

What have we learned from the 1st mesoscale modelling intercomparison?

http://turbulencia.uib.es/intercomp_liaise/

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Eastern Ebro Subbasin

Complex terrain

- ✓ Topography
- ✓ Soil uses

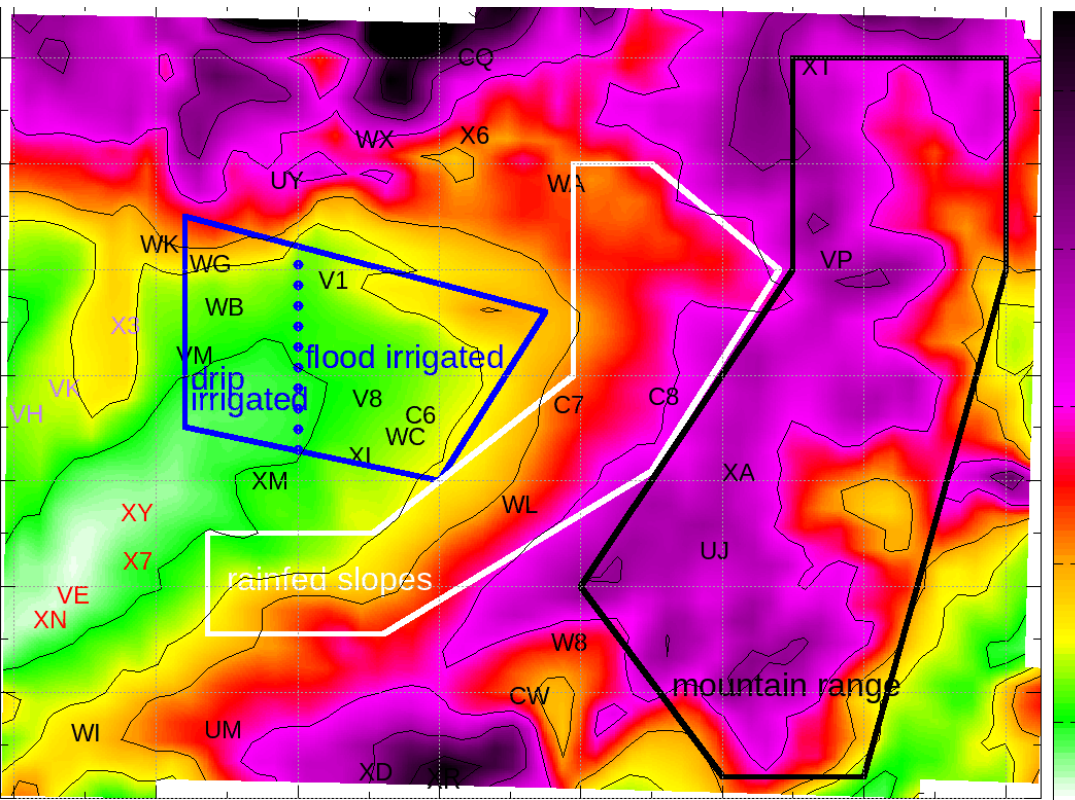
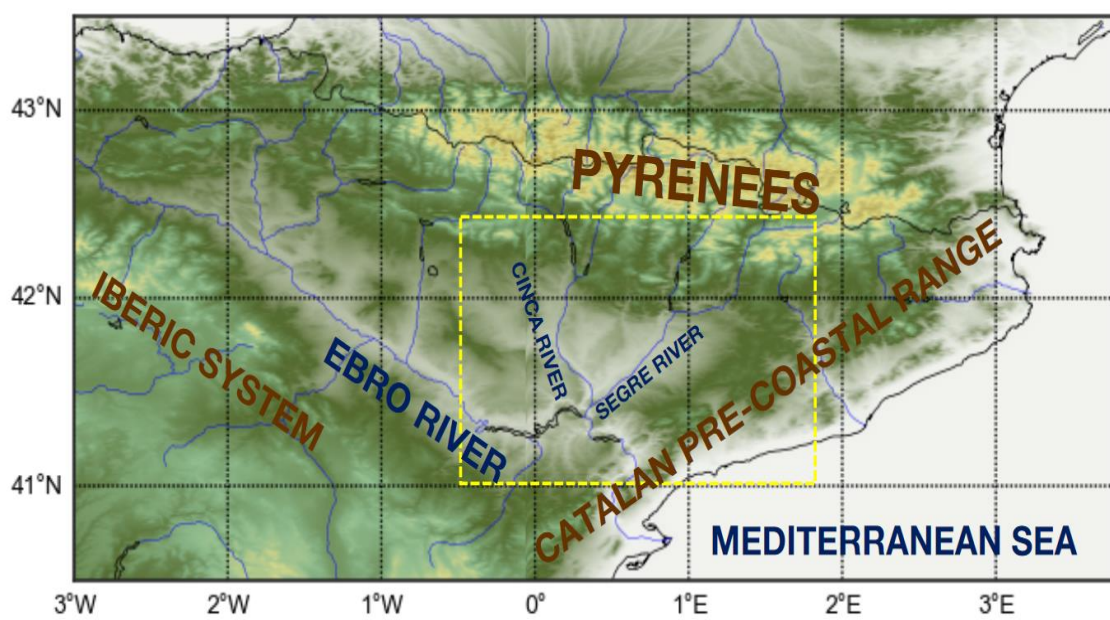


Heterogeneities

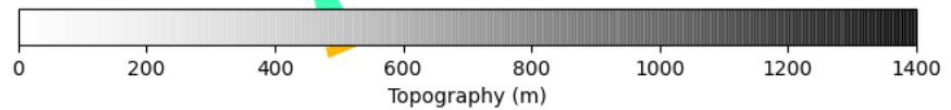
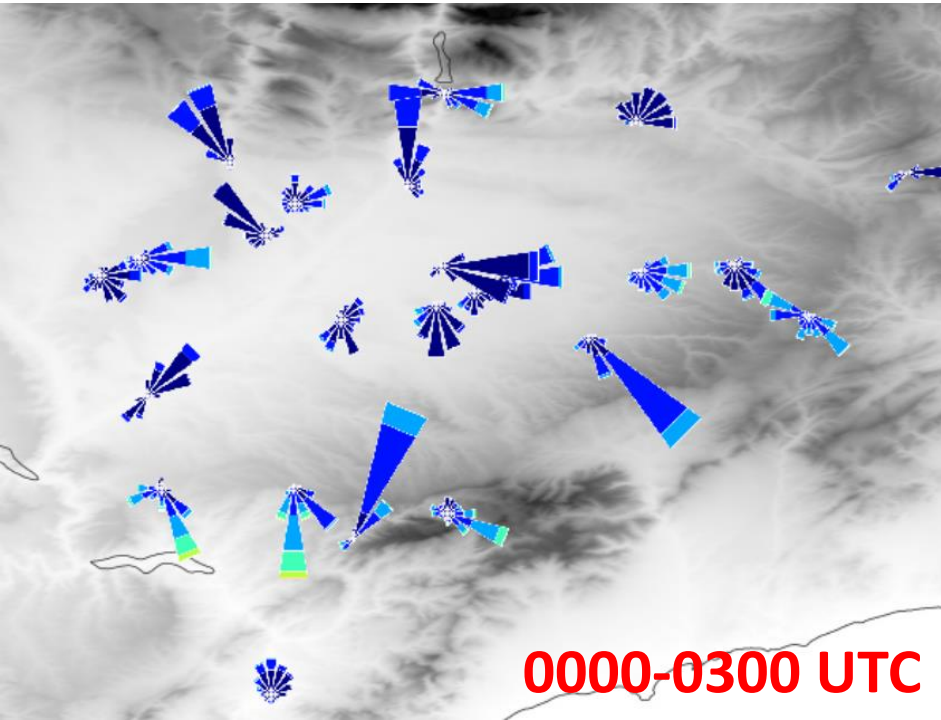
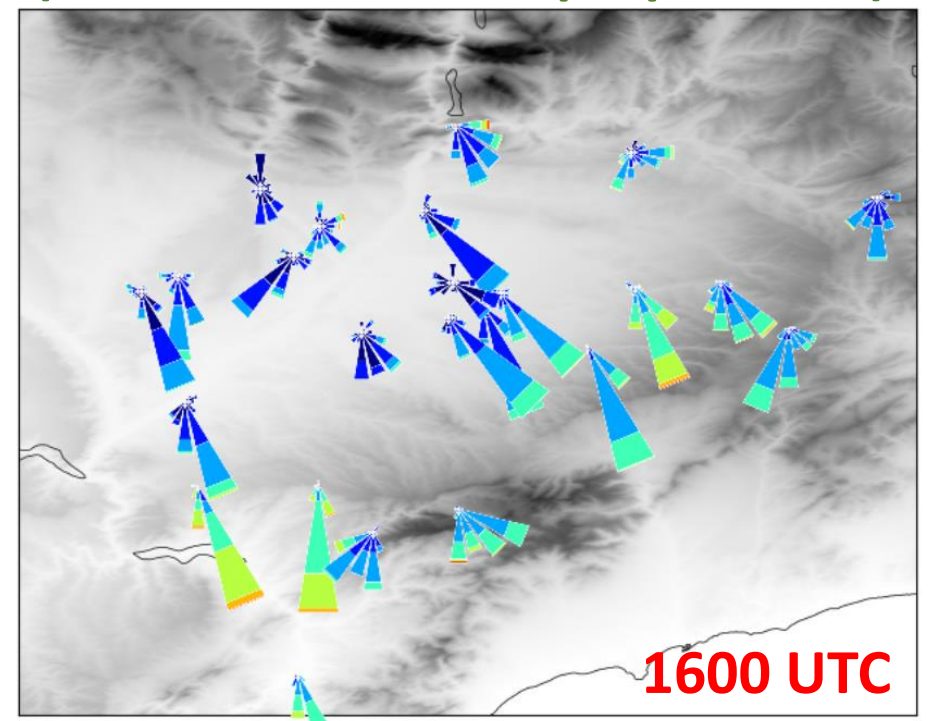
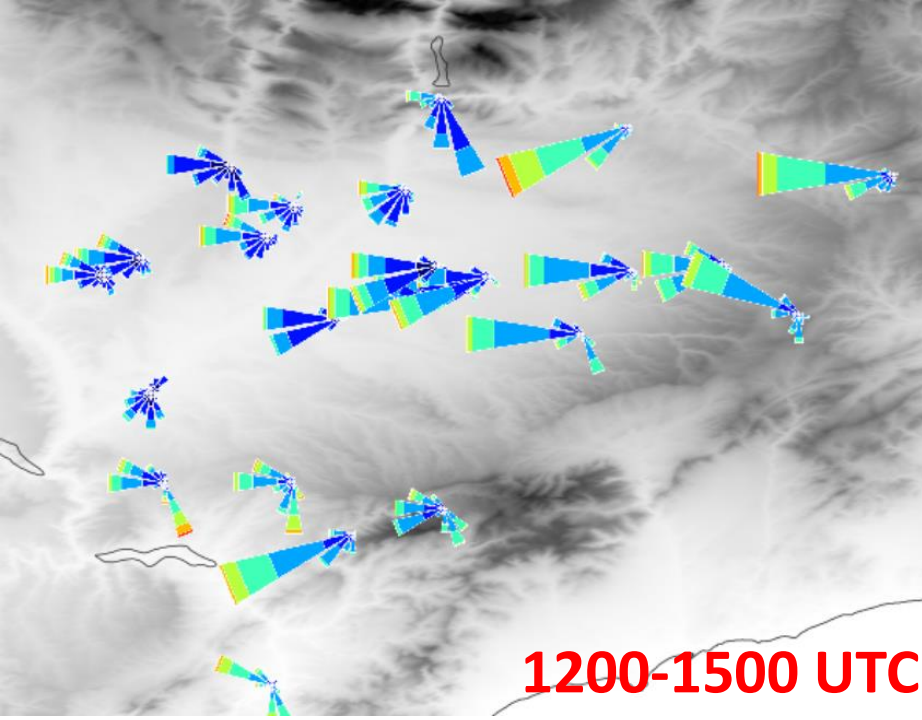
(circulations)

Local, basin, meso-synop

(*Grau et al., 2022*)



Locally-driven winds (2003-2021, IJOC in preparation)



Wind Speed (ms^{-1})

- [0.0 : 1.0]
- [1.0 : 2.0]
- [2.0 : 3.0]
- [3.0 : 4.0]
- [4.0 : 5.0]
- [5.0 : 6.0]
- [6.0 : 7.0]
- [7.0 : inf]

The 1st mesoscale intercomparison case

16-18 July 2016

* clear skies, A conditions

* locally/basin/mesoscale generated winds (interact)

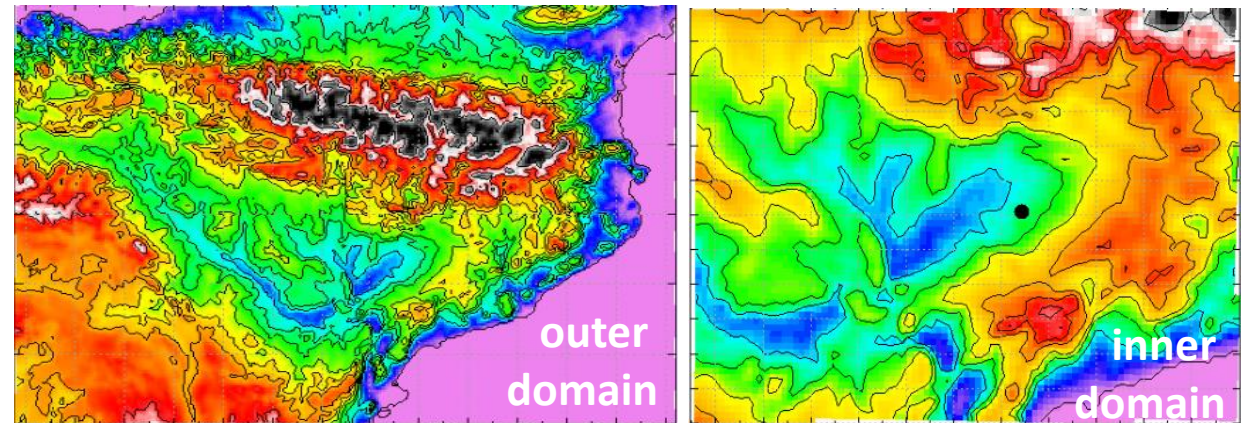
Models

MesoNH (MNH)

MOLOCH (MOL)

Unified Model (UM)

WRF



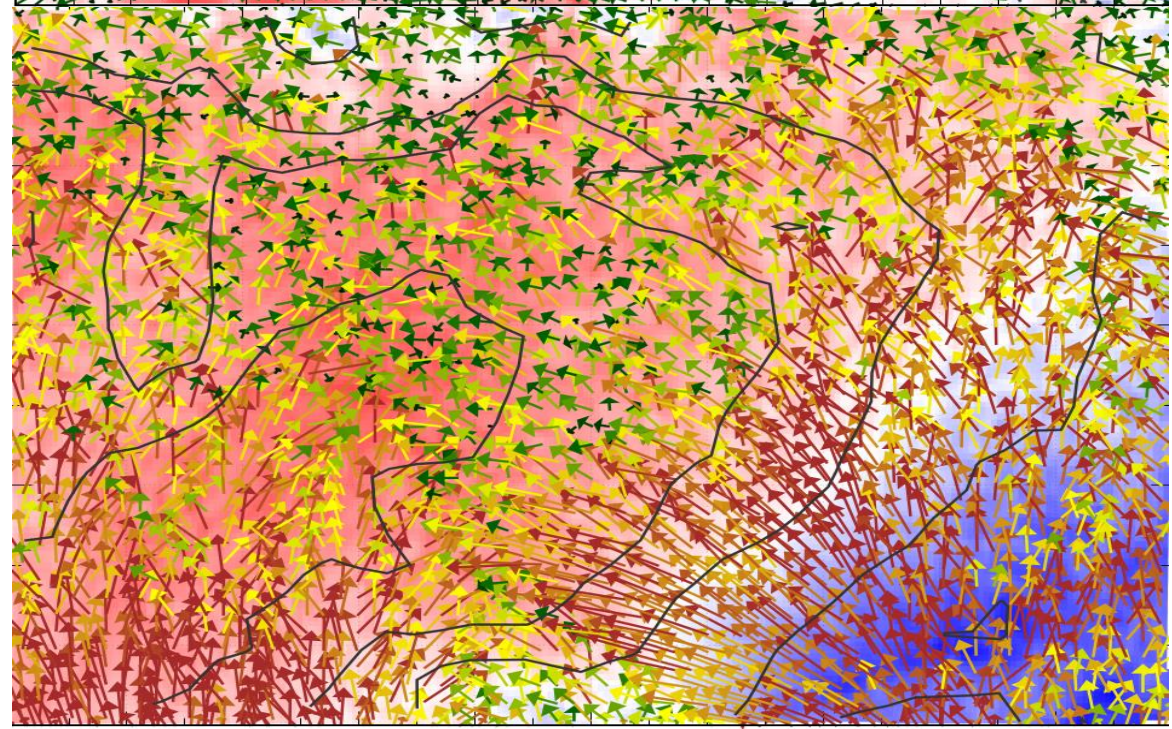
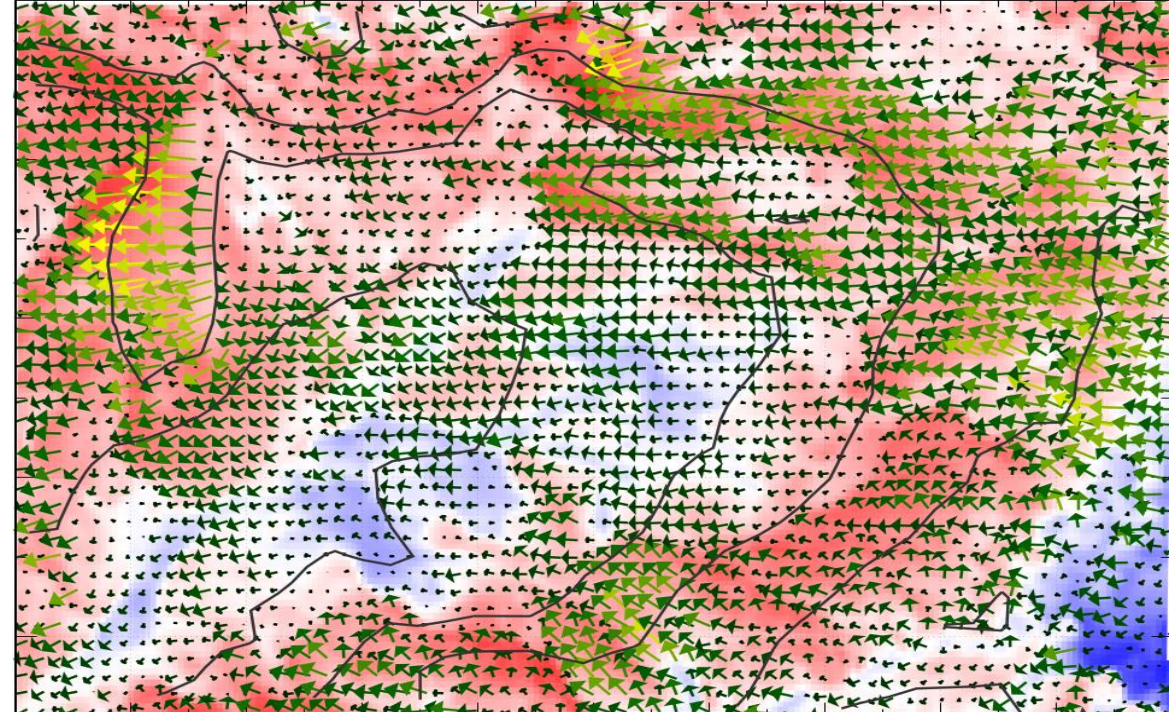
Model setup

- 36h run (from 16 July at 1800 UTC to 18 July at 0600UTC)
- 2 nested domains (1-way): 2km x 2 km and 400m x 400m resolution (540 x 450 gridpoints)
- Vertical resolution (2m and stretched above, 85 levels)
- Initial/Lateral BC: ECMWF
- Differences: Turbulence, Radiation (5min), Surface

10 m (agl)
wind vectors
(MesoNH)

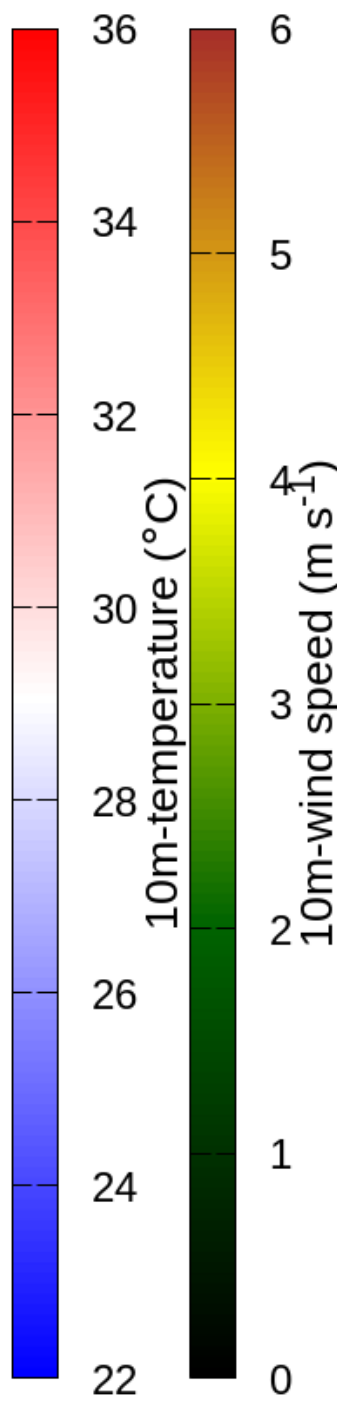
17th July
0600 UTC

E-wind prevail

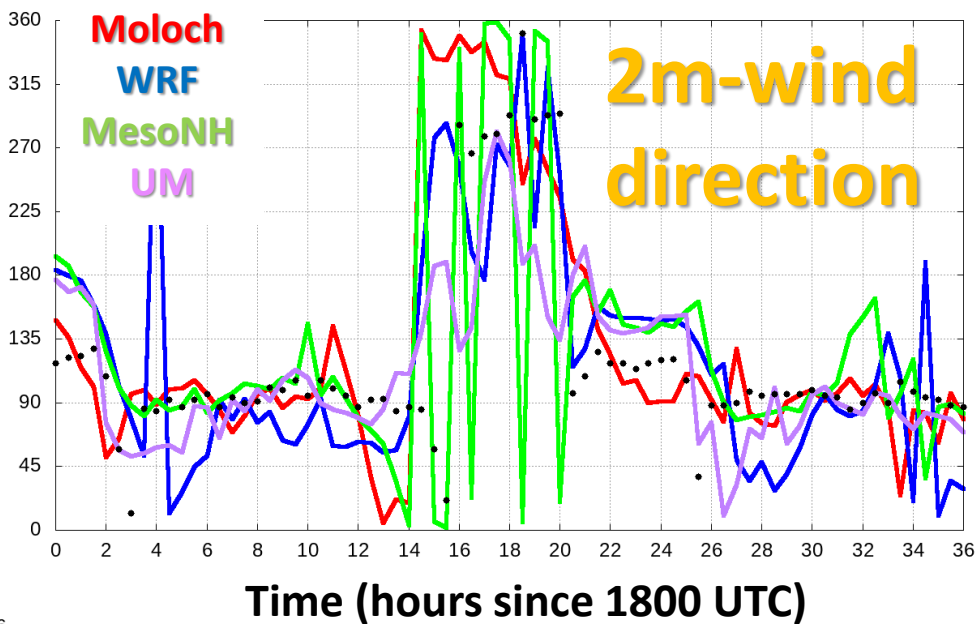
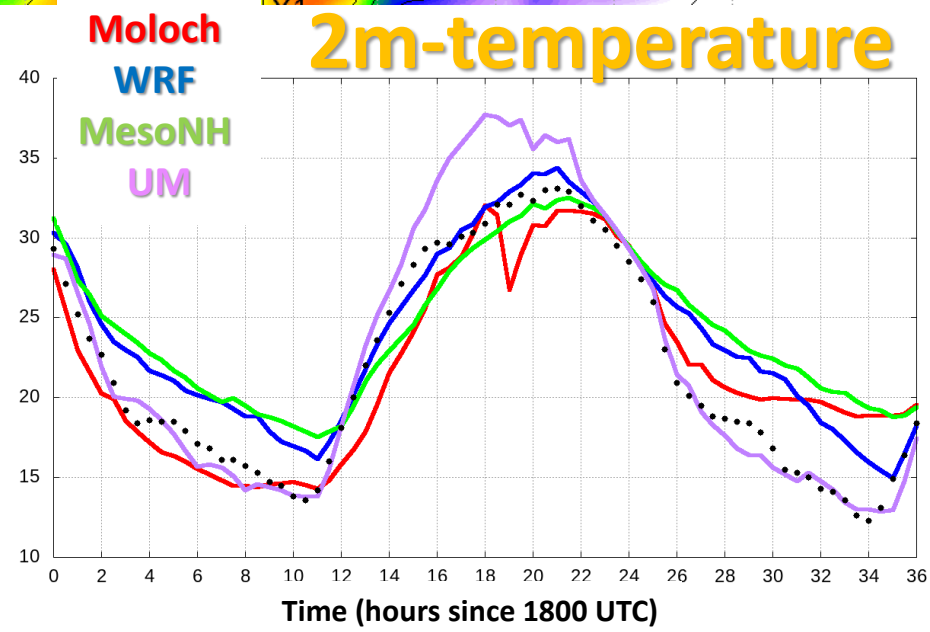
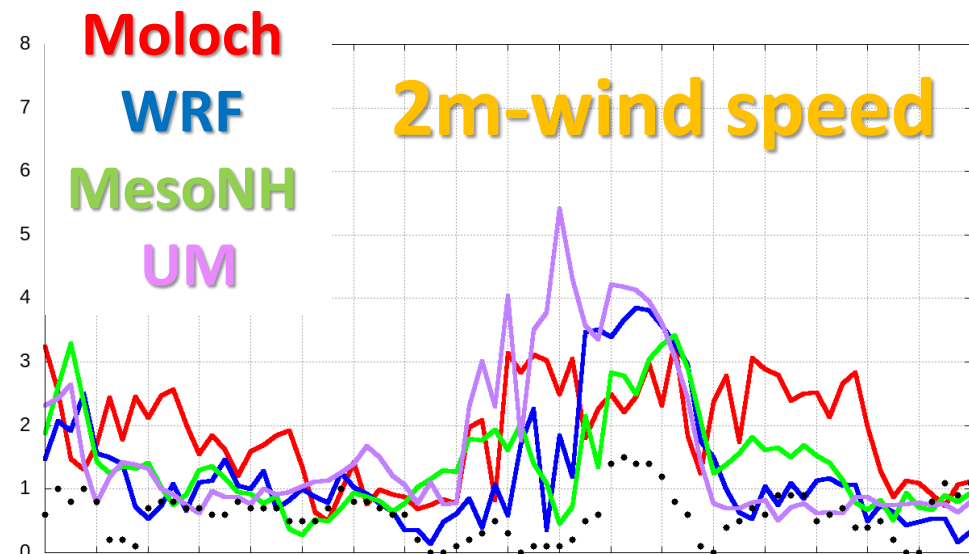
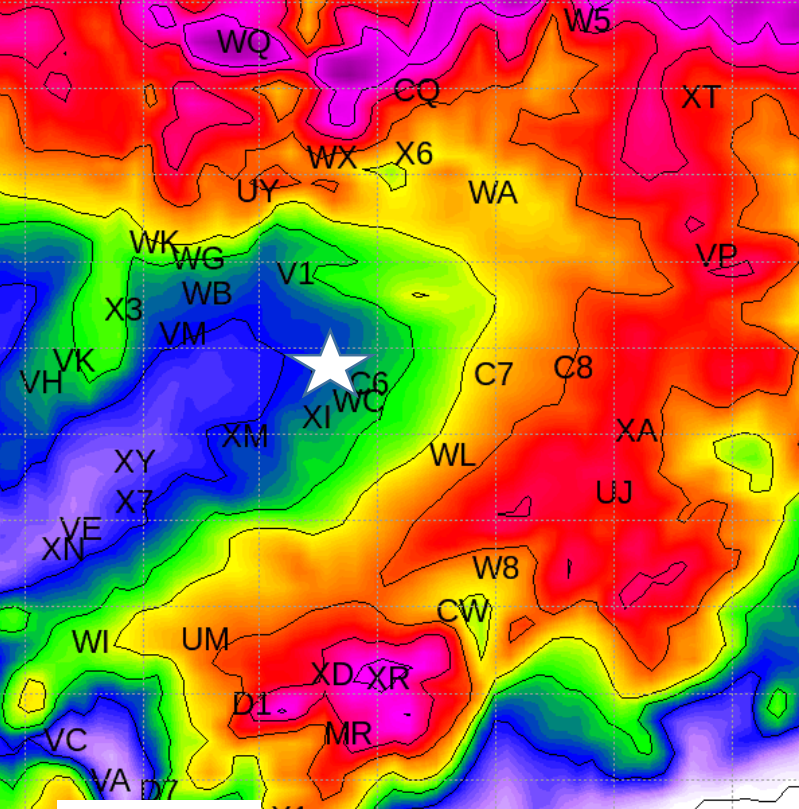


17th July
1500 UTC

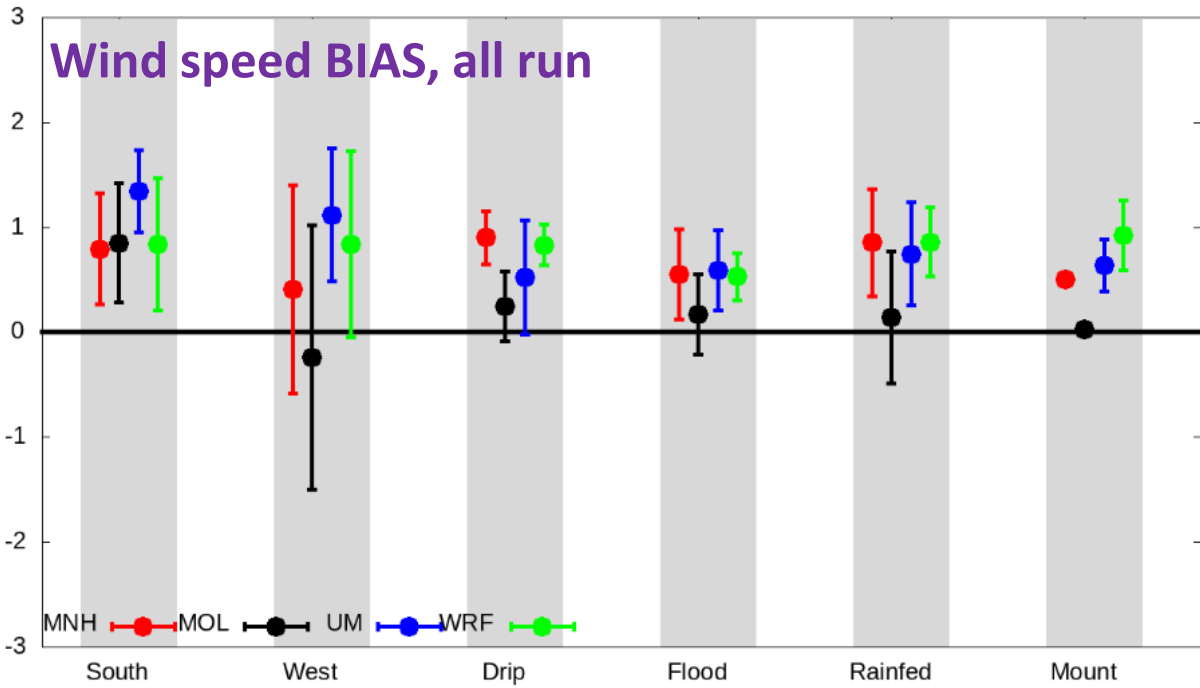
SB front
interacts with
local winds



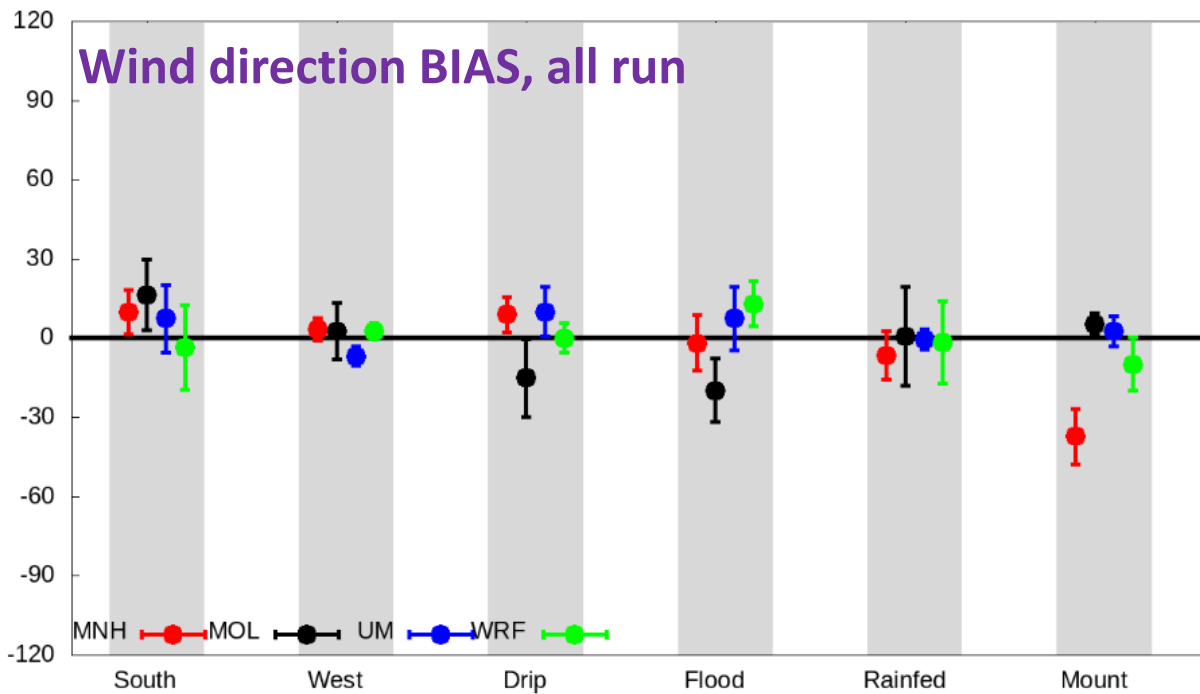
Validation using AWS El Poal (V8) - FLOOD



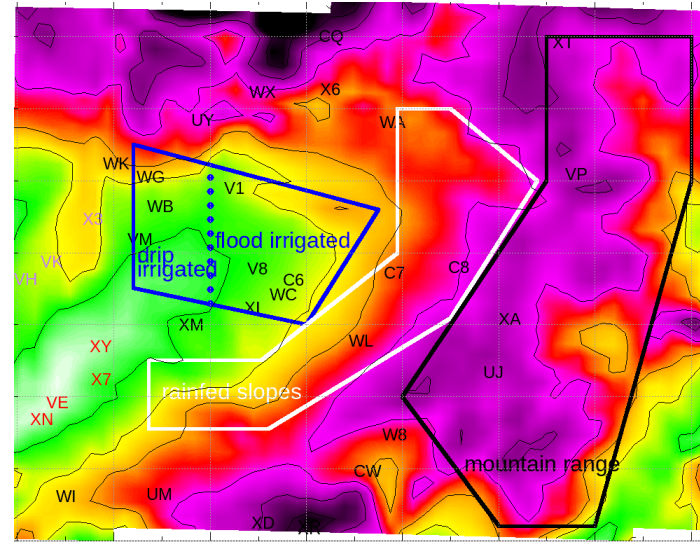
Wind speed BIAS, all run



Wind direction BIAS, all run



MesoNH
Moloch
UM
WRF



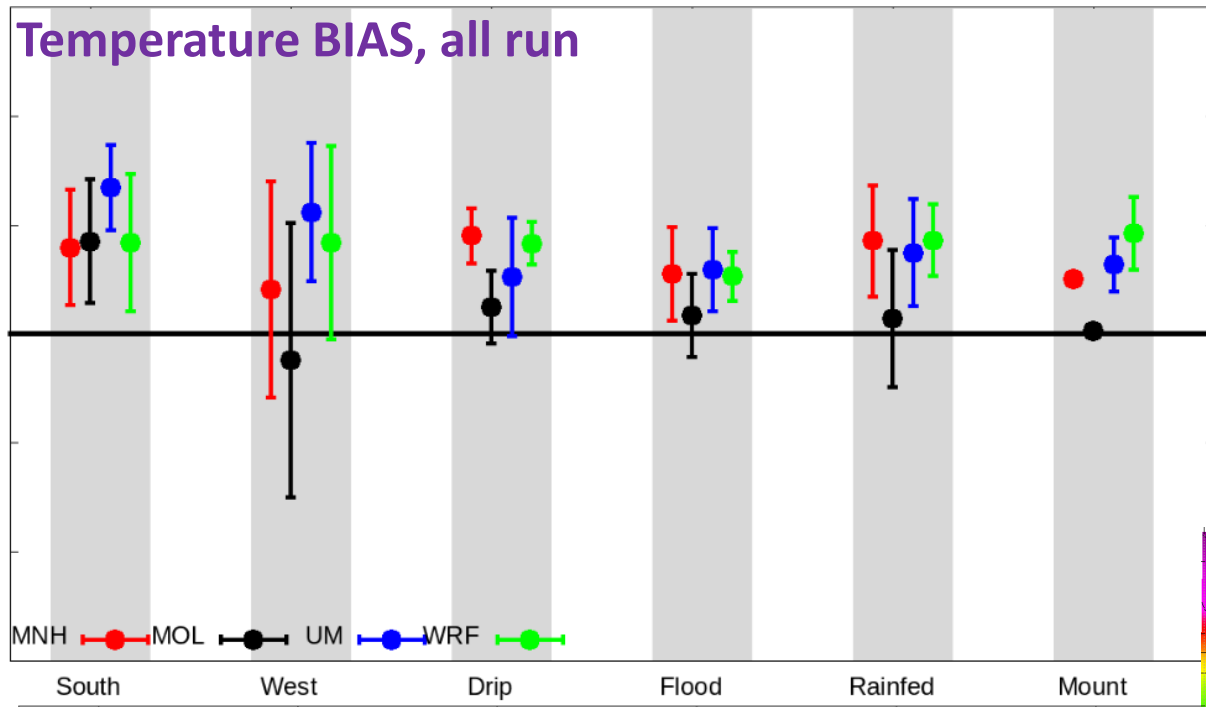
MesoNH

Moloch

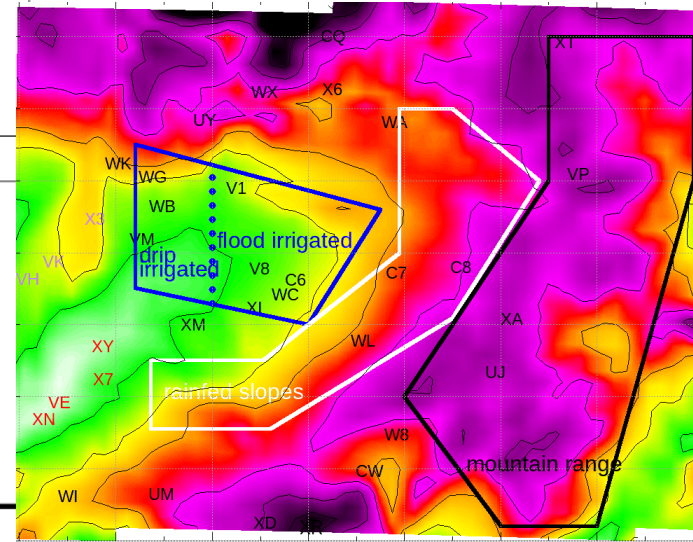
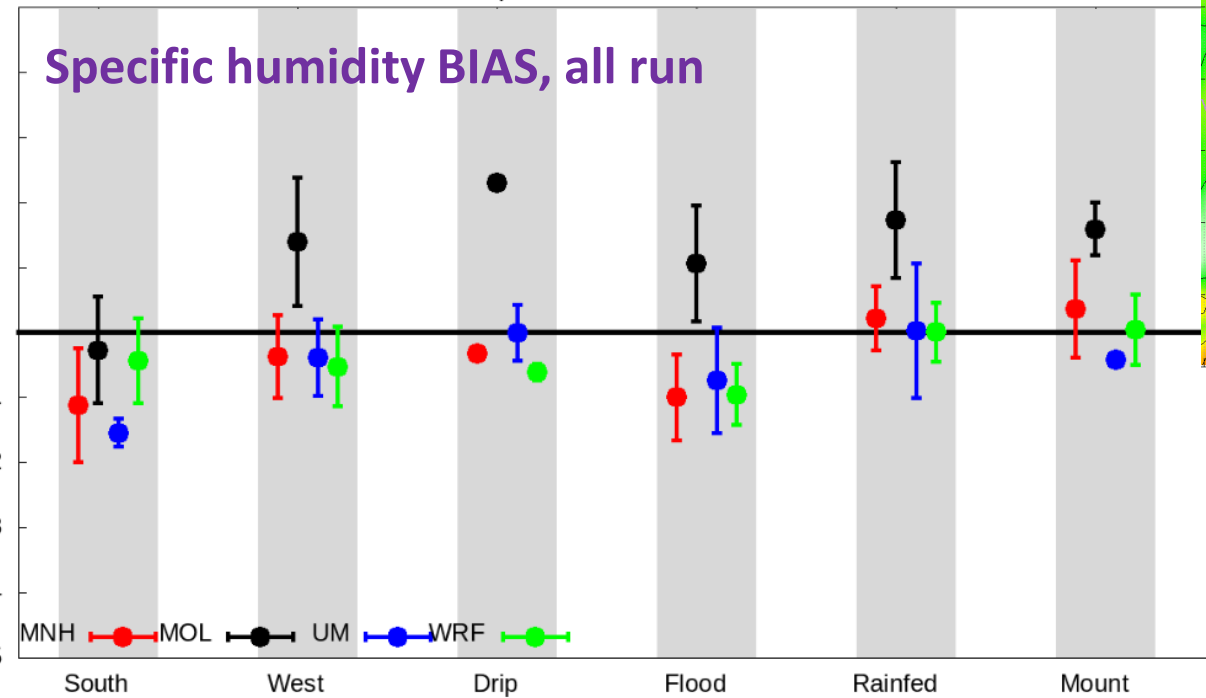
UM

WRF

Temperature BIAS, all run



Specific humidity BIAS, all run



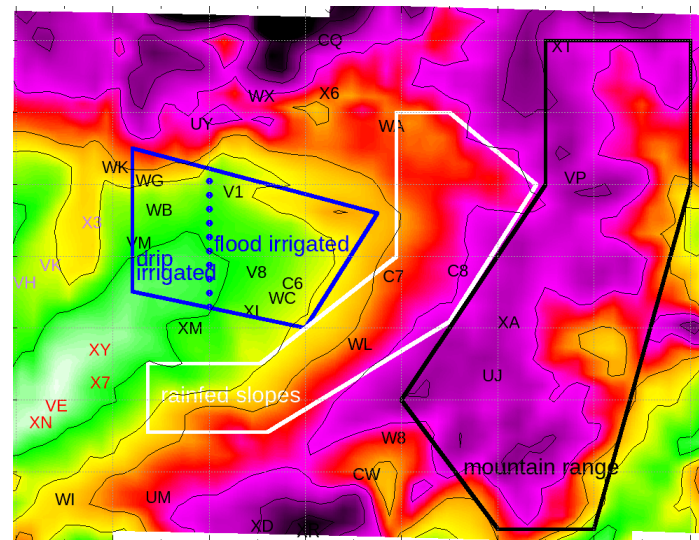
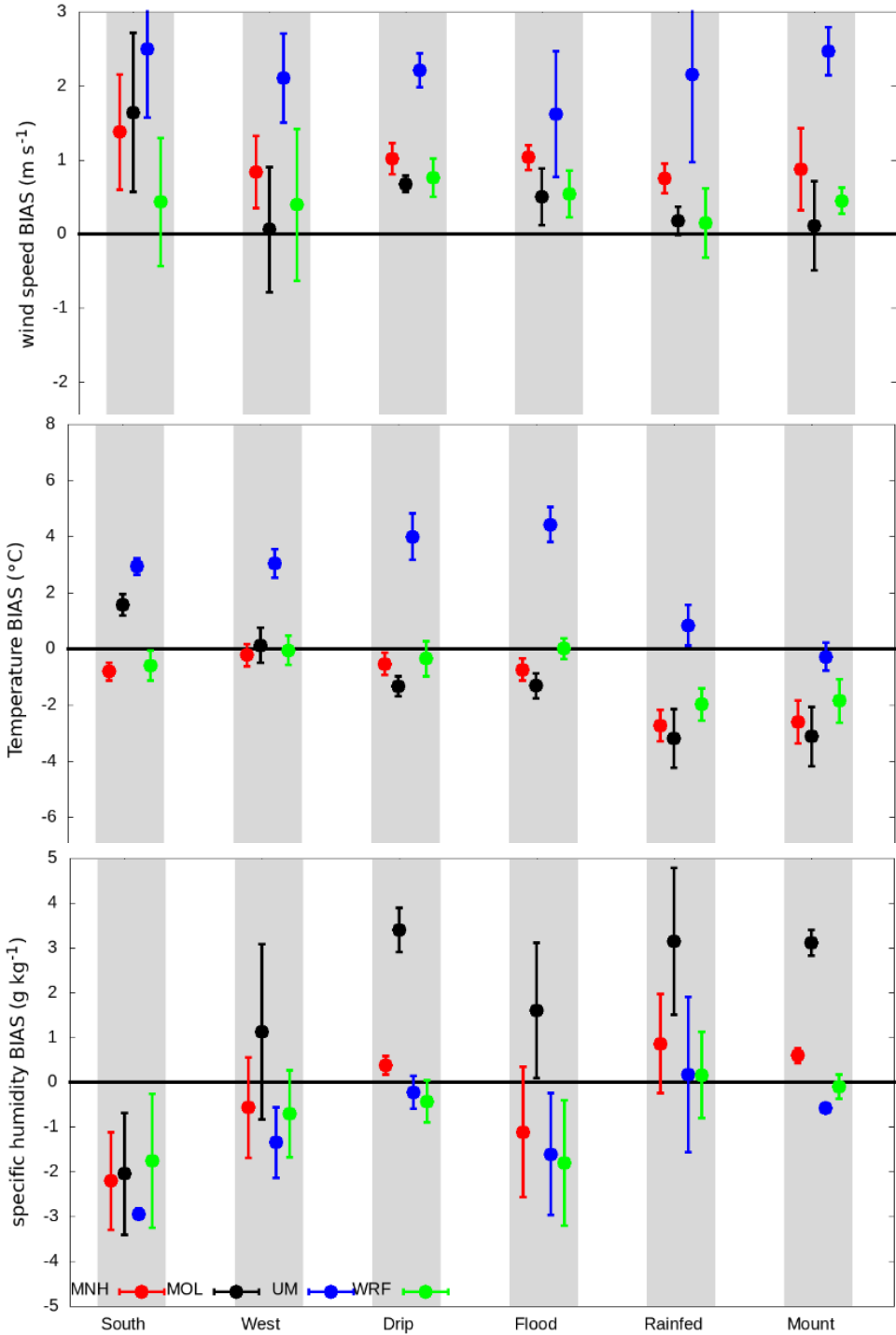
Daytime (10-14 UTC)

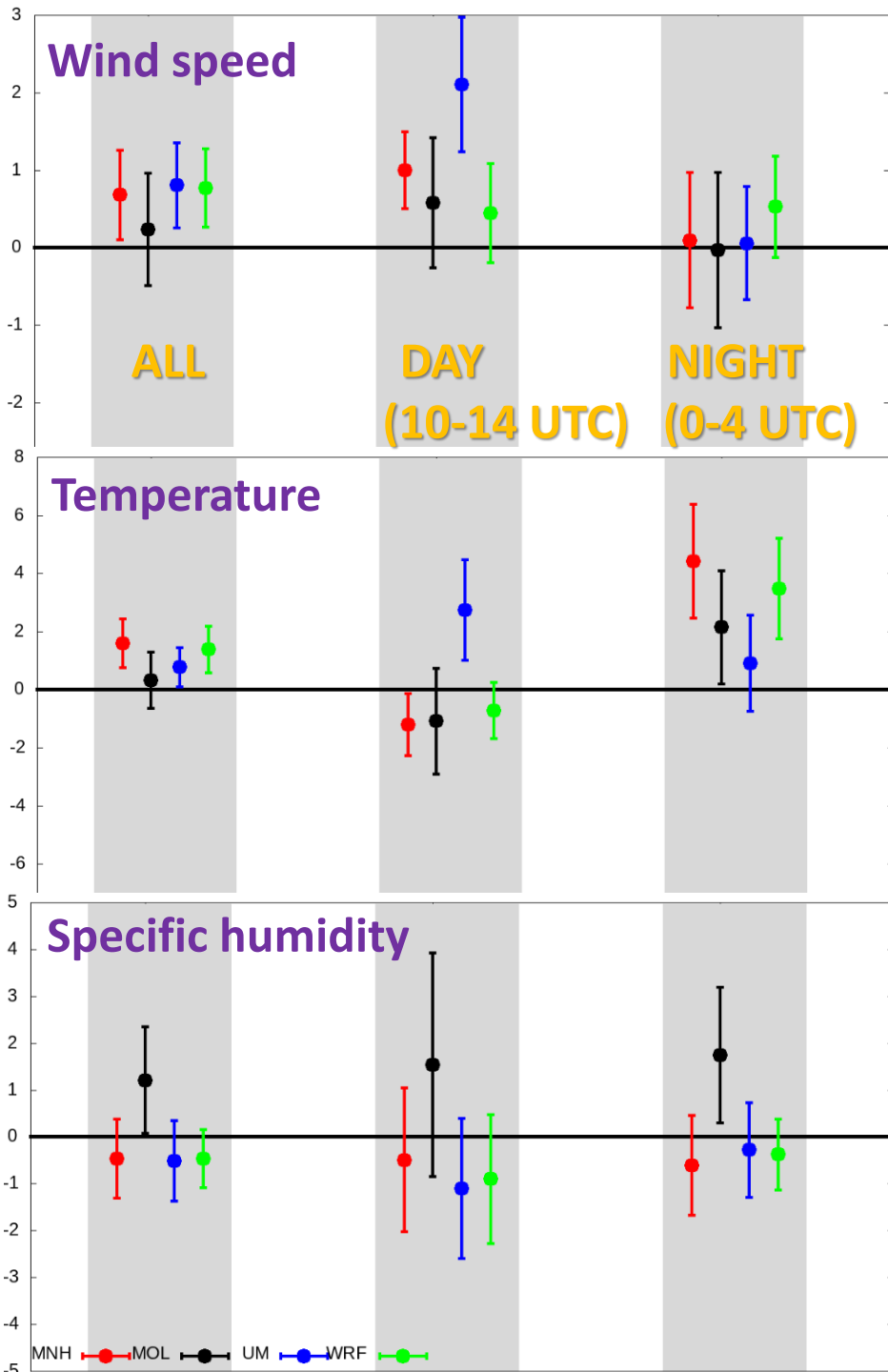
MesoNH

Moloch

UM

WRF





Mean BIAS (model-obs)

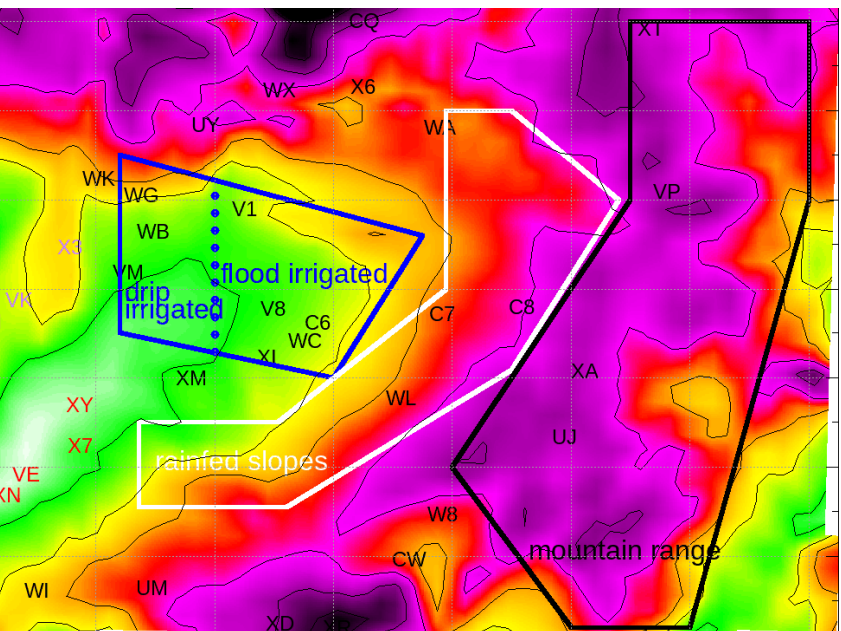
MesoNH

Moloch

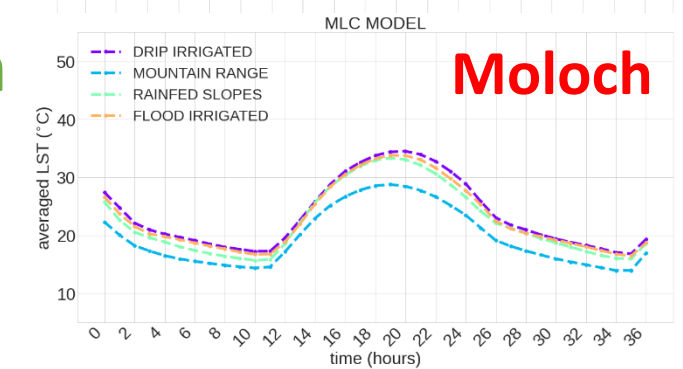
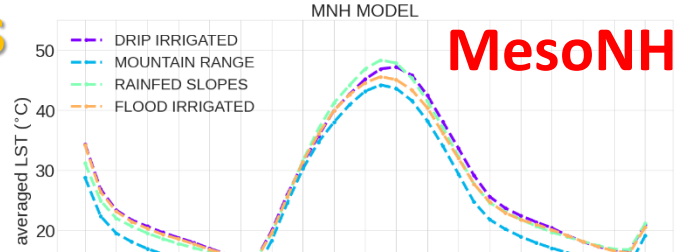
UM

WRF

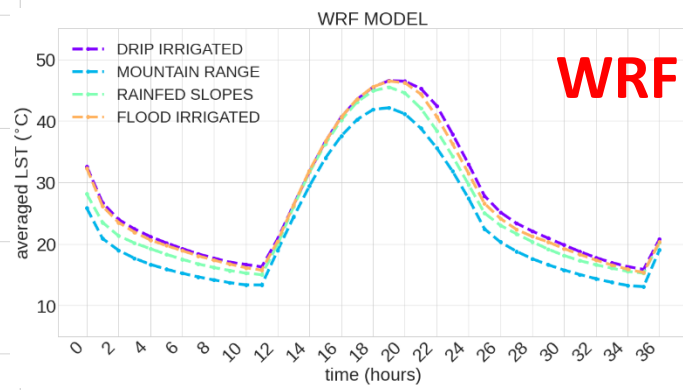
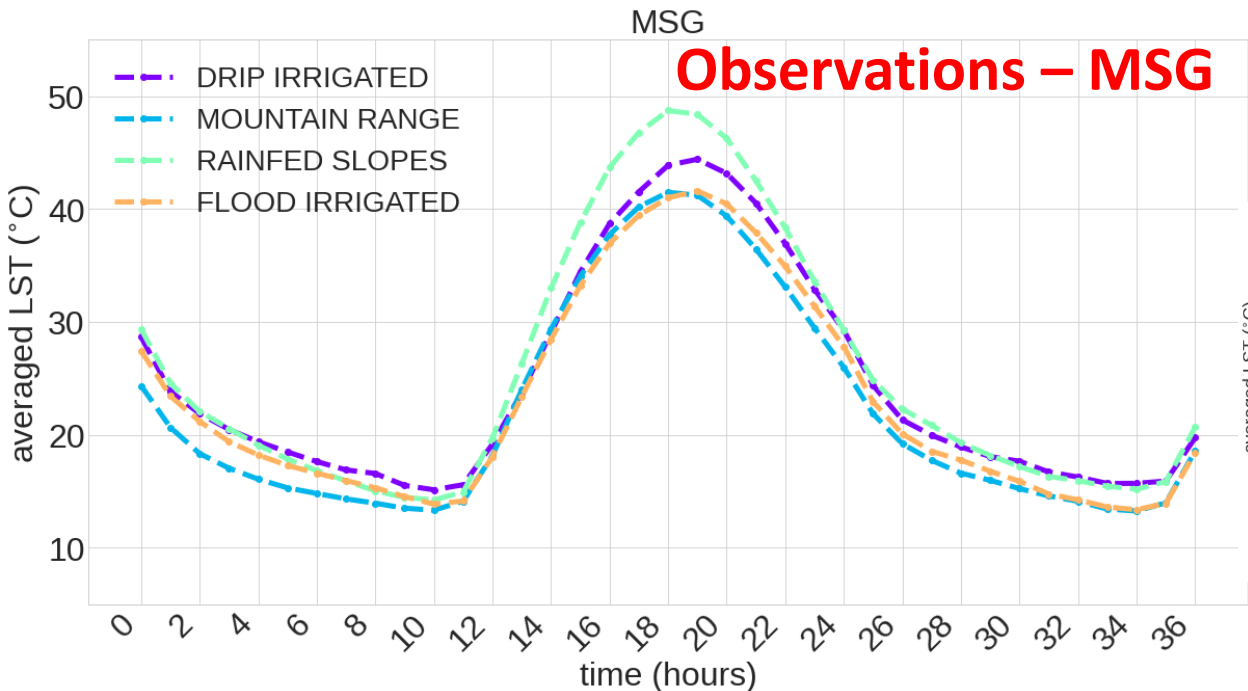
Averaged temperature over the regions



✓ Spatial resolution
✓ Soil features



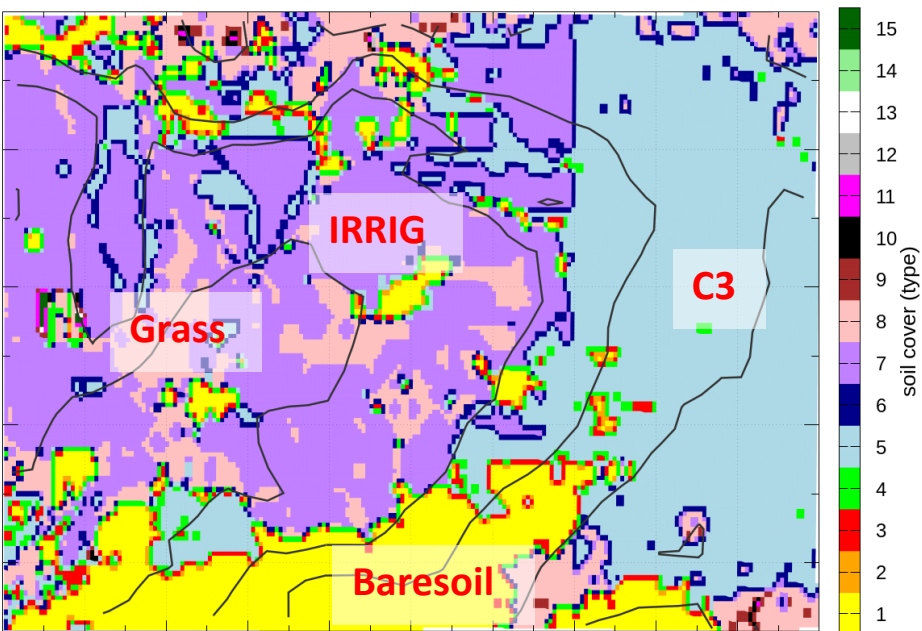
Sorry, to be processed...



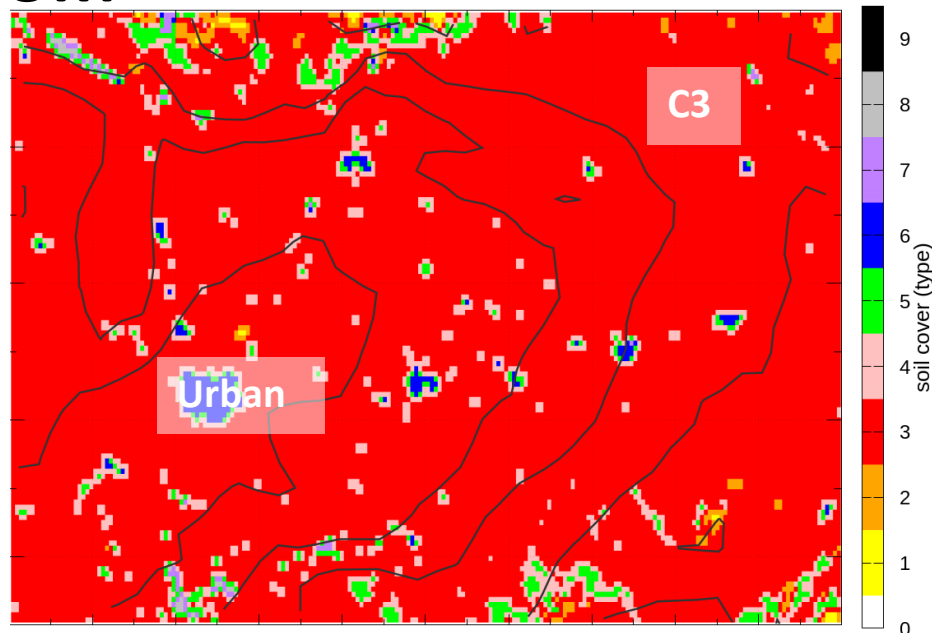
Validation using LST

Variability of the surface cover

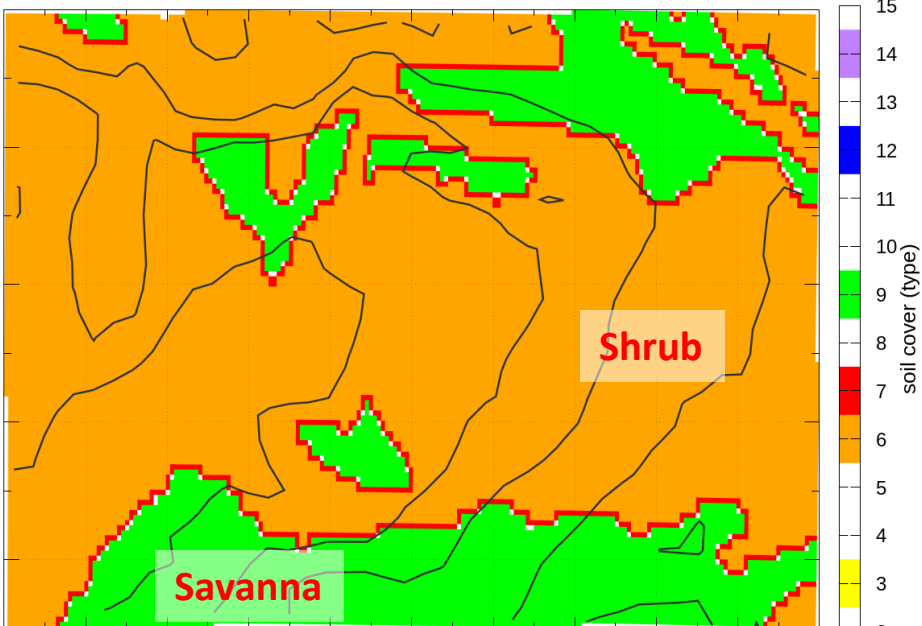
MesoNH



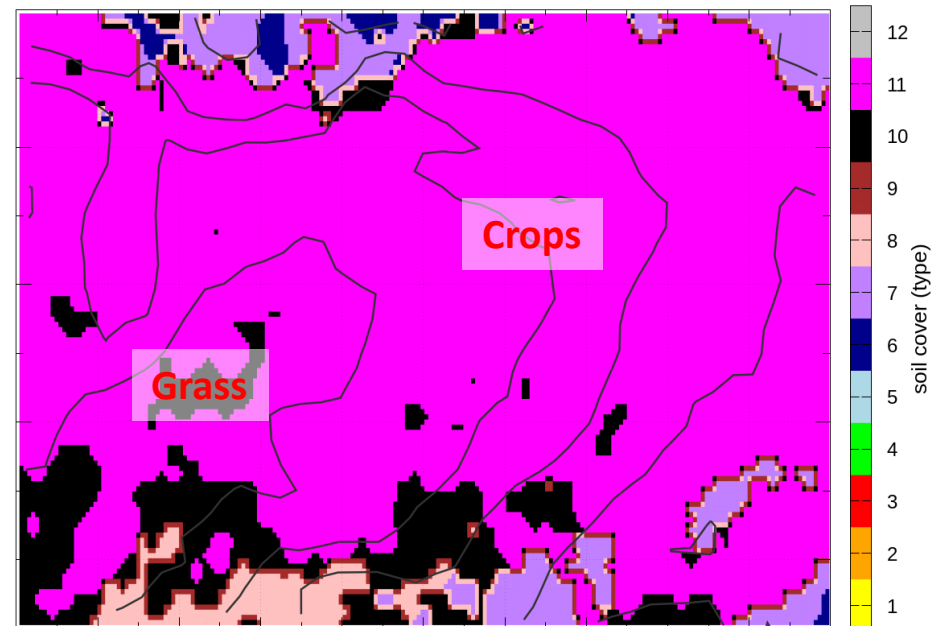
UM



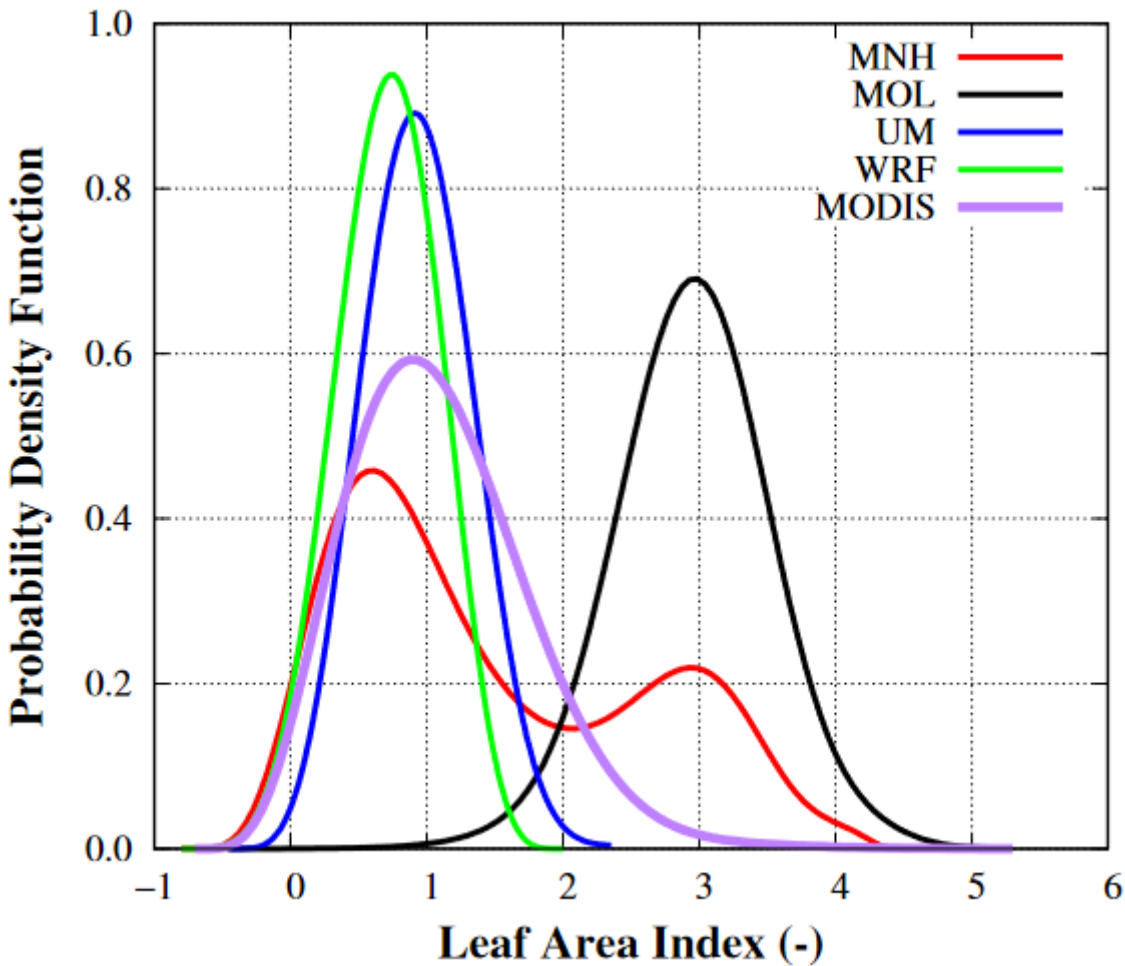
WRF



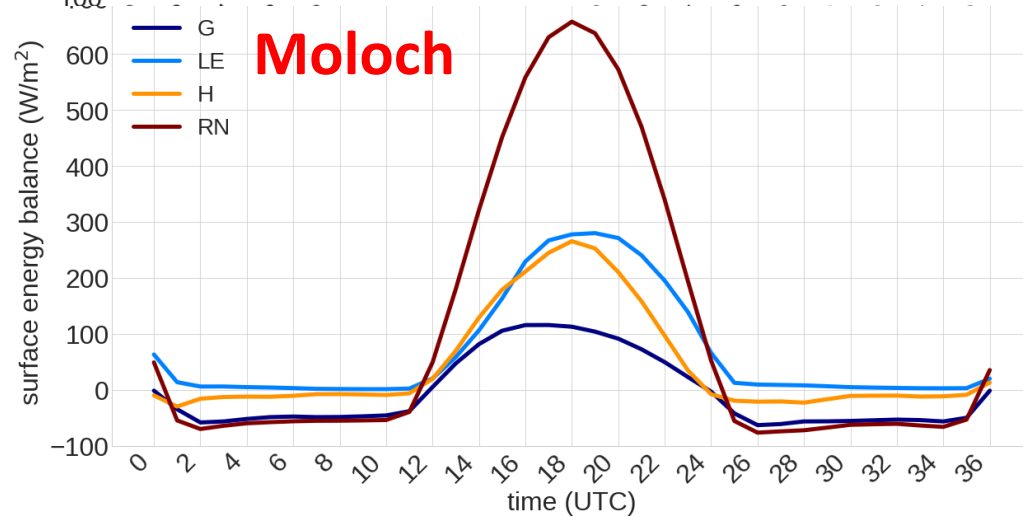
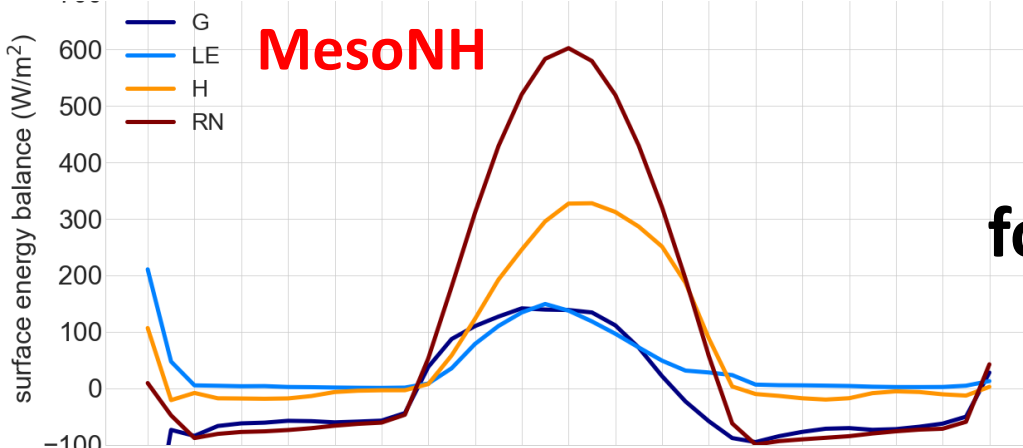
MOLOCH



Variability of the surface cover



Models present differences in the surface parameters (LAI, fveg, albedo, ...)



Variability of SEB

SEB terms averaged
for each region (drip irrigated)

Ground Flux

Latent Heat Flux

Sensible Heat Flux

Net Radiation

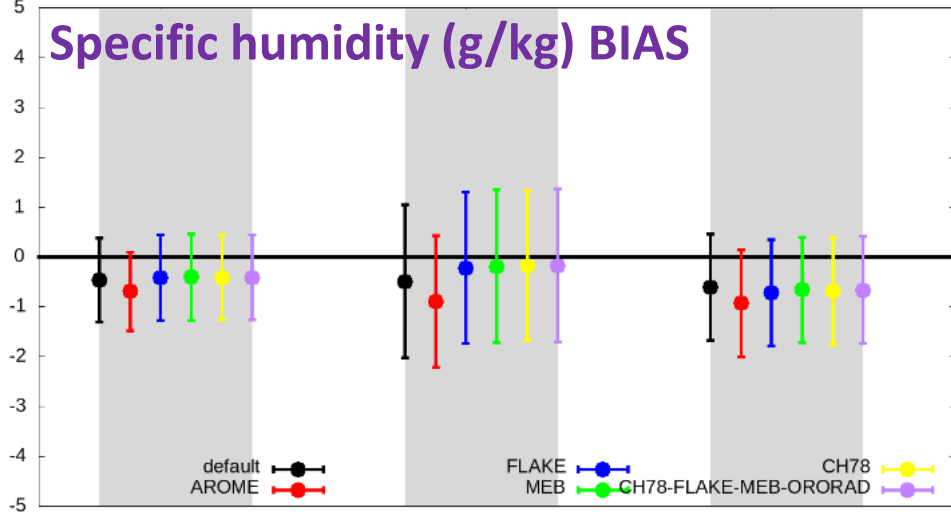
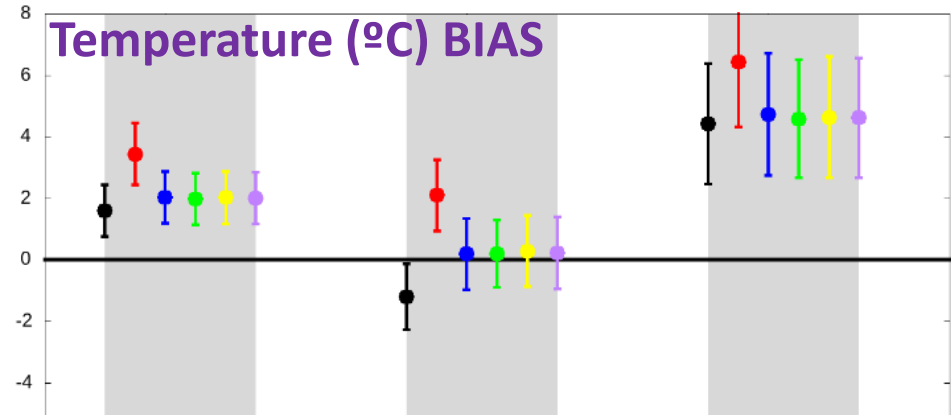
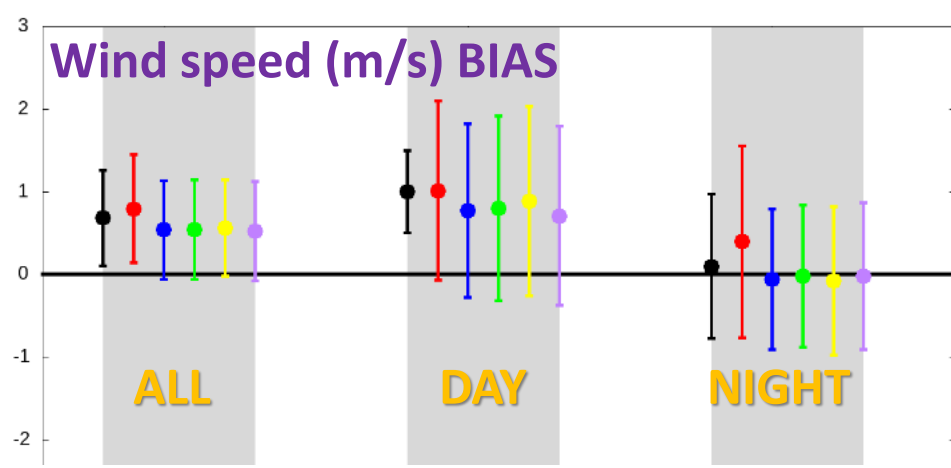
UM & WRF to be processed

All the models

do not present significant differences

in the SEB terms for each region

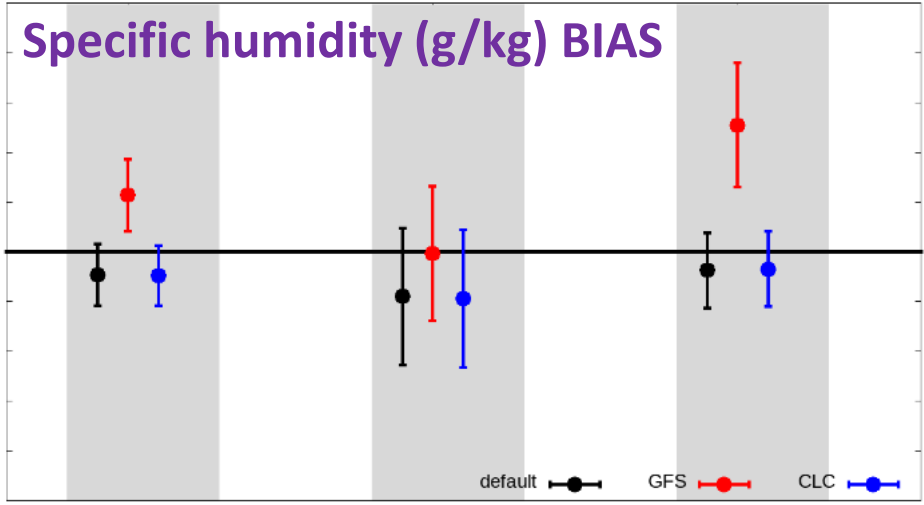
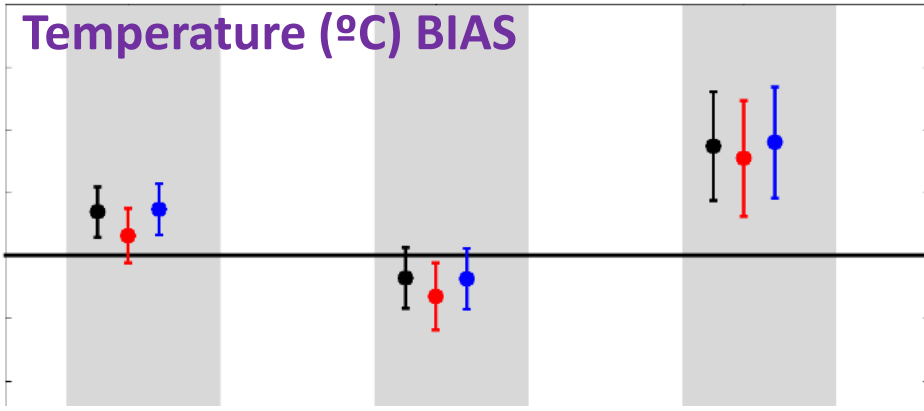
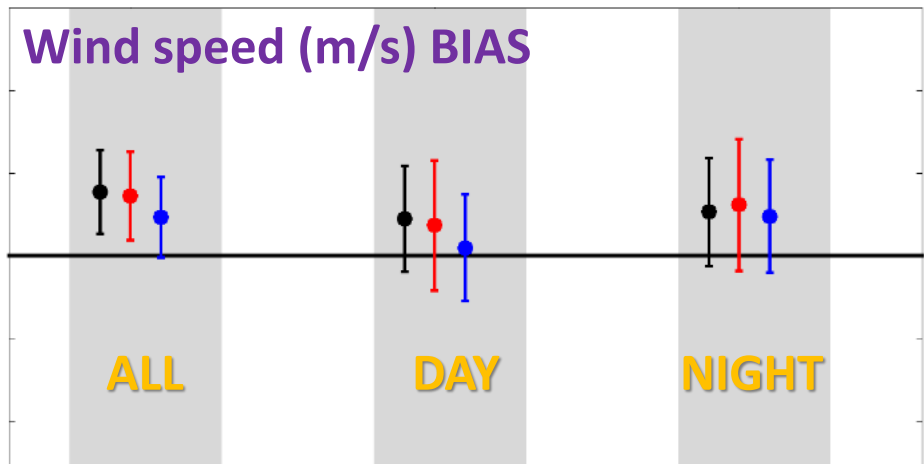
MESONH sensitivity tests



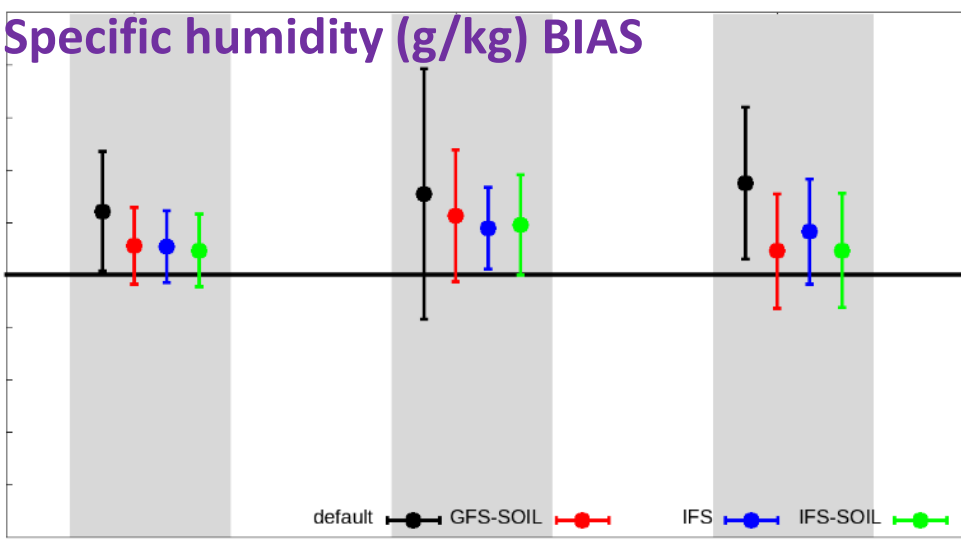
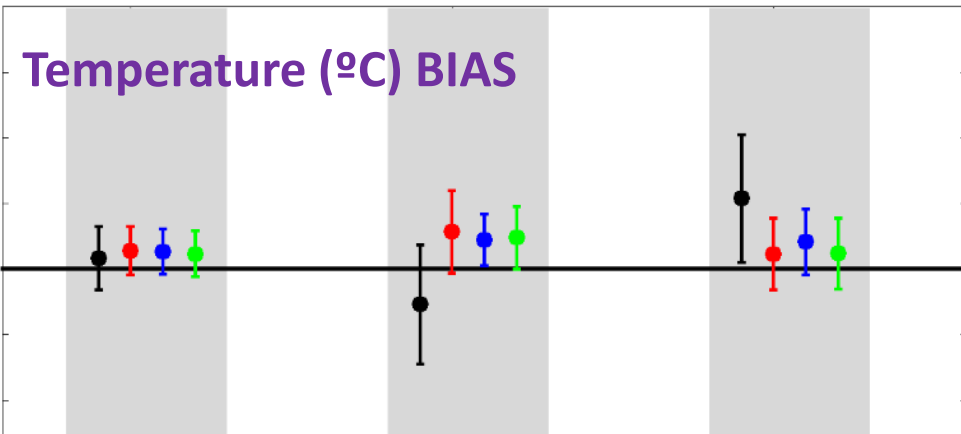
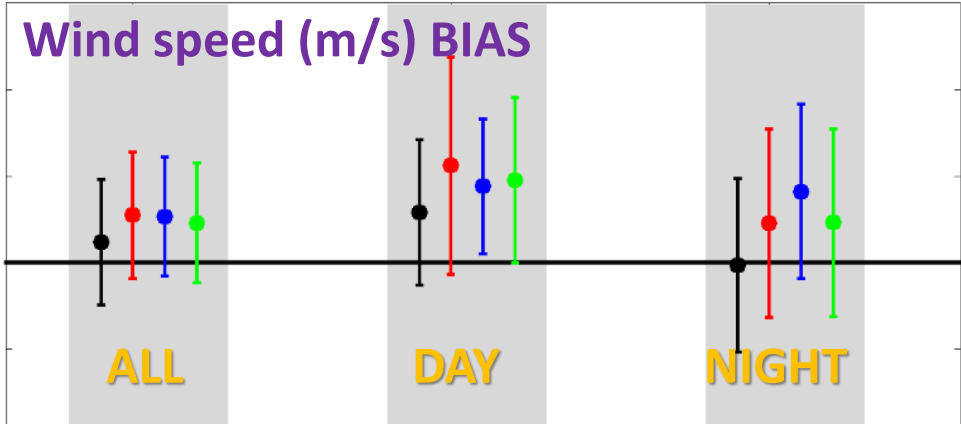
- Default
- AROME
- Inland water
- SEB
- Transfer function
- ALL

WRF sensitivity tests

Default
GFS
Surface features

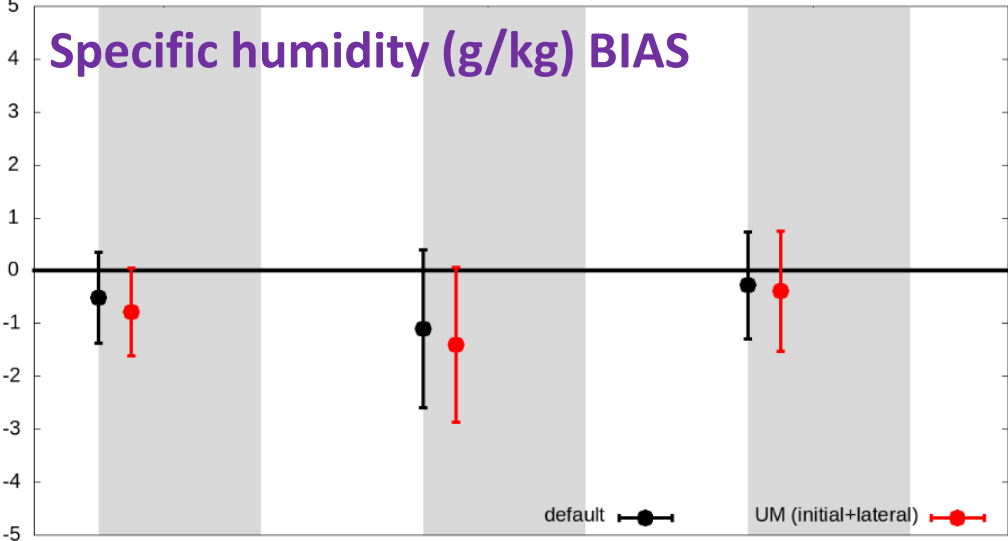
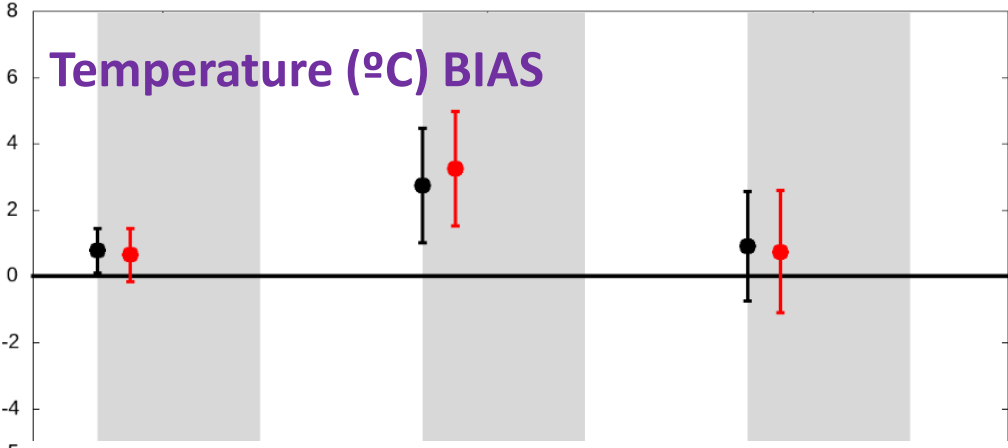
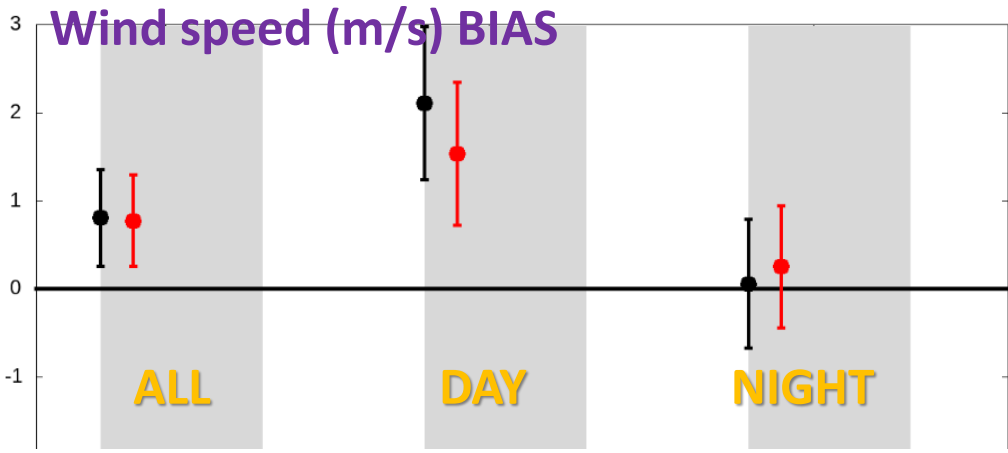


MOLOCH sensitivity tests



Default
GFS+soil
IFS
IFS+soil

UM sensitivity tests



Default
UM (LBC, initial)

Summary

- **Results (known features):** models are able to reproduce the general patterns of the region **BUT**:
 - ✓ **Models tend to overestimate wind speed** (daytime)
 - ✓ **Difficulties in reproducing nocturnal calm conditions & cooling**
- Models are not able to reproduce the heterogeneities:
 - ✓ **Surface model** (processes included, irrigation)
 - ✓ **Surface parameters & initialitation**
(irrigated, rainfed,... zones)
 - ✓ **Parameterizations** (turbulence, advection, radiation)
- **Sensitivity tests**
 - ✓ **Initial and lateral BC** (GFS, AROME, UM), **Surface features**