

HARMO 15:

**15th International Conference on Harmonisation within
Atmospheric Dispersion Modelling for Regulatory Purposes
6-9 May 2013, Madrid, Spain**

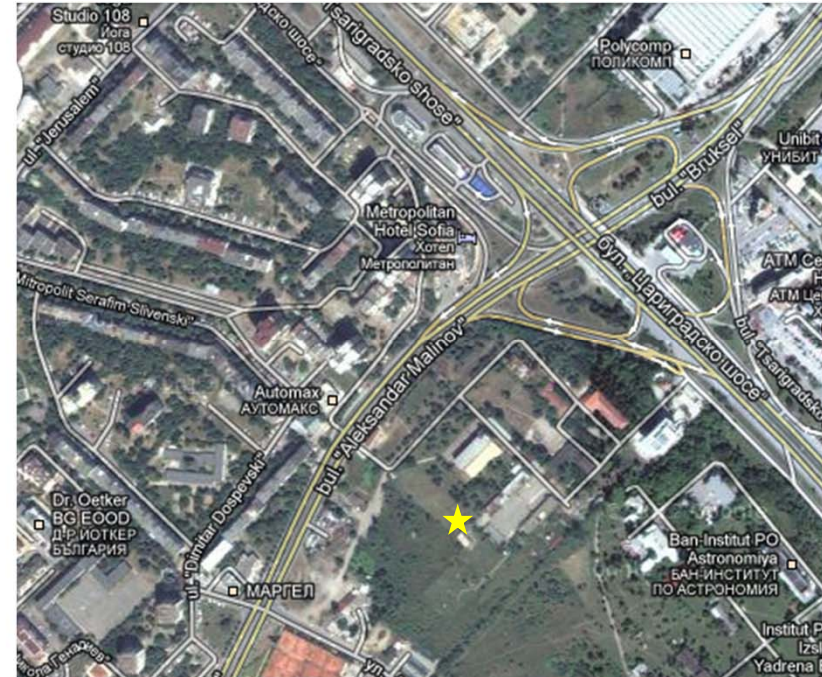
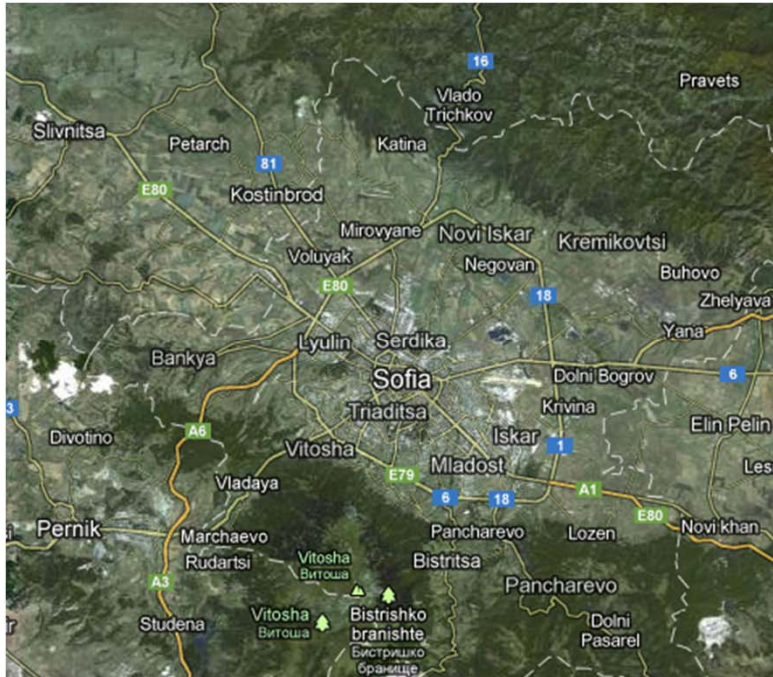
**Convective Boundary Evolution in Urban Area
Situated in a Complex Terrain - evaluation of
Mesoscale Model Profiles against Radiosounding Data**

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Methodology	Analysis and Results
Sofia Experiment 2003 Model configuration	Comparison between measured and modelled profiles Diurnal variability Variability in height and time
	Conclusions

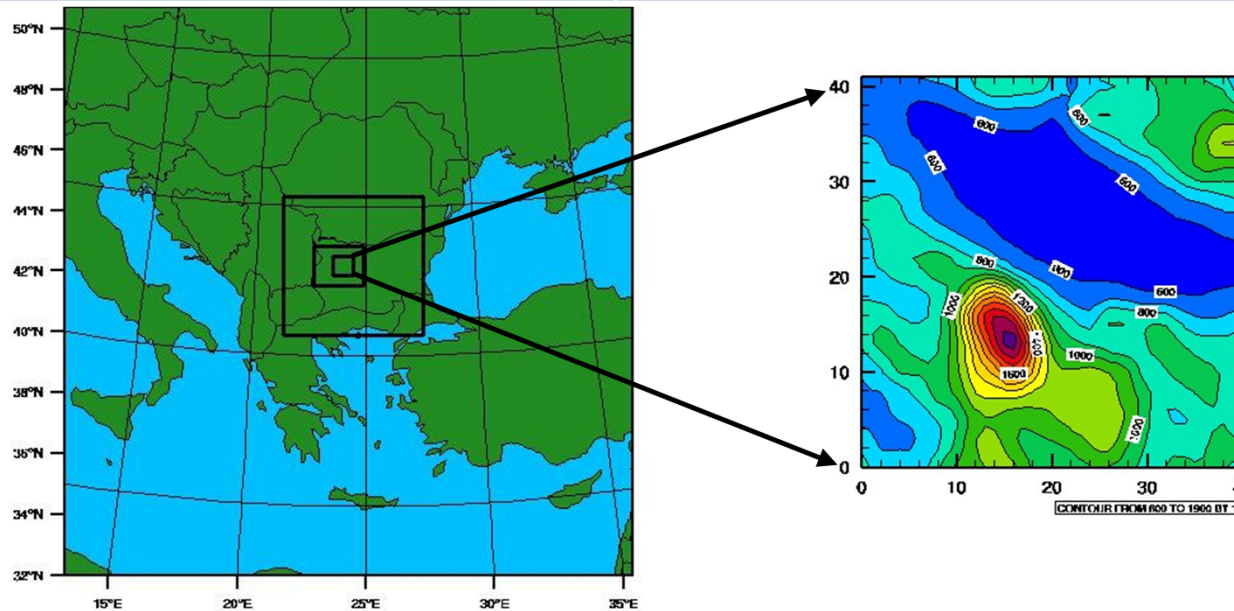
Sofia experiment 2003



Seven radiosounding per day starting at 7 a.m. and ending at 7 p.m. LST with 2 hour time resolution
ascend velocity $3-4 \text{ ms}^{-1}$, 27 September – 03 October 2003

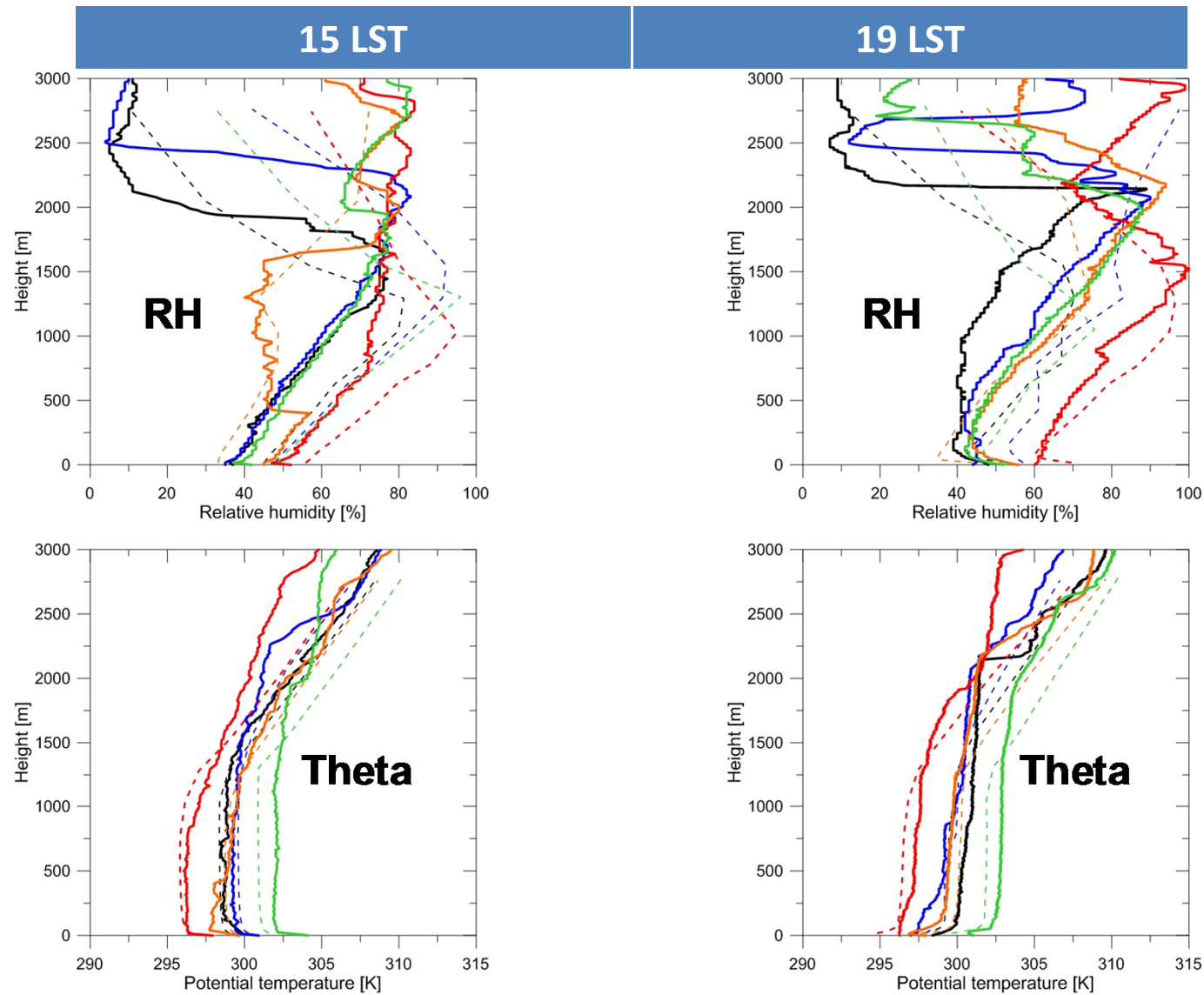
Model configuration: WRF (ARW) v3. 3. 1

Initialisation	FNL (1x1 degree, 6 hours)
4 domains	36, 12, 4, 1.33 km; 58x58, 43x43, 37x34, 43x43 gr. points
Map projection	Lambert conformal conic
Land use categories	USGS-24 category data



Mycrophysics	Thompson graupel scheme (D3, 4); WSM 5-class scheme (D1, D2)	Surface layer	Monin-Obukhov (Janjic-Eta) scheme
Longwave radiation	RRTM	Land surface	Noah LSM
Shortwave radiation	Goddard	ABL	Maylor-Yamada-Janjic (MYJ)
Cumulus parametrization		New Grell (D1,D2)	

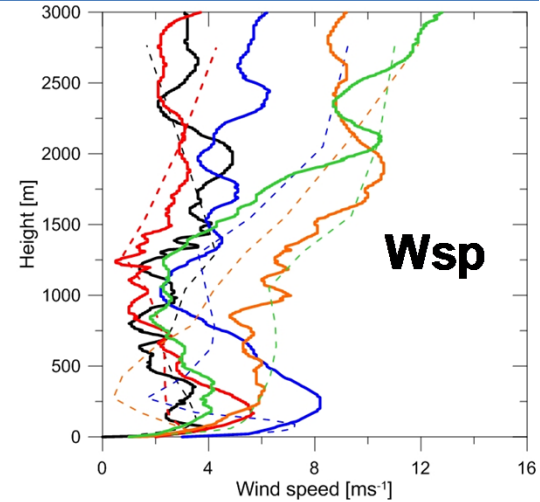
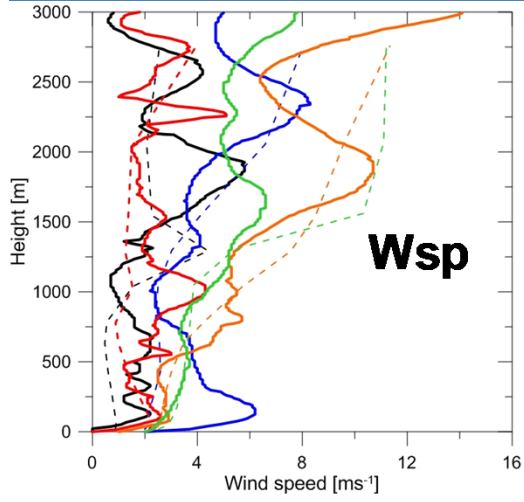
Comparison between measured and modelled profiles (1)



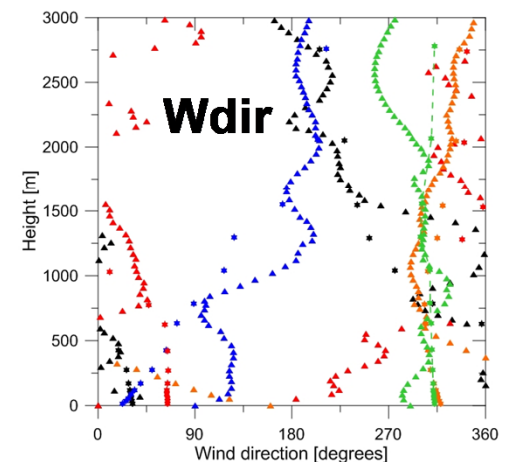
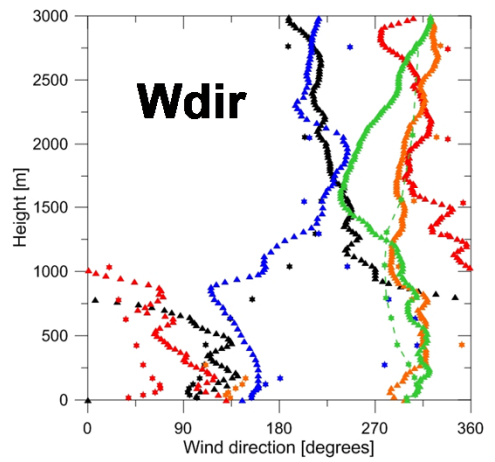
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 - - - WRF 28.09 - - - WRF 29.09 - - - WRF 01.10 - - - WRF 02.10 - - - WRF 03.10

Comparison between measured and modelled profiles (2)

15 LST **19 LST**



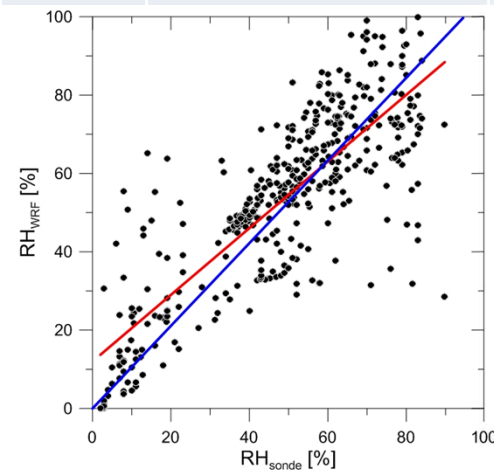
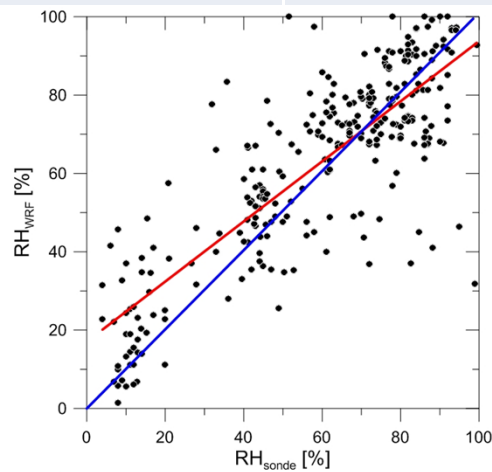
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- - - WRF 02.10
- - - WRF 03.10



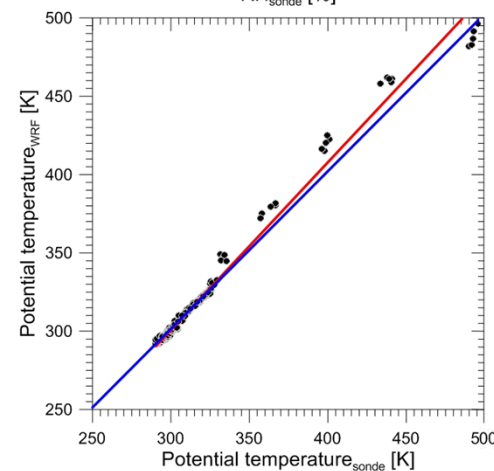
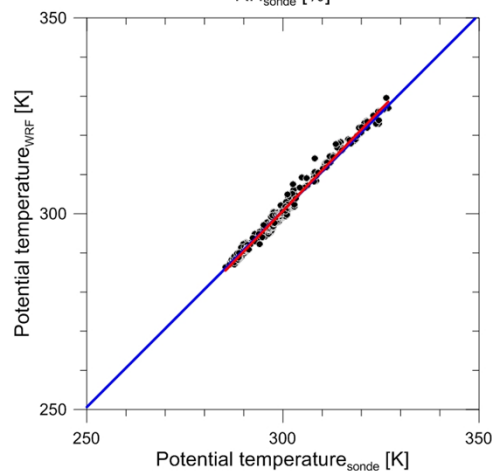
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▲▲▲ Sonde 03.10
★★★ WRF 28.09
★★★ WRF 29.09
★★★ WRF 01.10
★★★ WRF 02.10
★★★ WRF 03.10

Diurnal variability

Coefficient of determination R-squared					
	Morning hours	Afternoon hours		Morning hours	Afternoon hours
RH	0.676919	0.674078	Wsp	0.782512	0.828081
Theta	0.988321	0.987029	Wdir	0.240608	0.16046
Temp	0.993557	0.992711			



● ● ● **RH**
 — Fit 1: Linear
 — Fit 2: Through origin



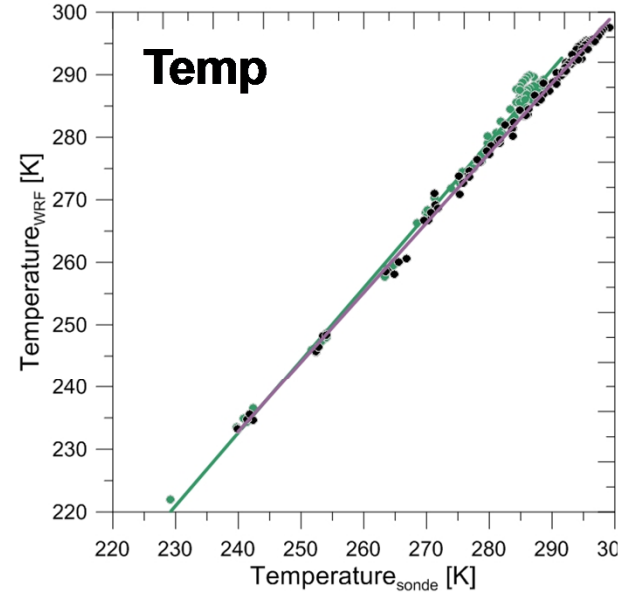
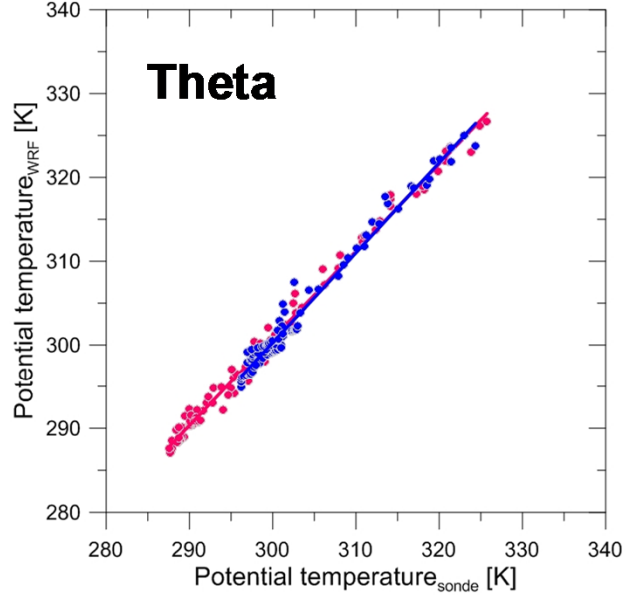
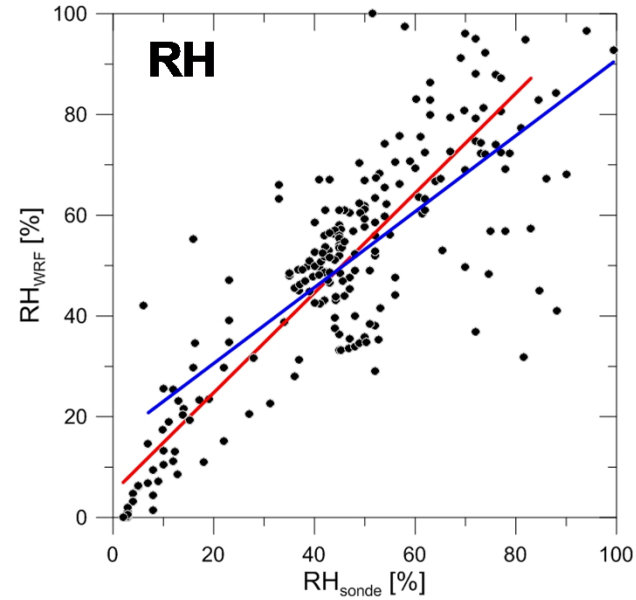
● ● ● **Theta**
 — Fit 1: Linear
 — Fit 2: Through origin

Morning hours

Afternoon hours

Time variability

LST	Coefficient of determination R-squared for specific hour of observation averaged for the lowest 19 of WRF levels		
	RH	Theta	Temp
7	0.669613	0.991046	0.99368
9	0.732143	0.991874	0.995019
11	0.542442	0.9834	0.992372
13	0.609062	0.984368	0.995586
15	0.77672	0.985747	0.995496
17	0.603693	0.980774	0.997025
19	0.570335	0.977433	0.995379

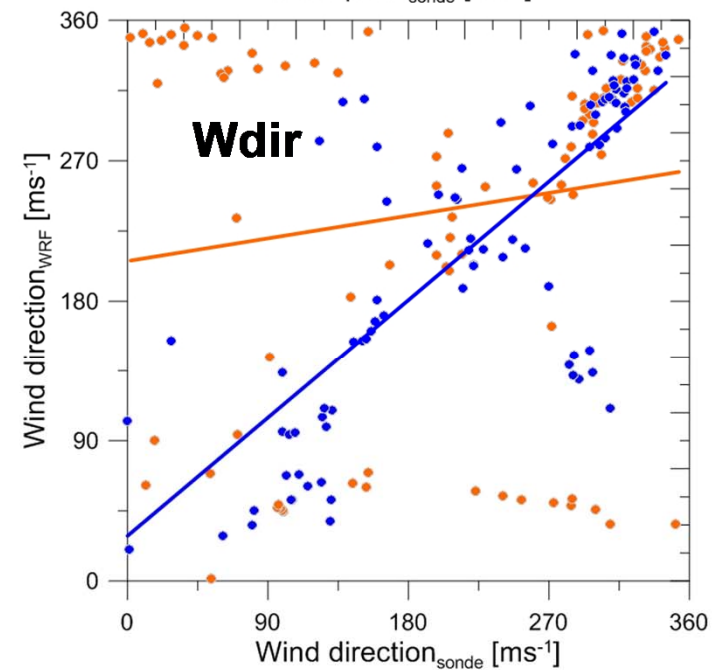
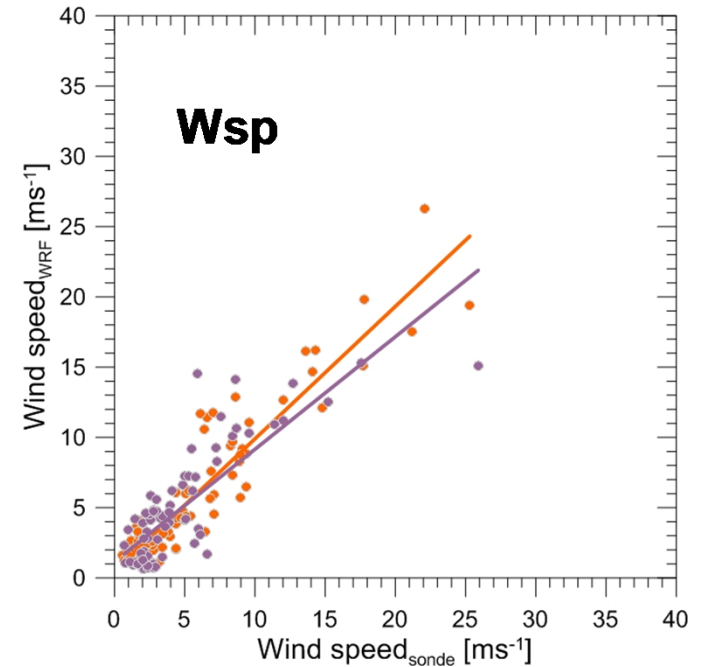


— Linear Fit: 07 LST
 — Linear Fit: 11 LST
 — Linear Fit: 15 LST
 — Linear Fit: 19 LST
— Linear Fit: 09 LST
 — Linear Fit: 13 LST
 — Linear Fit: 17 LST

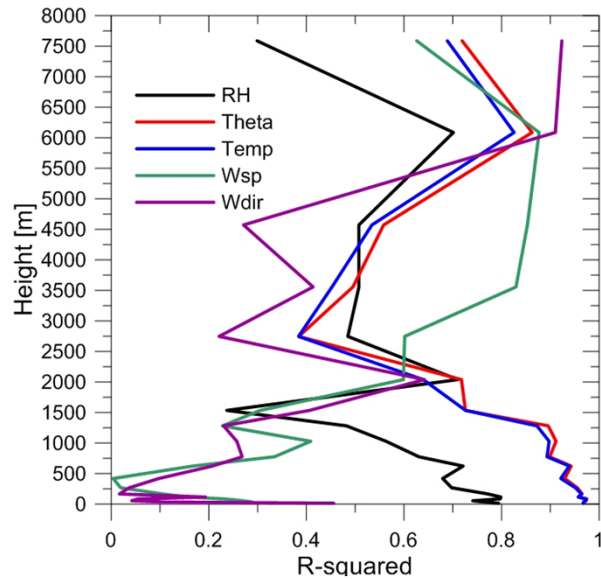
Time variability

LST	Coefficient of determination R-squared for specific hour of observation averaged for the lowest 19 of WRF levels	
	Wsp	Wdir
7	0.785667	0.1181
9	0.84443	0.128801
11	0.862205	0.047241
13	0.872867	0.024821
15	0.838167	0.337975
17	0.671144	0.319298
19	0.747809	0.607347

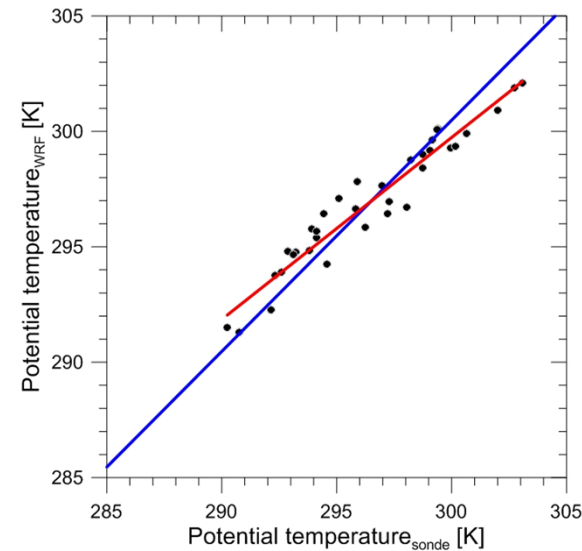
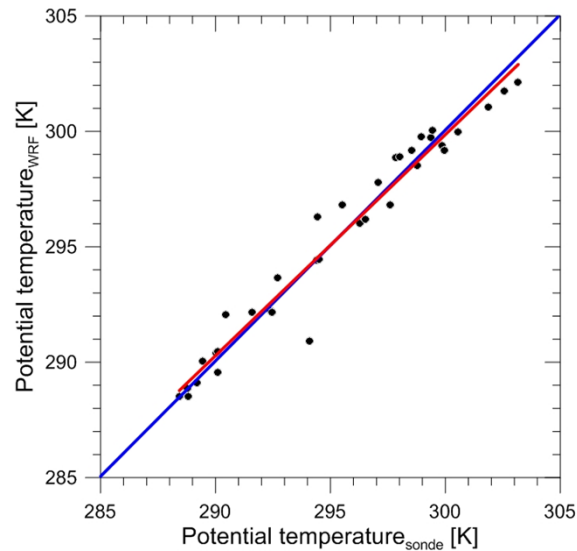
- Linear Fit: 07 LST
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- Linear Fit: 11 LST
- Linear Fit: 13 LST
- Linear Fit: 15 LST
- Linear Fit: 17 LST
- Linear Fit: 19 LST



Variability in height



Variations with height of the coefficient of determinations for RH, Theta, Temp, Wsp and Wdir at specific WRF modelling level averaged for all hours of observations.



Scatter plots of potential temperature at 100 m (left panel) and 400 m (right panel) averaged for all hours of observations

Conclusions

1. Statistical comparisons revealed:

- relative humidity, temperature, potential temperature and wind direction were slightly better simulated in the morning hours than in the afternoon hours,
- the wind speed was insignificantly better resolved in the afternoons.

2. Temporal variation and variation in height:

- best match between WRF and radiosounding data was observed at 15 LST, and the worst - at 19 LST
- better agreement between modelled and measured parameters was observed at lower heights

3. Reproduction ability of WRF model :

WRF model with Mellor-Yamada-Janjic PBL scheme simulated in satisfactory way vertical profiles of temperature, potential temperature and relative humidity

- the wind speed was reasonably resolved above 1500 m ag. The wind direction was poorly simulated in the lowest 1000 m

ACKNOWLEDGEMENTS

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Thank you for your attention