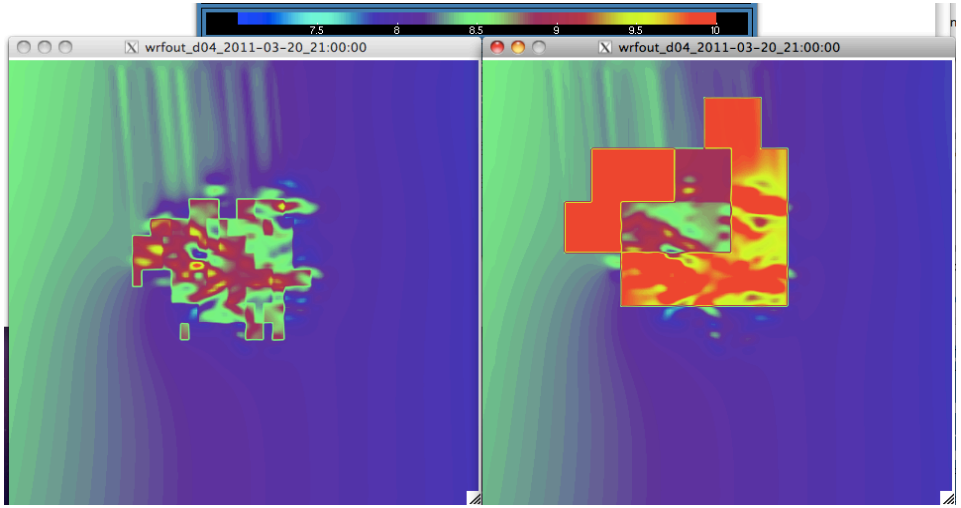
WRFLES
A system for high-resolution limited area numerical simulations



Ólafur Rögnvaldsson (IMR, UiB)
Hálfdán Ágústsson (IMR, UI)
Haraldur Ólafsson (UiB, UI, IMO)
Marius O. Jonassen (UiB)
Þór Sigurðsson (IMR)
Örnólfur E. Rögnvaldsson (IMR)

Introduction

- What is WRFLES?
- Some examples of its use
- SW-windstorm in Iceland
  - 2011 and the 10th century
- Summary

WRFLES

- The WRFLES software tool takes care of:
  - Setting up a directory hierarchy suitable for executing the steps of a WRF LES simulation
  - Calculating the namelist parameters corresponding to user defined criteria for the simulation region and generating the necessary namelists
  - Generating PBS scripts from templates that take care of the various steps in a WRF run

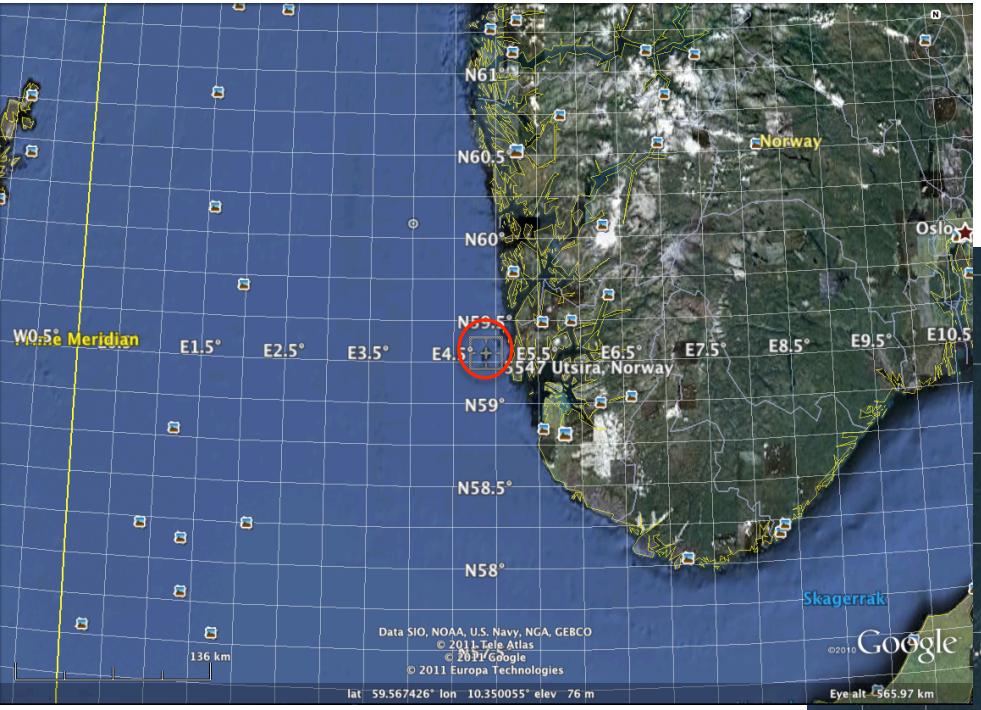
WRFLES

- Includes “stand alone” python scripts to correct the geo_em and met_em files
- Includes instructions on how to import 1sec ASTER topography data into WRF
- Can be used with high resolution Corine land use data

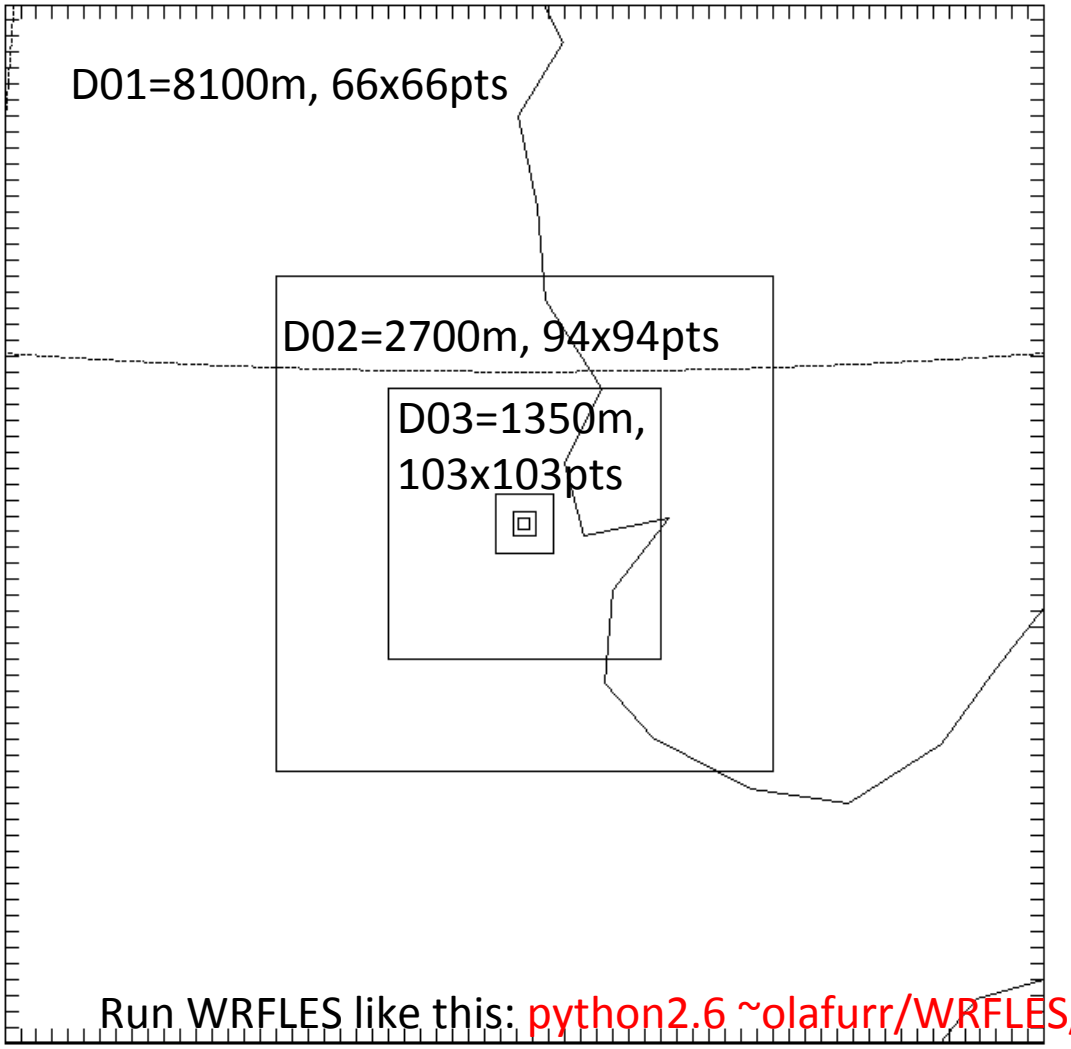
WRFLES

- The user should only need to edit one config file – WRFLES.config.yml
- Most important features are:
  - from_lat, from_lon, to_lat, to_lon – The innermost domain can be defined by setting a pair of corner points. The domain can also be defined by setting the center latitude and longitude, as well as radius, of the innermost domain. In the latter case the user comments out the from_* and to_* parameters and defines instead the center_lat, center_lon and radius parameters
  - start_date – Initial time of the simulation
  - end_date – Ending time of the simulation
  - input_data_timestep – The time interval (hours) between available input data
  - asterdir – The location of the 1 sec ASTER topography data for the region in question.

Example – Island of Utsira



Example – Island of Utsira



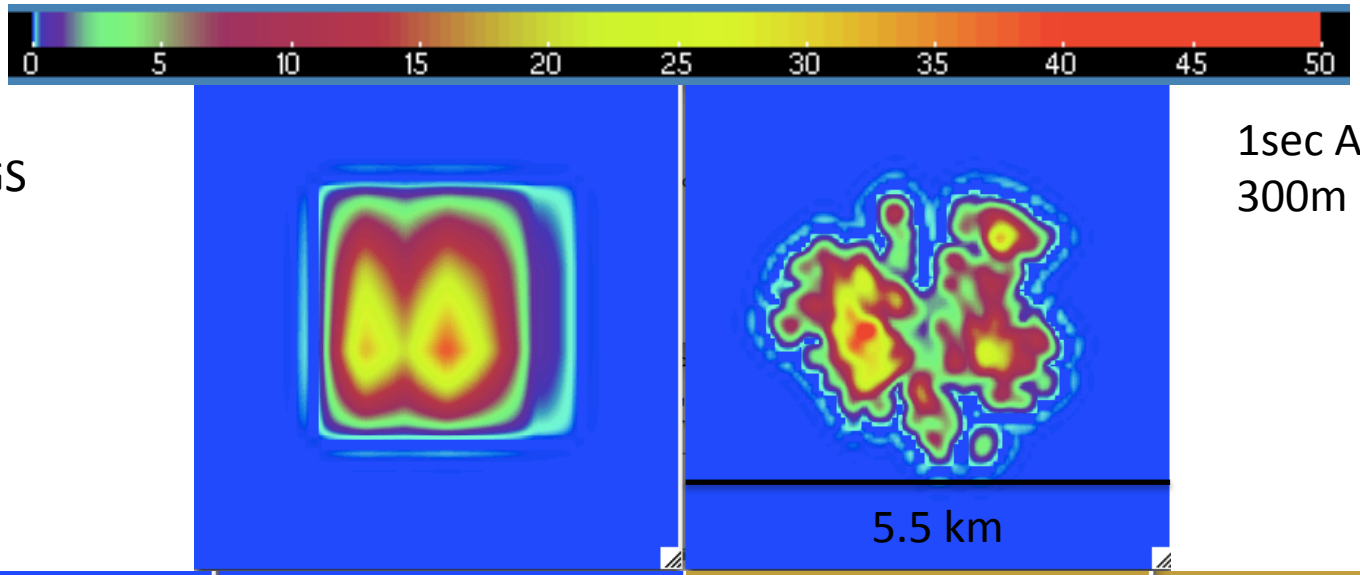
center_lat: 59.306732
center_lon: 4.885415
radius: 1.5

D04=450m, 67x67pts
D05=150m, 79x79pts
D06=50m, 112x112pts

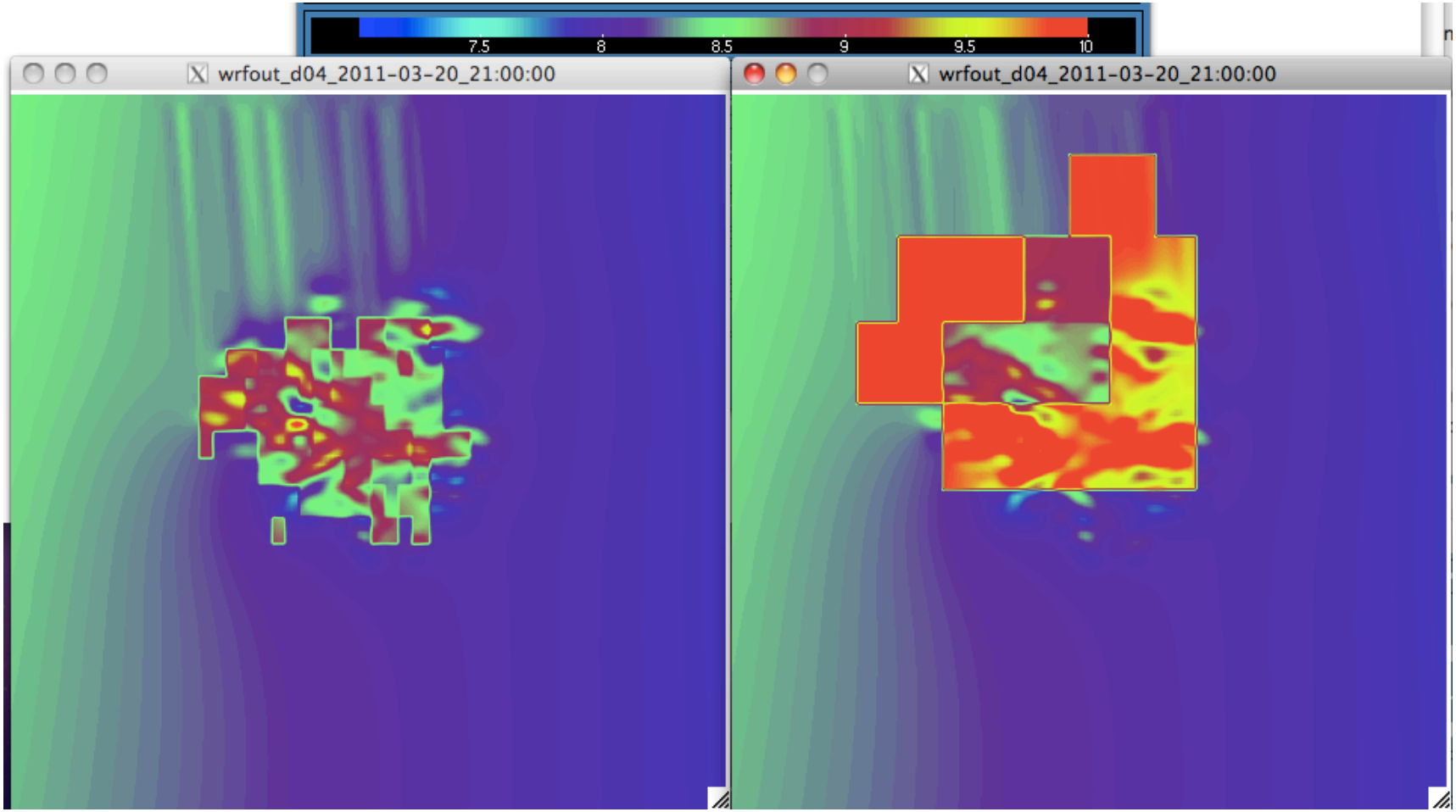
Additional parameter
border_width : [25, 20, 20, 40, 20, 17]

Run WRFLES like this: python2.6 ~olafurr/WRFLES/src/WRFLESSetup.py -d /home/geofysisk/olafurr/wrf-les/utsira/WRFLES.config.yml -o /work/olafurr/utsira

Example – Island of Utsira

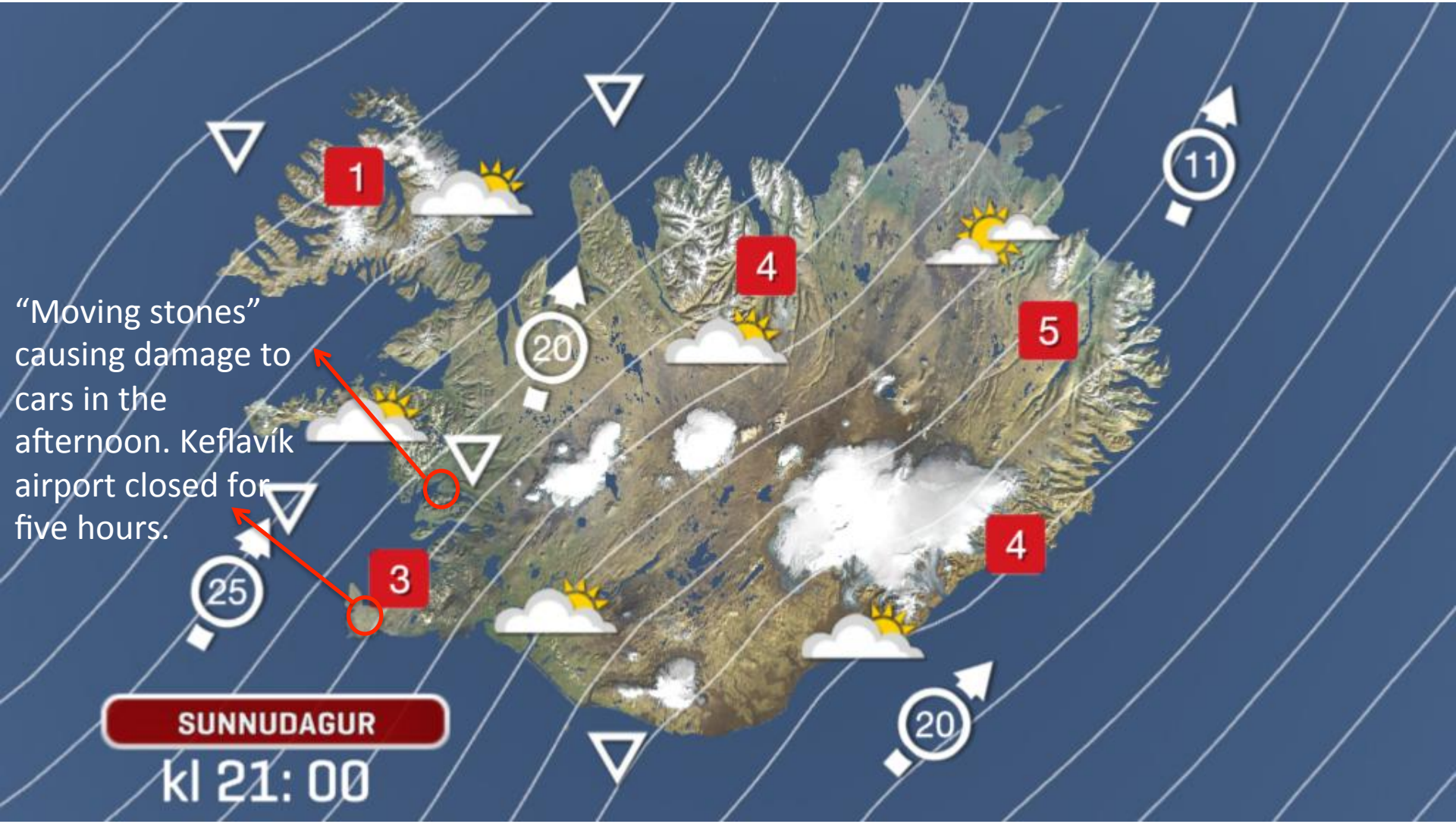


Does it matter?



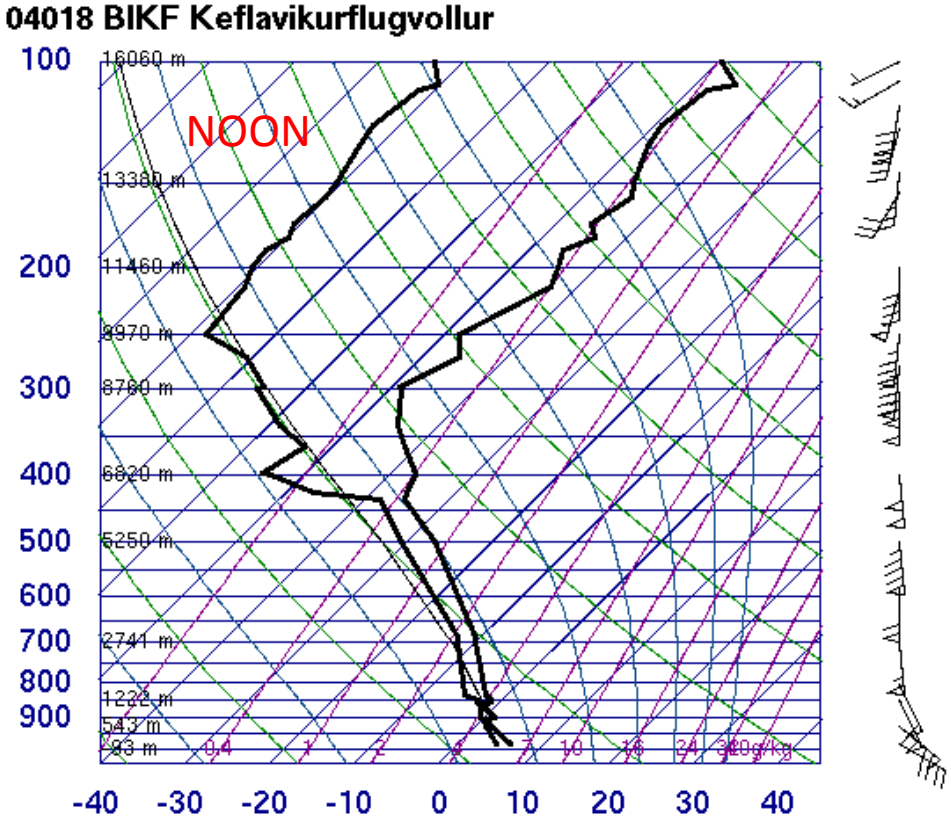
Simulated sfc wind speed over Utsira using Corine (left) and Modis (right) land use data

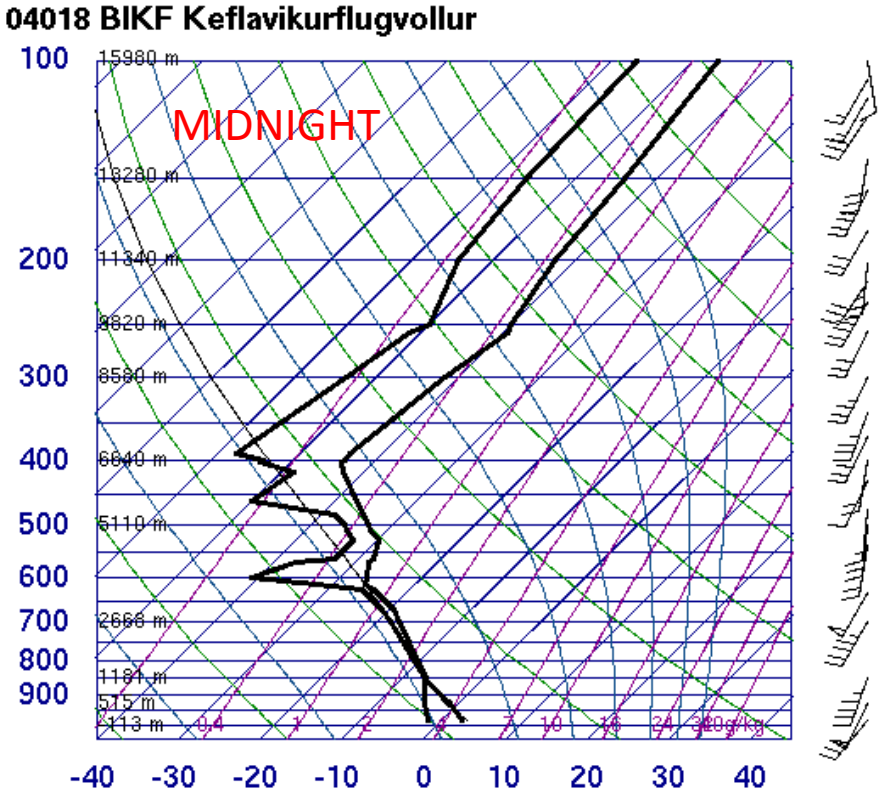
Windstorm of 10 April 2011



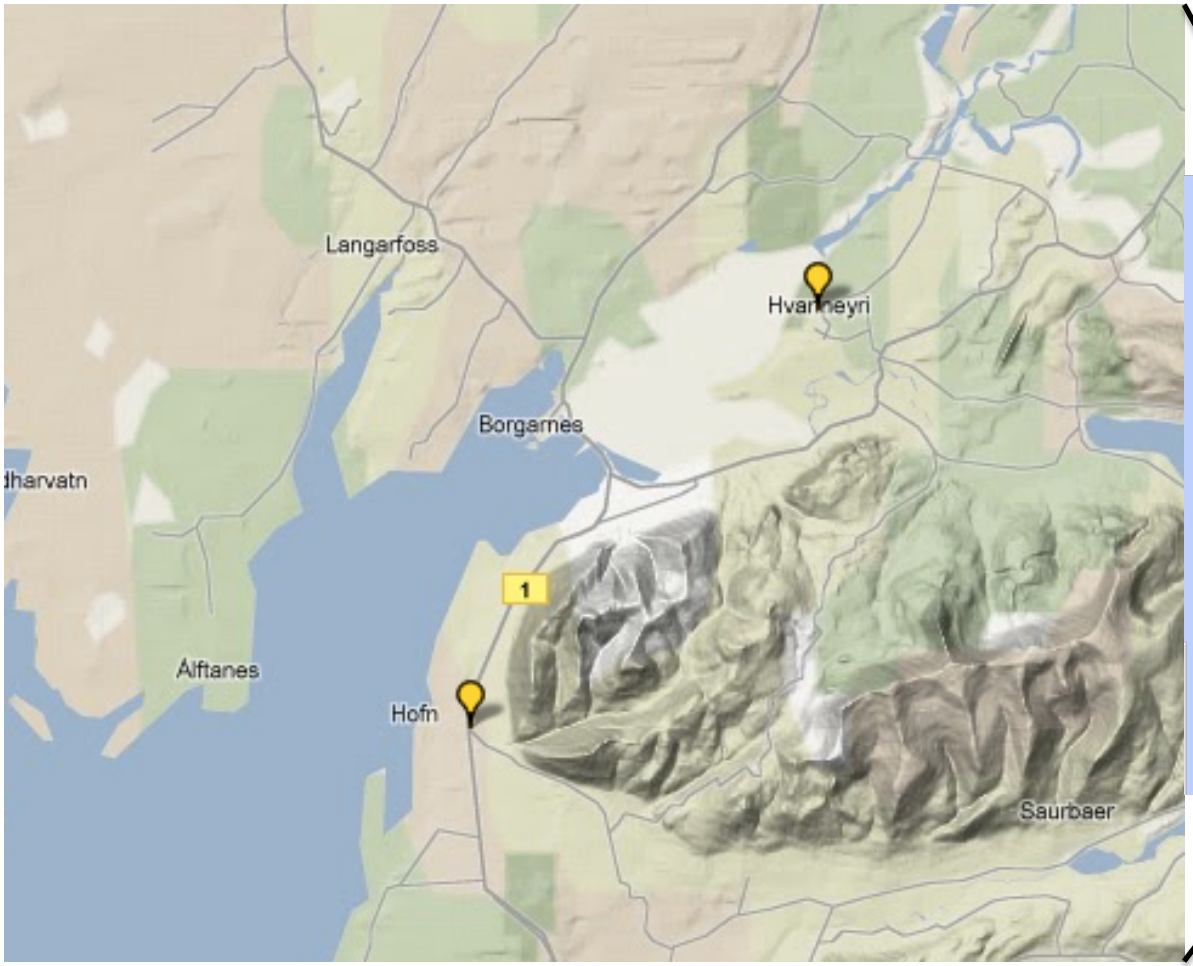
"Moving stones" causing damage to cars in the afternoon. Keflavík airport closed for five hours.

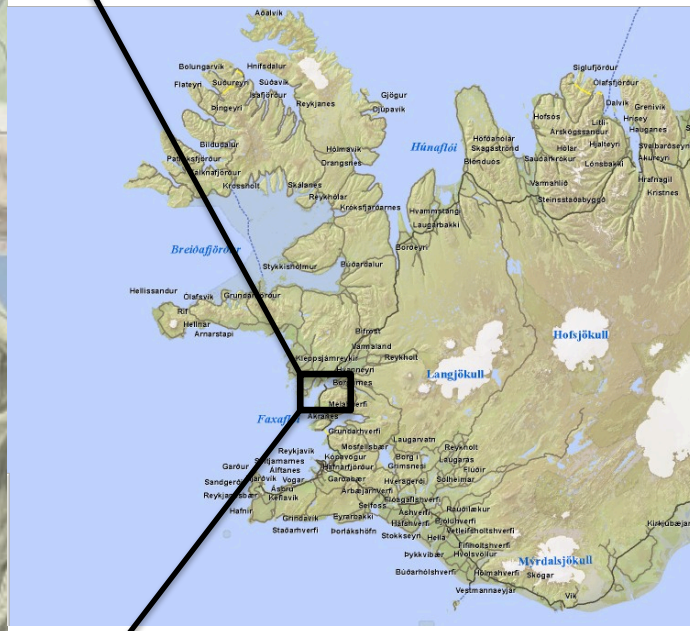
Upper air observations



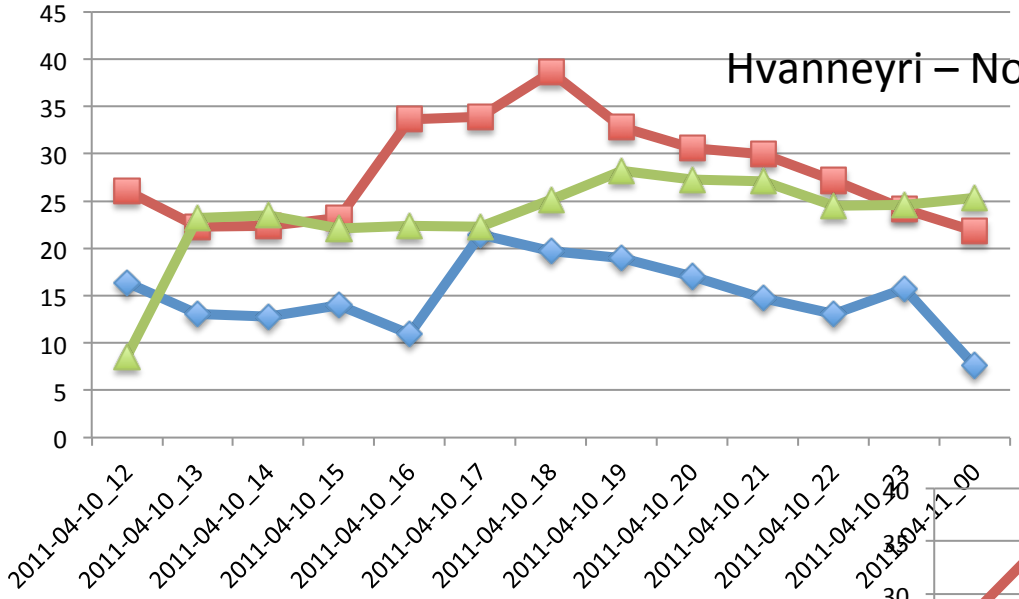


Surface observations

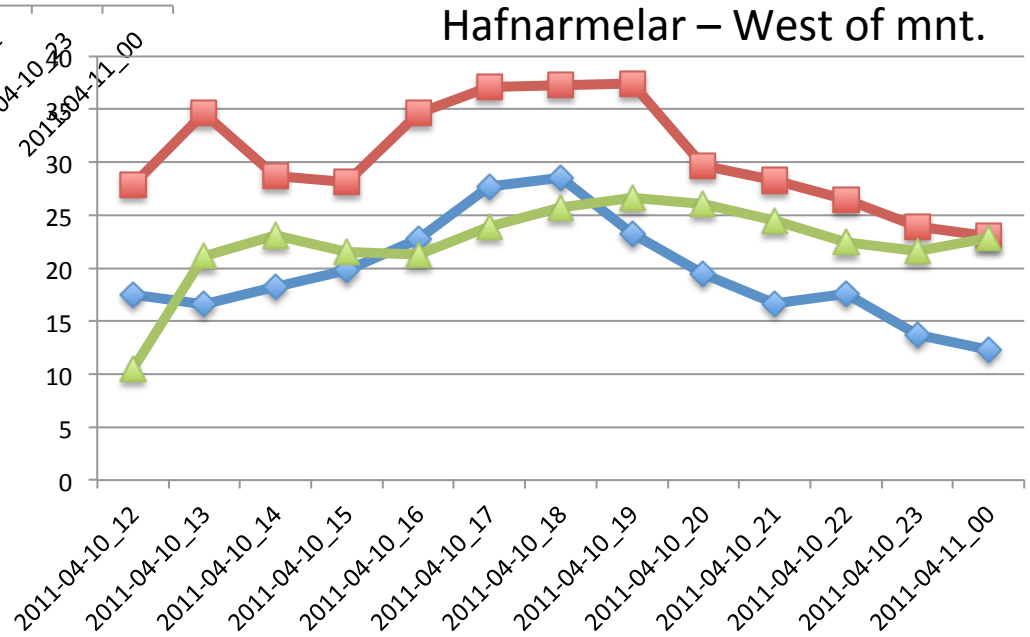




Strong winds and gusts

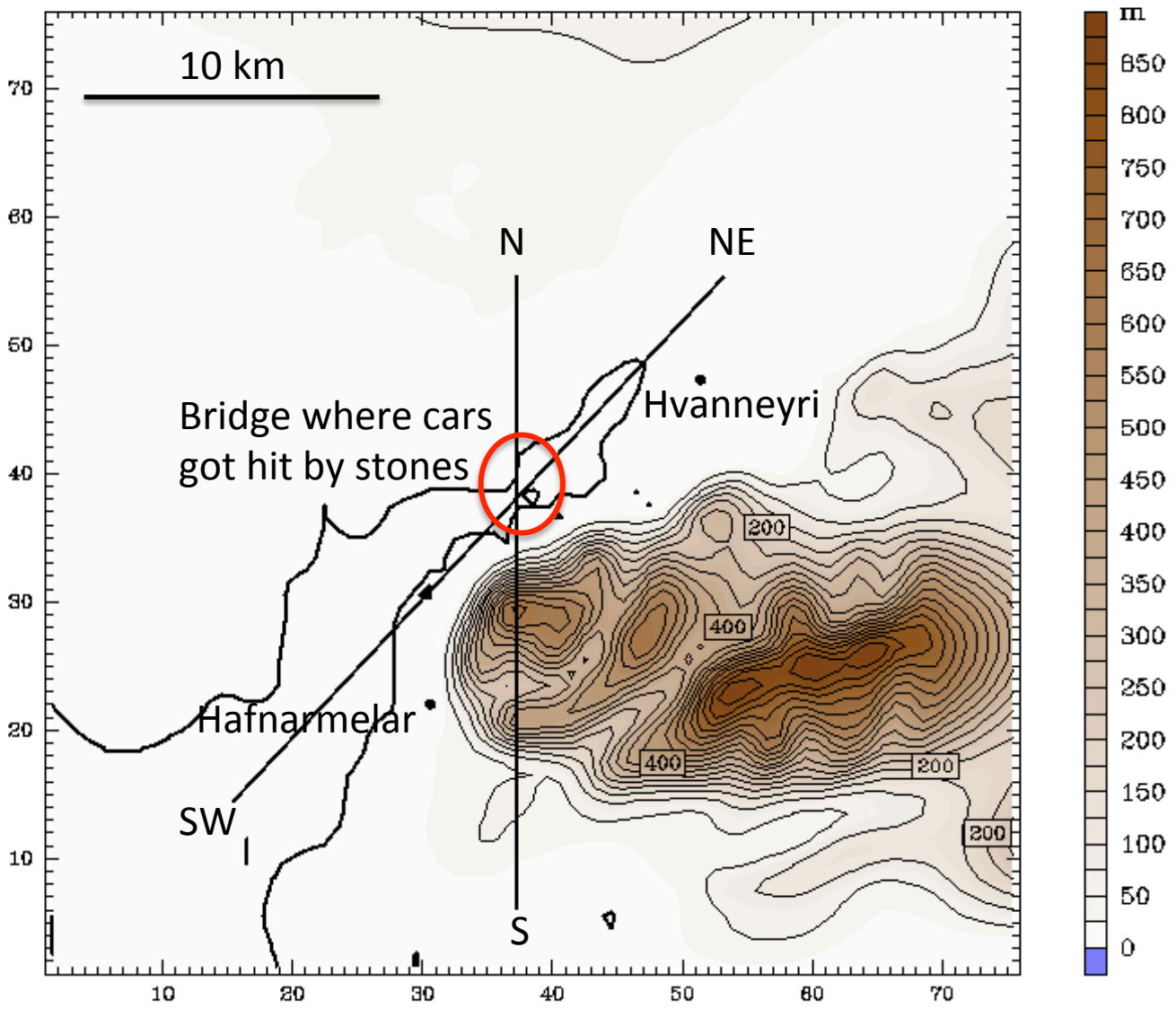


Obs. gusts
Sim @ 450m res.
Obs. 10min mean

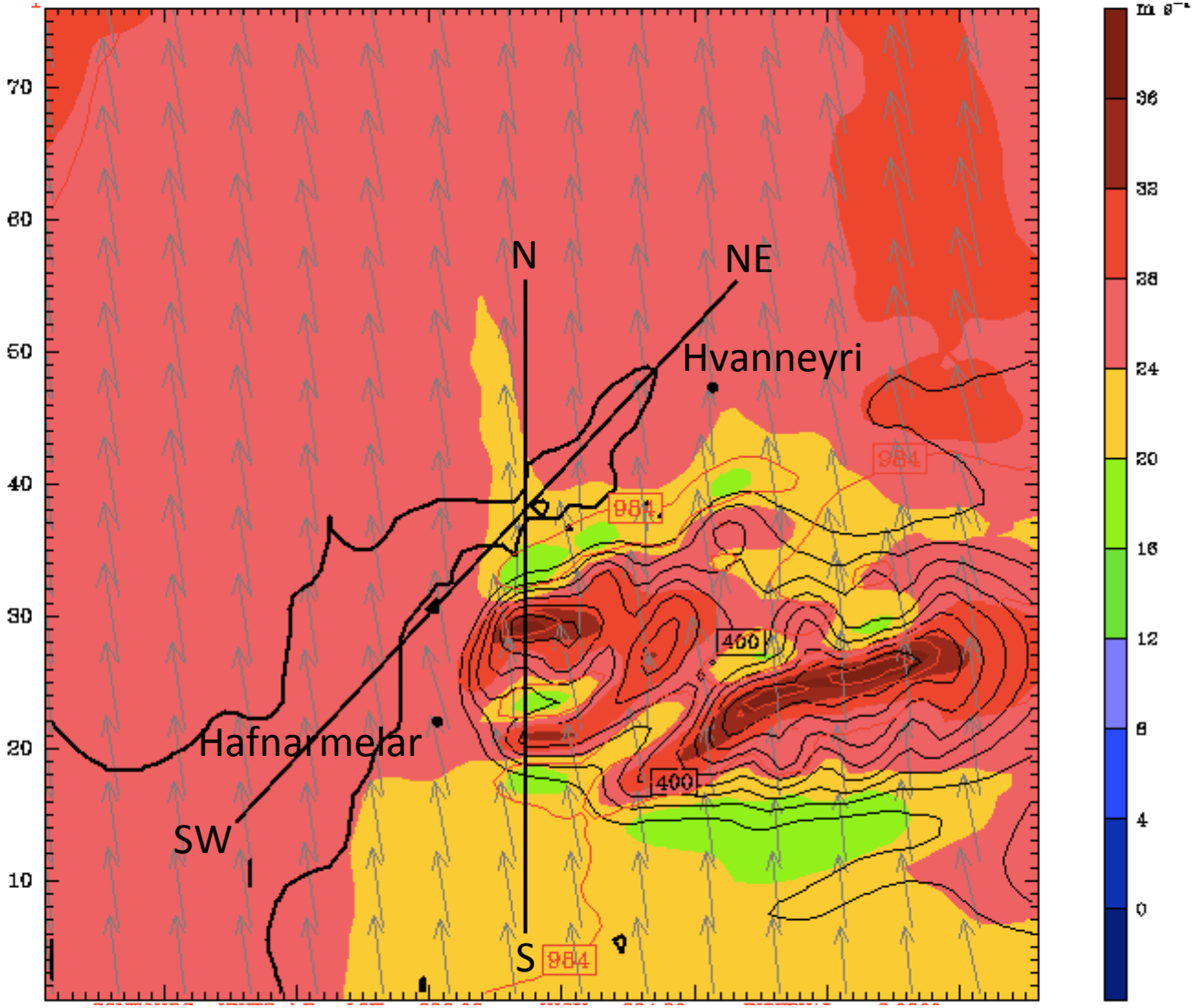


For most of the time, wind direction at location Hvanneyri (N) is 20-30°more to the west, compared to Hafnarmelar (W)

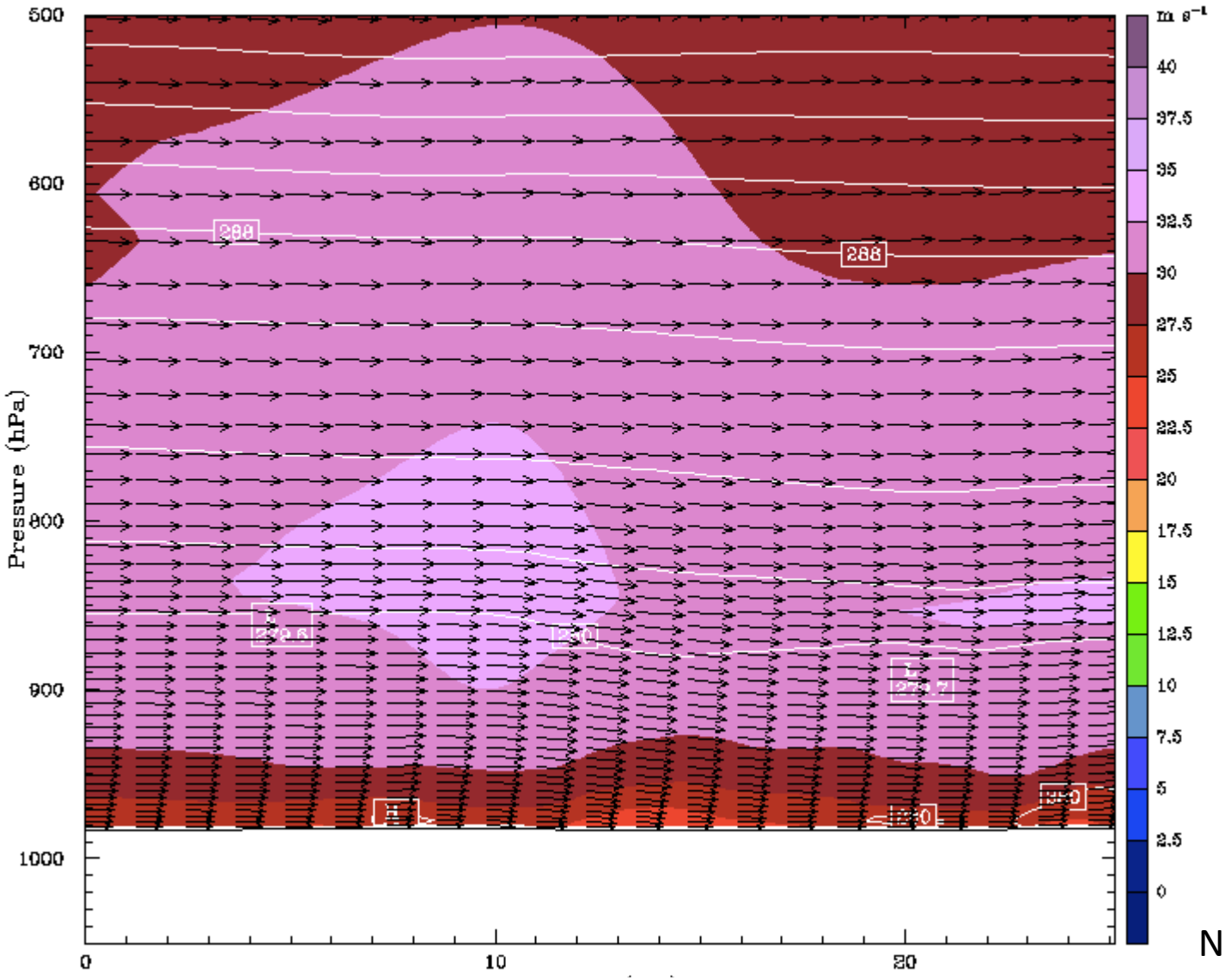
LES domain – 450m resolution



Simulated sfc winds @ 18:00hrs

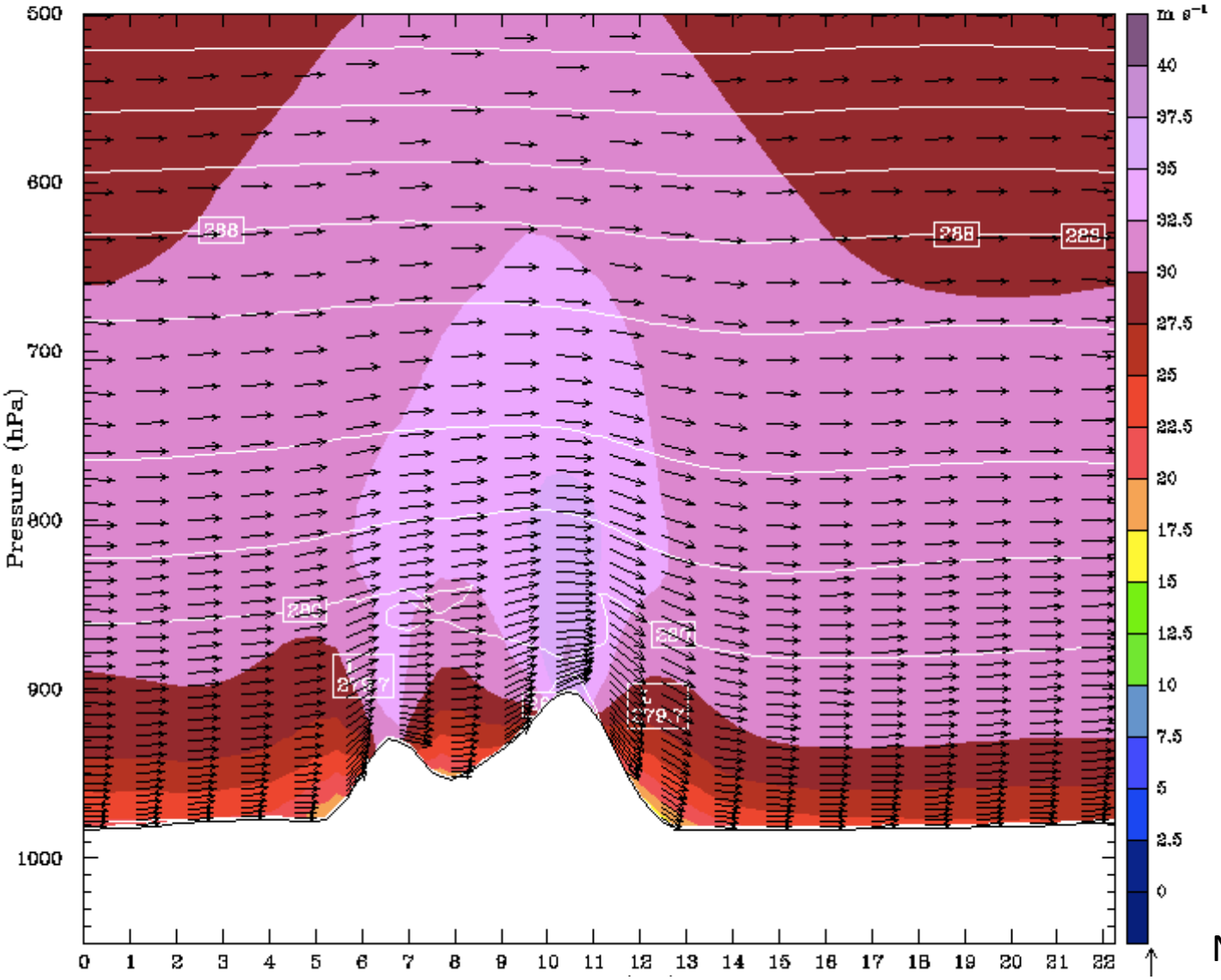


Cross sections @ 18:00hrs



SW NE

Cross sections @ 18:00hrs



S

N

Summary

- WRFLES simplifies running the WRF model in LES mode
  - Work was funded by the University of Bergen
  - Open source solution
    - Will be made available to the community soon
- The “moving stone” weather of April 2011
  - Strong winds observed and simulated
  - Neutral upstream conditions, yet a clear pattern that resembles blocked flow