

The Bergen Shelter

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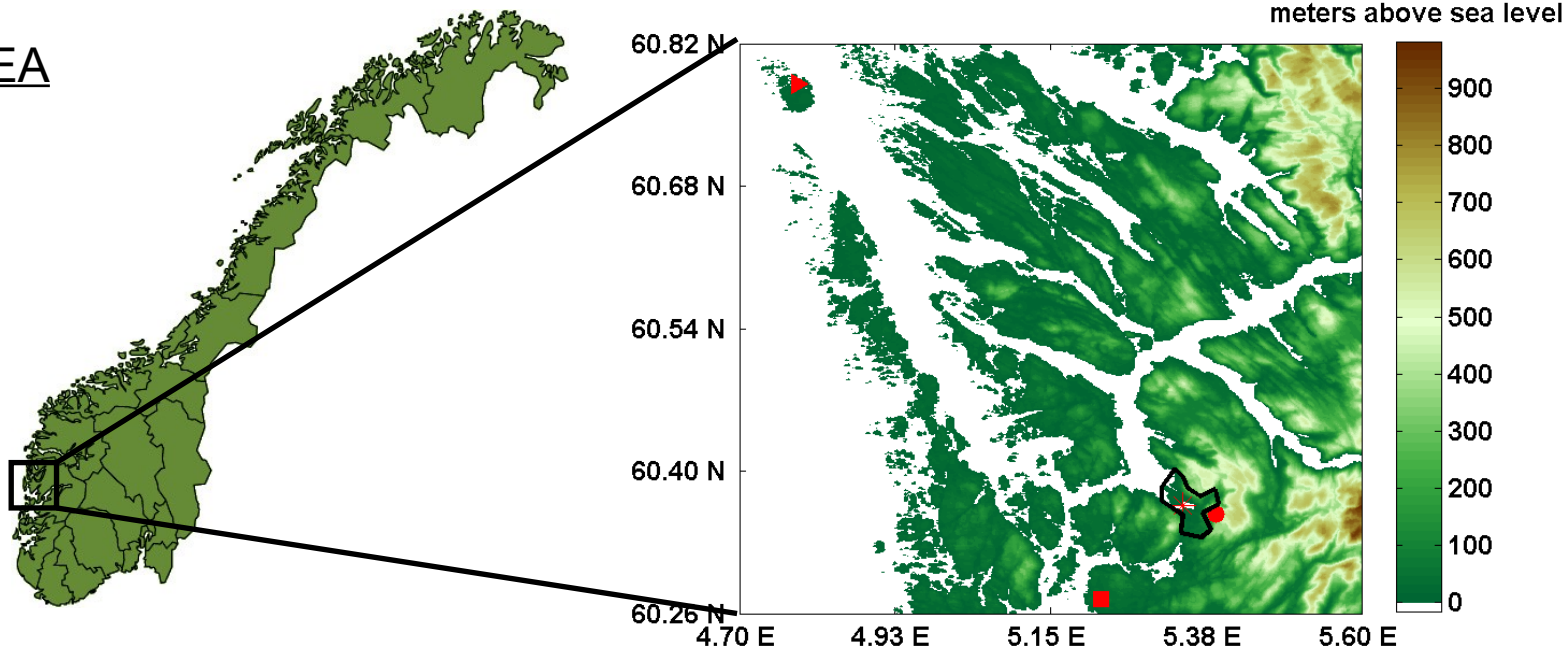
Background

OBSERVATIONS

Four automatic weather stations

- Florida (GFI/Aanderaa)
- Ulriken (GFI/Aanderaa)
- Flesland (met.no)
- Fedje (met.no)

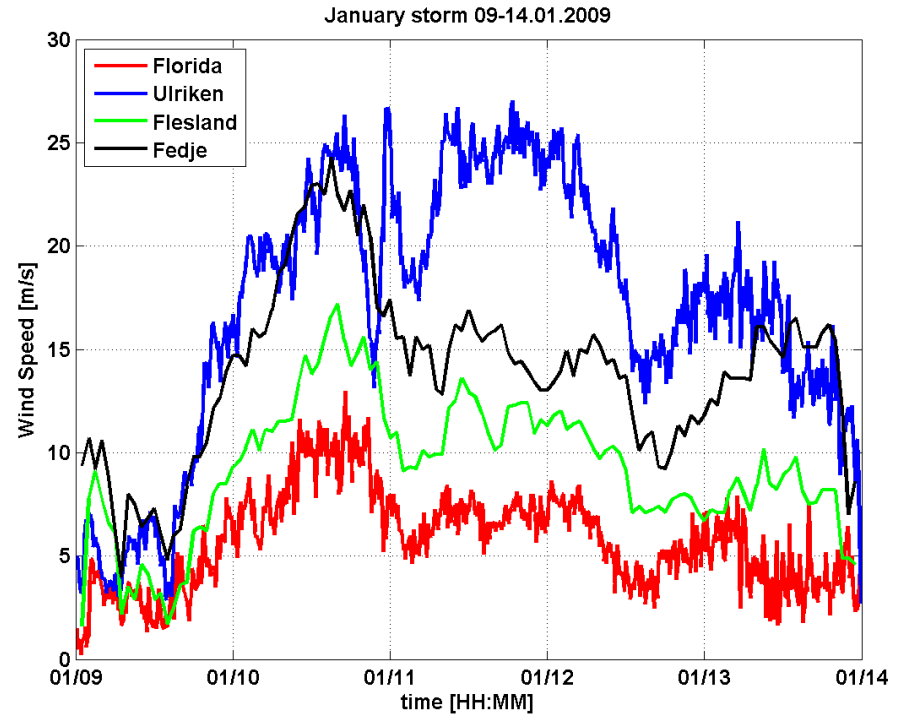
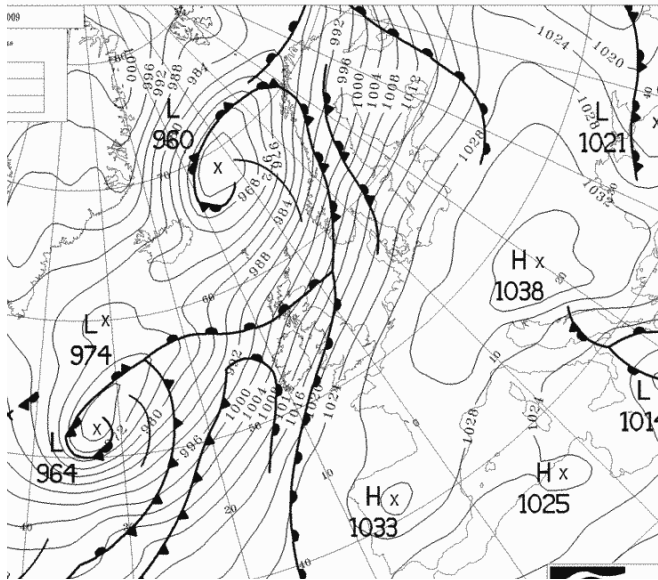
STUDY AREA



AWSs indicated by red dots

Background

Case, January 10
2009

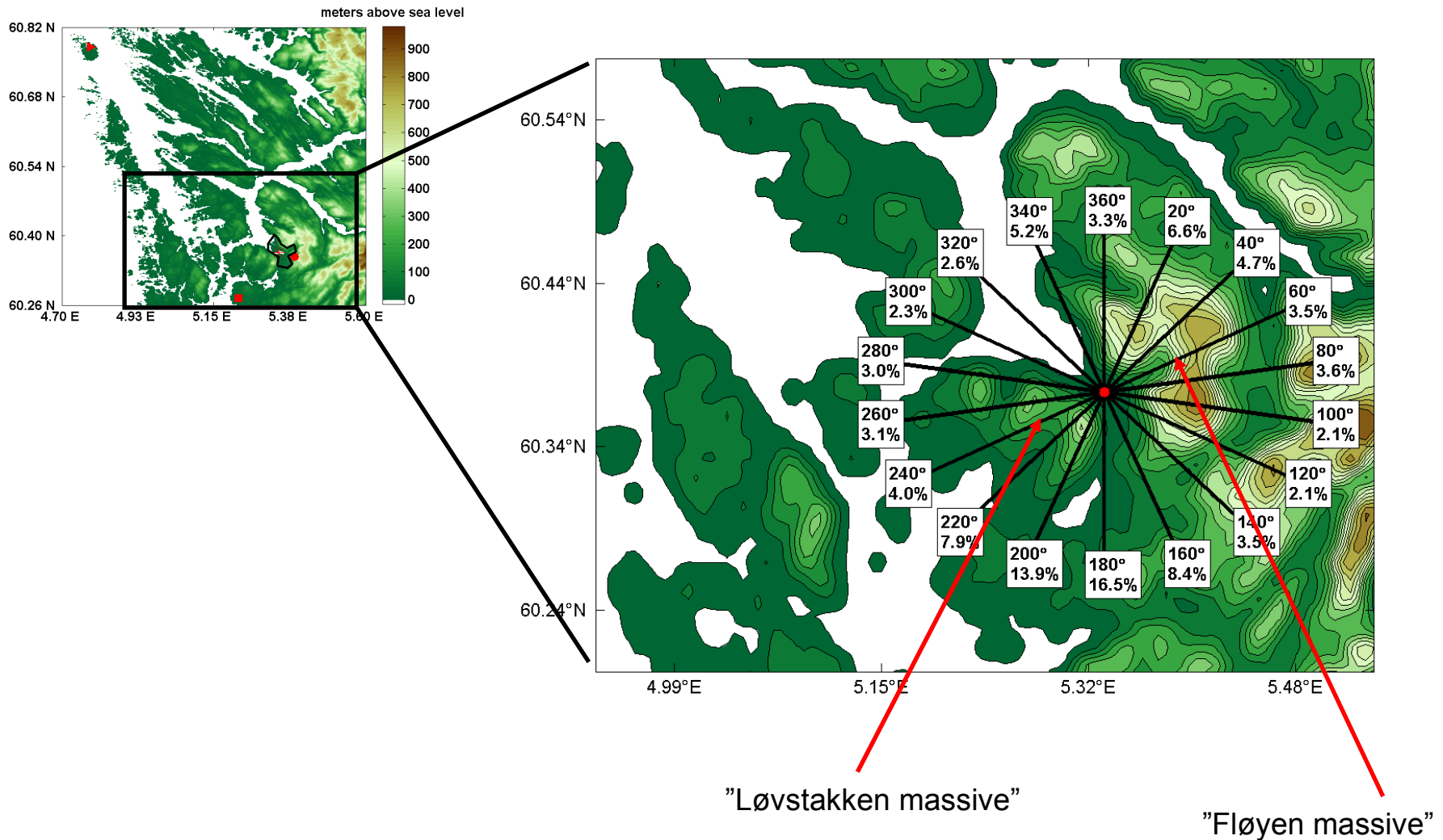


- Why such a big difference between Ulriken and Florida ?

Why do we have a shelter ?

The topography!

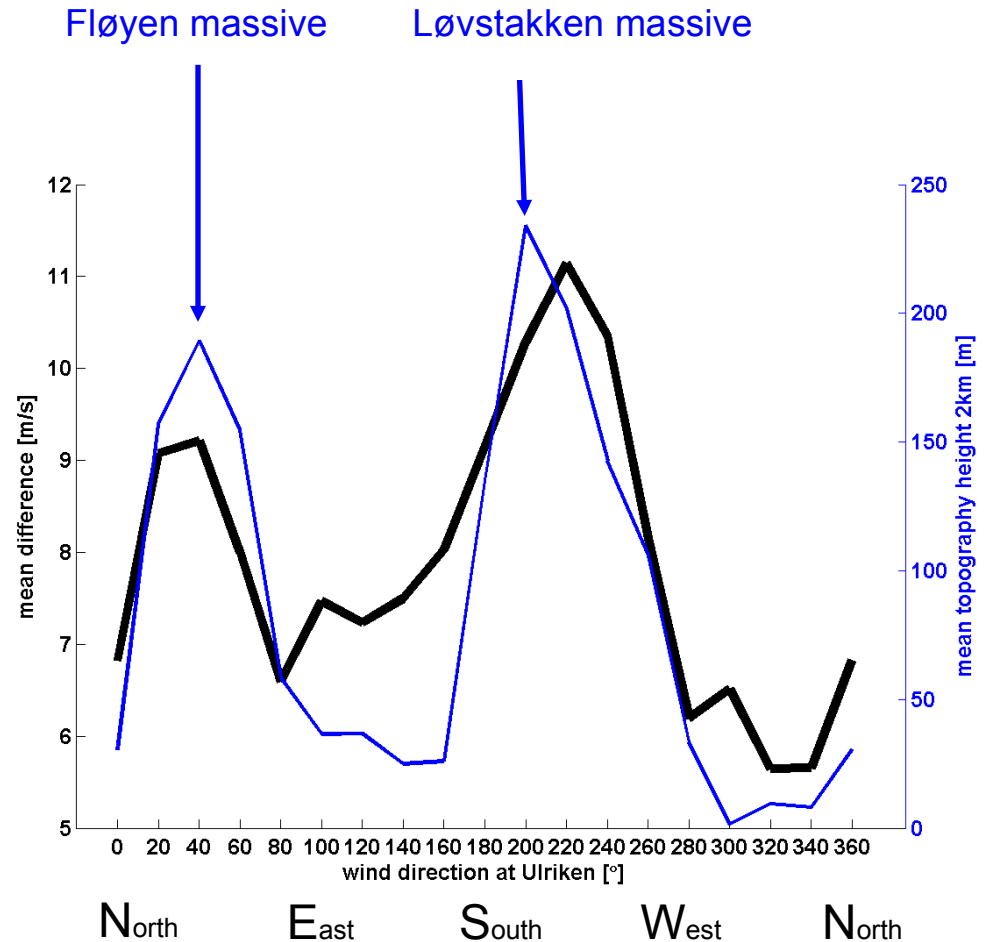
The "seven mountains"



Why a shelter ?

Topography height
and
Mean wind speed difference Ulriken - Florida

VS
Wind direction on Ulriken



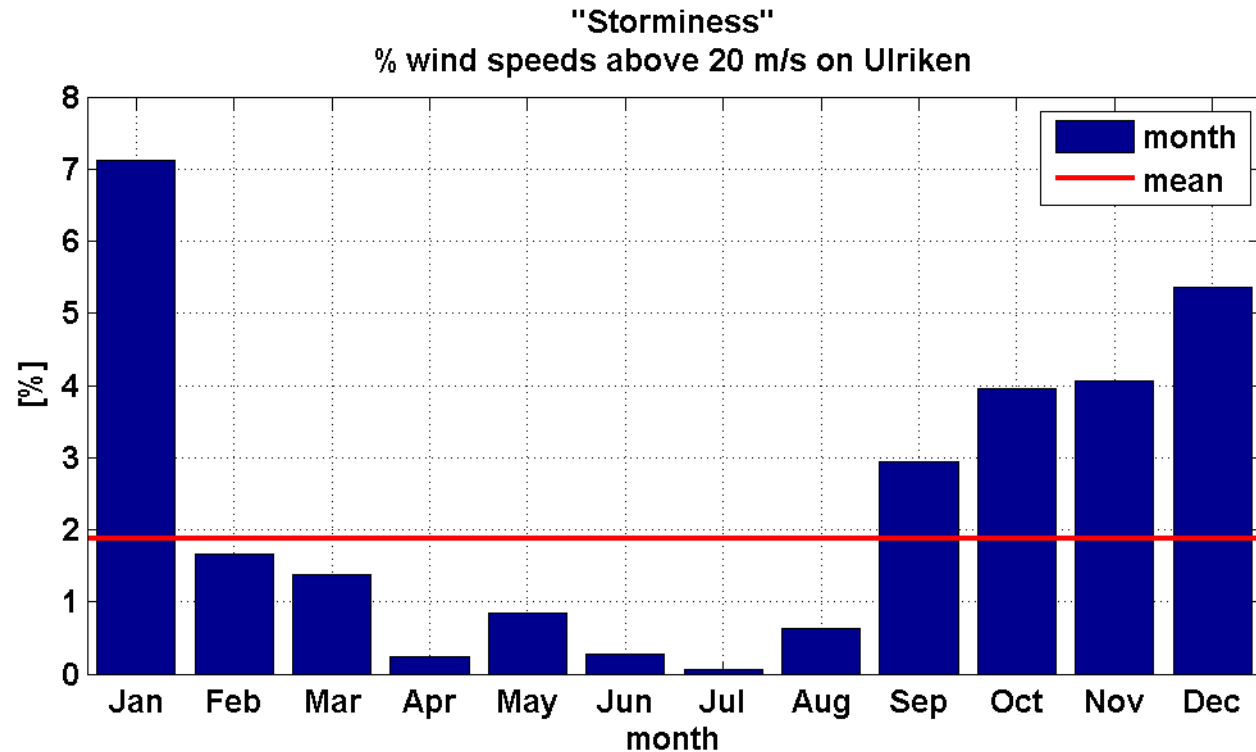
For wind speeds at Ulriken above 10 m/s

Correlations

Km	meanh	maxh
2	0.89	0.66
5	0.25	0.23
10	-0.01	0.06
15	-0.16	-0.07
20	-0.14	-0.06
30	-0.16	-0.08
45	-0.12	-0.08

How common ?

- "Storminess" on Ulriken:

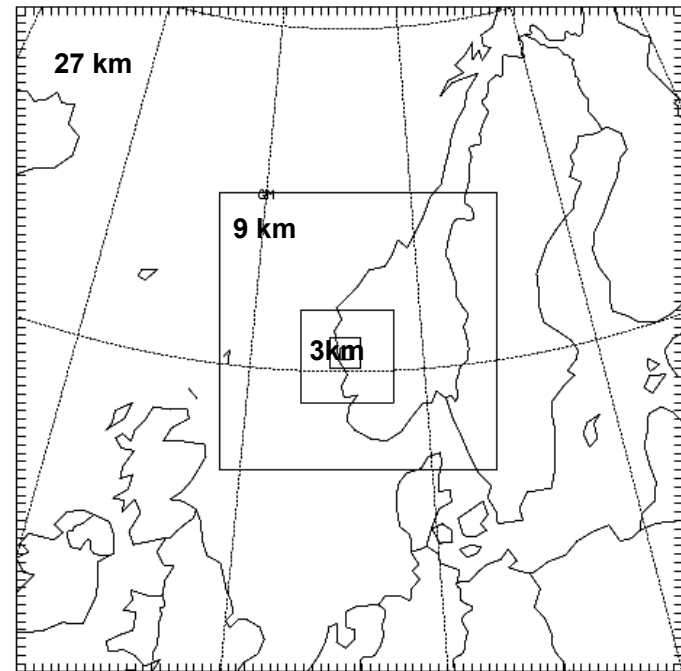


"Strength of the shelter" : Difference between Ulriken and Florida

- For wind speeds at Ulriken > 20 m/s, the mean difference is 15.4 m/s

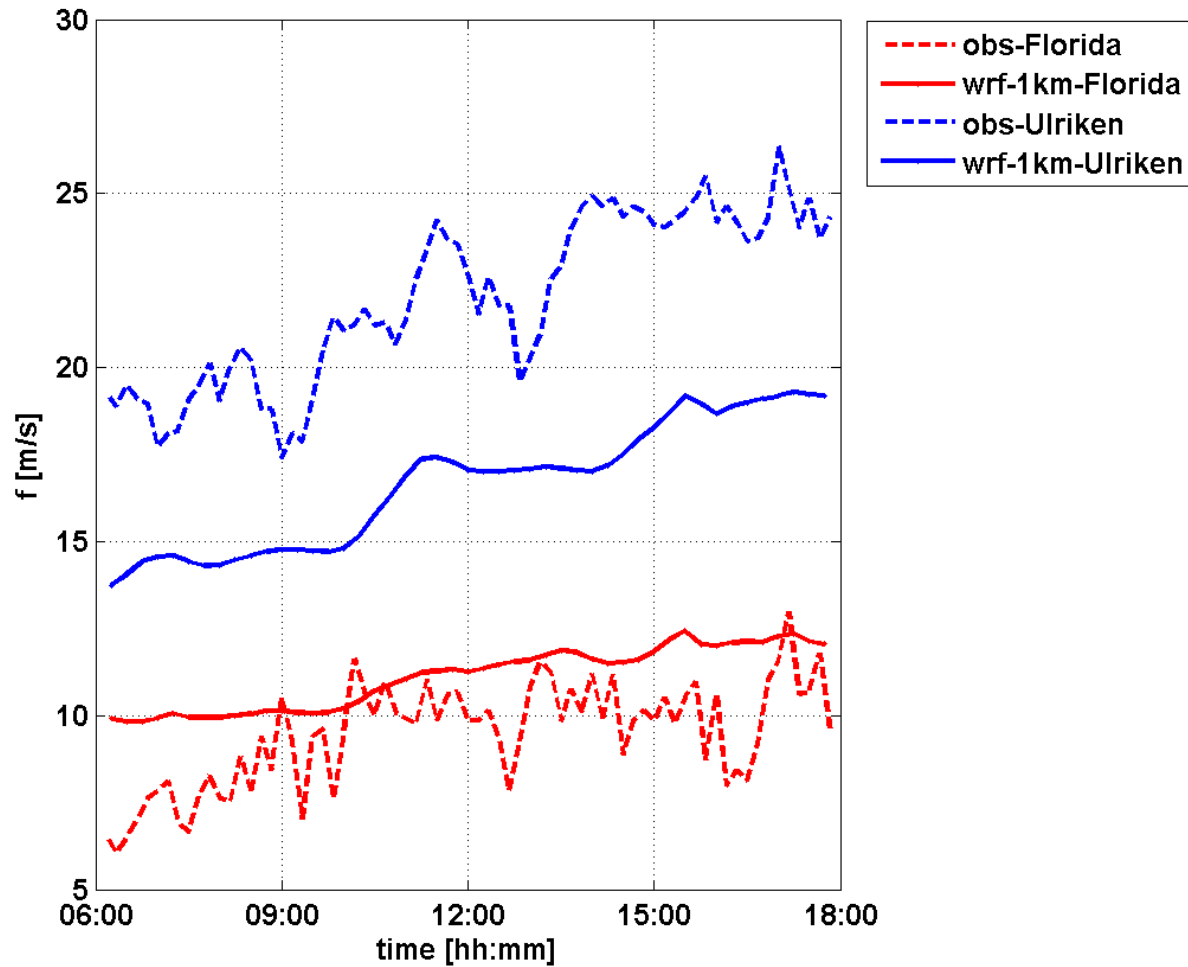
Numerical simulations

- WRF 3.0.1.1
 - non-hydrostatic mode
 - ECMWF data for initialization and forcing at boundaries
 - 6 two-way nested domains
 - 27-9-3-1 km – 333 -111 m
 - 62 sigma levels



Case study

10.01.2009



- HOW CAN WE IMPROVE THE MODEL RESULT ?

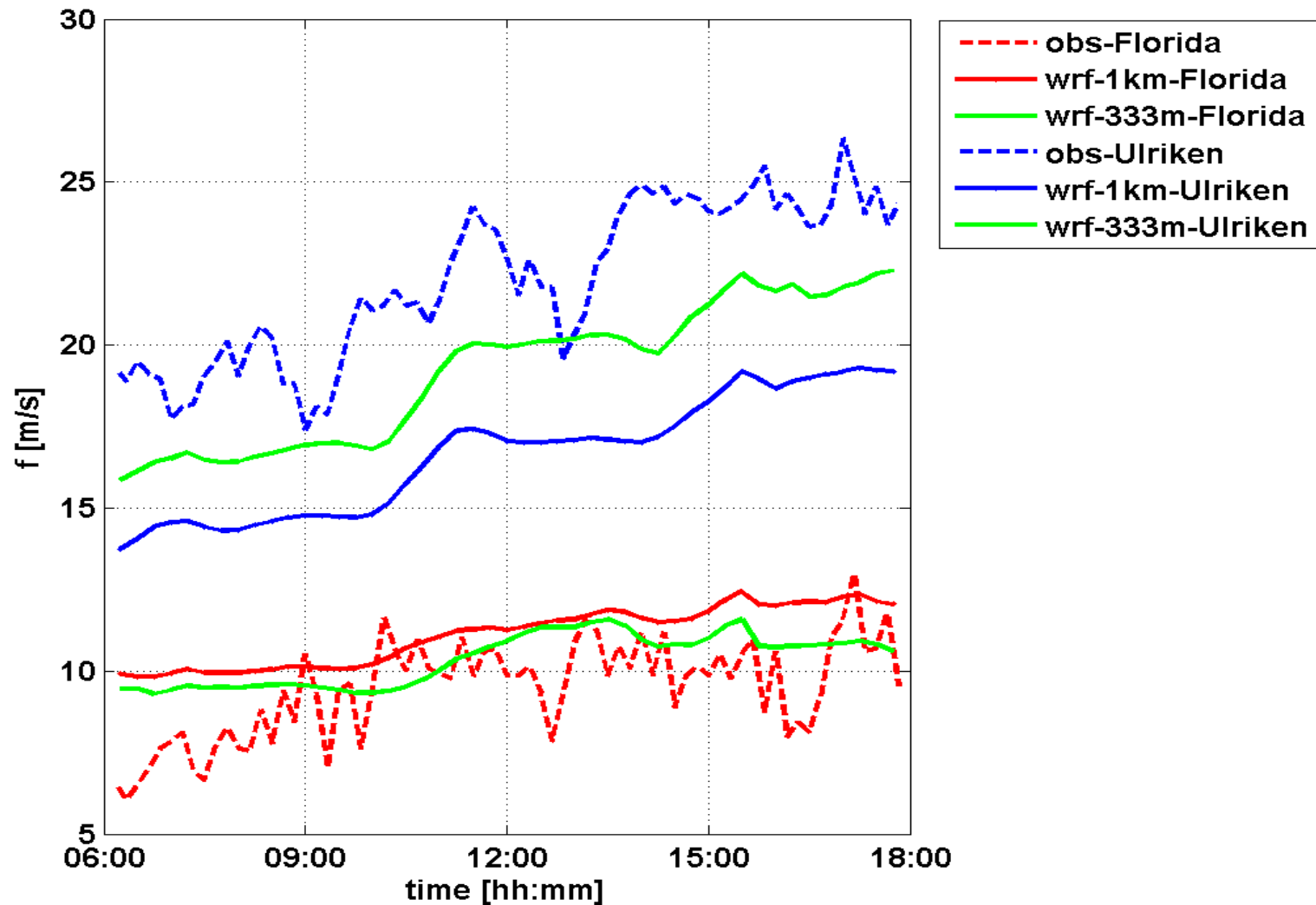
- Higher horizontal resolution

- Better topography data

- Better landuse data

Aid 1: Higher horizontal resolution

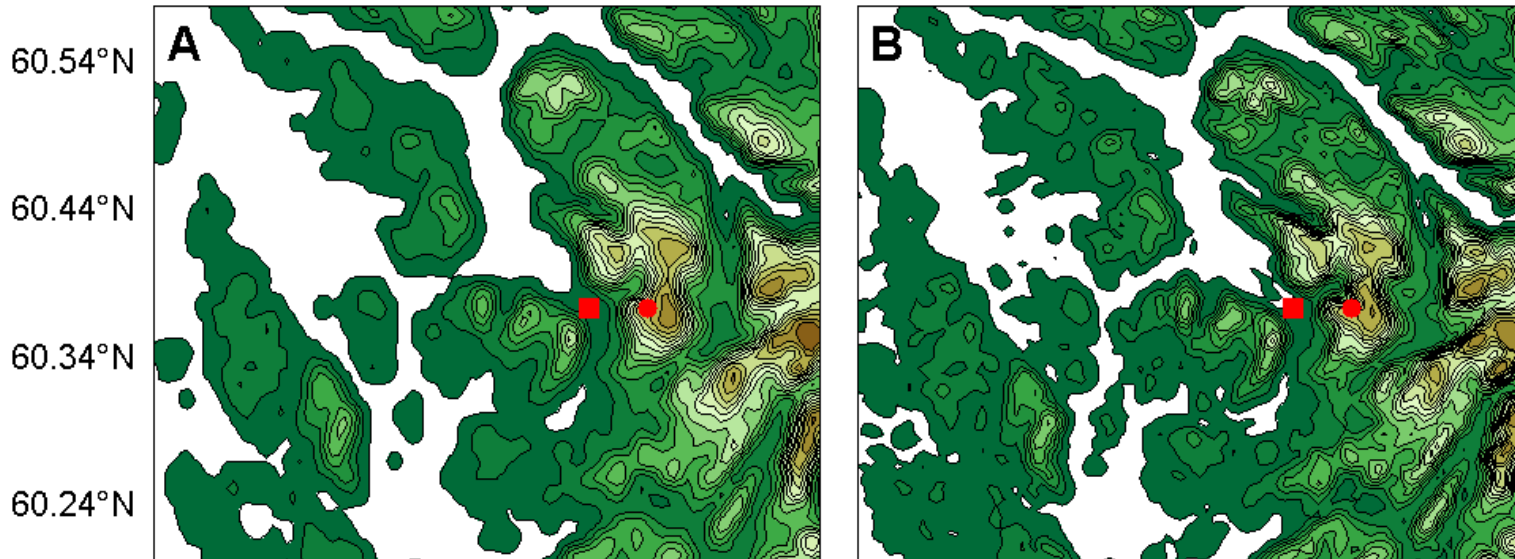
1km -> 333m



Aid 2: Higher resolution topography

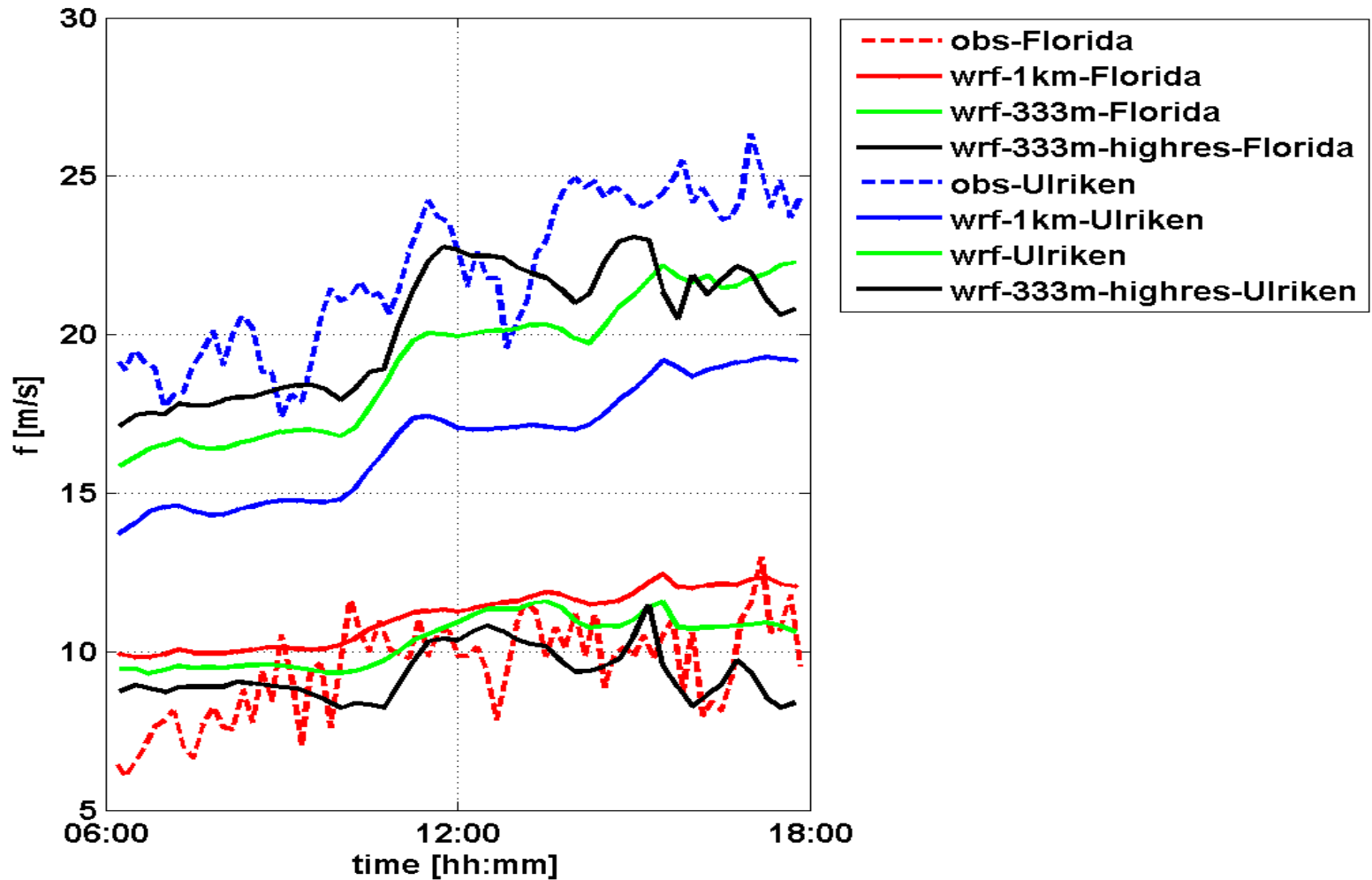
USGS, 30s (~1km)
(default in WRF)

Statens Kartverk (25m)

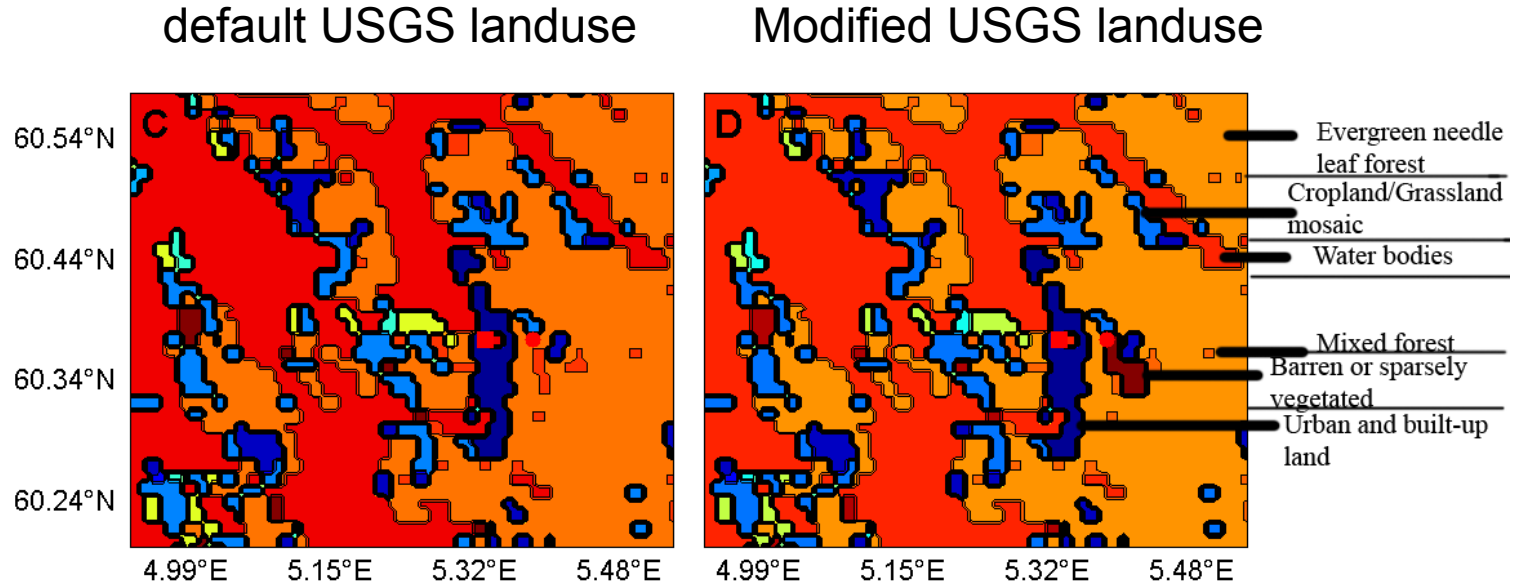


Both figures show the 333m domain

Aid 2: Higher resolution topography

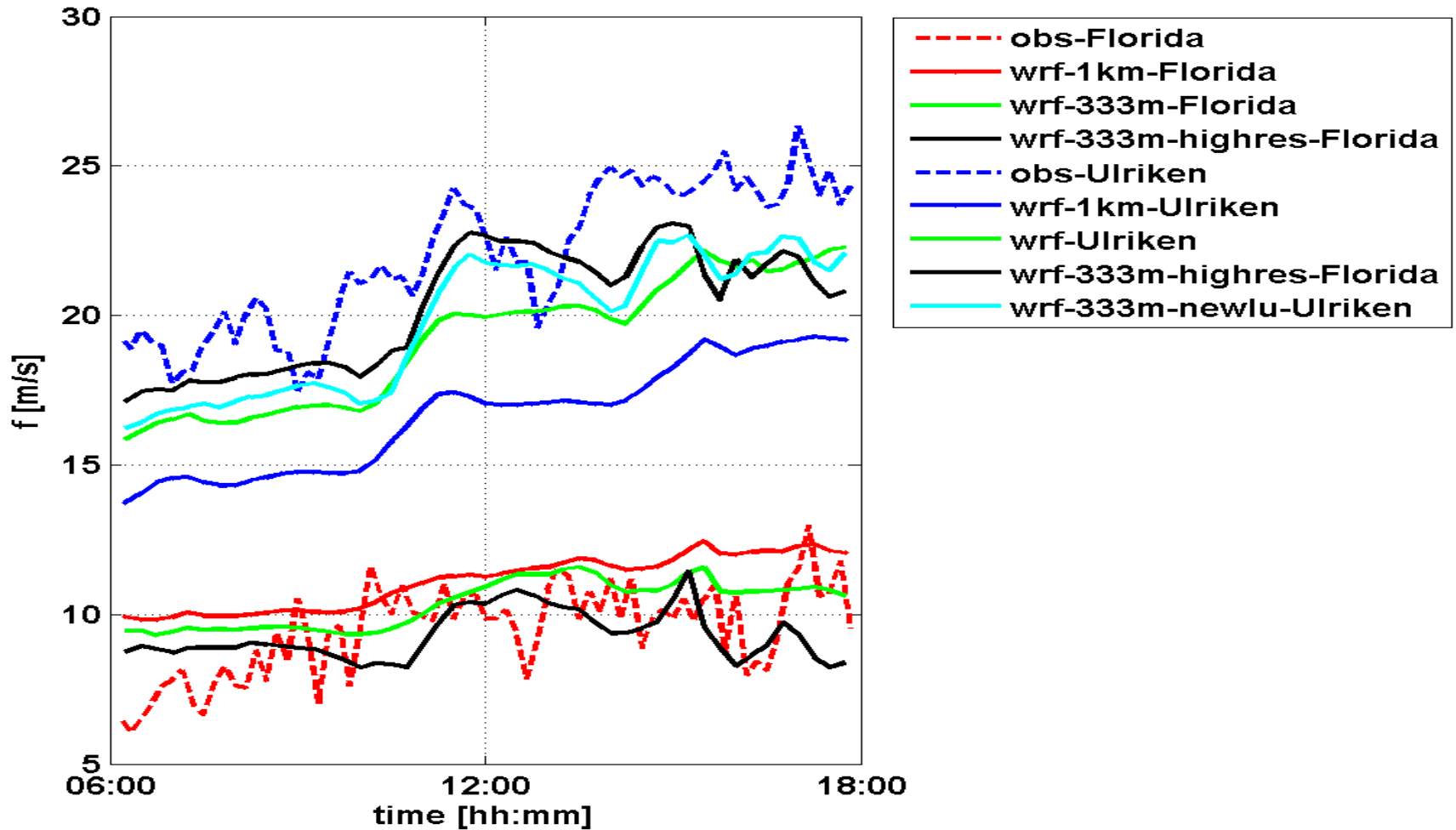


Aid 3: More realistic landuse



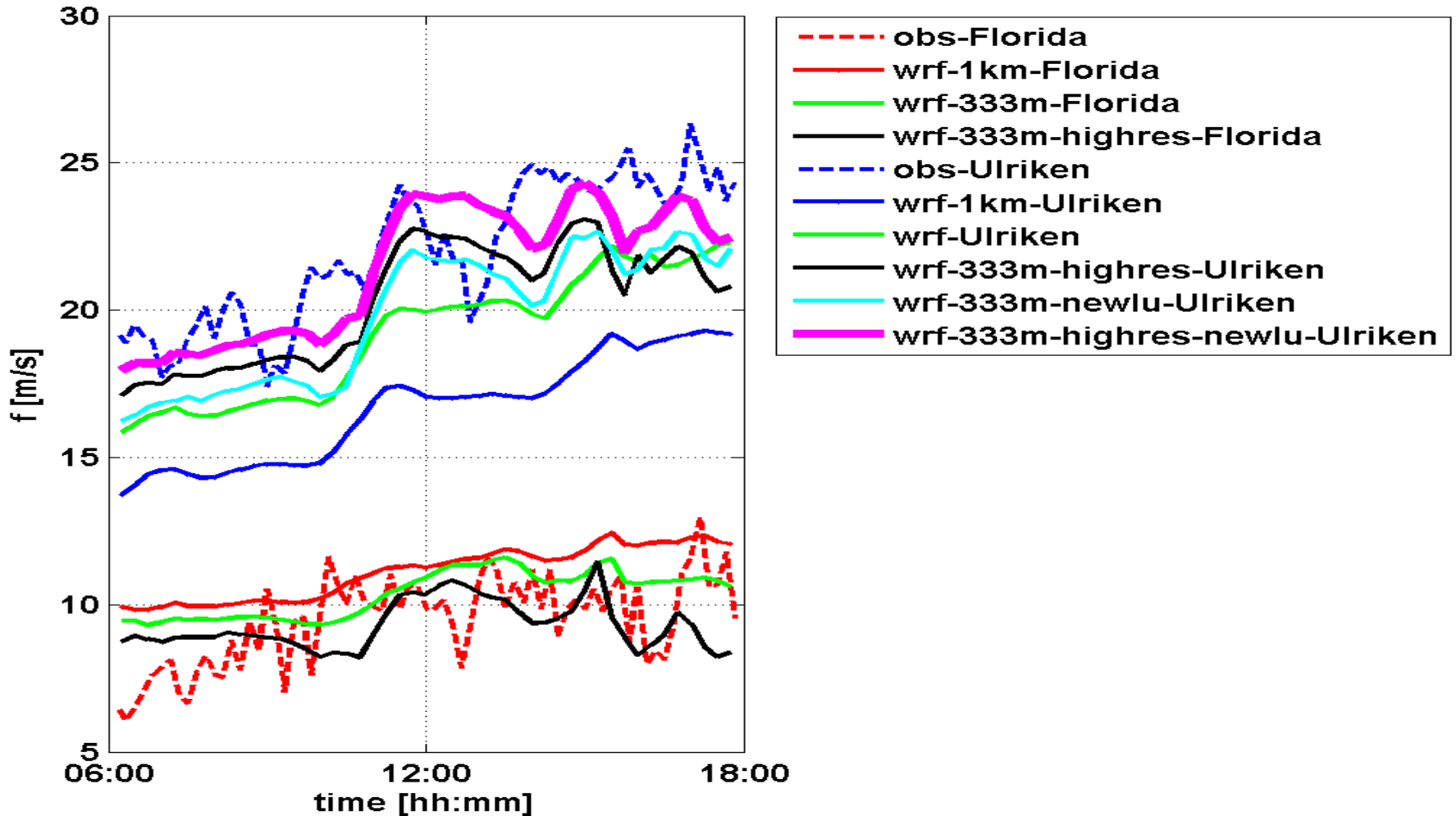
Both figures show the 333m domain

Aid 3: More realistic landuse



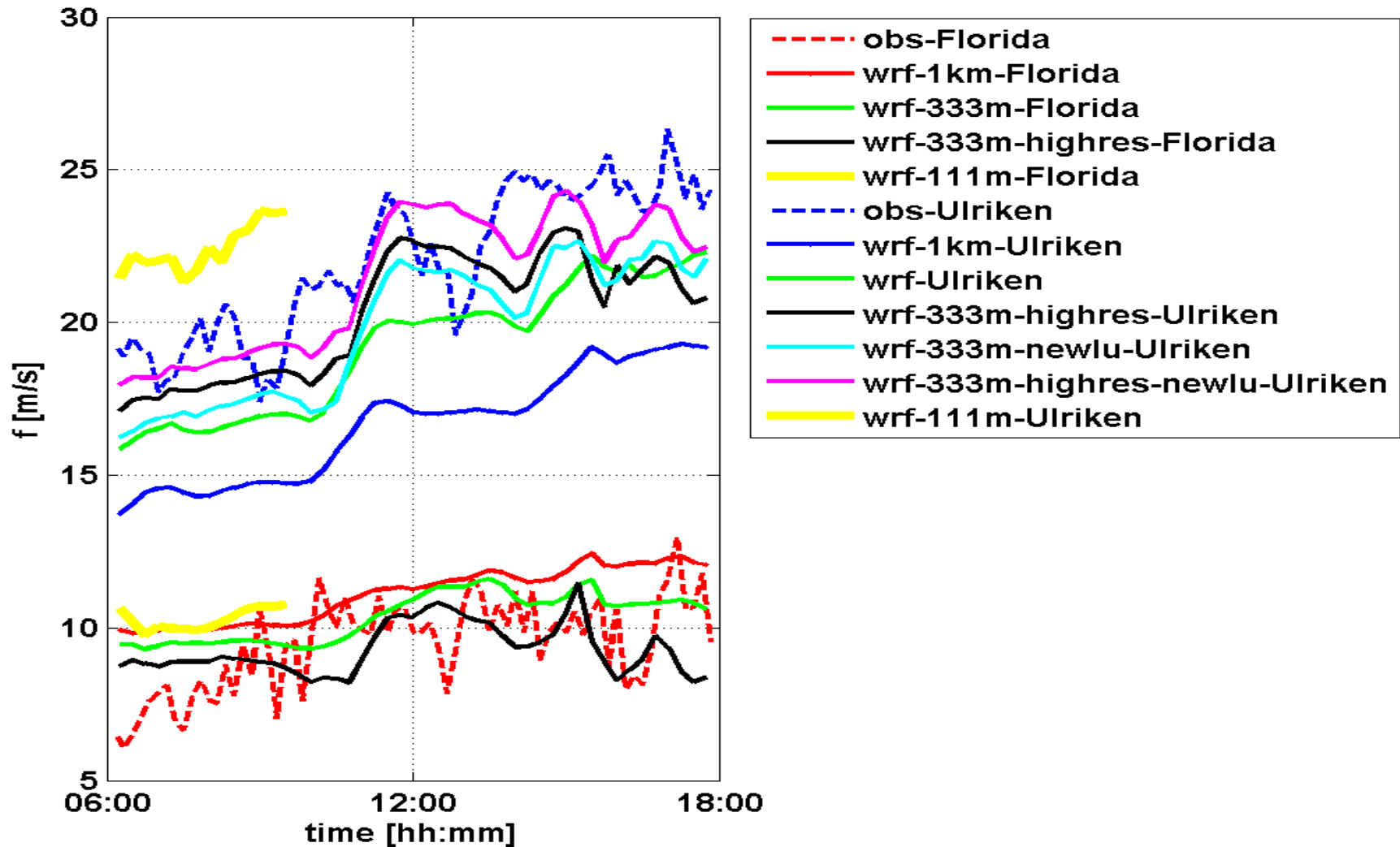
Final result

Better landuse and topography



Even higher horizontal resolution

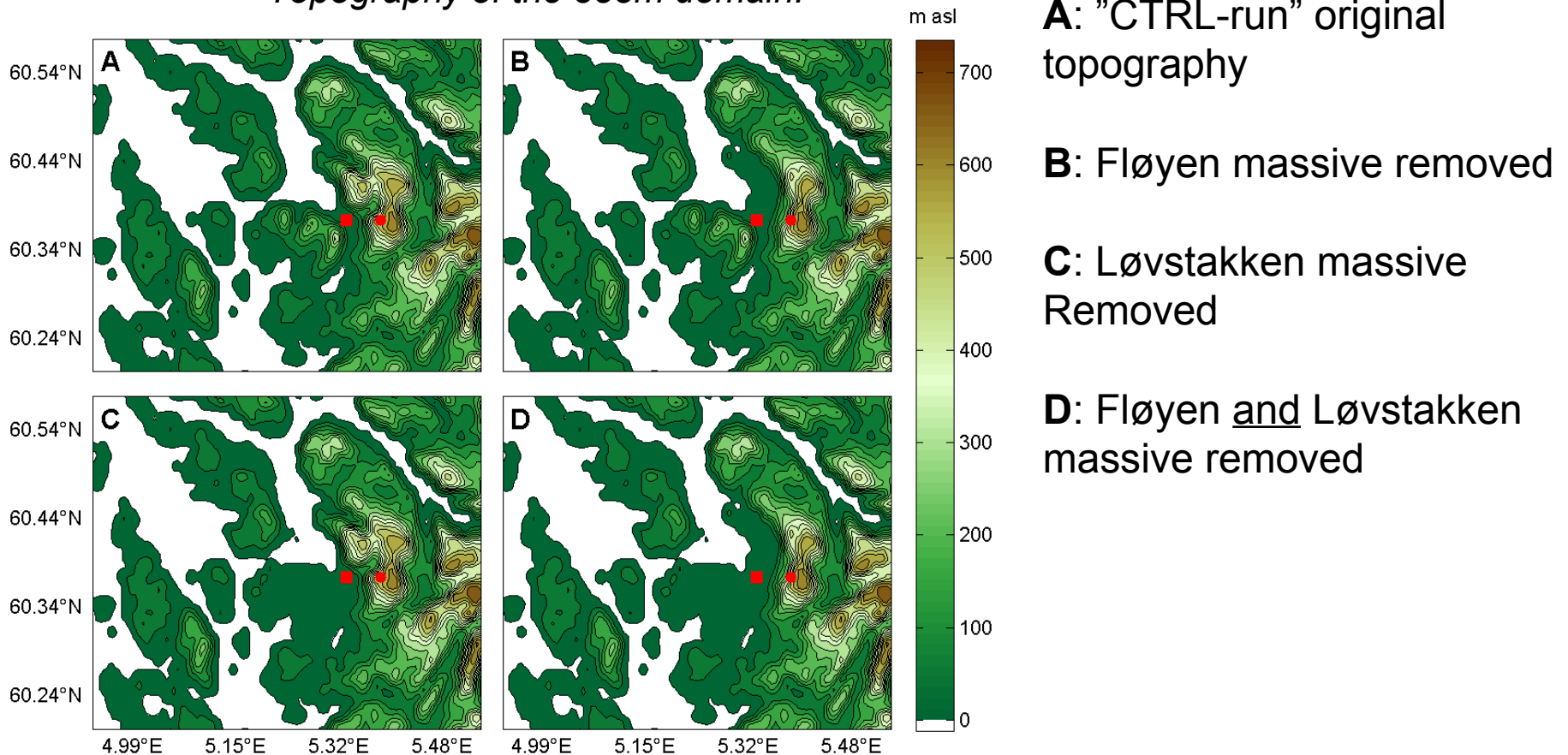
111m

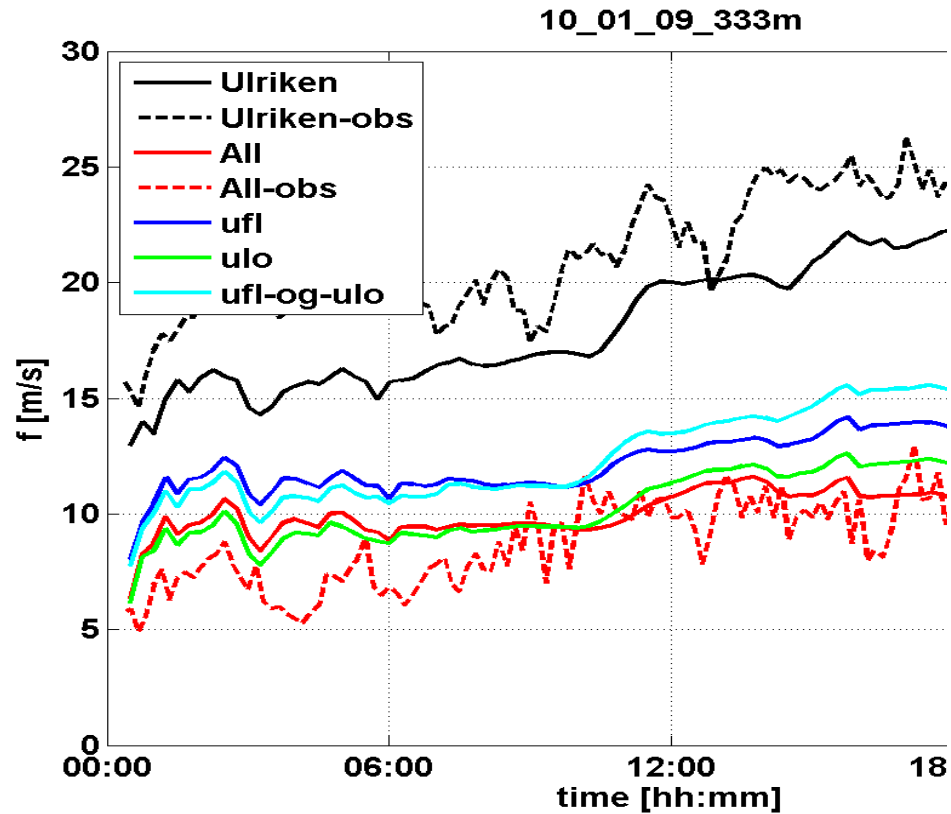


The effect of the topography *-Blocking and/or wake ?*

- USGS, 30s (~1km) topography

Topography of the 333m domain:





The Fløyen massive acts more to block than the Løvstakken massive acts to create a wake =>

- *More a blocking than a wake effect*

- **Future plans**

- Only one case... test the current model setup for more cases.
- Test different physics/parameterization options in WRF (there are about 10 000 combinations)
- Ingest better landuse data
- Remove topography from higher res dataset
- *Assimilate observational data with 3D/4D –VAR (?)*
 - *F.ex using an Unmanned Aircraft System*

Why a shelter ?

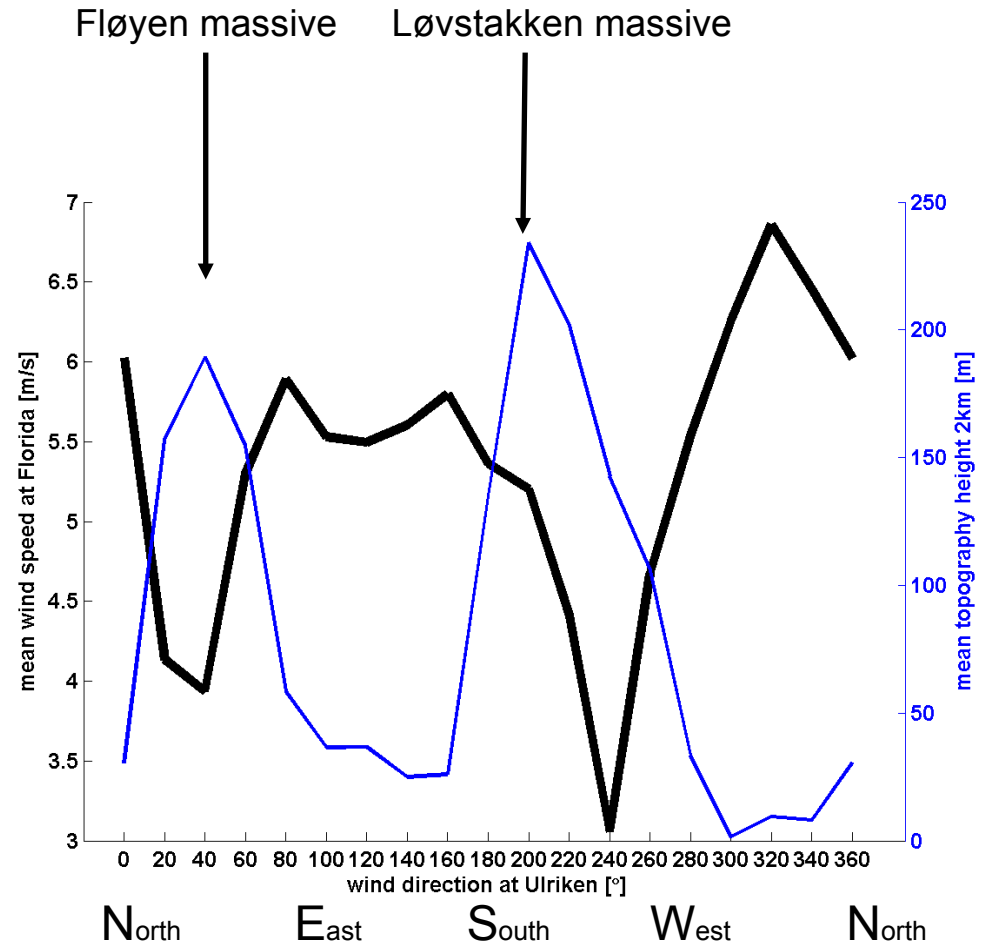
Topography height
and
Mean wind speed at Florida

VS

Wind direction on Ulriken

Correlations

Km	meanh	maxh
2	-0.74	-0.62
5	-0.42	-0.32
10	-0.15	-0.17
15	0.05	-0.03
20	0.03	-0.01
30	0.03	0.00
45	-0.00	-0.02



For wind speeds at Ulriken above 10 m/s

The role of the horizontal resolution

