Cerdanya-2017:
presentation and preliminary results

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*

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Workshop Mallorca, May 2018, Palma de Mallorca

OUTLINE

LOCATION

MOTIVATION

CAMPAIGNS

INSTRUMENTATION

PRELIMINARY RESULTS

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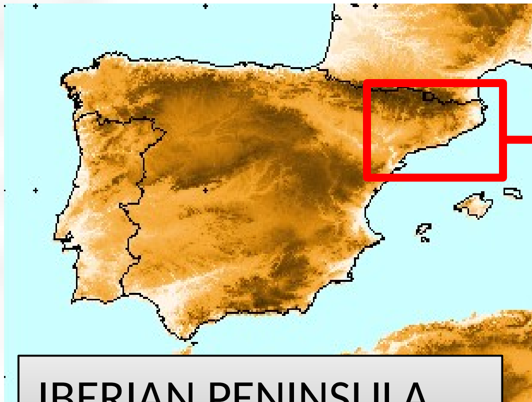
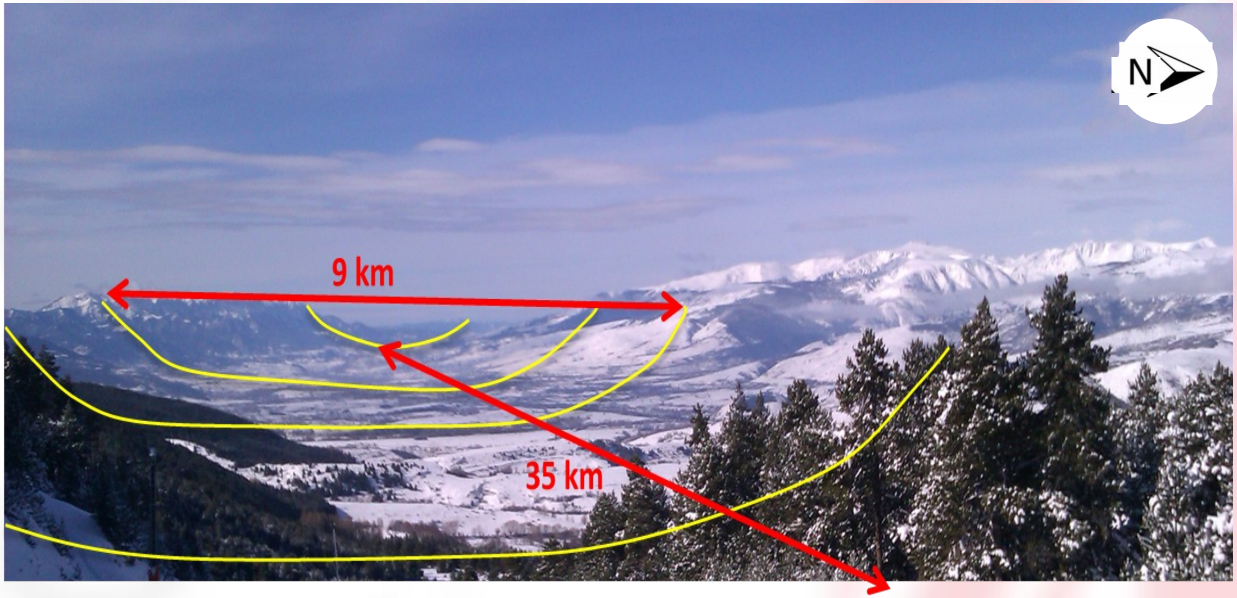
LOCATION



IBERIAN PENINSULA

CATALONIA

CERDANYA VALLEY



- Bottom at around 1000 m (asl)

- Surrounded by ranges 2000 m (asl) in the N and S.

- In the W it narrows into a more incised valley and in the E it is limited by the Col de la Perche 1500 m (asl)

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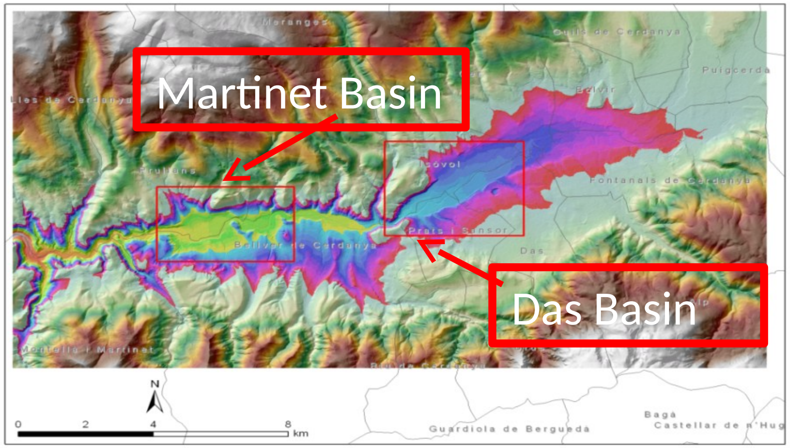
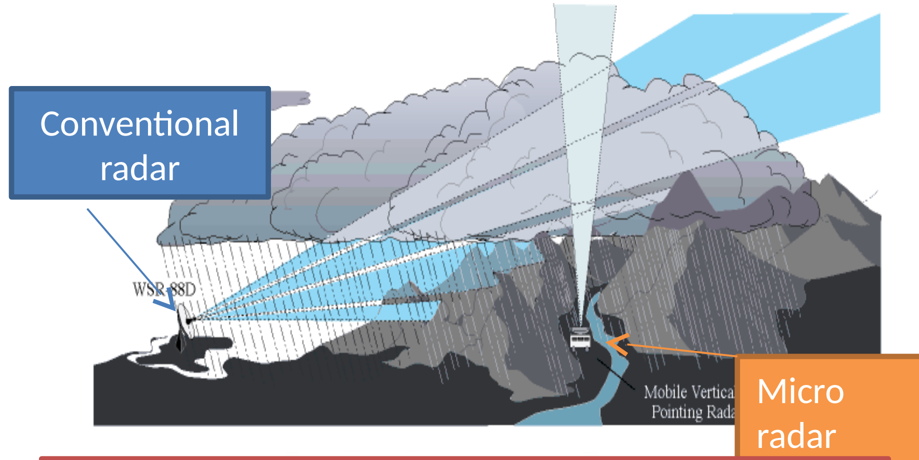
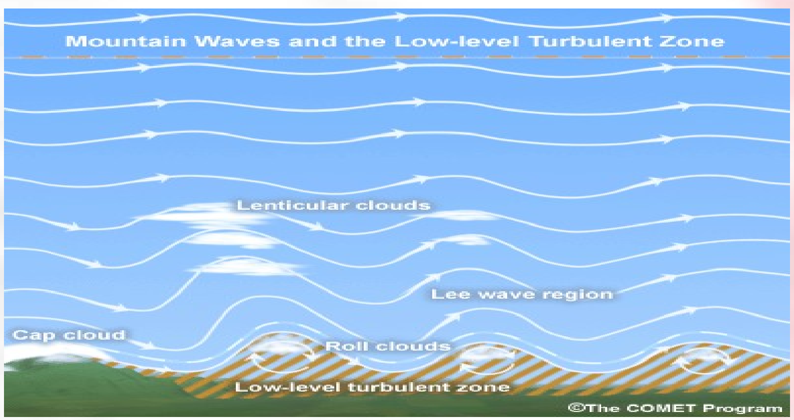
MOTIVATION



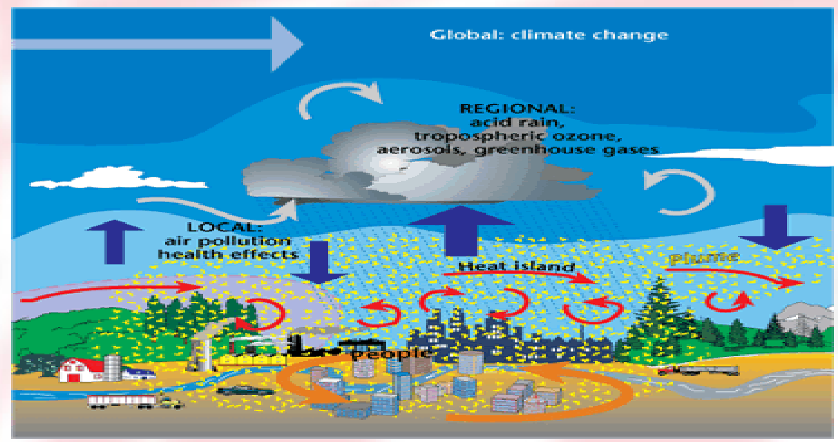
Cold Air Pool formation



Orographic precipitation



Mountain wave formation



Global climate change

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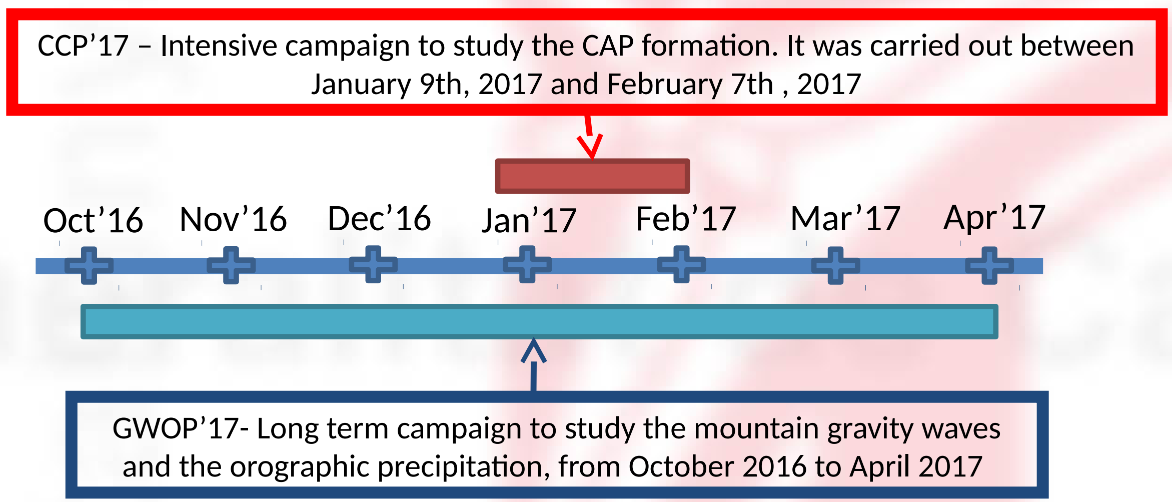
CAMPAIGNS

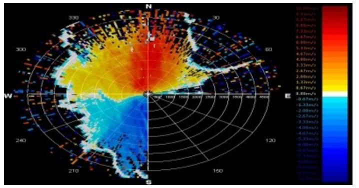
- **CCP'17:** This campaign was intensive (1 month) and focused on understanding the formation and destruction of CAP in winter conditions (with snow cover). During this campaign a tethered balloon was operated during the morning and evening transitions and a 2 meters column, full equipped with thermocouples and thermistors, recorded temperature and humidity near the ground.

- **GWOP'17**: This campaign is a long term campaign covering 7 months and focuses on the study of the mountain waves and orographic precipitations. Automatic measuring equipment are being used for this study: micro rain radar (MRR), disdrometer, wind profiler, radiometer, etc.



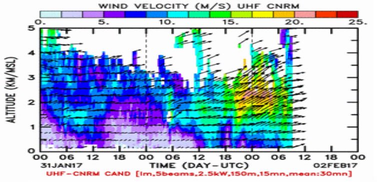
INSTRUMENTATION

LIDAR
(METEO-FRANCE)



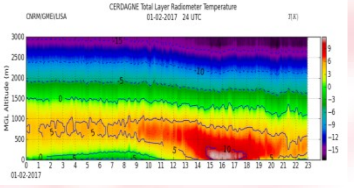
Horizontal wind
(range 5 km)

UHF RADAR
(METEO-FRANCE)



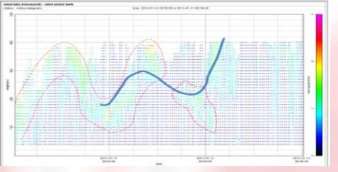
Vertical wind profile
up to 5 km

MWR RADIOMETER
(METEO-FRANCE)



T and RH profiles up
to 3 km

WINDRASS
(METEOCAT)



T and RH profiles up
to 300 m

RADIOSONDE
(METEOCAT)

Temperature, RH,
wind and pressure
along the
sonde path

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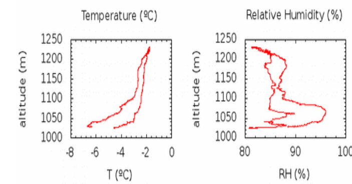
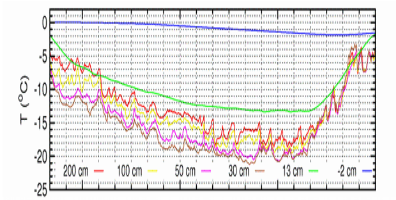
TETHERED BALLOON
(UIB)



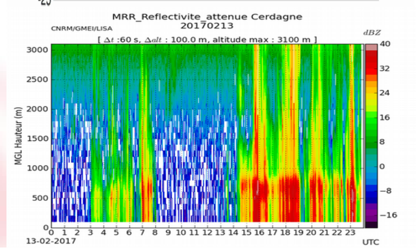
Temperature, RH and wind profiles up to 300 m.

THERMISTORS AND THERMOCOUPLES
(UIB)



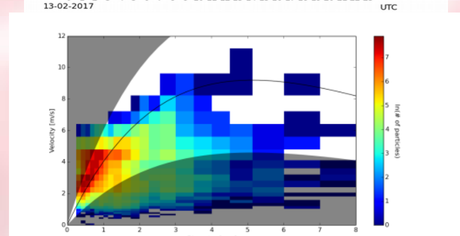
Temperature near the ground

MRR (Micro Rain Radar)
(UB)



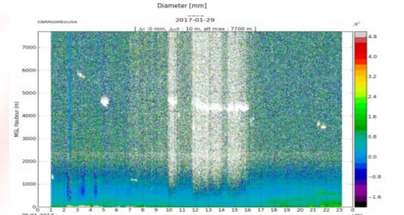
Vertical profile of reflectivity

DISDROMETER
(UB)



Droplets size and fall velocity

CEILOMETER
(Laboratoire d'Aerologie)



Backscatter coefficients profile

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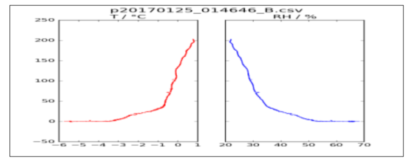
INSTRUMENTATION

2 EDDY COVARIANCE STATION
(METEOCAT & METEO-FRANCE)

These stations measures parameters related to turbulence

DRONE-MULTICOPTER
(OWL University)



Temperature, RH and wind profiles up to 200 m

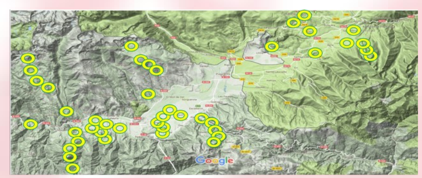
5 AWS (fix)
(METEOCAT)

Temperature, RH, 10m wind speed and direction, pressure and precipitation

10 AWS (9 mobile +1 fix)
(METEO-FRANCE)

Temperature, RH, 10m wind speed and direction, pressure and precipitation

43 SENSORS T & RH
(Univ. Portsmouth)



Temperature and RH transects

Surveillance Camera
(METEO-FRANCE)

Panoramic pictures

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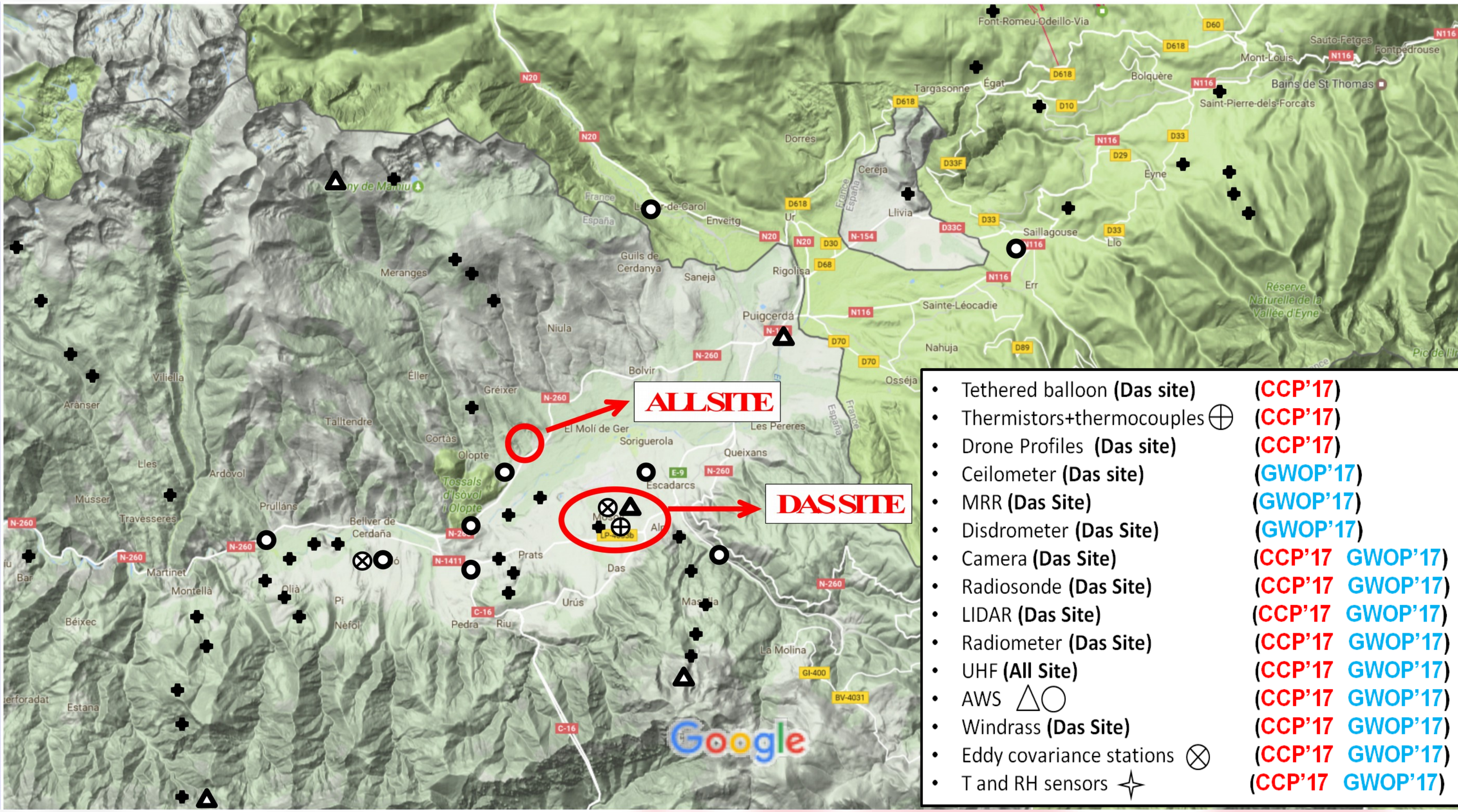

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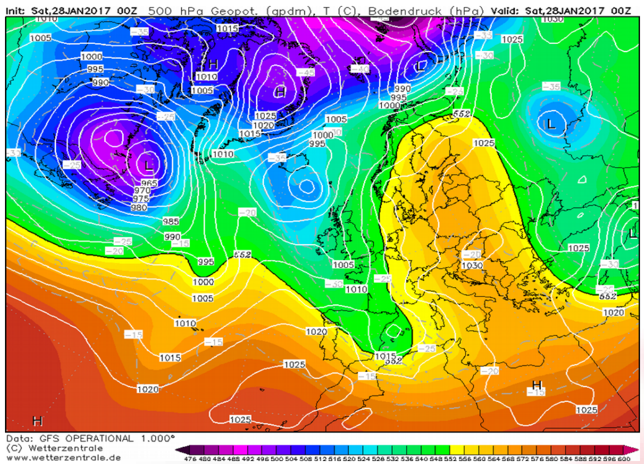
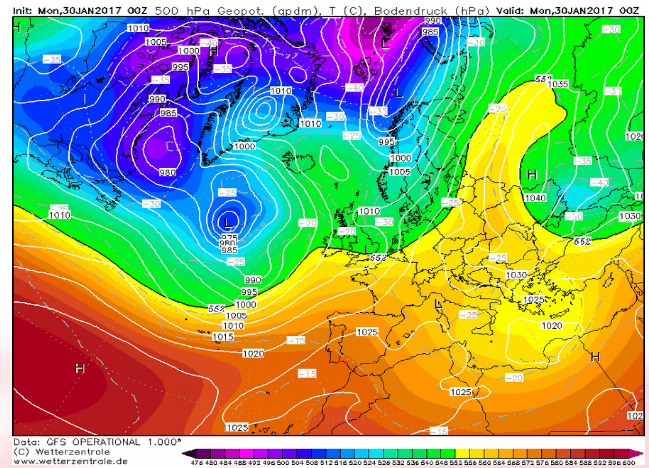
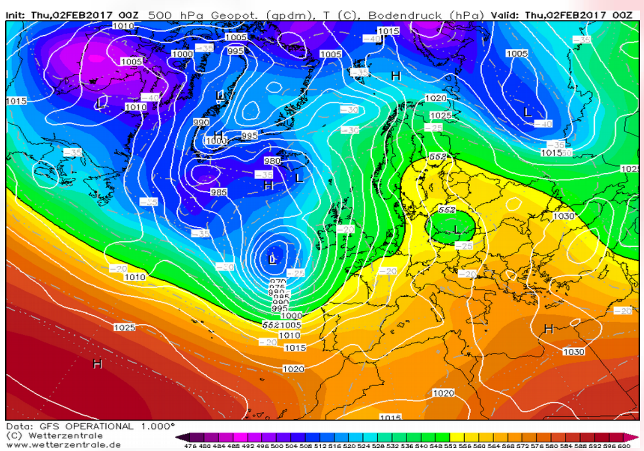
PRELIMINARY RESULTS: MODEL vs OBSERVATION

STUDY CASE: 28 January 2017 – 03 Febraury 2017







MSLP and HGT 500 hPa charts

Situation with moderate/strong winds aloft and CAP formation during the nights

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PRELIMINARY RESULTS: MODEL vs OBSERVATION

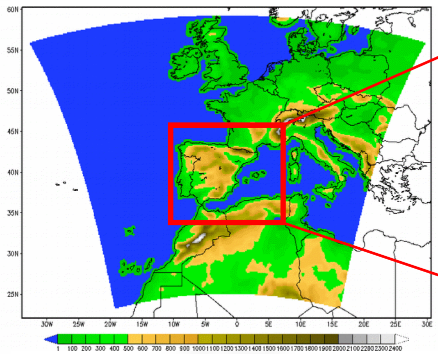
MODEL CONFIGURATION

- WRF model version 3.5
- NX = 202   NY = 175   NZ = 61
- DT = 6 s
- DX = DY = 1km
- Long Wave Radiation: RRTM   Short wave radiation: Dudhia
- Surface Scheme: Similarity Theory (MM5)
- Land Surface Model: Noah LSM
- Planetary Boundary Layer scheme: YSU*
- Damping options: gravity-wave damping layer
- Damping depth: 5000 m
- Damping coefficient: 0.05

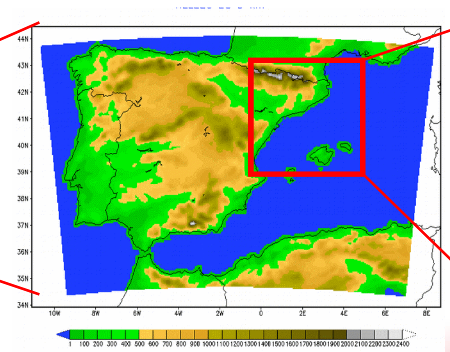
* YSU was slightly modified (change topo_wind)

PRELIMINARY RESULTS: MODEL vs OBSERVATION

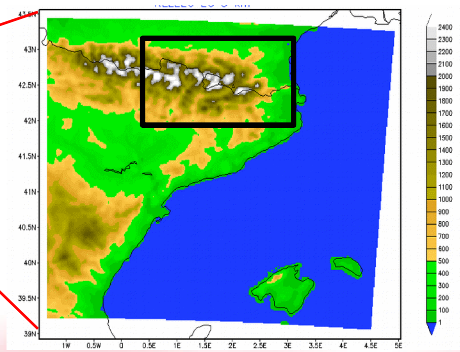
MODEL DOMAIN



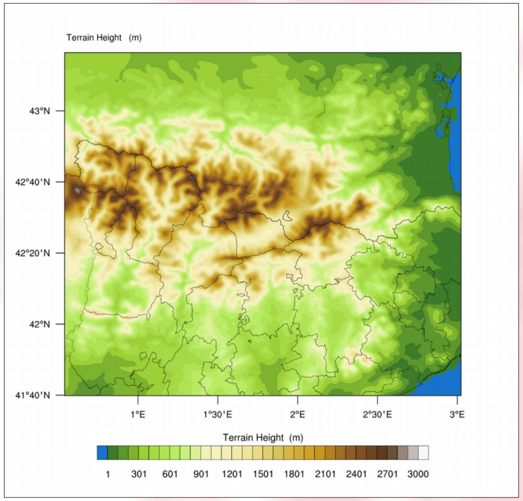
27 km



9 km



3 km



1 km

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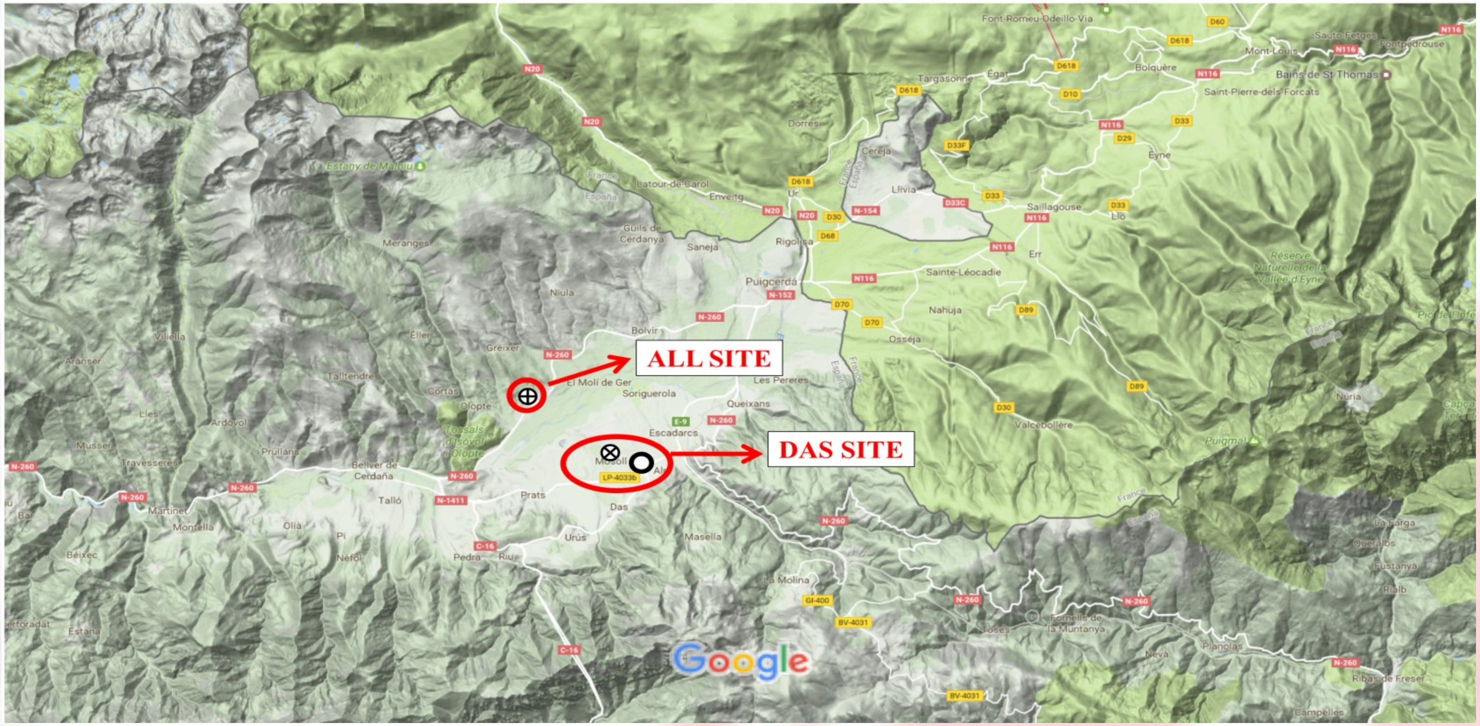
PRELIMINARY RESULTS: MODEL vs OBSERVATION

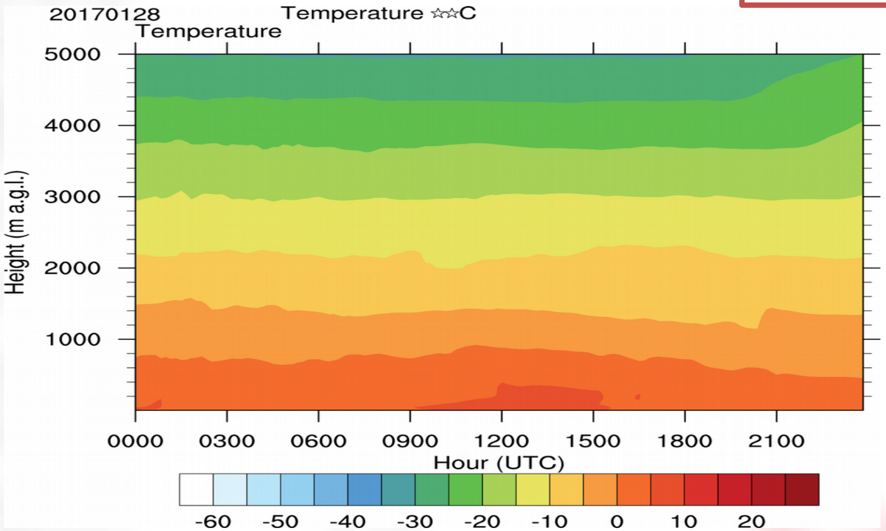
OBSERVATIONS: Vertical profiles

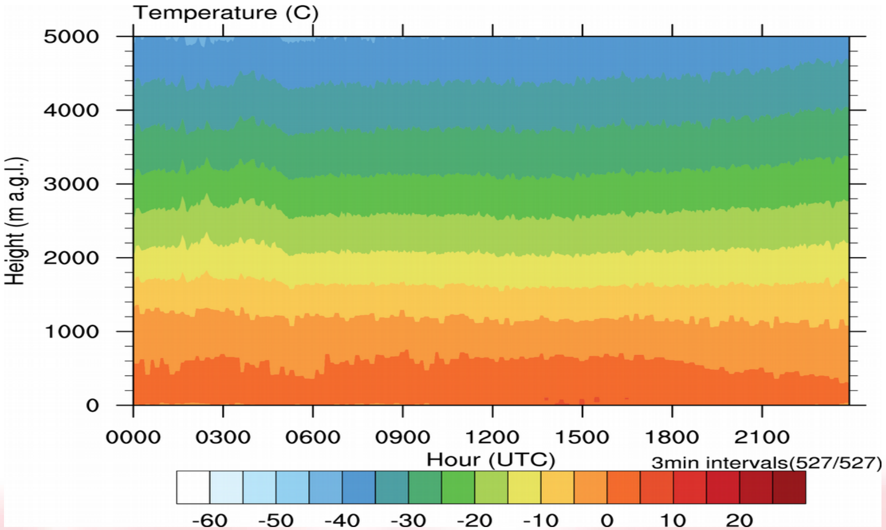


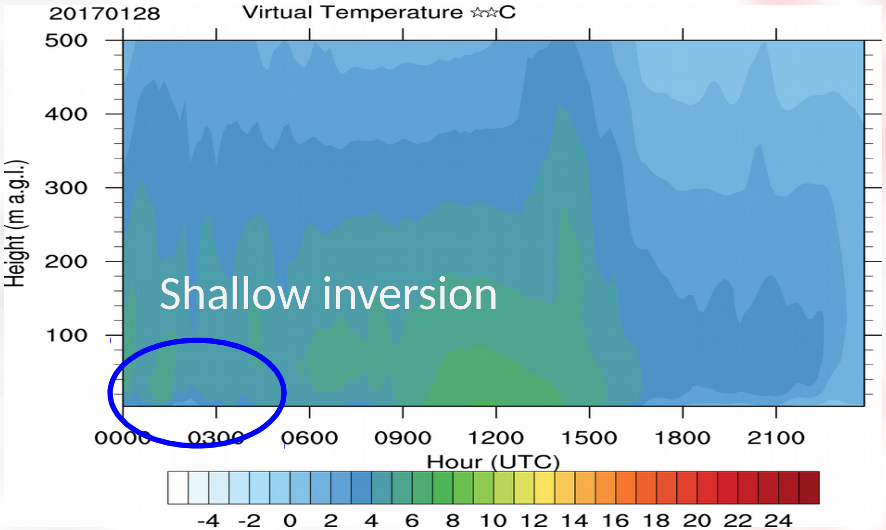
⊕ Wind profiler UHF ⊗ Windrass ○ Radiometre

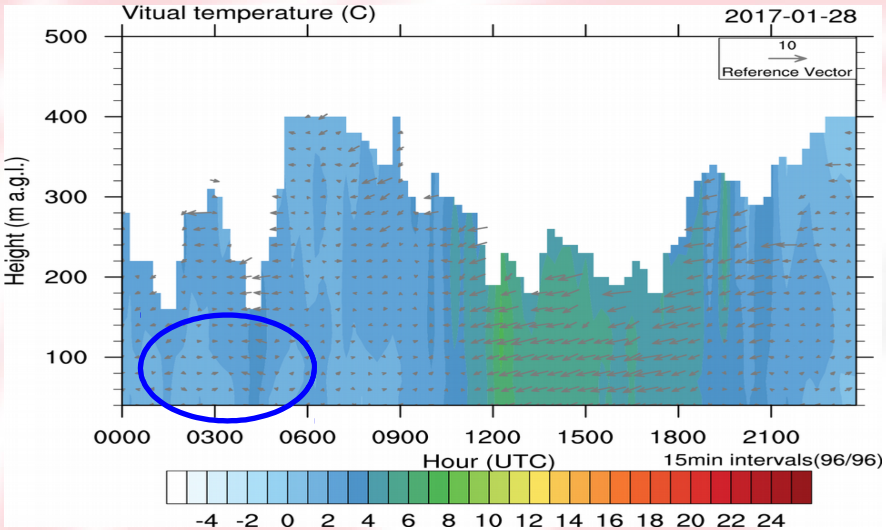
PRELIMINARY RESULTS: MODEL vs OBSERVATION

TEMPERATURE









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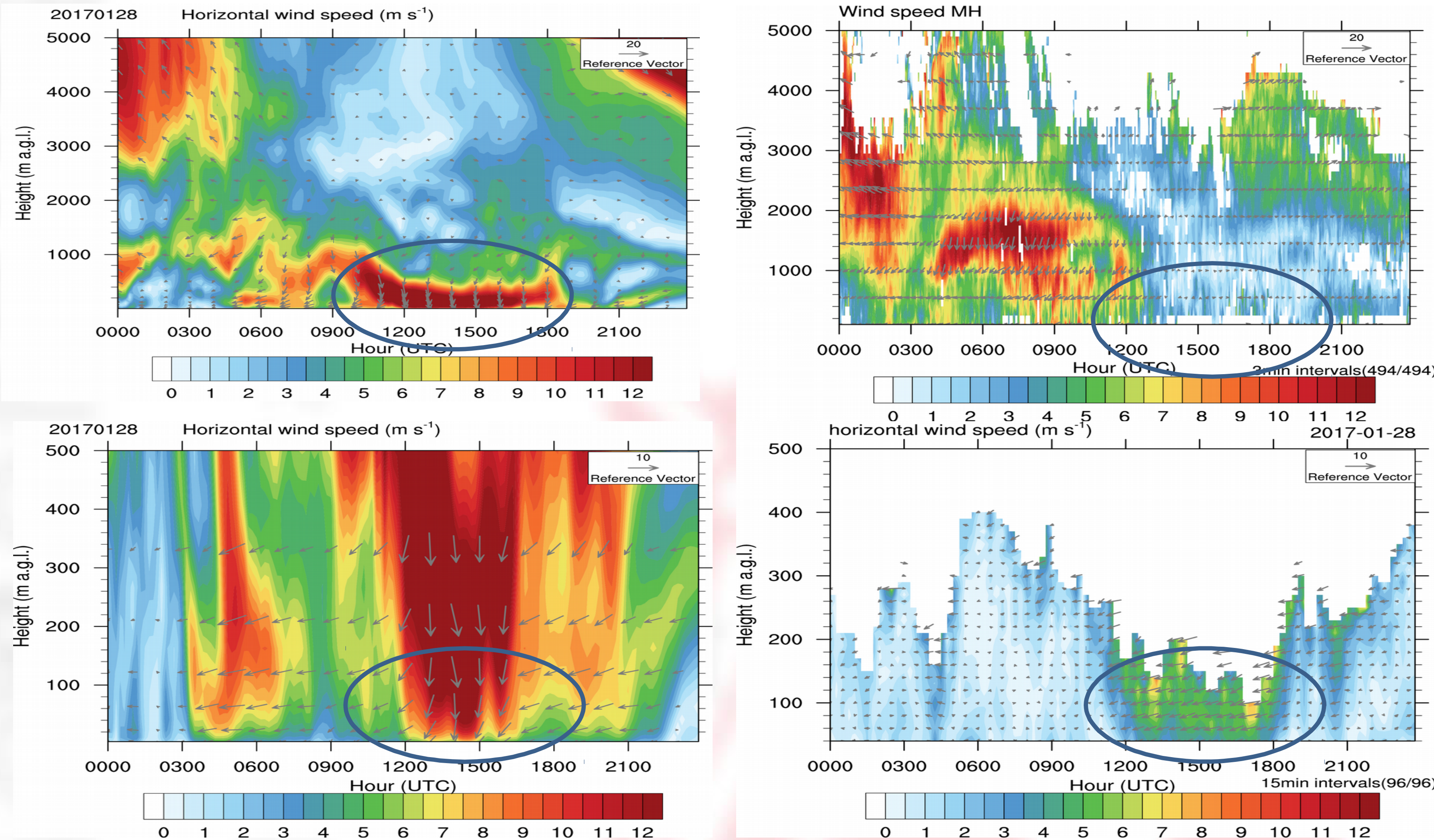
PRELIMINARY RESULTS: MODEL vs OBSERVATION

HORIZONTAL WIND



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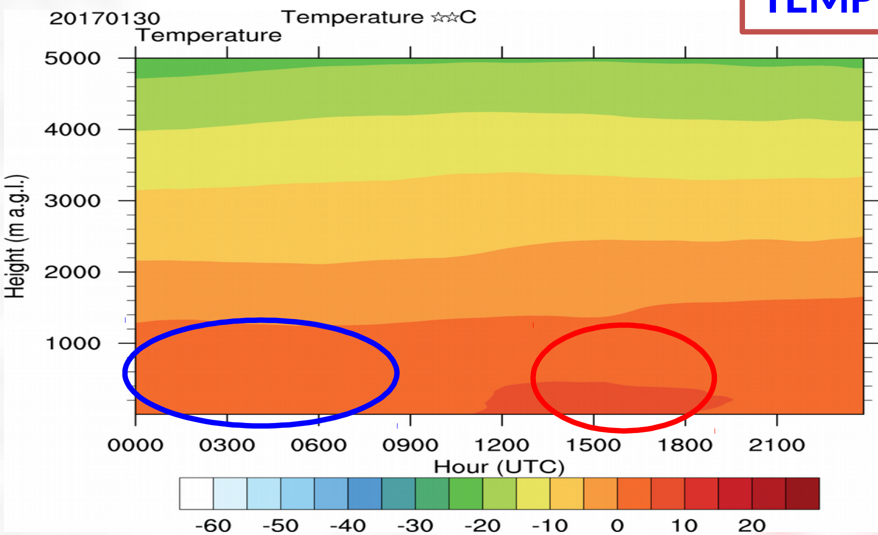
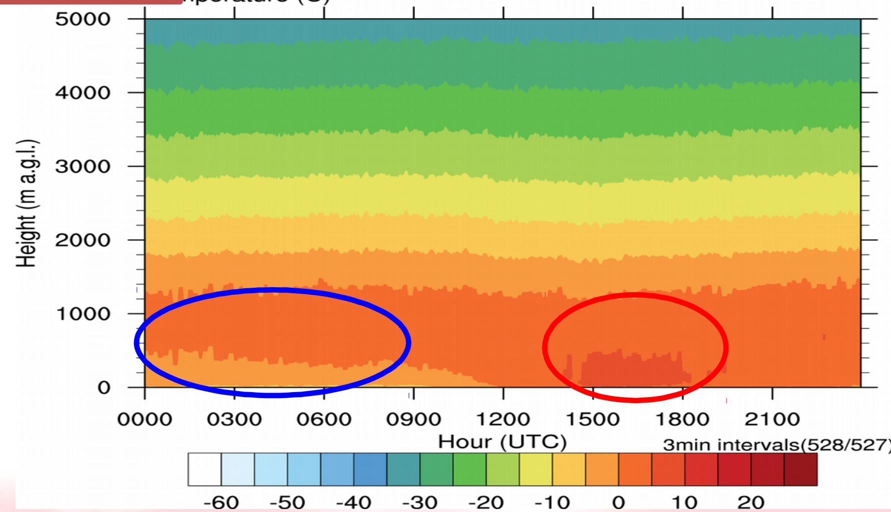
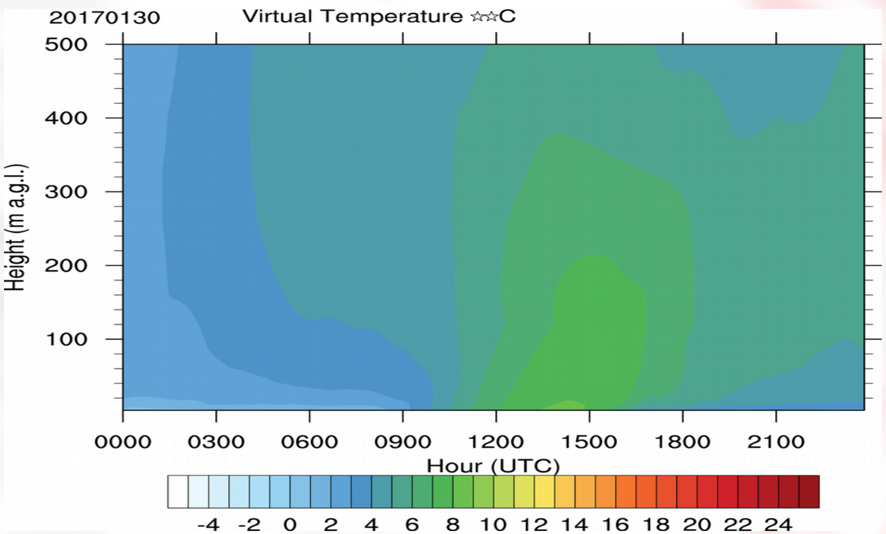
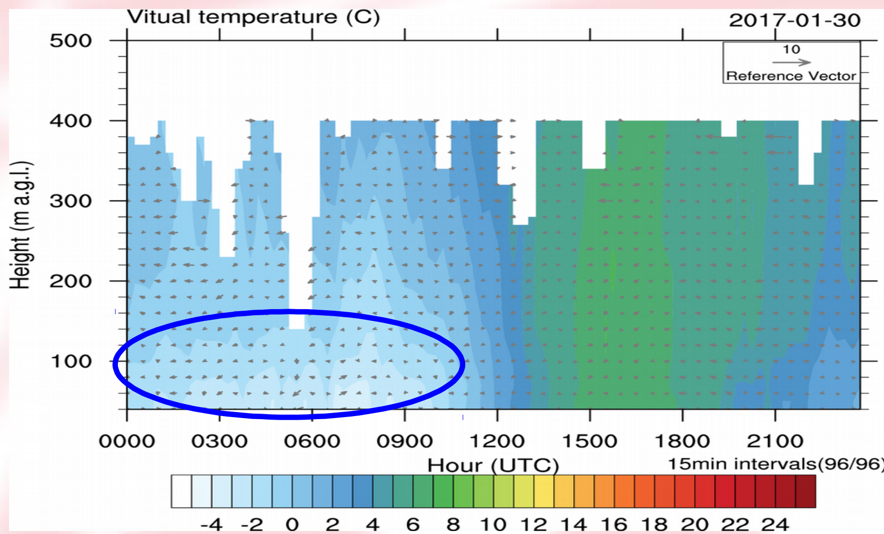
PRELIMINARY RESULTS: MODEL vs OBSERVATION

TEMPERATURE









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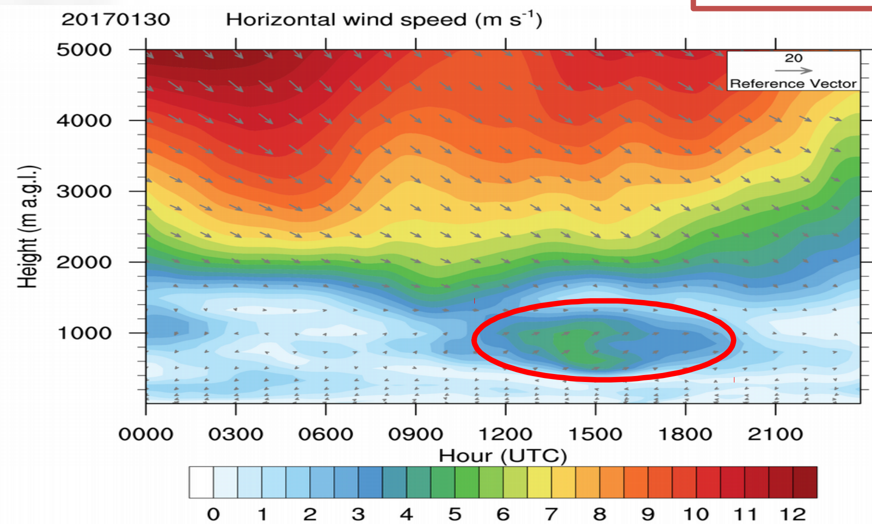
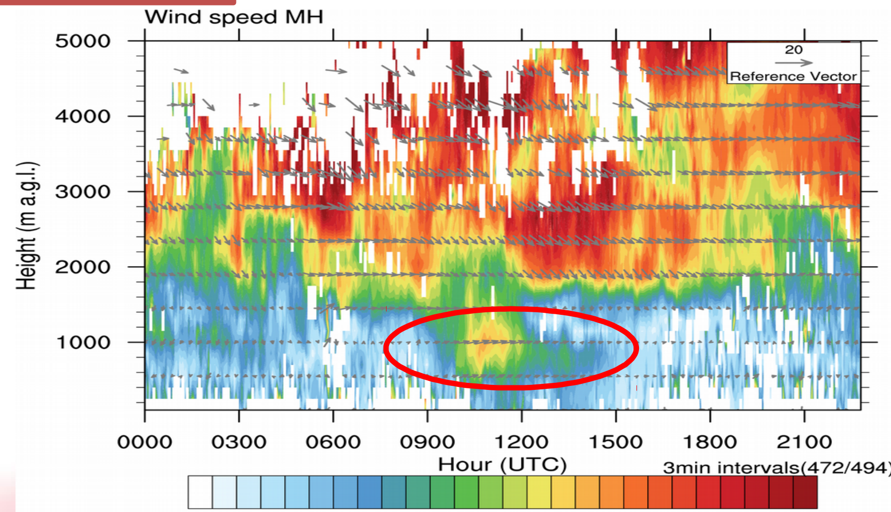
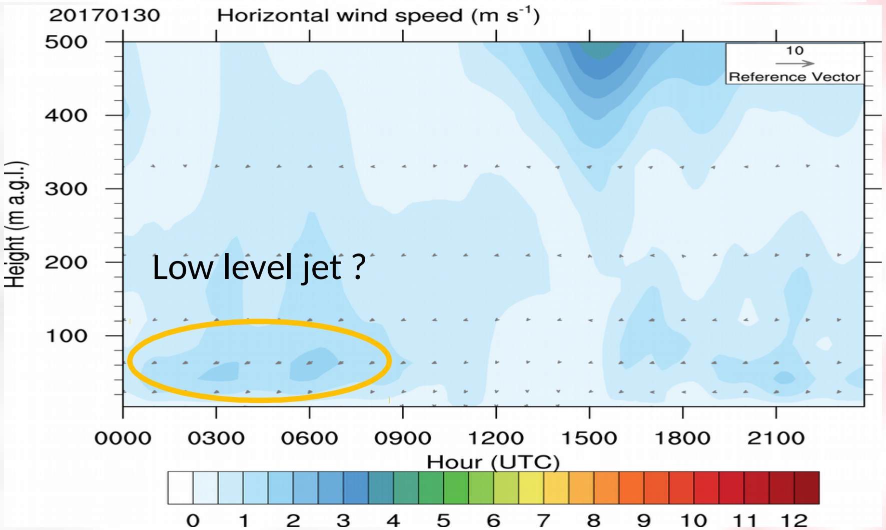
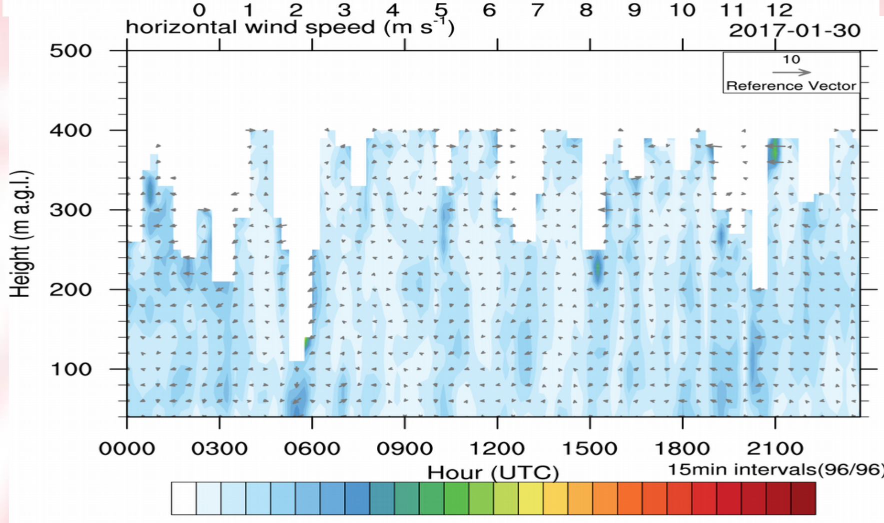
PRELIMINARY RESULTS: MODEL vs OBSERVATION

HORIZONTAL WIND









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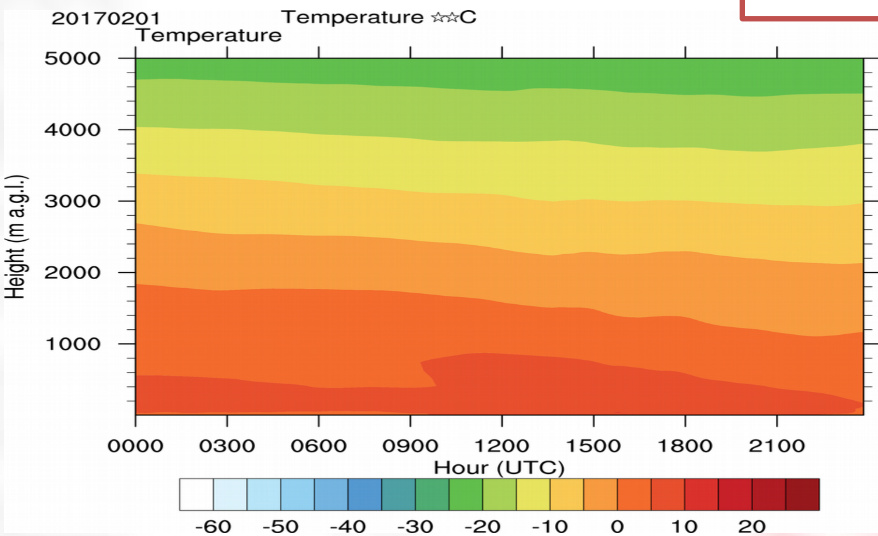
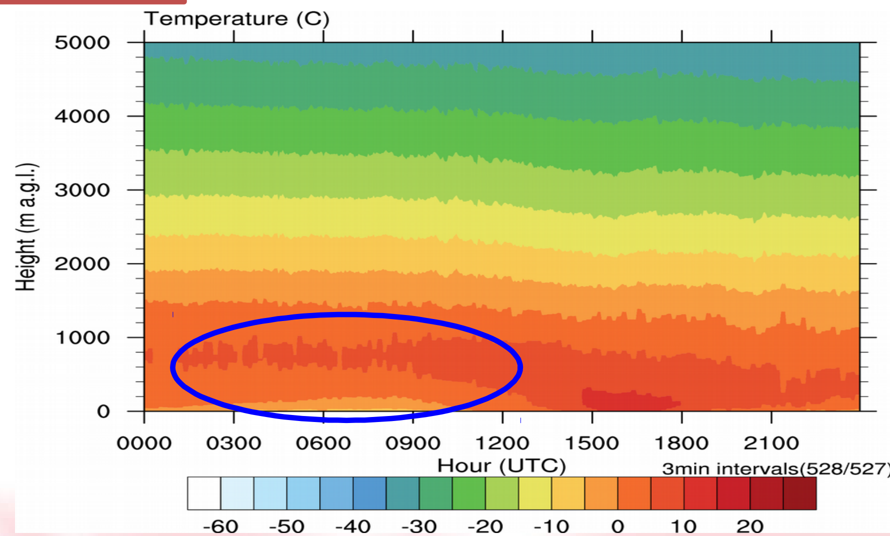
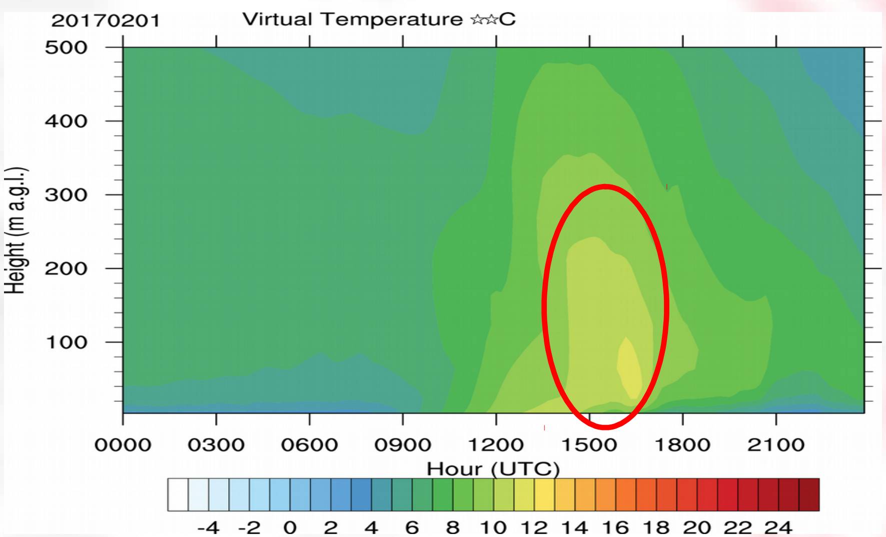
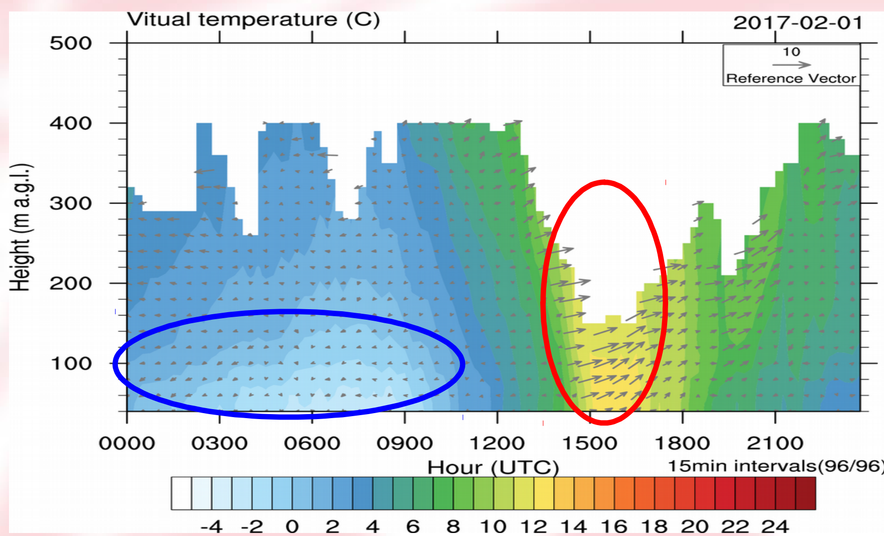
PRELIMINARY RESULTS: MODEL vs OBSERVATION

TEMPERATURE









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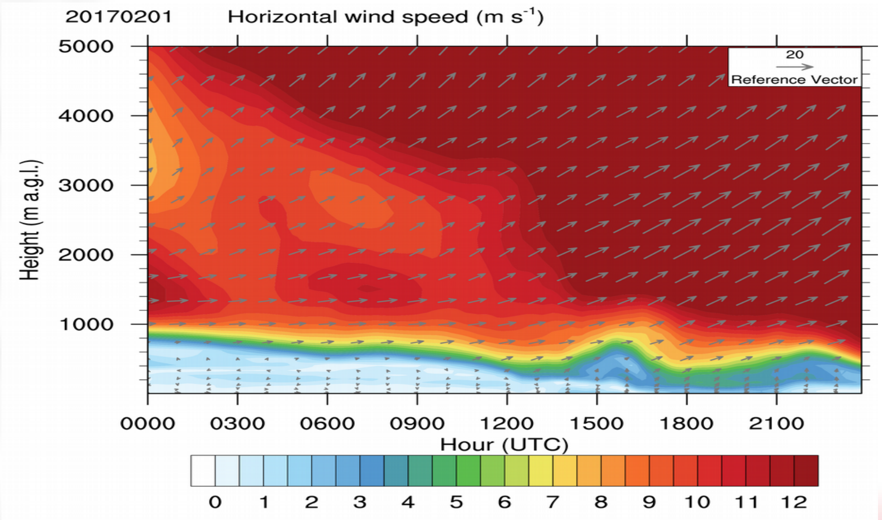
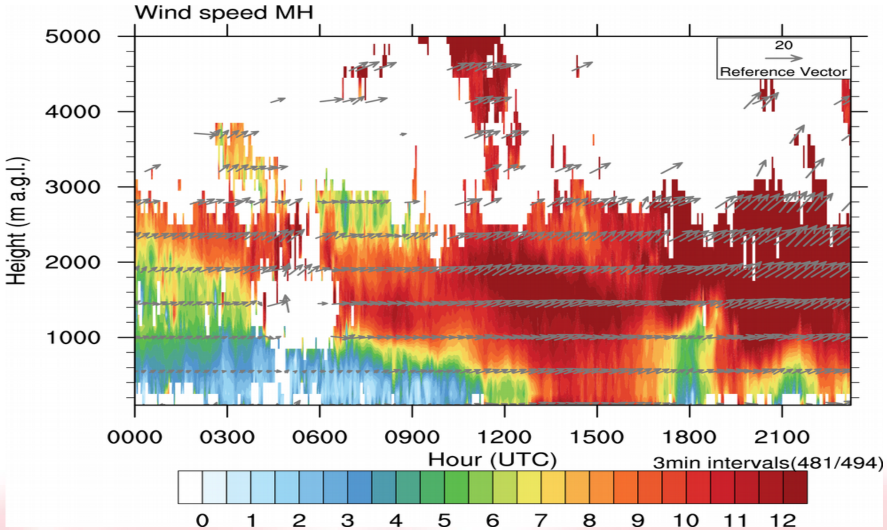
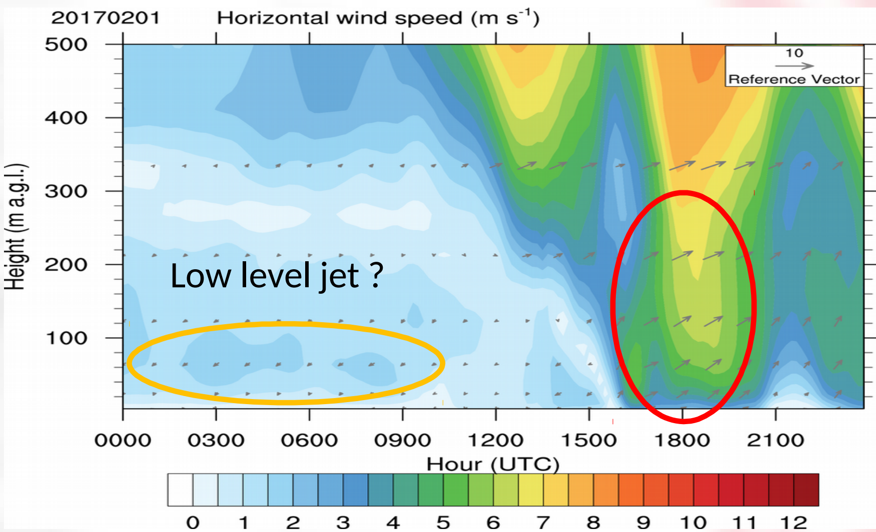
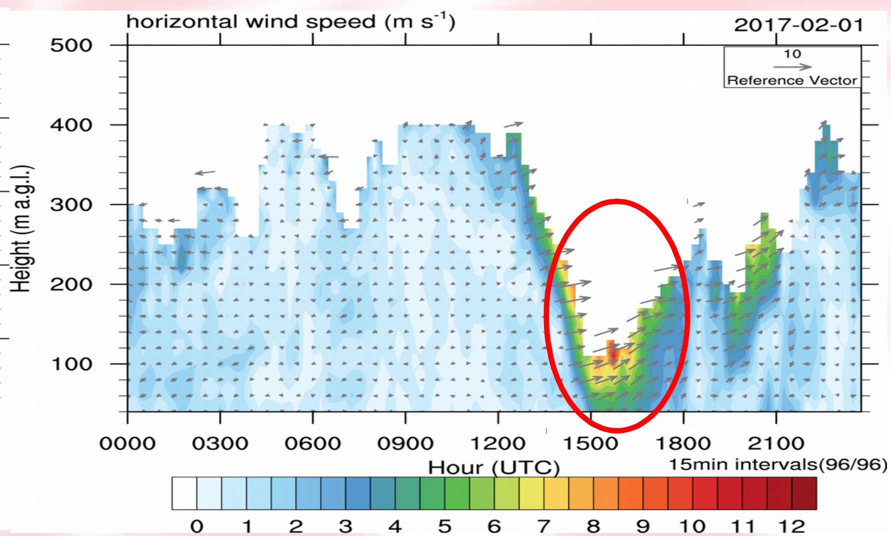
PRELIMINARY RESULTS: MODEL vs OBSERVATION

HORIZONTAL WIND









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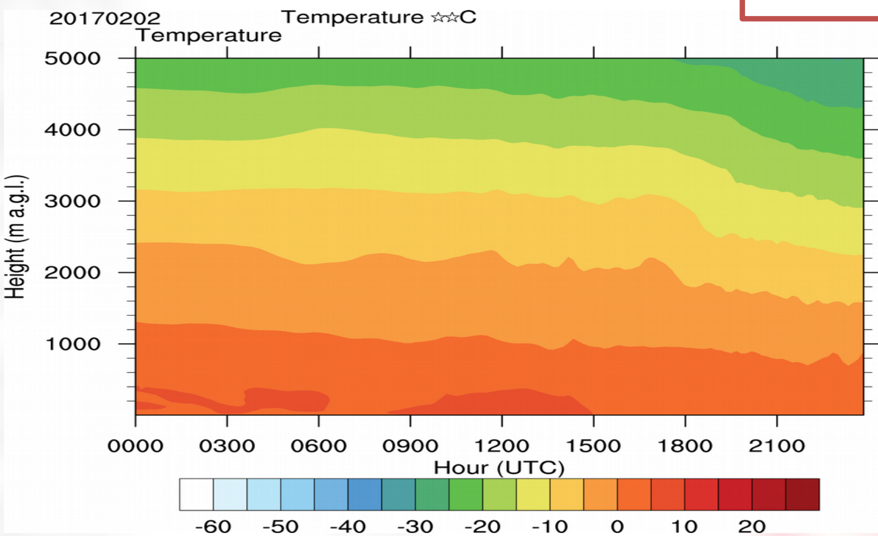
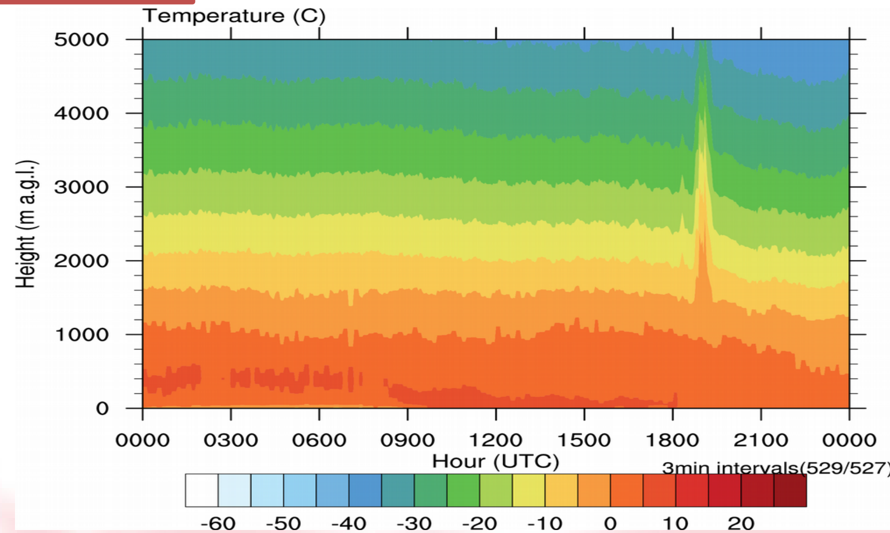
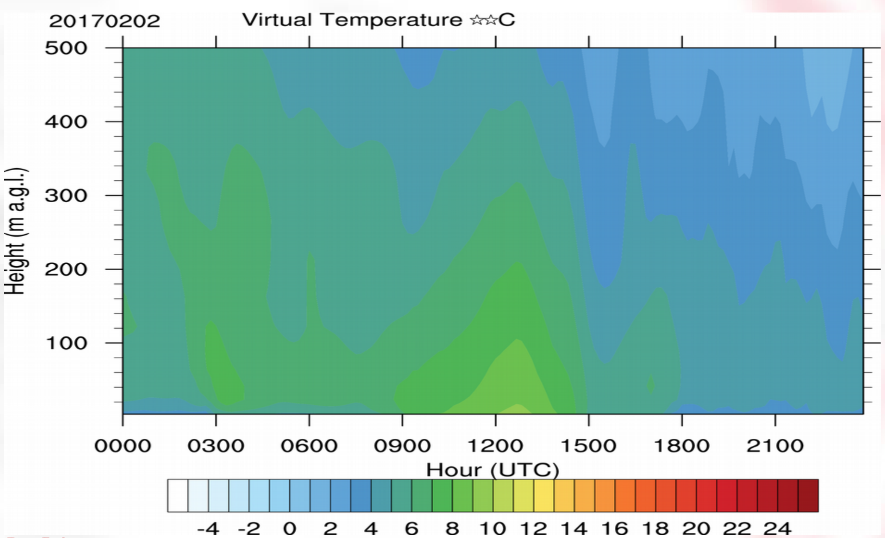
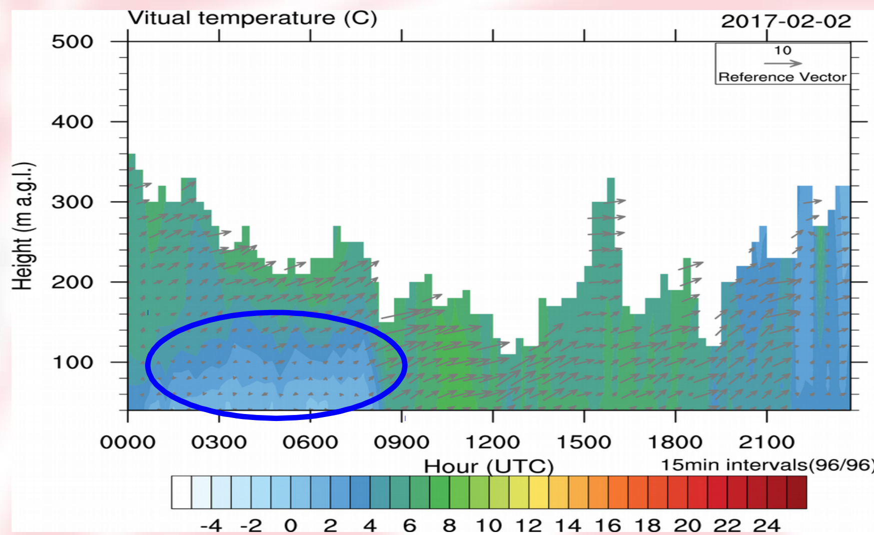
PRELIMINARY RESULTS: MODEL vs OBSERVATION

TEMPERATURE









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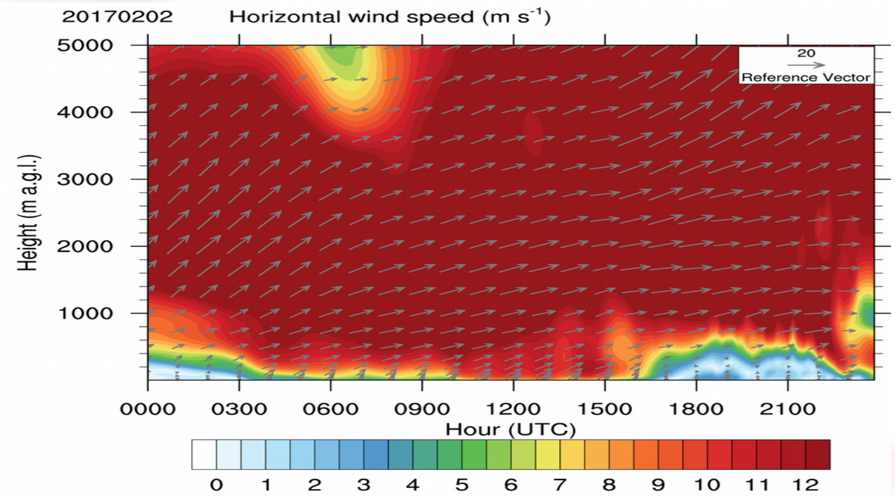
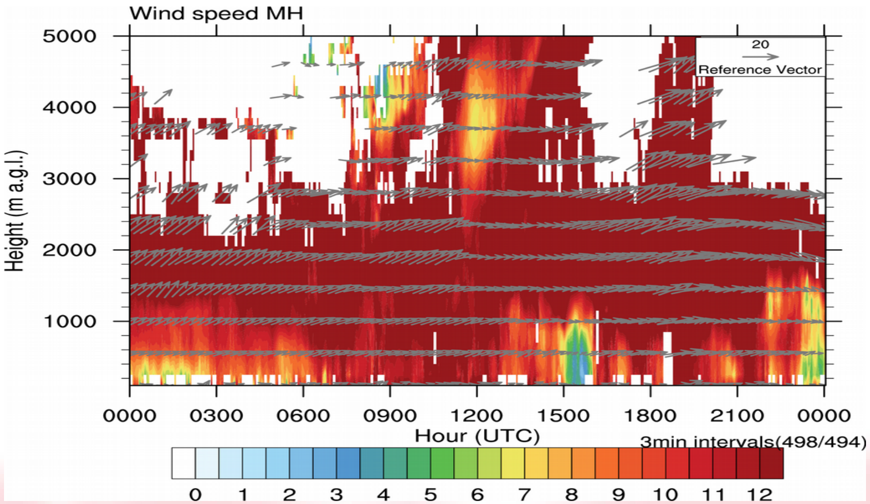
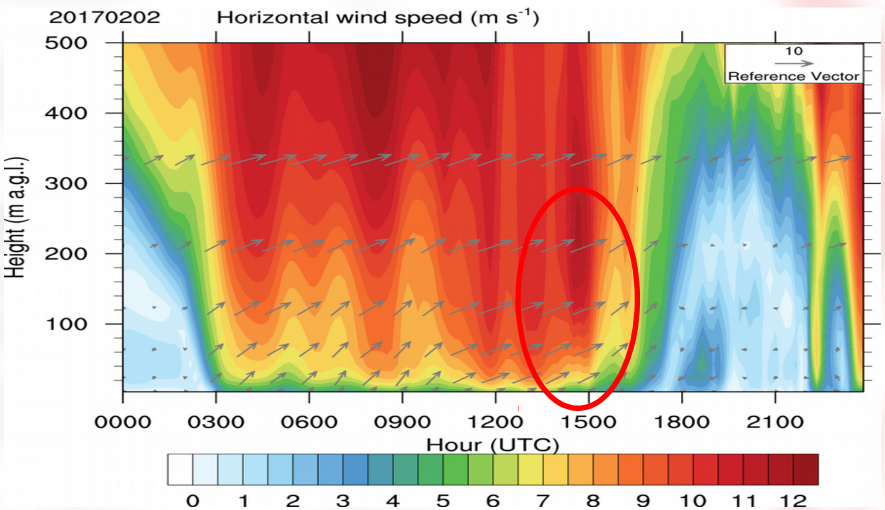
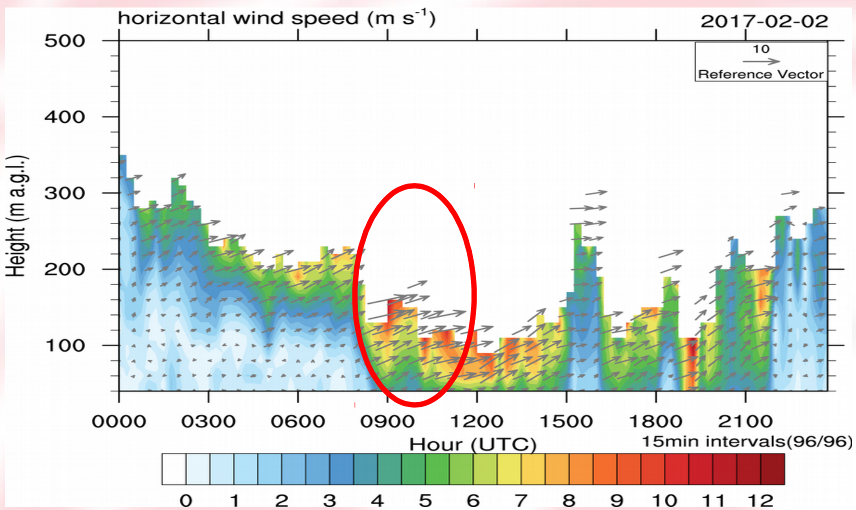
PRELIMINARY RESULTS: MODEL vs OBSERVATION

HORIZONTAL WIND









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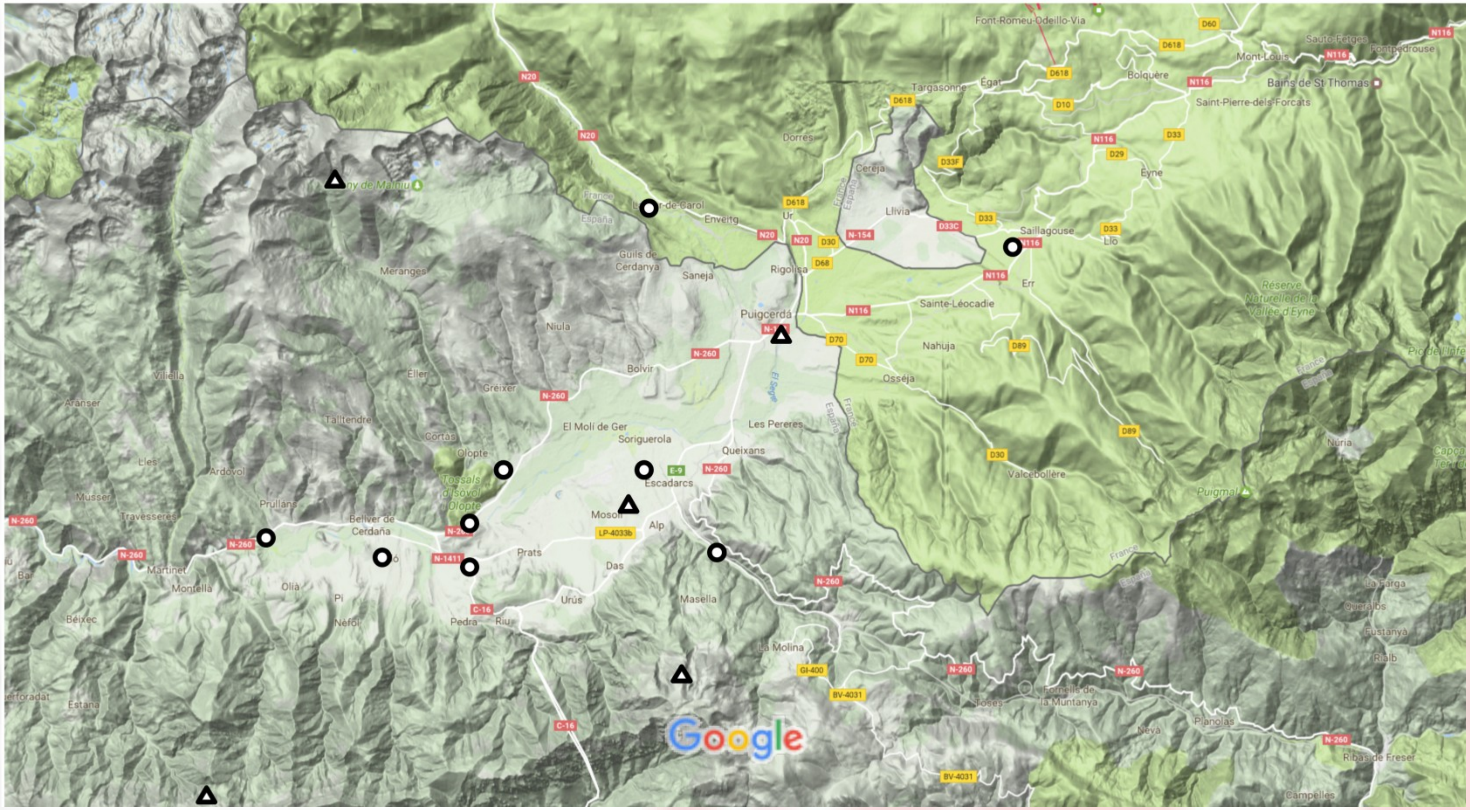
PRELIMINARY RESULTS: MODEL vs OBSERVATION

OBSERVATIONS (AWS): Time series



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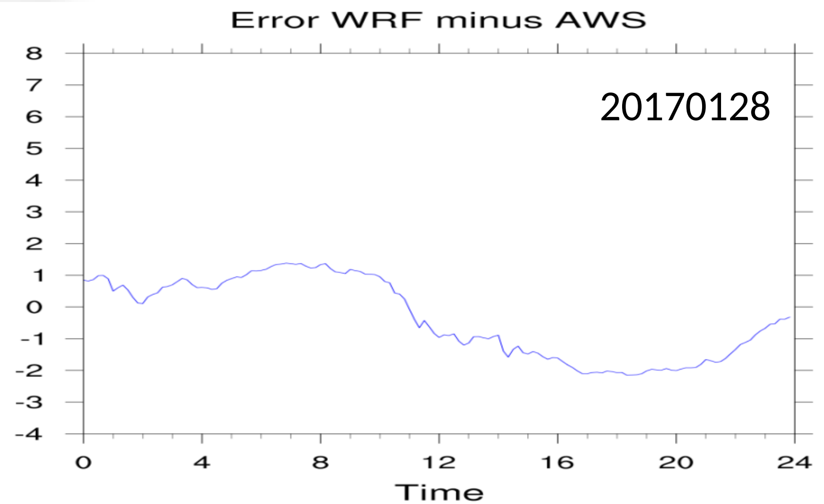
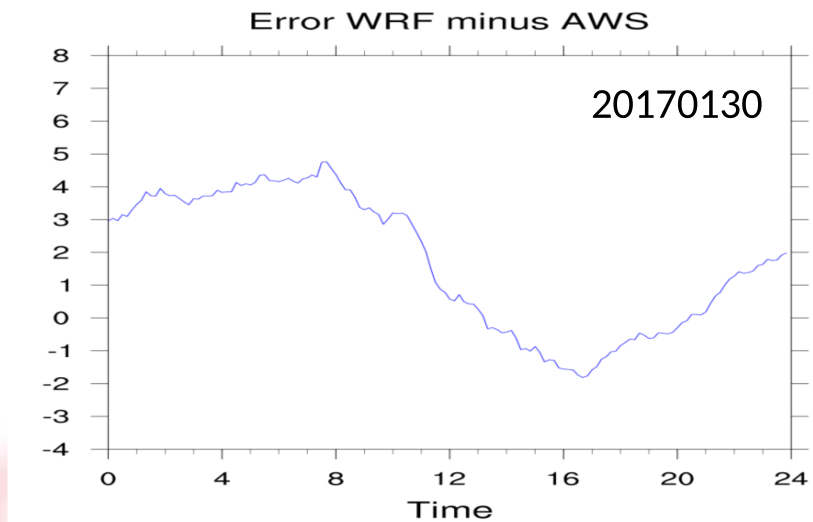
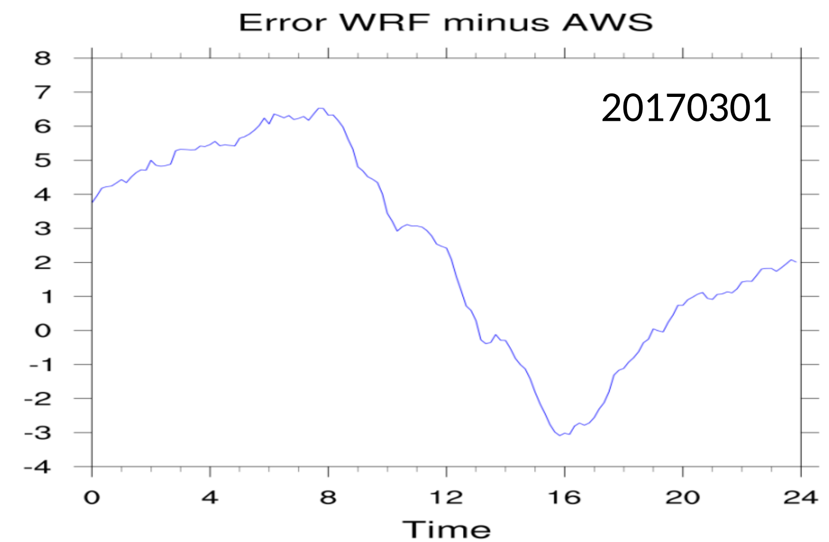
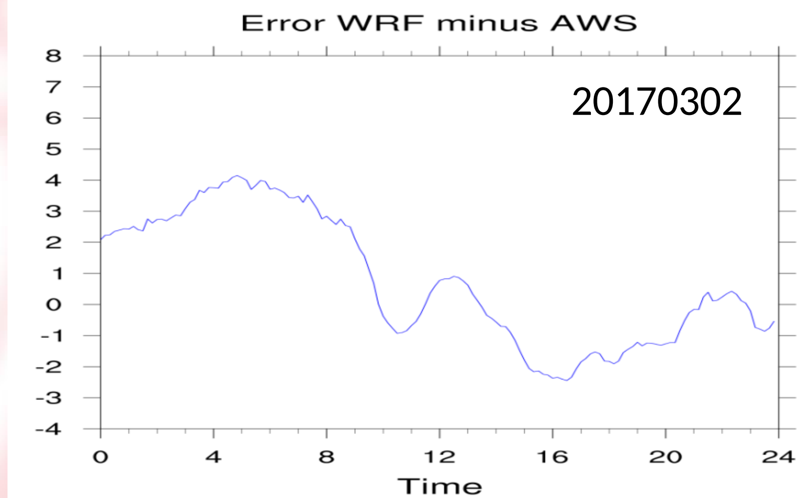
PRELIMINARY RESULTS: MODEL vs OBSERVATION

TEMPERATURE MEAN ERROR









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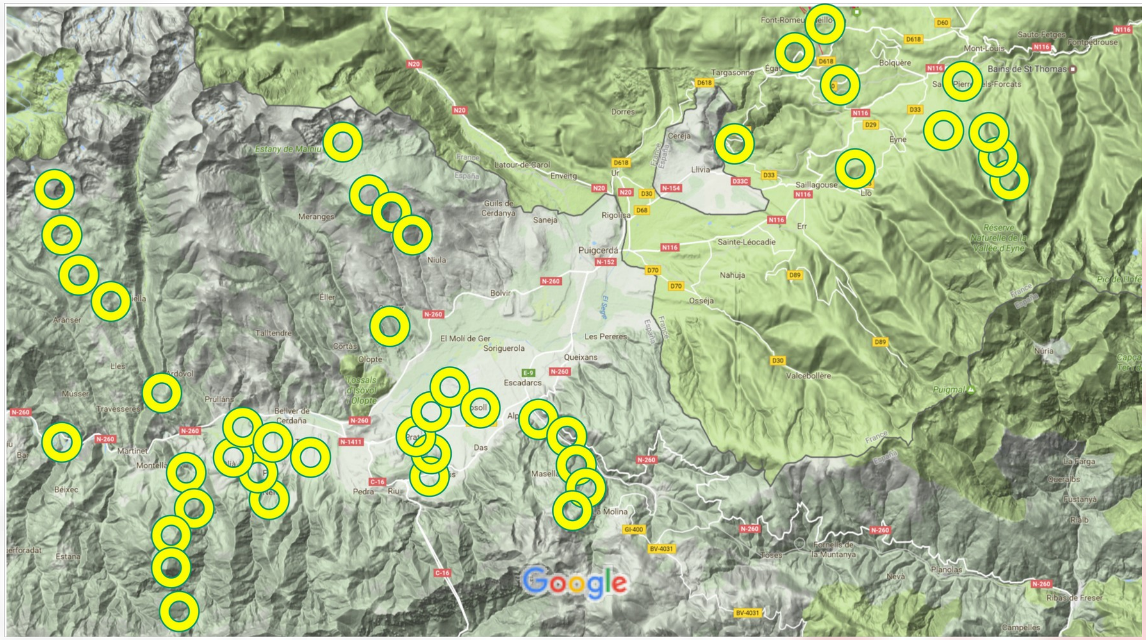
PRELIMINARY RESULTS: MODEL vs OBSERVATION

OBSERVATIONS (HOBO): Time series



- HOBO’s below 1200m
- HOBO’s between 1200m and 1700m
- HOBO’s above 1700m

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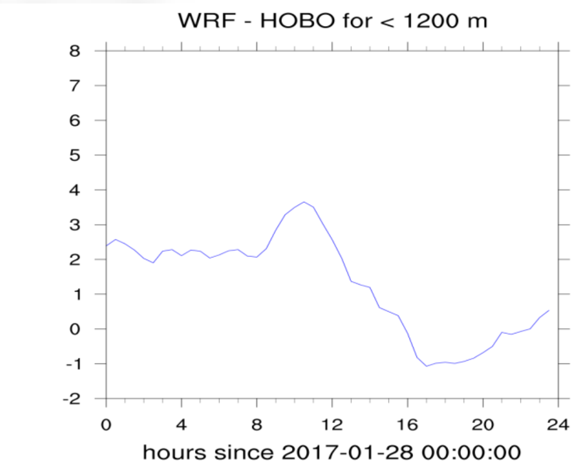
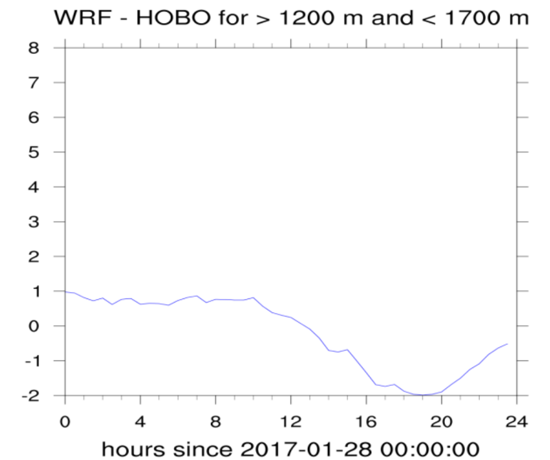
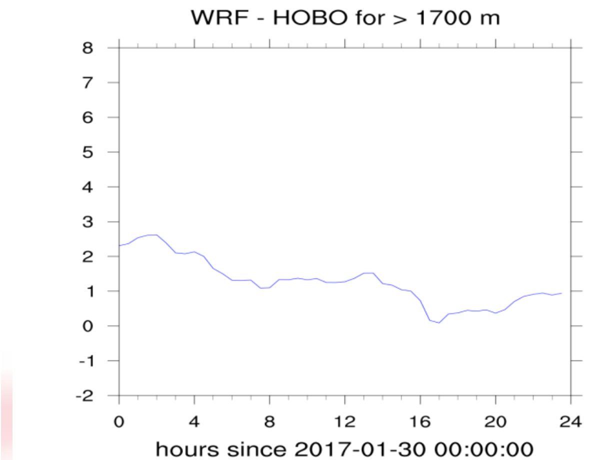
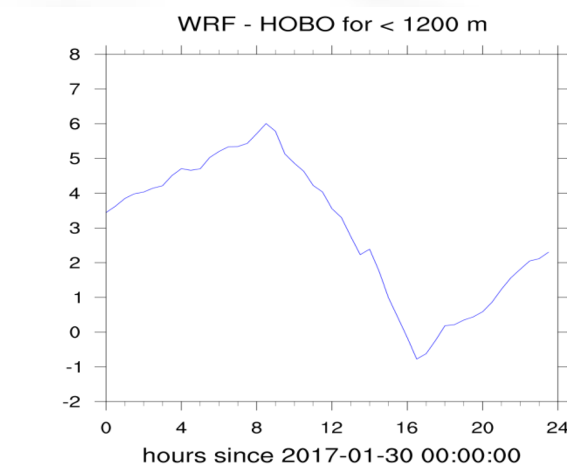
PRELIMINARY RESULTS: MODEL vs OBSERVATION

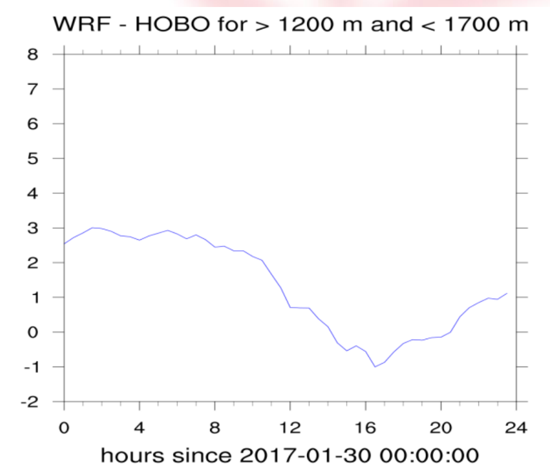
TEMPERATURE MEAN ERROR

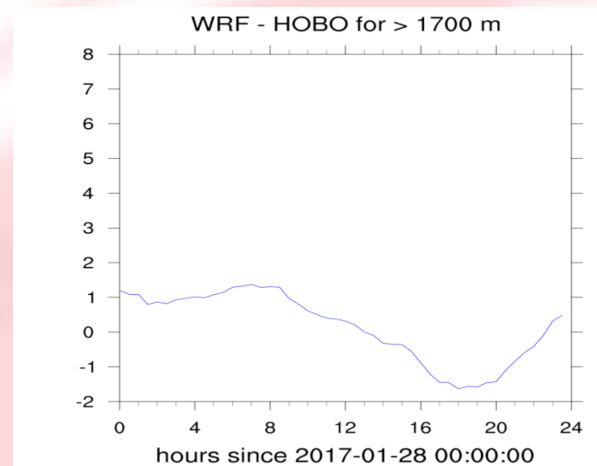












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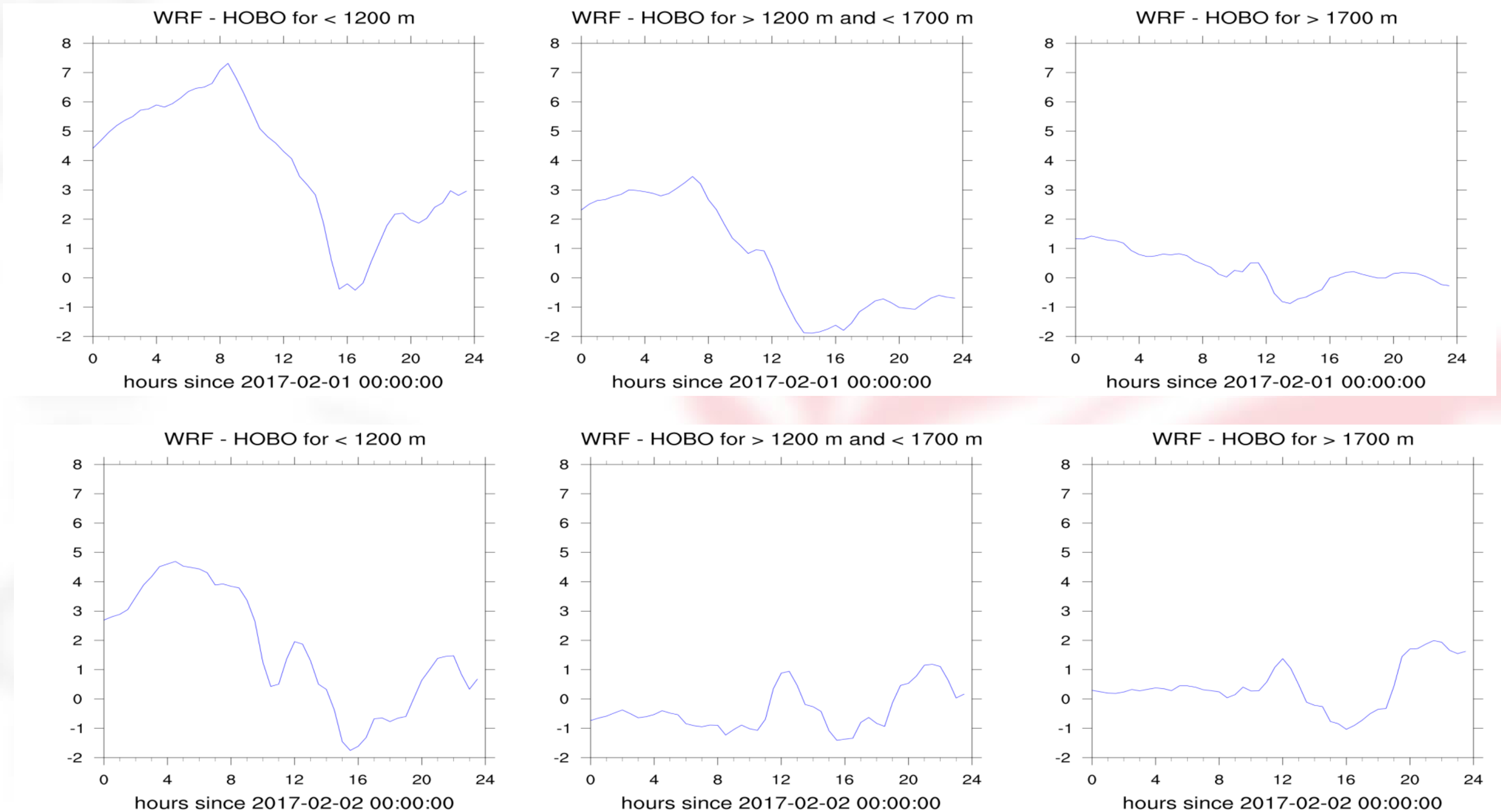
PRELIMINARY RESULTS: MODEL vs OBSERVATION

TEMPERATURE MEAN ERROR



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CONCLUSIONS

- The patterns of wind are usually well represented but overestimated by the model.
- The structure of Low level Jet quite well represented bye the model
- The temperature is overestimated in the low levels from 0 to 1000 meters above ground and mainly in stable days (Turbulence ?)
- The model underestimates the intensity of the thermal inversions (Nocturnal Colling? or Low level Jet?)
- Using AWS/HOBO observation, the most important differences in temperature are in the morning (overestimation) and in the afternoon (underestimation)
- And as we move to the mountaintops the errors produced are lower.

FUTURE WORK

- Answering the doubts and questions related to thermal inversions a detailed deep analysis is needed.
- Validation of more parameters related to the temperature: latent and heat fluxes, radiation, turbulent kinetic energy, etc.
- Investigate the influence of data assimilation and the physical processes related to wind and temperature
- Run a WRF simulation at higher resolution than 1 km
- Study other stable cases

THANKS FOR YOUR ATTENTION !!

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