

# The Bergen Shelter

By Marius O. Jonassen

PhD student at the University of Bergen

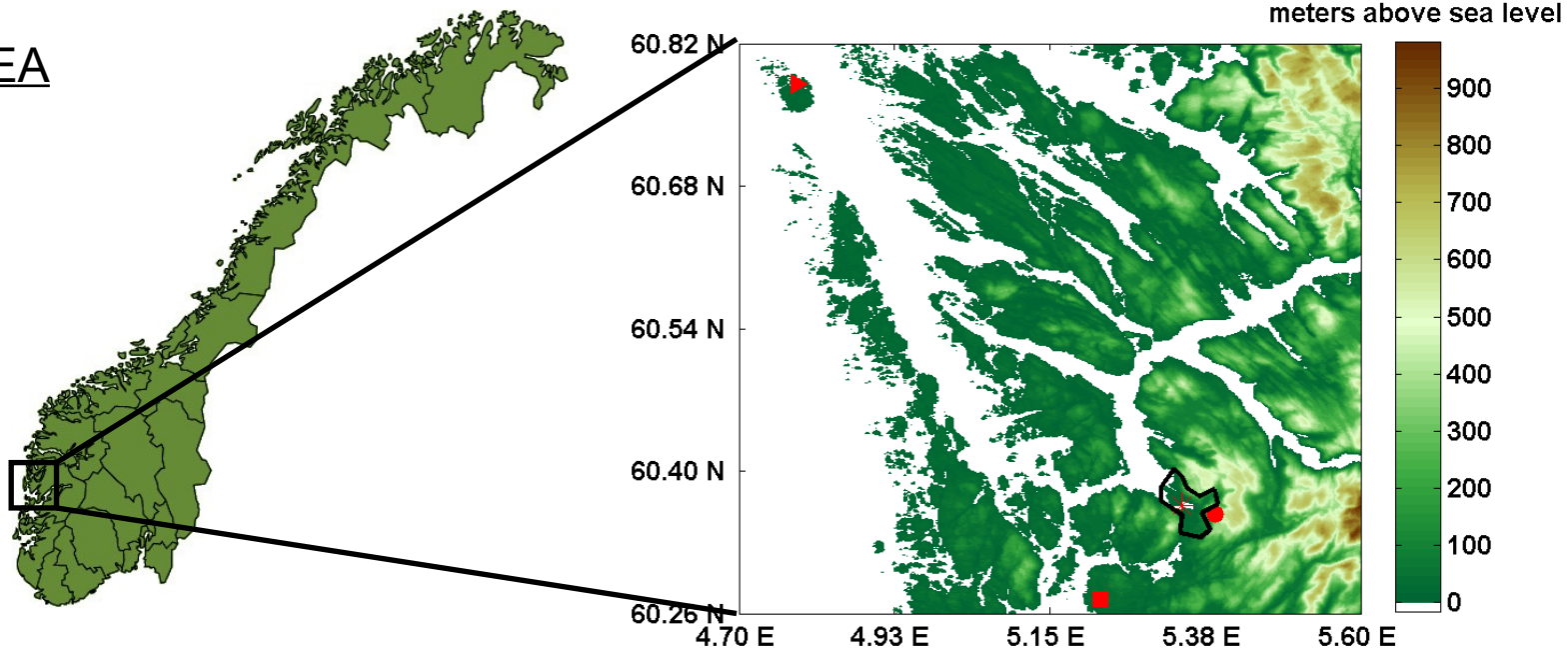
# Background

## OBSERVATIONS

Four automatic weather stations

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

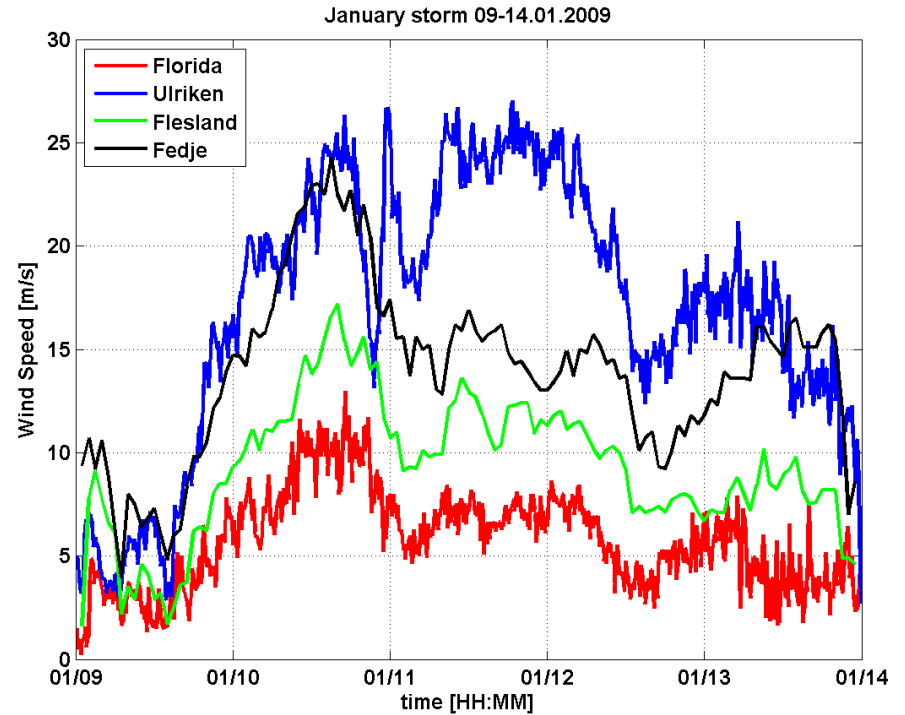
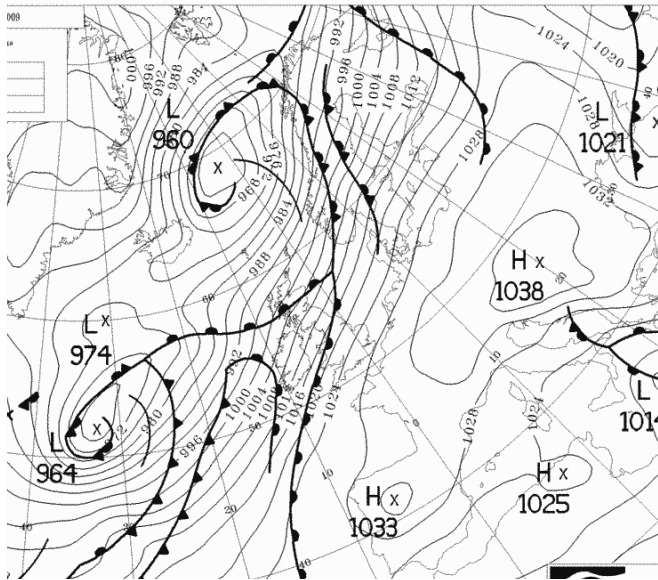
## STUDY AREA



*AWSs indicated by red dots*

# Background

Case, January 10  
2009

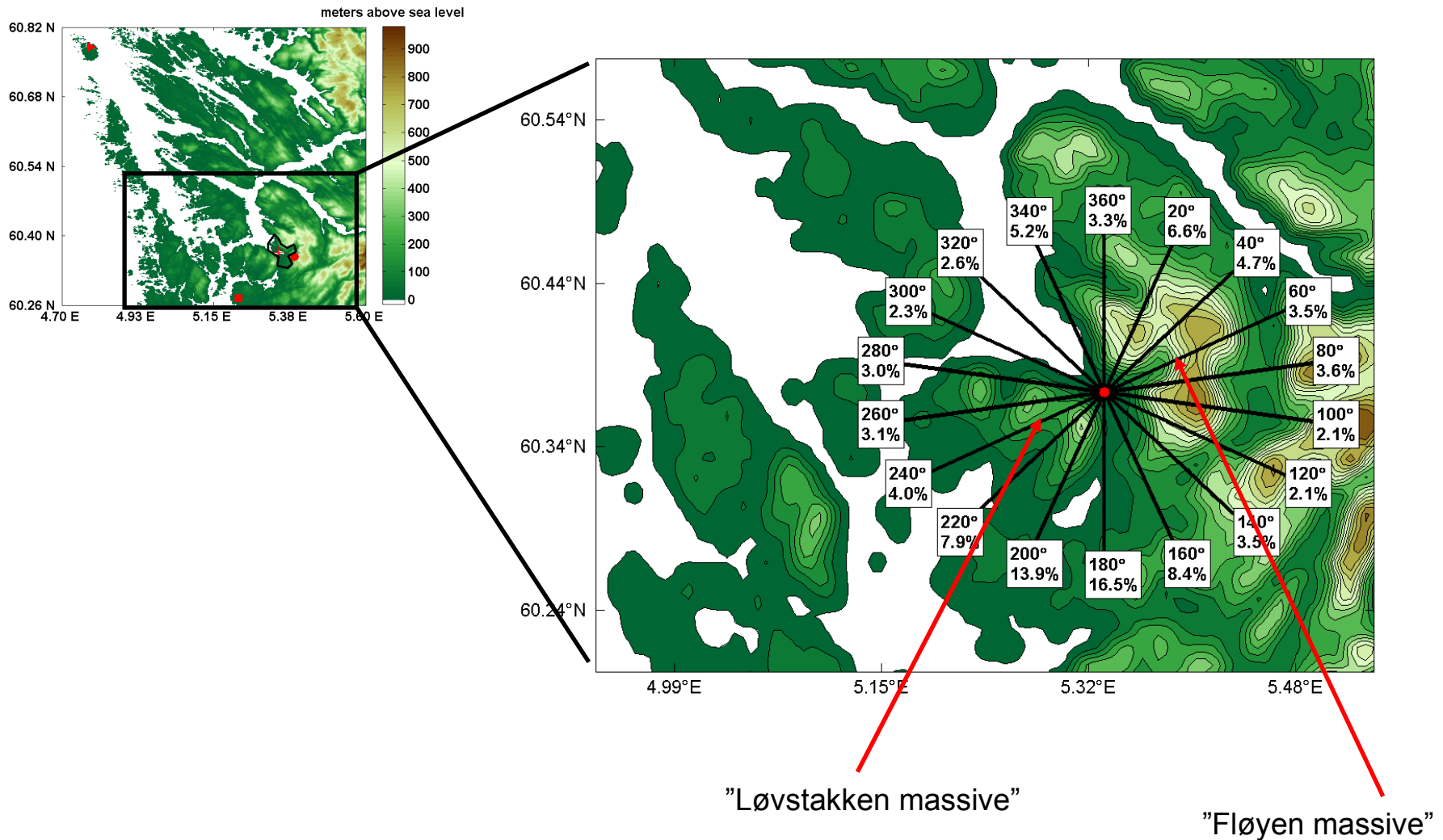


- Why such a big difference between Ulriken and Florida ?

# Why do we have a shelter ?

The topography!

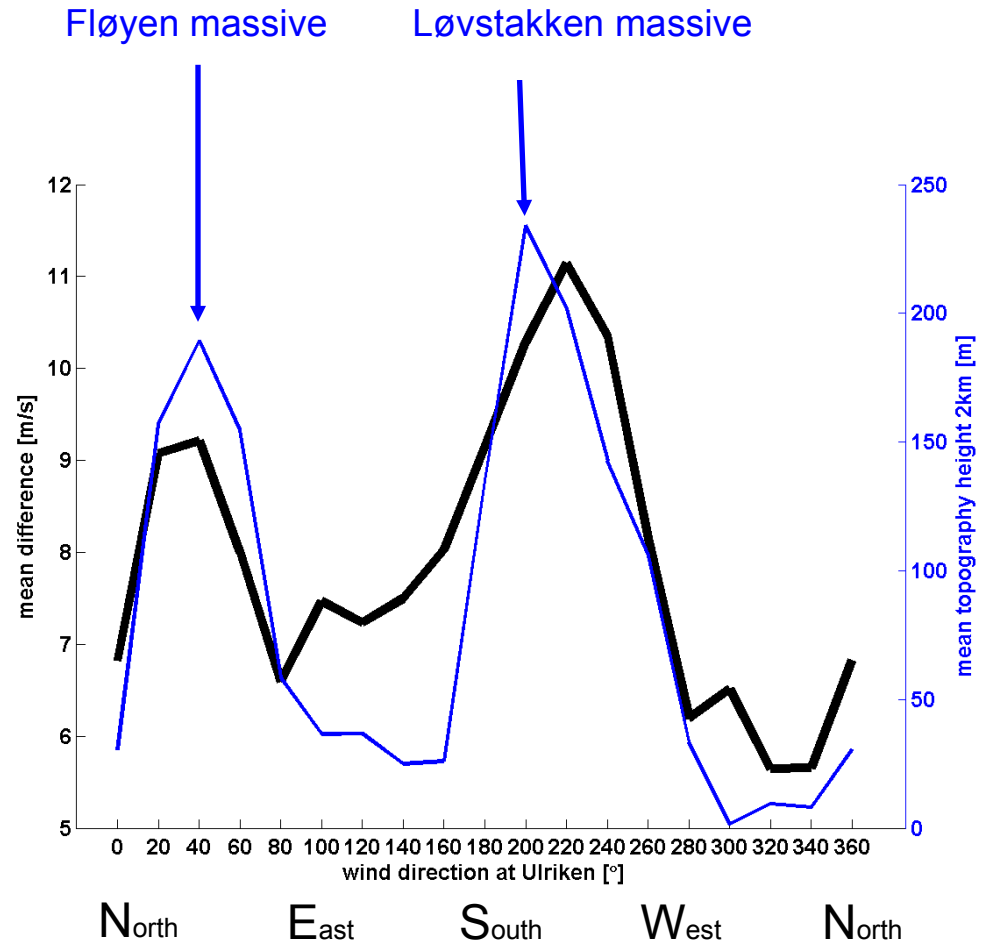
*The "seven mountains"*



# Why a shelter ?

Topography height  
and  
Mean wind speed difference Ulriken - Florida

VS  
Wind direction on Ulriken



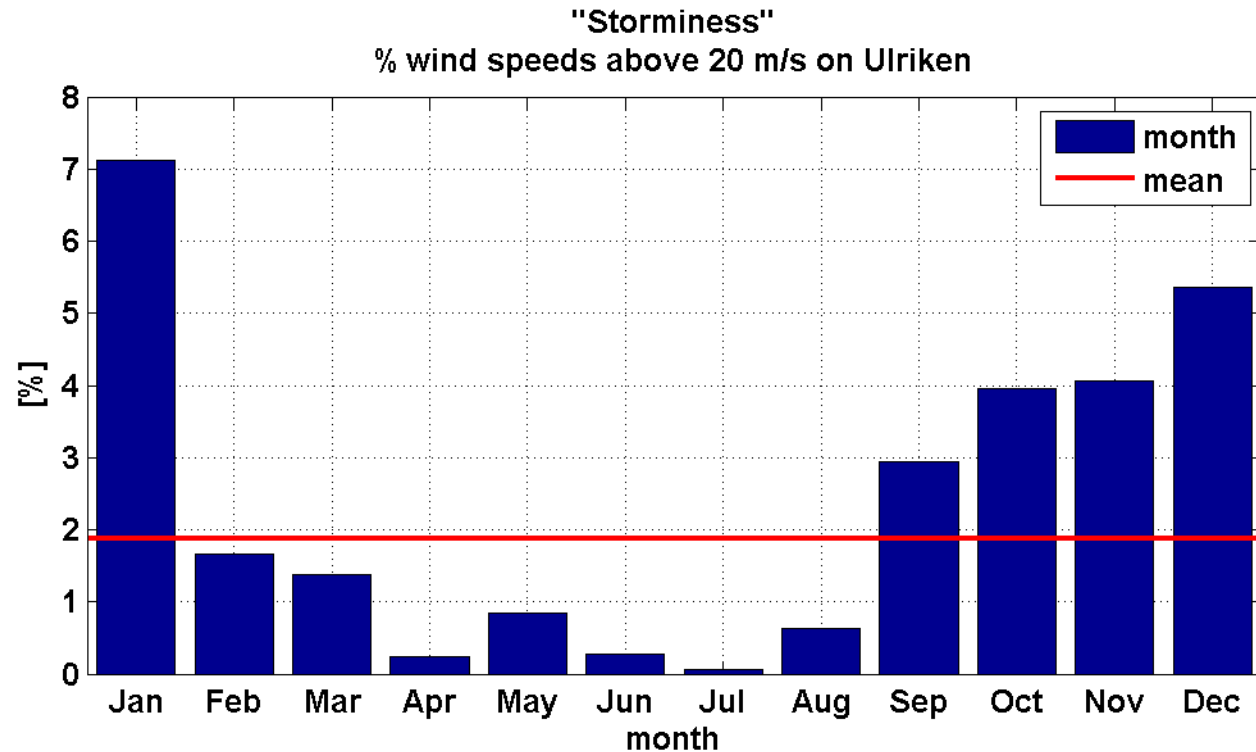
For wind speeds at Ulriken above 10 m/s

## Correlations

Km	meanh	maxh
2	<b>0.89</b>	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:

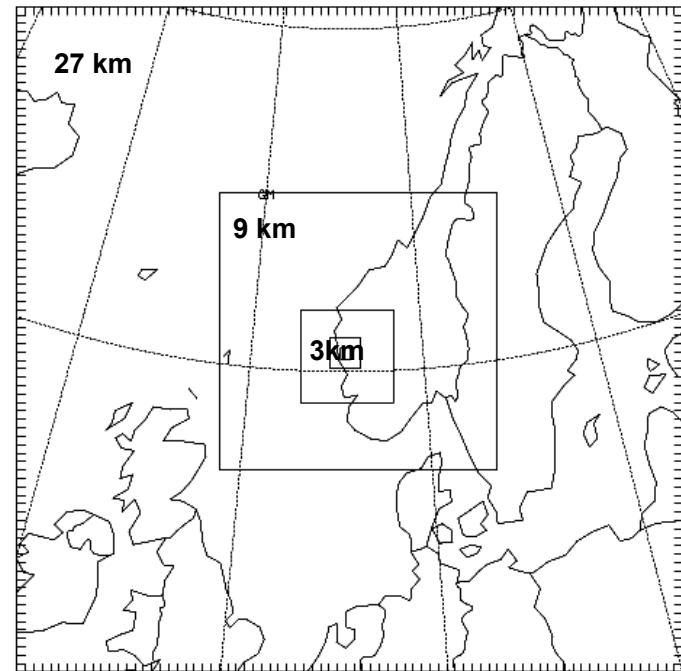


*"Strength of the shelter"* : Difference between Ulriken and Florida

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

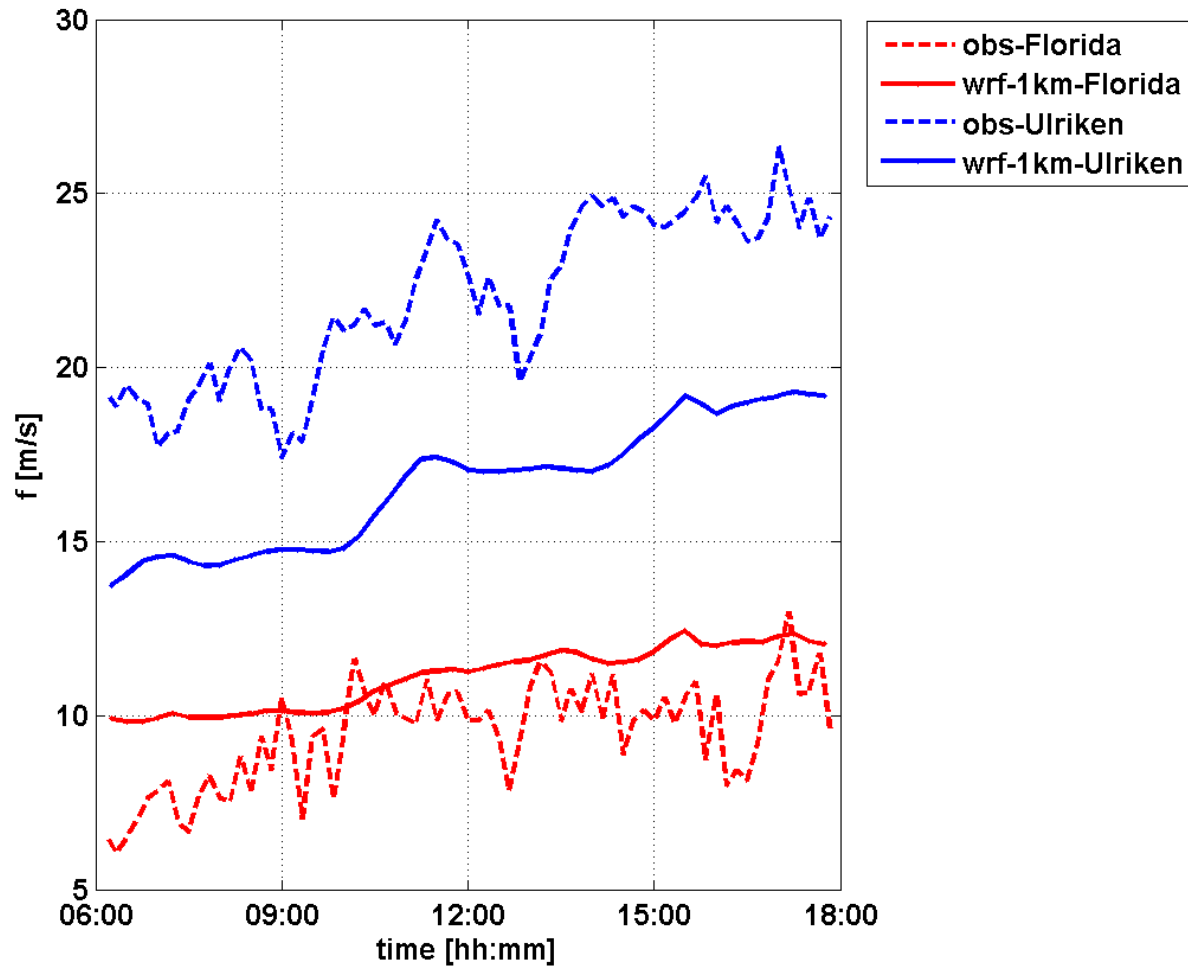
# Numerical simulations

- 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 ?

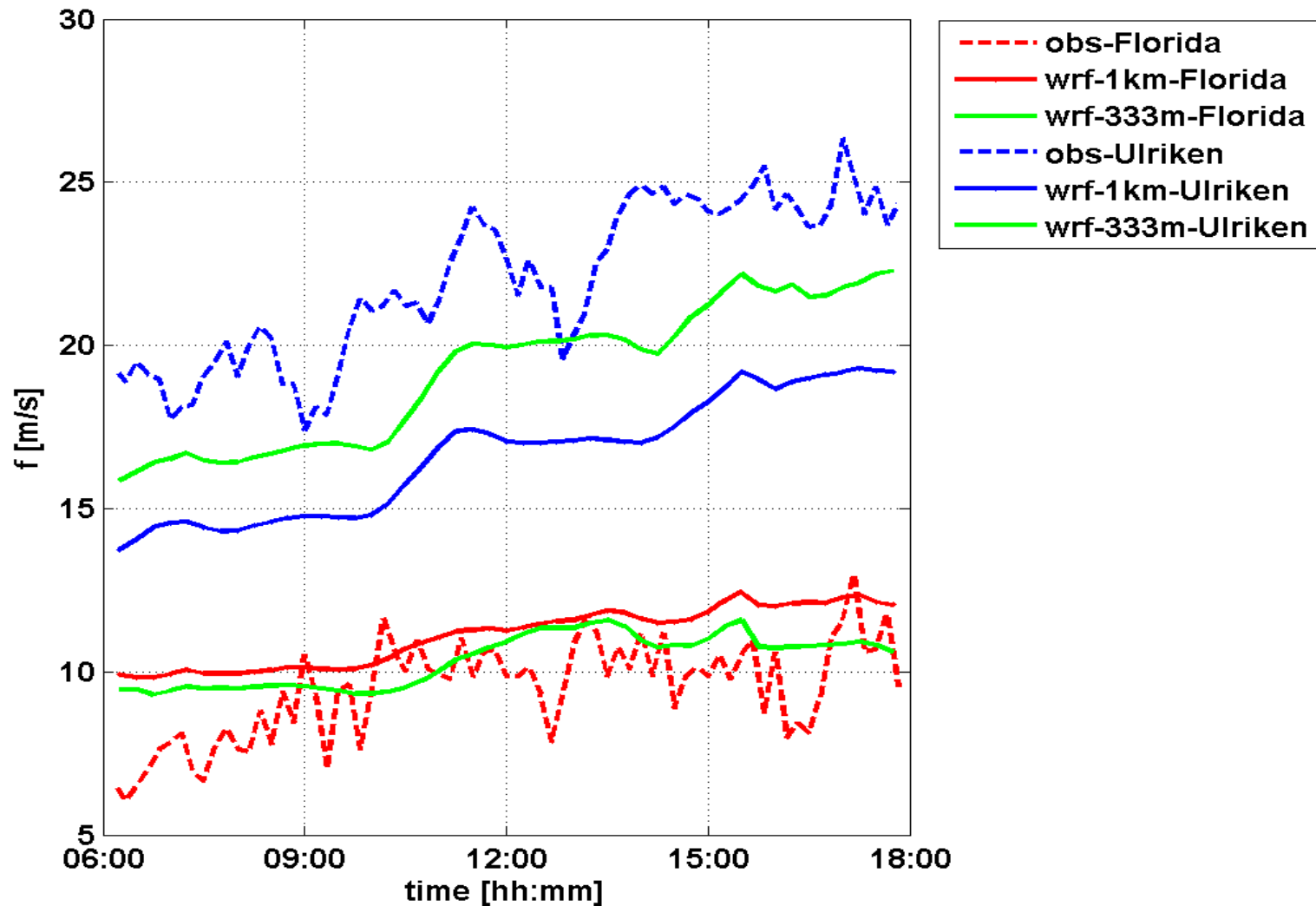
- Higher horizontal resolution

- Better topography data

- Better landuse data

# Aid 1: Higher horizontal resolution

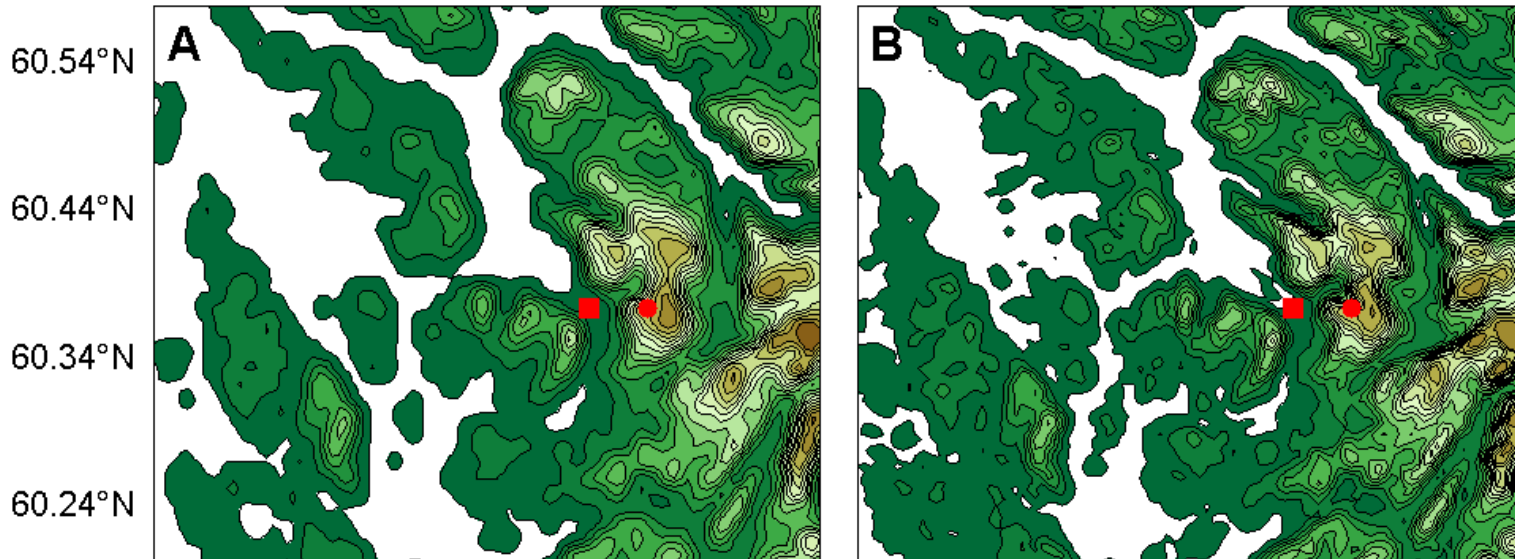
1km -> 333m



# Aid 2: Higher resolution topography

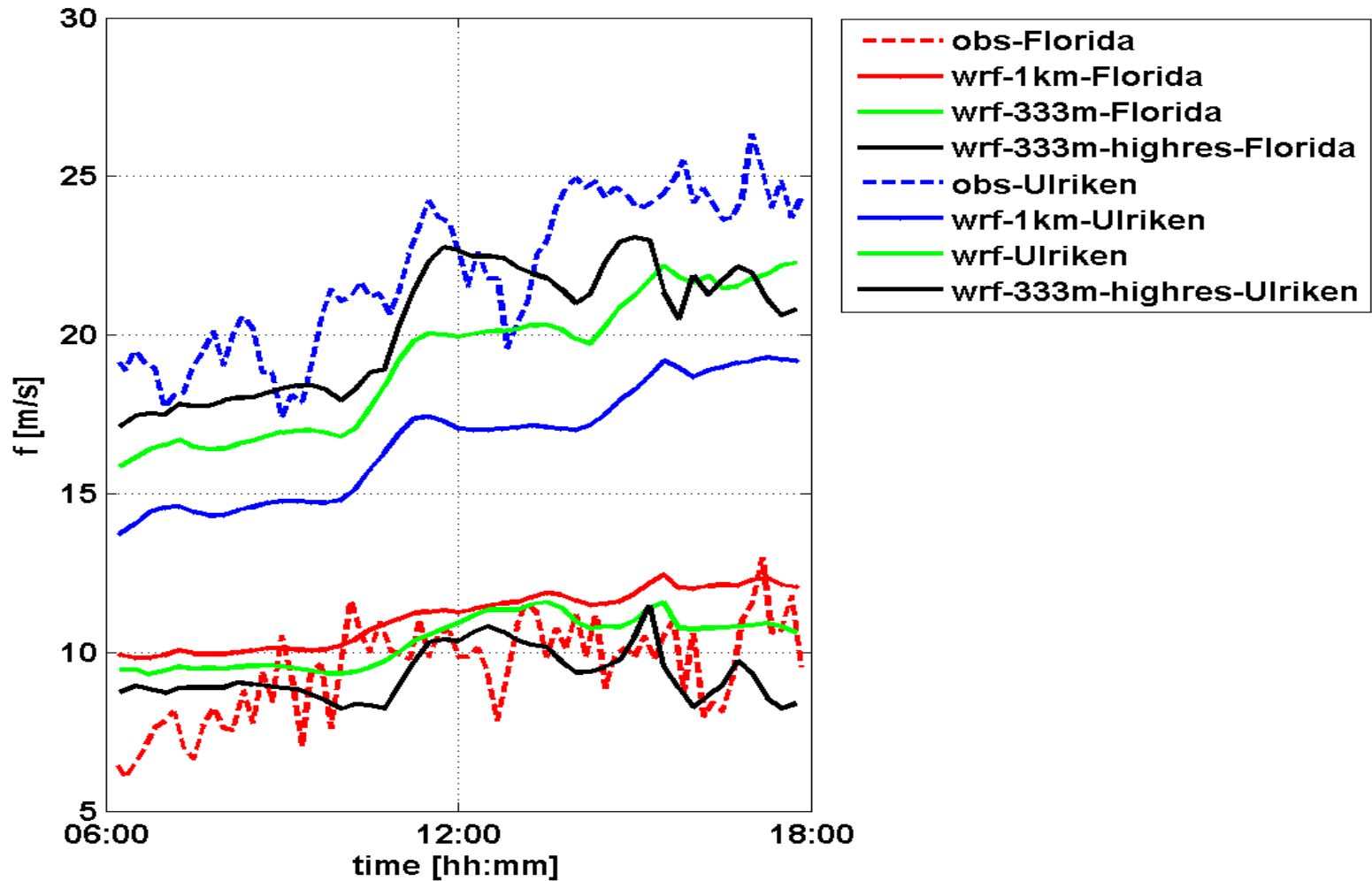
USGS, 30s (~1km)  
(default in WRF)

Statens Kartverk (25m)

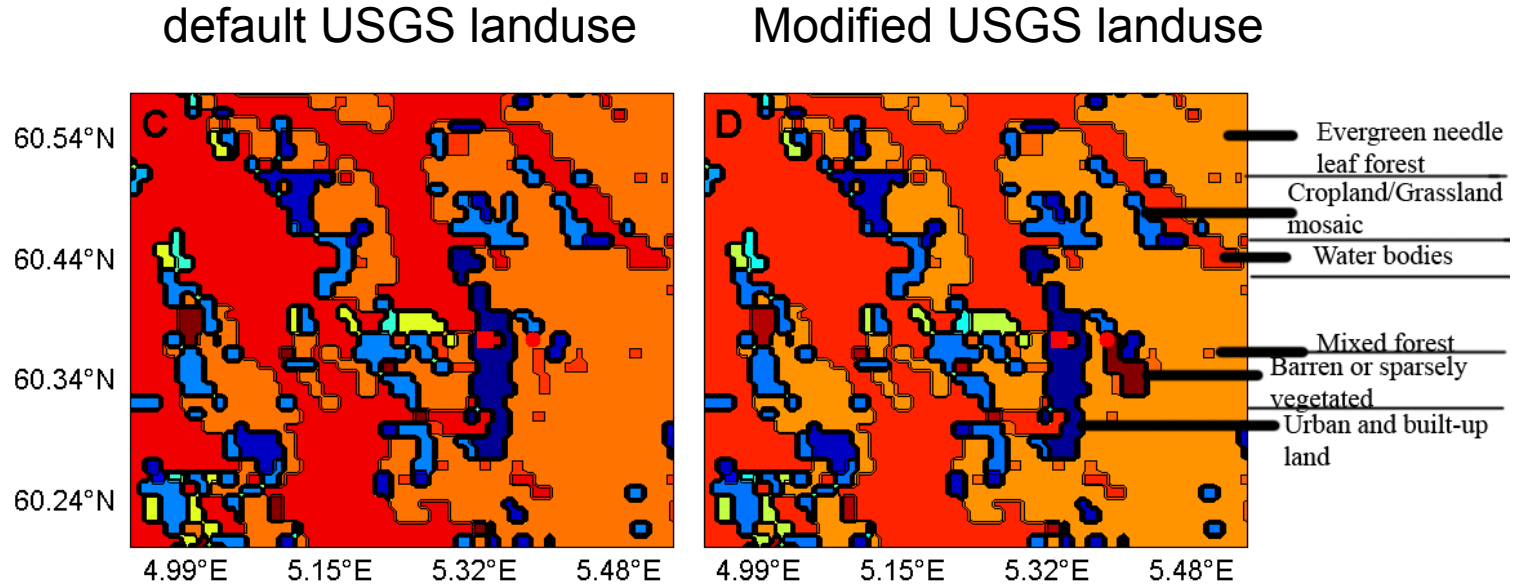


*Both figures show the 333m domain*

# Aid 2: Higher resolution topography

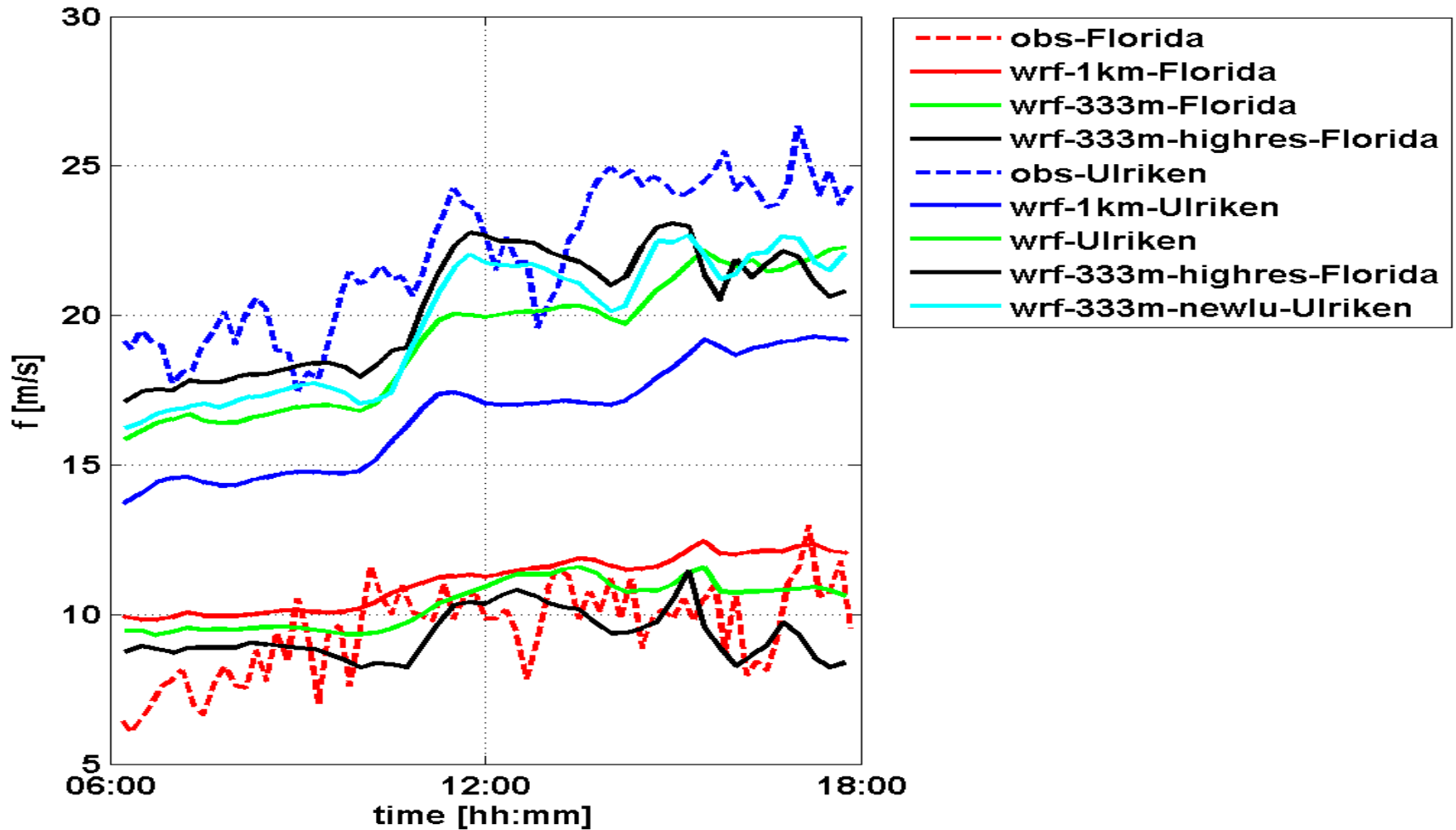


# Aid 3: More realistic landuse



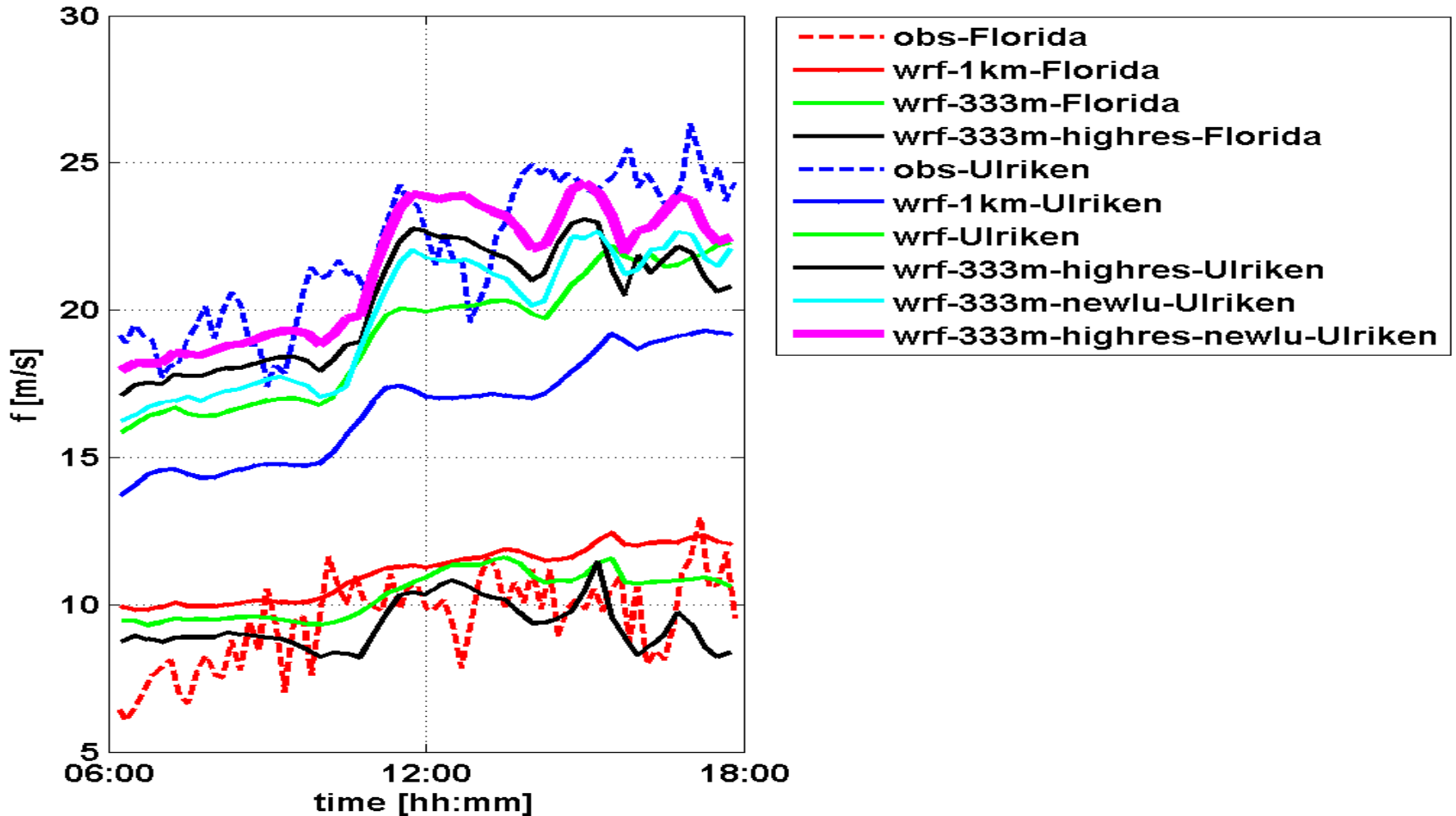
*Both figures show the 333m domain*

# Aid 3: More realistic landuse



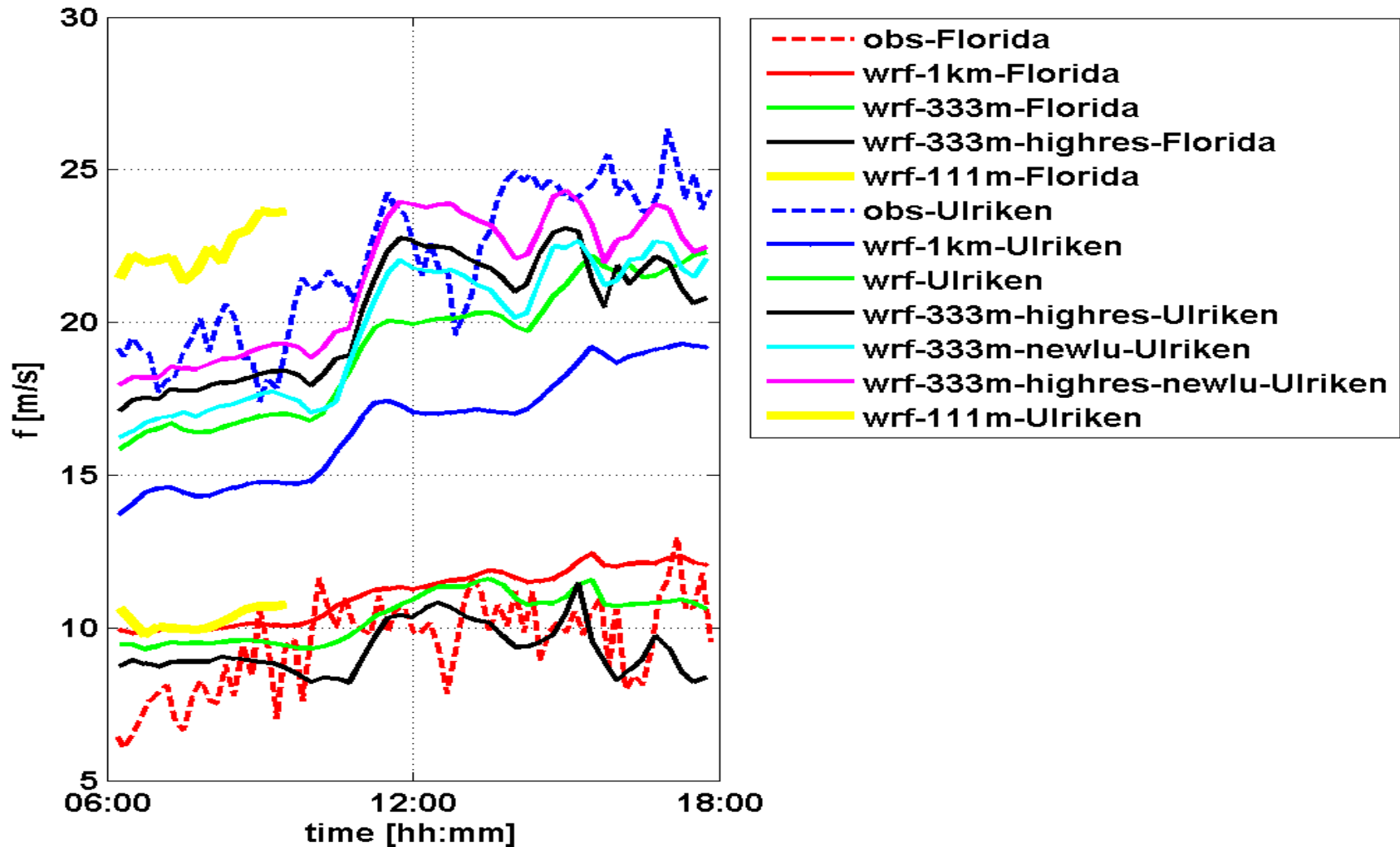
# Final result

*Better landuse and topography*



# Even higher horizontal resolution

*111m*

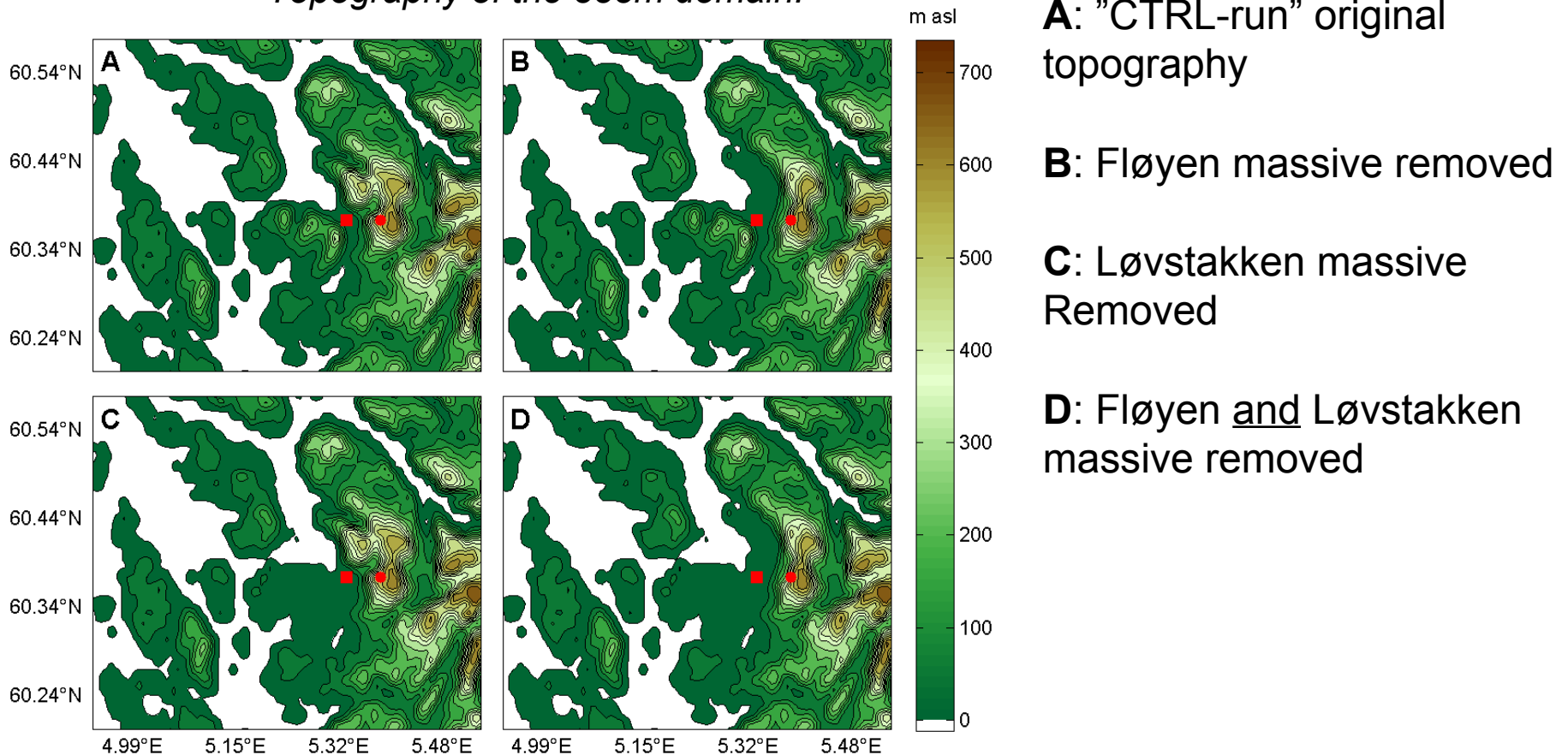


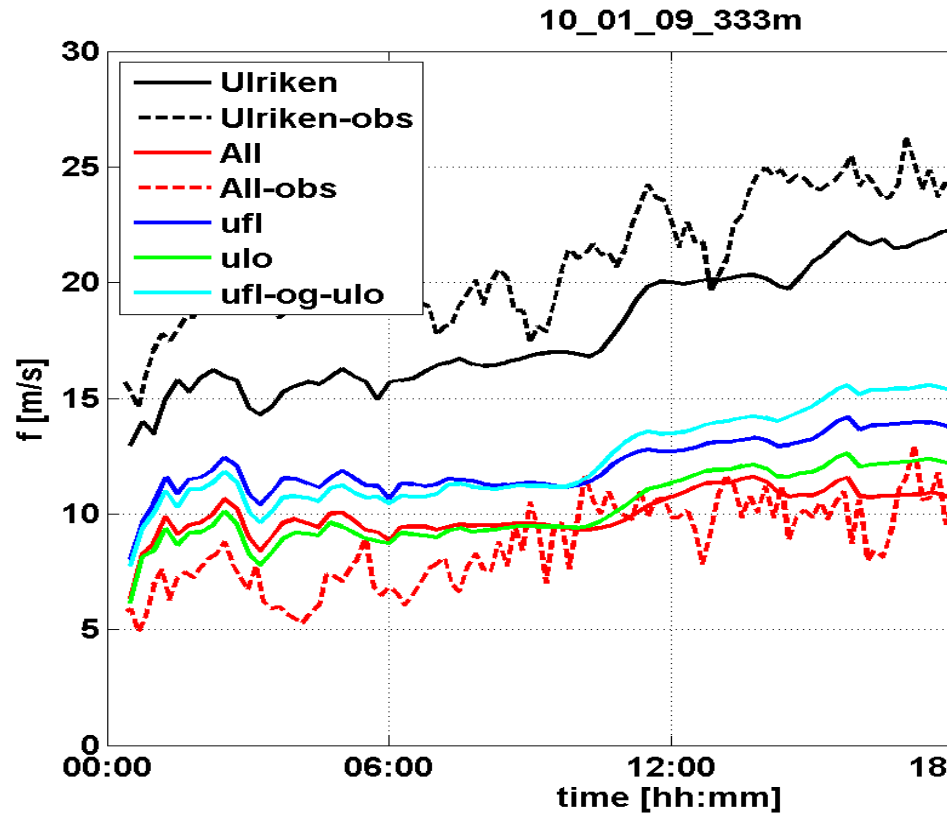


# The effect of the topography *-Blocking and/or wake ?*

- 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 ?

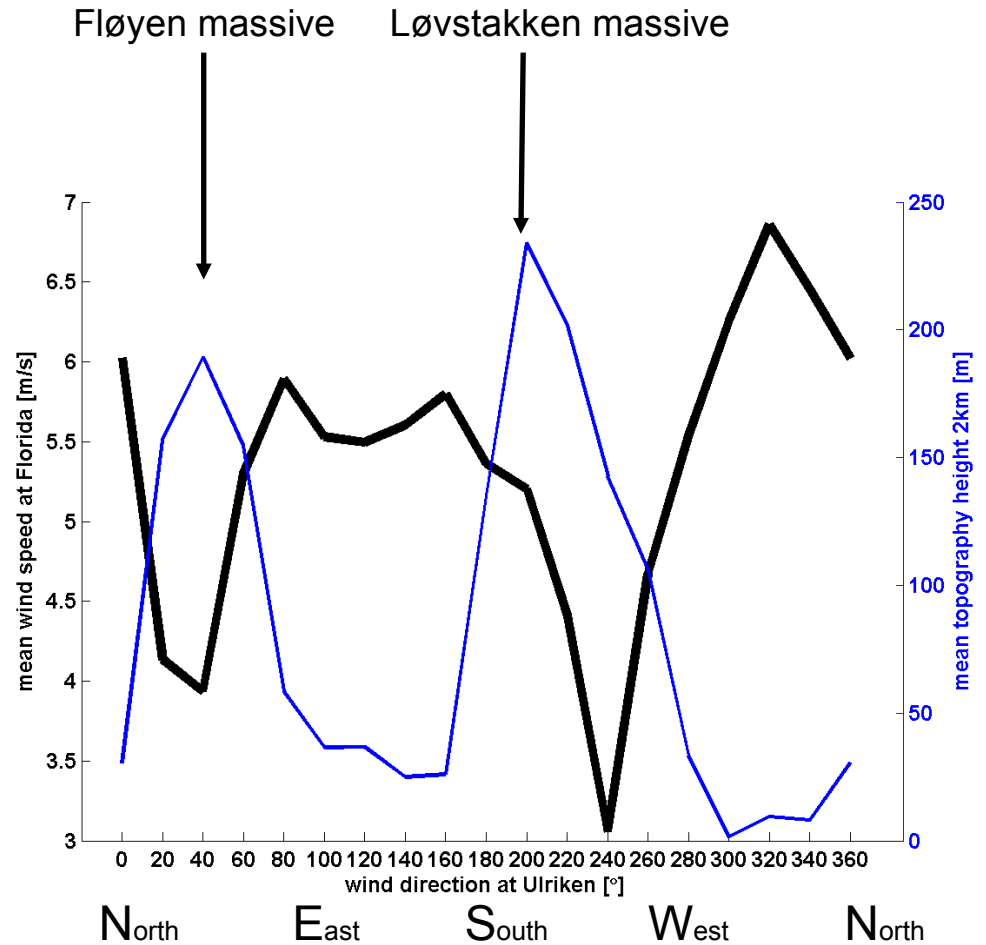
Topography height  
and  
Mean wind speed at Florida

VS

Wind direction on Ulriken

## Correlations

Km	meanh	maxh
2	<b>-0.74</b>	-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

