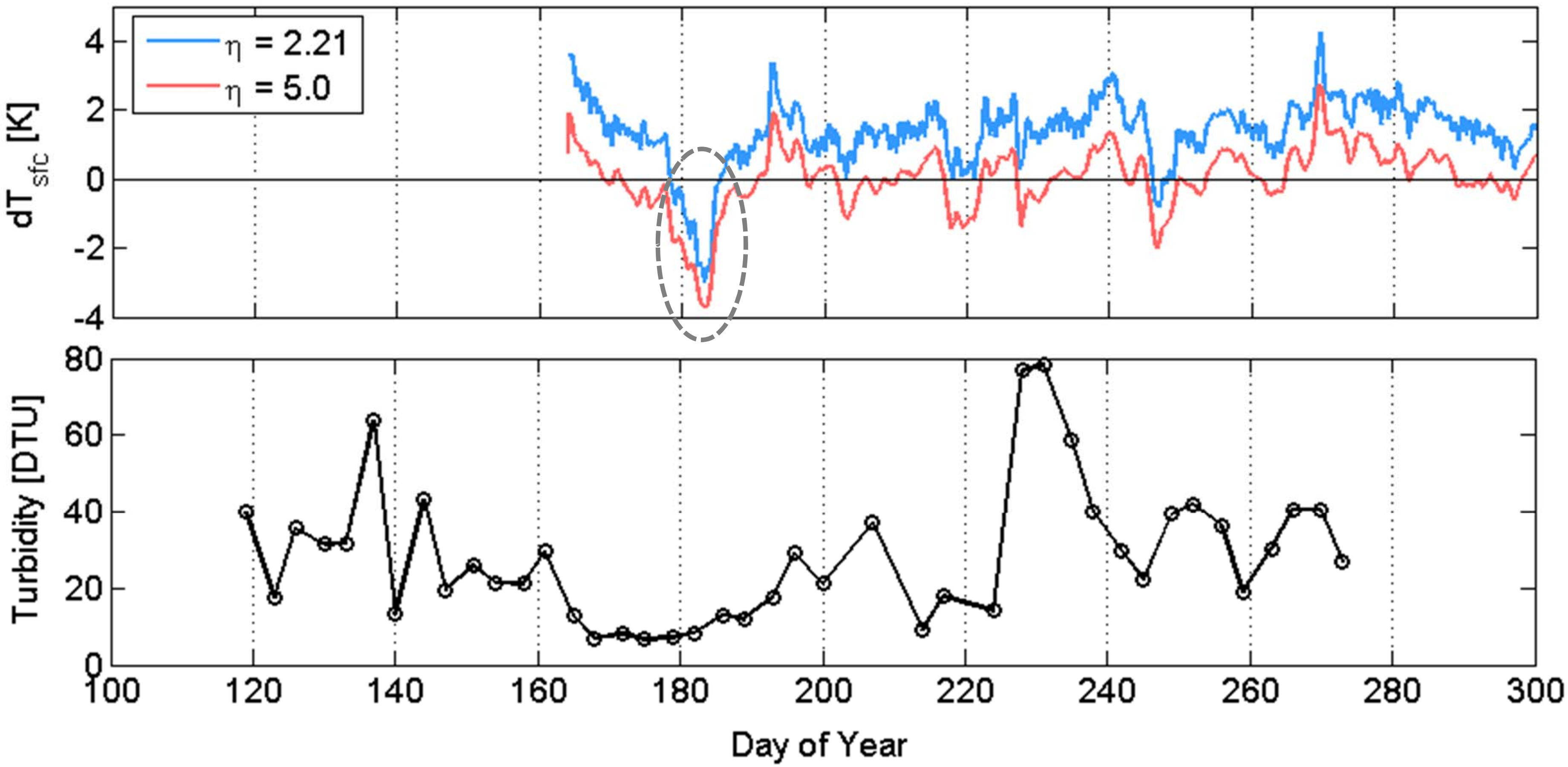
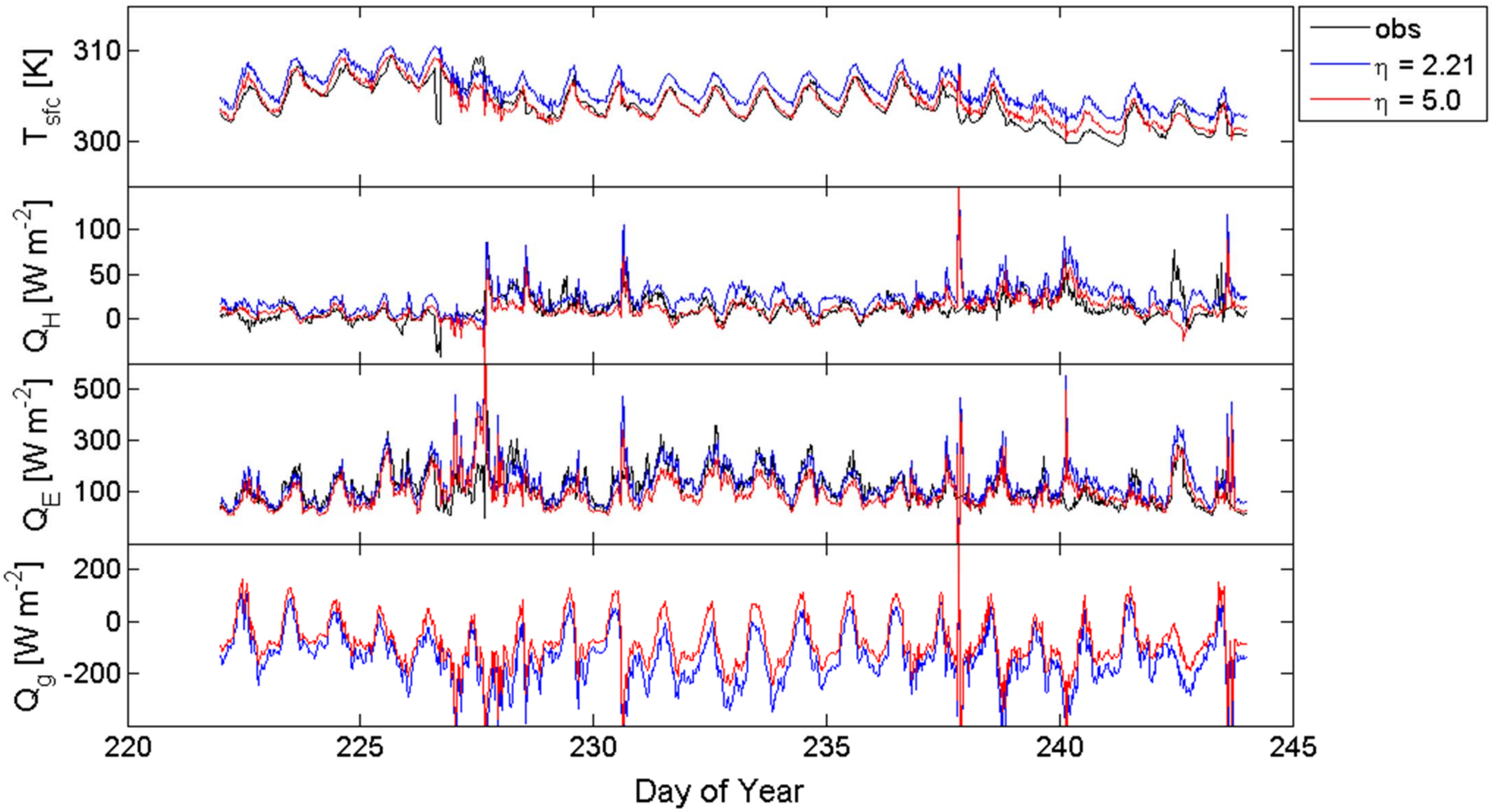


320
300
280
260
obs
all tuned (η = 2.21)
obs
all tuned (η = 5)
150
200
250
300
350
35
85
135
185
Day of Year



Note: Turbidity data used here are from #4 sampling site (120.18E, 31.44N), which is close to MLW site.



How does the solver balance the SEB?

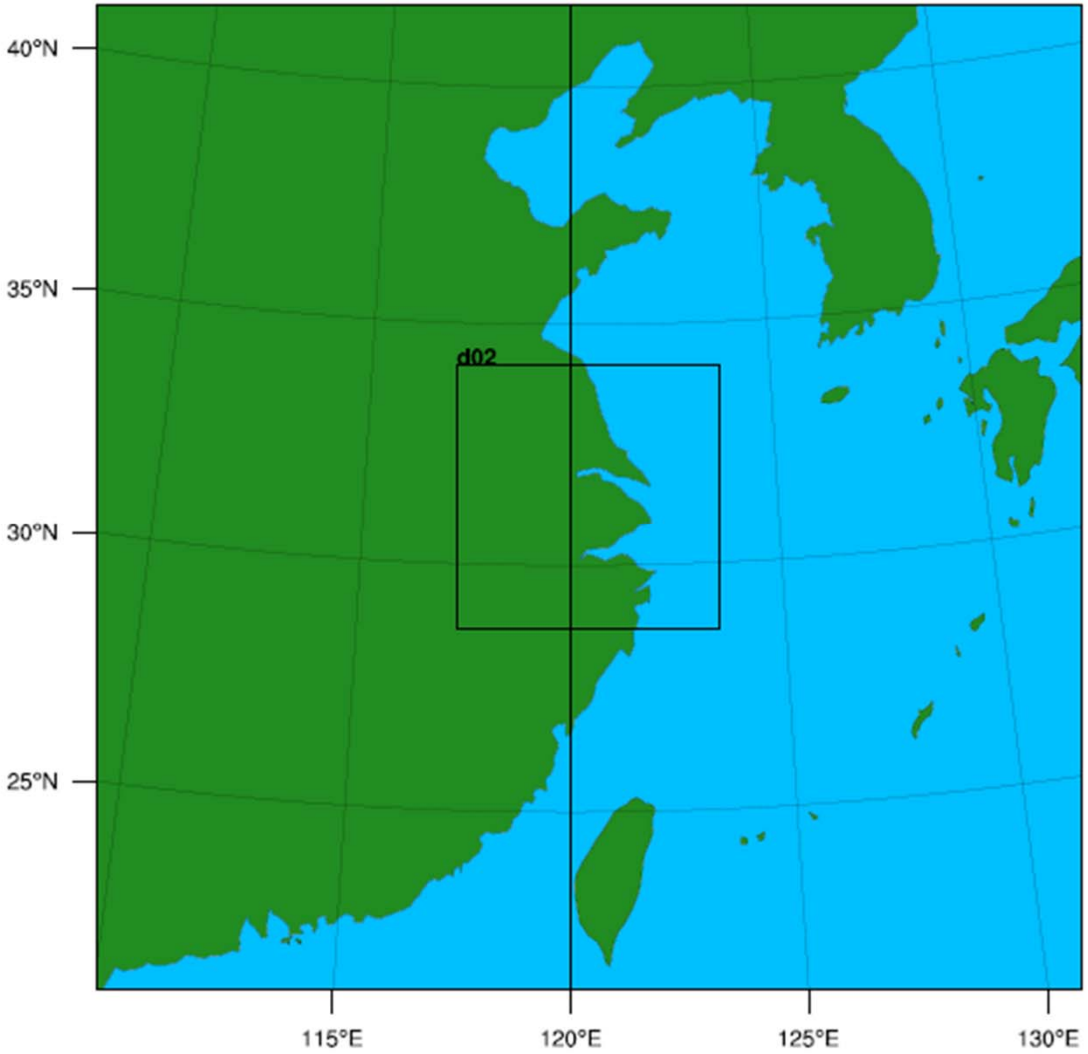
In case of larger η, more K↓ retained in the lake surface layer, less Q_H, more heat flux (Q_g) into the layer below (i.e., the 2nd layer)

Part 3: Updates on WRF

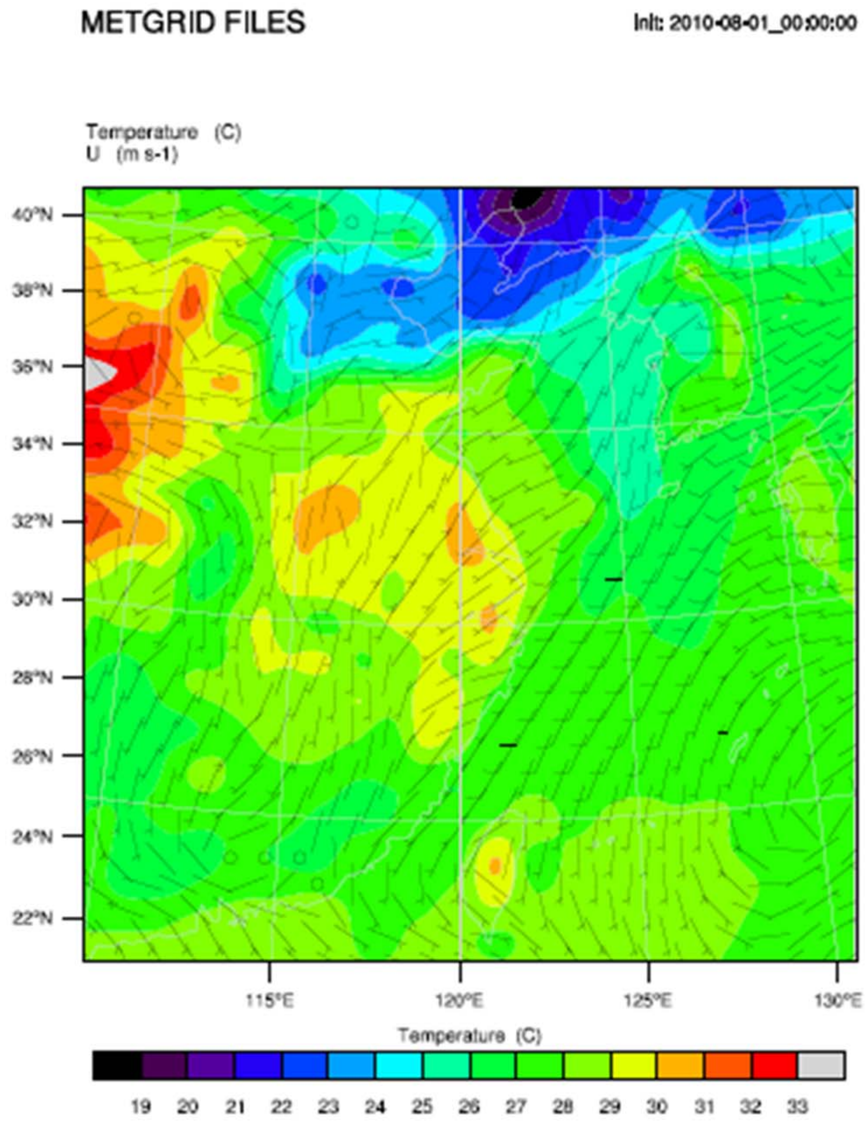
2.1 Study domain

“namelist.wps”

e_we = 91, 121,
e_sn = 91, 121,
e_vert = 51,
geog_data_res = '2m','30s,
parent_grid_ratio = 1, 5,
dx = 25000,
dy = 25000,
map_proj = 'lambert',



2.2 Lateral boundary condition Source: GFS (1°, 6h)



2.3 em_real run (physics packages)

- mp_physics = 6 (WRF single moment 6-class microphysics scheme);
- ra_lw_physics = 4 (RRTMG); (CAM leads to segmentation fault, CFL violation)
- ra_sw_physics = 4 (RRTMG); (coule be compiler related)
- sf_srclay_physics = 1 (Monin Obukhov similarity theory);
- sf_surface_physics = 2 (Noah land surface model with UCM option)
- bl_pbl_physics = 1 (MRF PBL scheme from MM5);
- cu_physics = 1 (New Kain-Fritsch)

2.4 Options for long-term simulations (**ongoing work**)

- sst_update: sea surface temperature
- tmn_update: deep soil temperature
- For the Taihu study, urban canopy option turned on (requires urban land use map for the area of interest) – 3 categories: low density residential, high density residential, commercial/industry/tranportation
- Nudging?