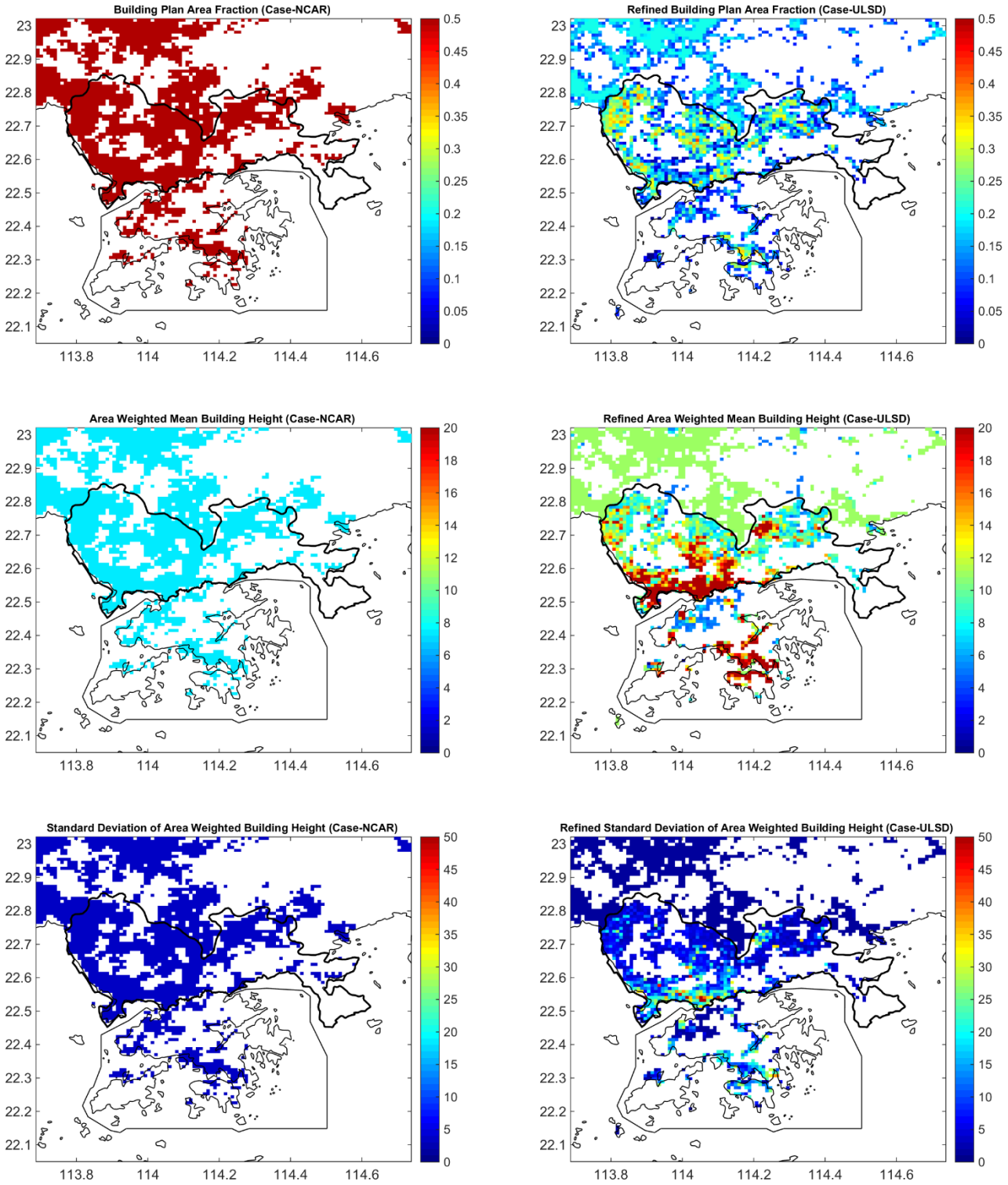
Supplementary Material

S1 Comparisons in the urban morphology indicators

(a) **(b)**



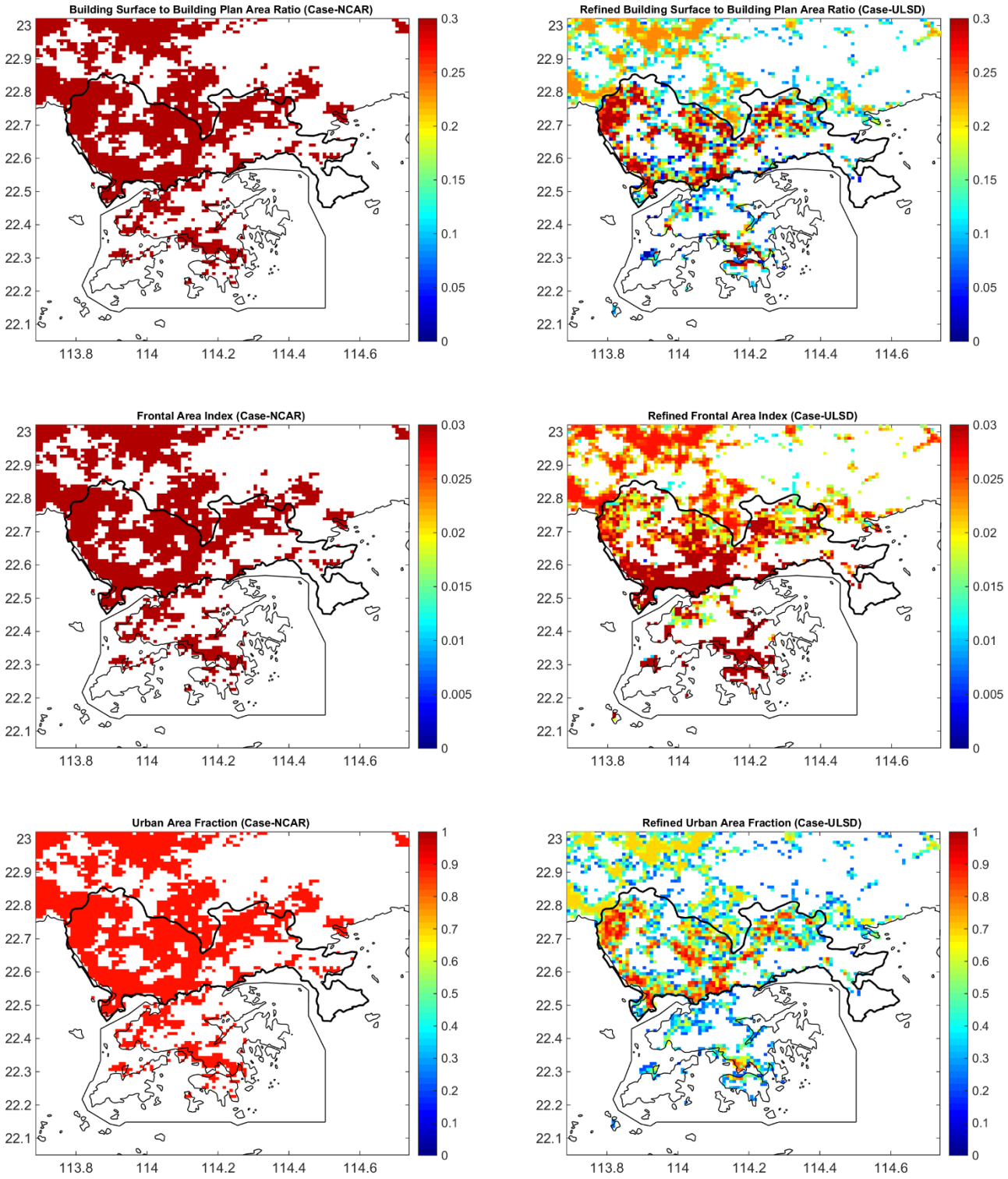
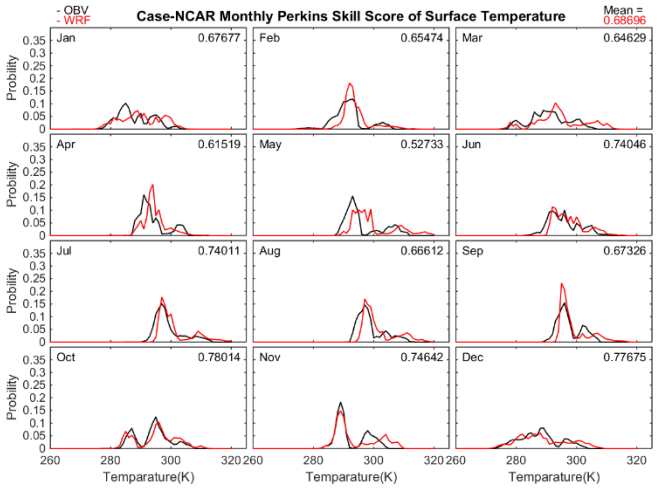
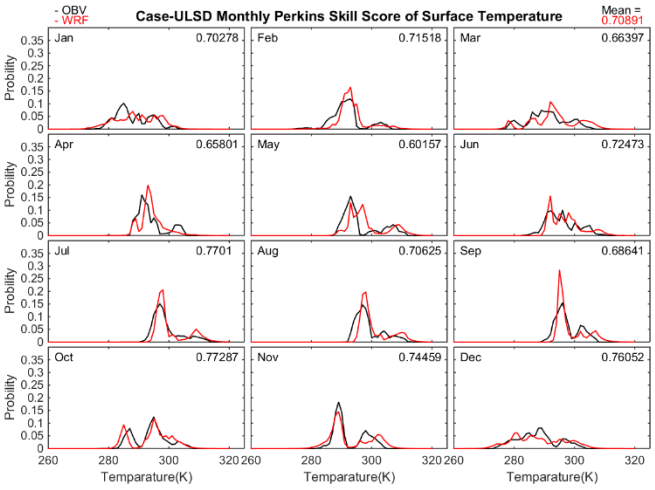


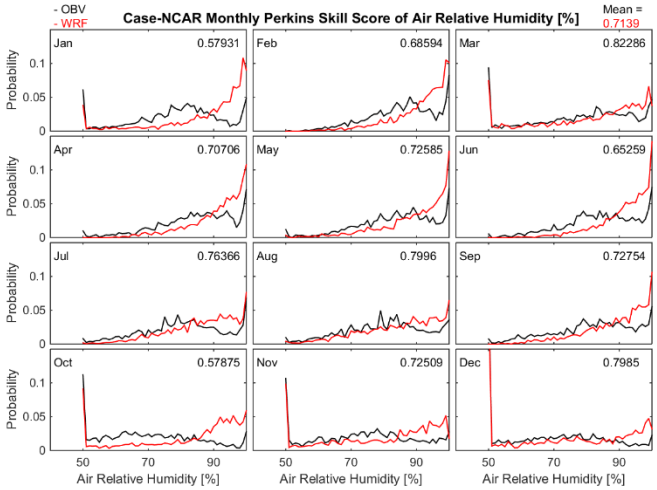
Figure S1: Case-NCAR (a) and Case-ULSD (b, data source: Li et al., 2019 a and b) building plan area fraction, area weighted mean building height, standard deviation of area weighted mean building height, building surface to building plan area ratio, frontal area index, and urban area fraction.

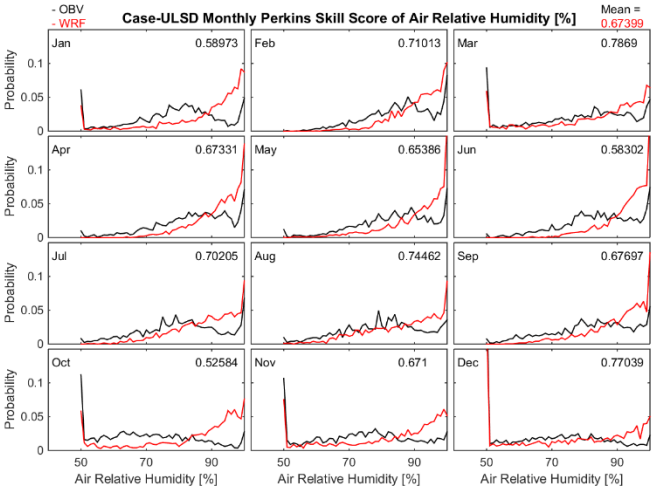
S2 Comparisons in the PSS monthly variations of surface temperature, relative humidity, precipitation, and wind speed

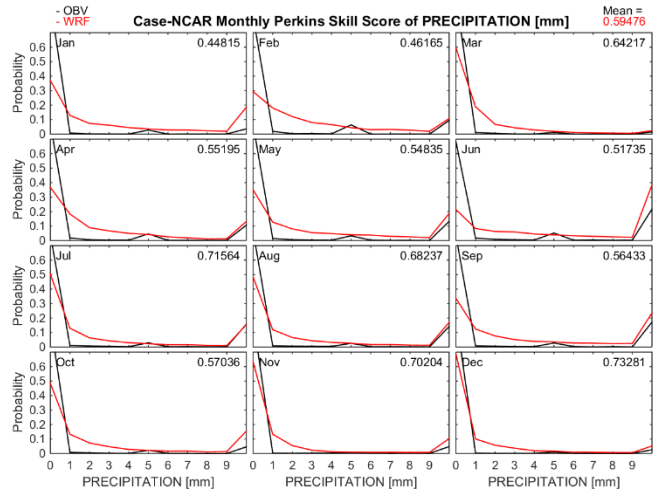
(a) **(b)**

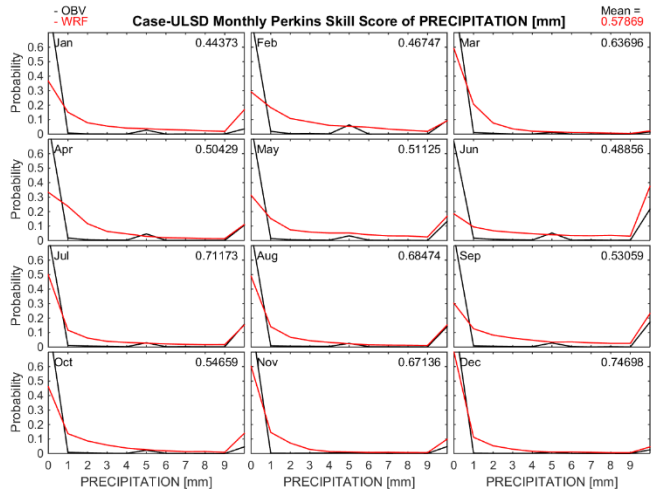

- OBV
- WRF
Case-NCAR Monthly Perkins Skill Score of Surface Temperature
Mean =
0.68696
Jan 0.67677
Feb 0.65474
Mar 0.64629
Apr 0.61519
May 0.52733
Jun 0.74046
Jul 0.74011
Aug 0.66612
Sep 0.67326
Oct 0.78014
Nov 0.74642
Dec 0.77675
Probility
Temparature(K)


- OBV
- WRF
Case-ULSD Monthly Perkins Skill Score of Surface Temperature
Mean =
0.70891
Jan 0.70278
Feb 0.71518
Mar 0.66397
Apr 0.65801
May 0.60157
Jun 0.72473
Jul 0.7701
Aug 0.70625
Sep 0.68641
Oct 0.77287
Nov 0.74459
Dec 0.76052
Probility
Temparature(K)


- OBV
- WRF
Case-NCAR Monthly Perkins Skill Score of Air Relative Humidity [%]
Mean =
0.7139
Jan 0.57931
Feb 0.68594
Mar 0.82286
Apr 0.70706
May 0.72585
Jun 0.65259
Jul 0.76366
Aug 0.7996
Sep 0.72754
Oct 0.57875
Nov 0.72509
Dec 0.7985
Probability
Air Relative Humidity [%]


- OBV
- WRF
Case-ULSD Monthly Perkins Skill Score of Air Relative Humidity [%]
Mean =
0.67399
Jan 0.58973
Feb 0.71013
Mar 0.7869
Apr 0.67331
May 0.65386
Jun 0.58302
Jul 0.70205
Aug 0.74462
Sep 0.67697
Oct 0.52584
Nov 0.671
Dec 0.77039
Probability
Air Relative Humidity [%]


- OBV
- WRF
Case-NCAR Monthly Perkins Skill Score of PRECIPITATION [mm]
Mean =
0.59476
Jan 0.44815
Feb 0.46165
Mar 0.64217
Apr 0.55195
May 0.54835
Jun 0.51735
Jul 0.71564
Aug 0.68237
Sep 0.56433
Oct 0.57036
Nov 0.70204
Dec 0.73281
Probability
PRECIPITATION [mm]


- OBV
- WRF
Case-ULSD Monthly Perkins Skill Score of PRECIPITATION [mm]
Mean =
0.57869
Jan 0.44373
Feb 0.46747
Mar 0.63696
Apr 0.50429
May 0.51125
Jun 0.48856
Jul 0.71173
Aug 0.68474
Sep 0.53059
Oct 0.54659
Nov 0.67136
Dec 0.74698
Probability
PRECIPITATION [mm]

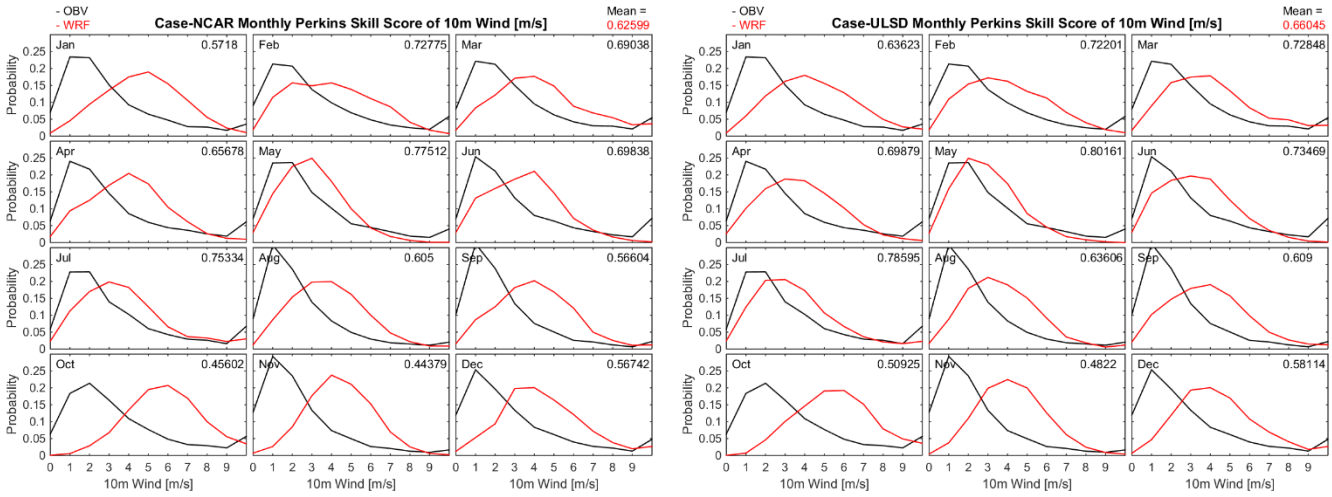
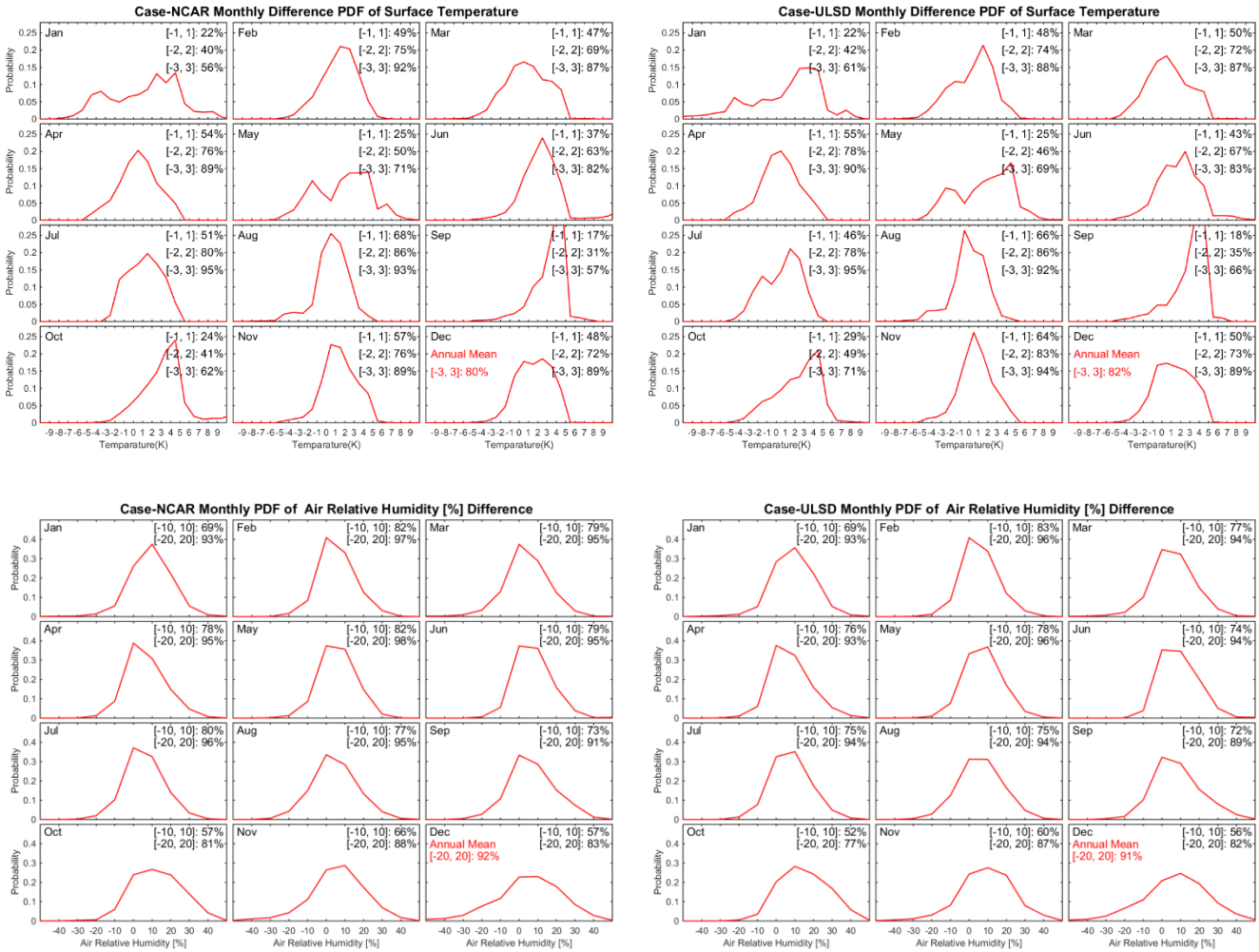


Figure S2: PSS of surface temperature, relative humidity, precipitation, and 10-meters wind of Case-NCAR (a) and Case-ULSD (b, data source: Li et al., 2019 a and b).

S3 Comparisons in the PDFD monthly variations of surface temperature, and relative humidity, precipitation, and wind speed

(a) **(b)**



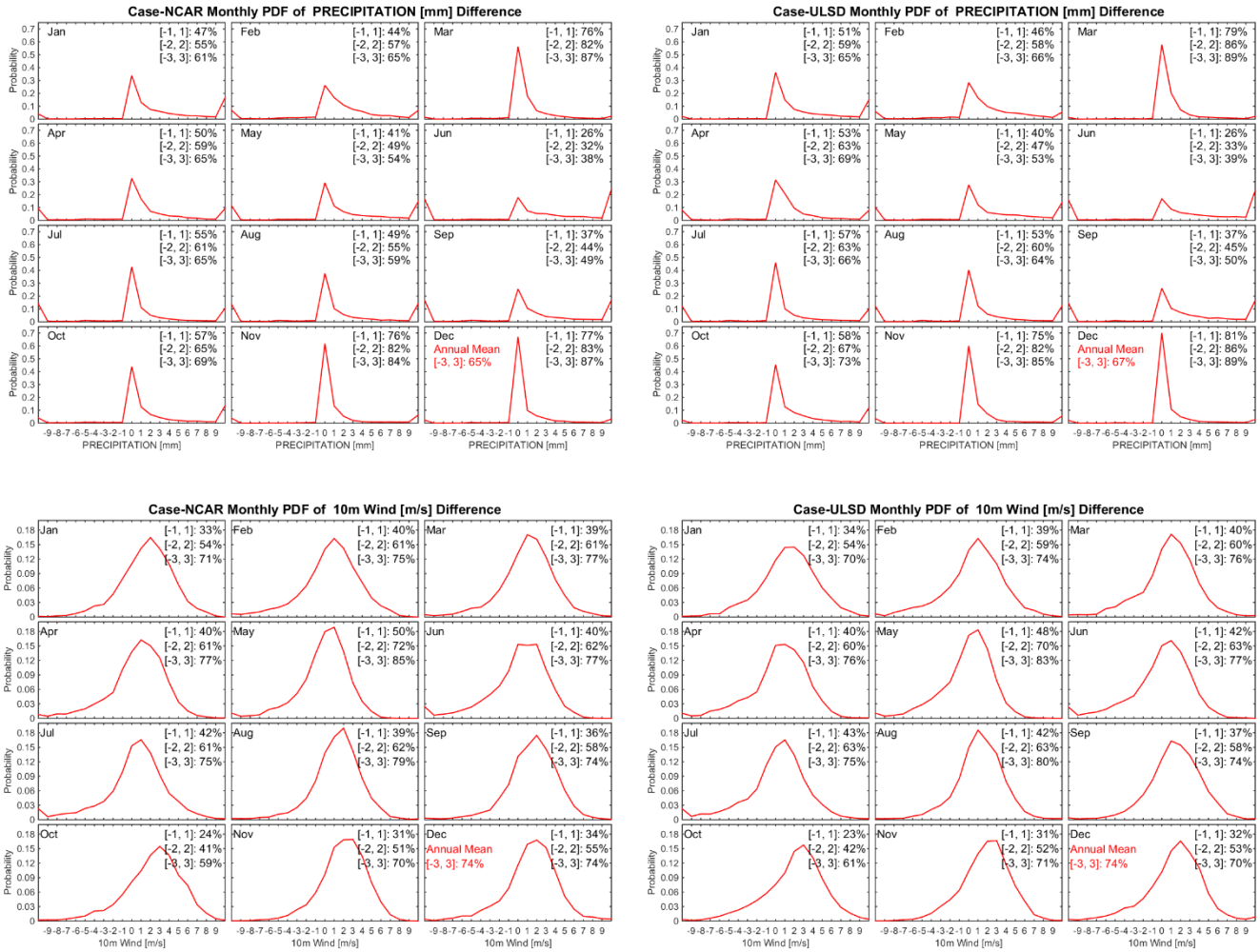
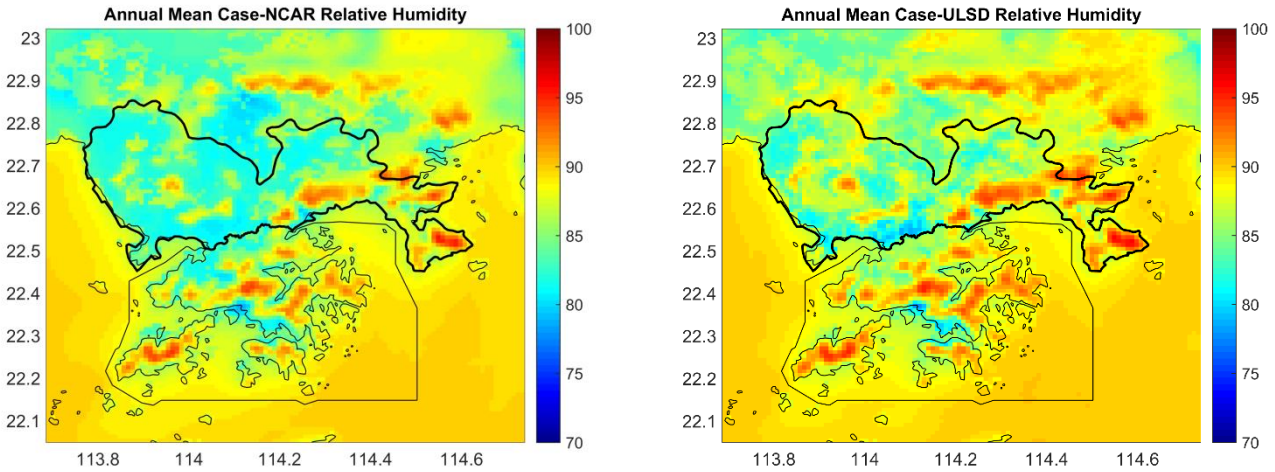


Figure S3: PDF of the difference of surface temperature, relative humidity, precipitation, and 10-meters wind of Case-NCAR (a) and Case-ULSD (b, data source: Li et al., 2019 a and b).

S4 Comparisons in the spatial distribution of surface temperature, relative humidity, precipitation, and wind speed



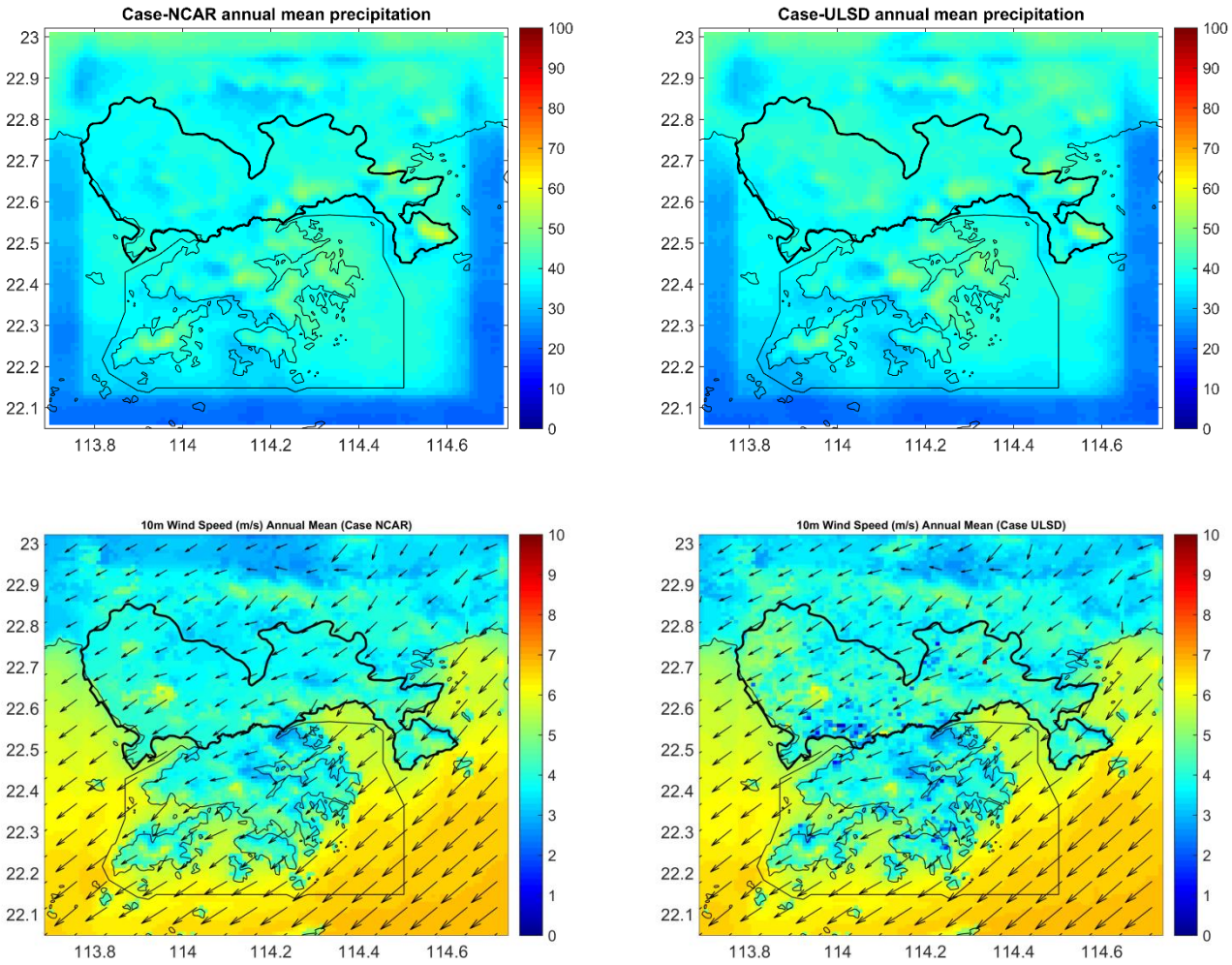


Figure S4: Spatial distribution of relative humidity, precipitation, and 10-meters wind of Case-NCAR (a) and Case-ULSD (b).