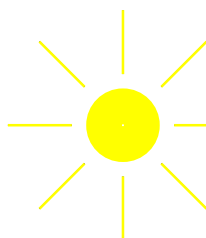


Wind gust forecasting in MM5

Hálfván Ágústsson and Haraldur Ólafsson

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Veðurstofa Íslands, Reiknistofa í veðurfræði and Háskóli Íslands



Reiknistofa í veðurfræði

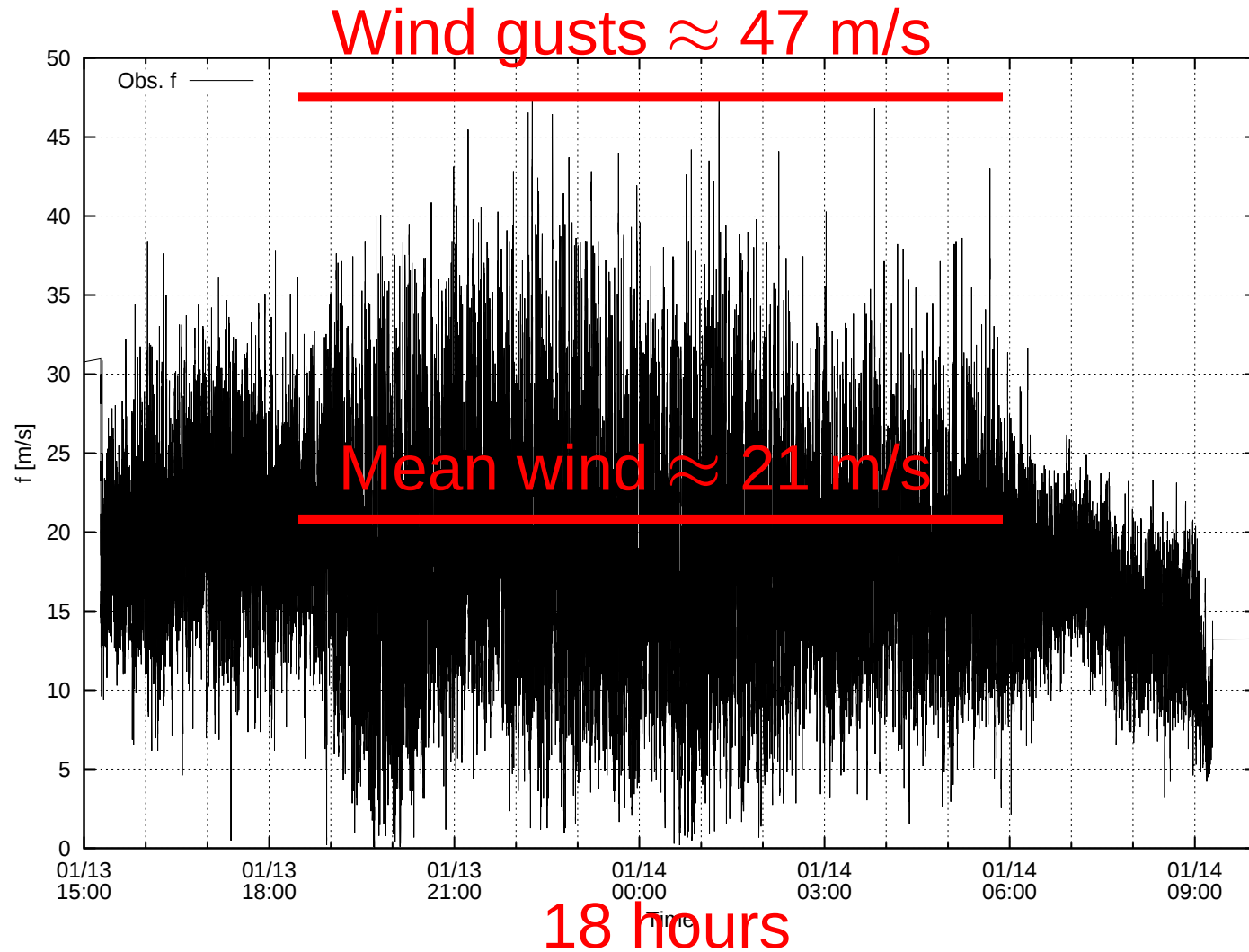


HÁSKÓLI ÍSLANDS

Capturing the mean wind
correctly is very nice...

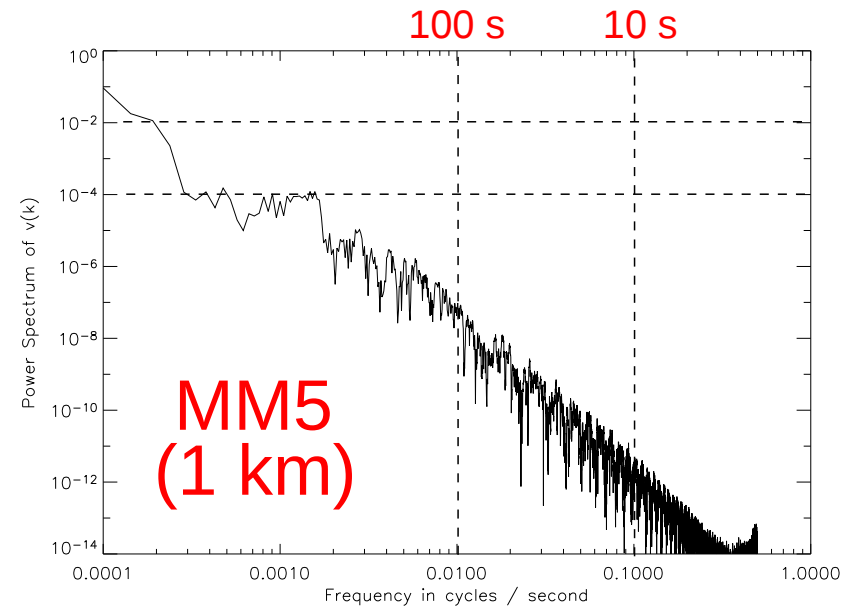
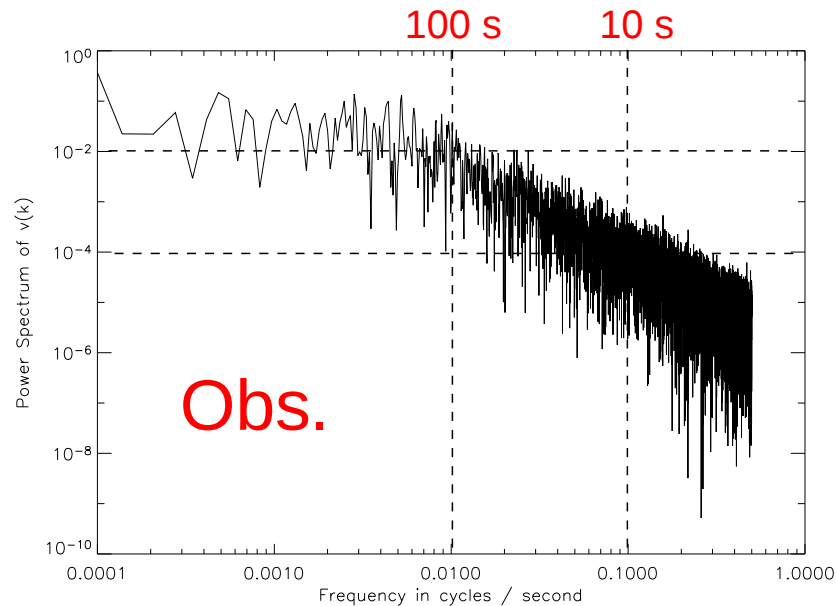
But the wind gusts are
causing the damage

Observed windspeeds in a windstorm

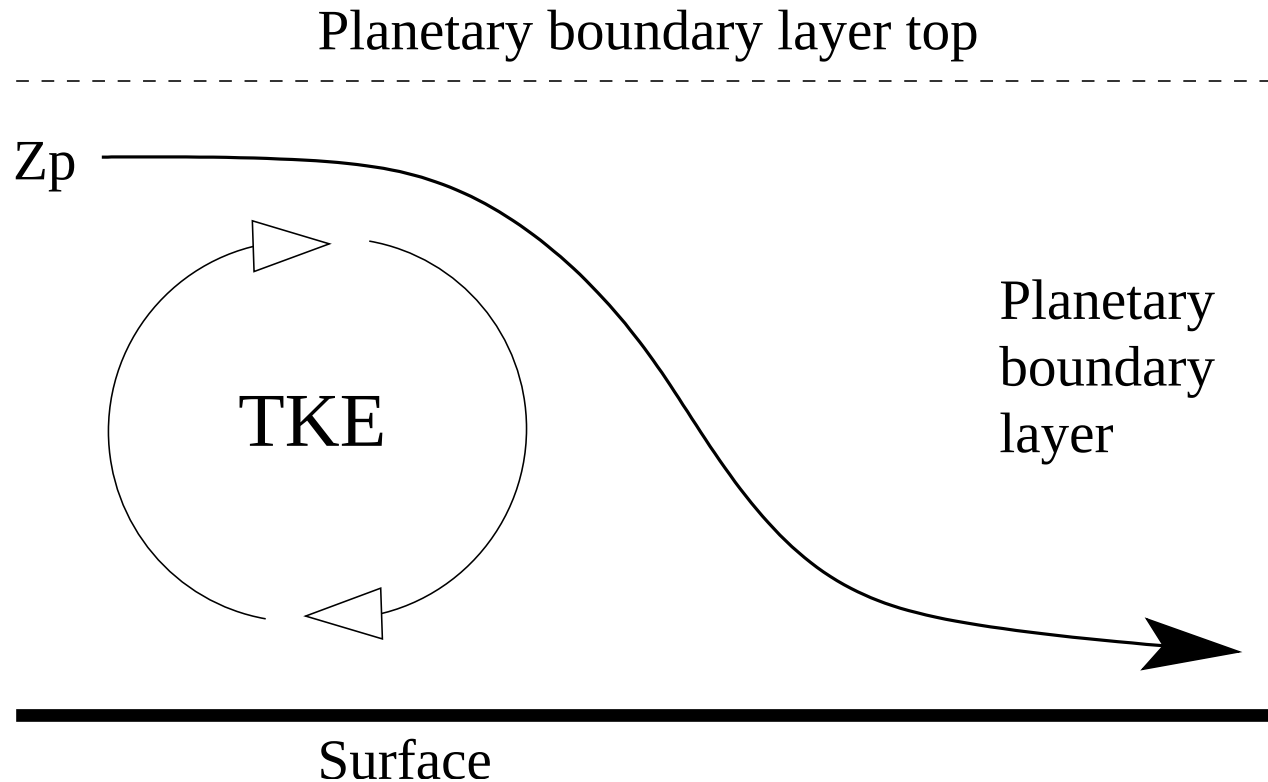


Wind power spectrum

In spite of short time steps and high resolution, the numerical models do not give us the gusts...

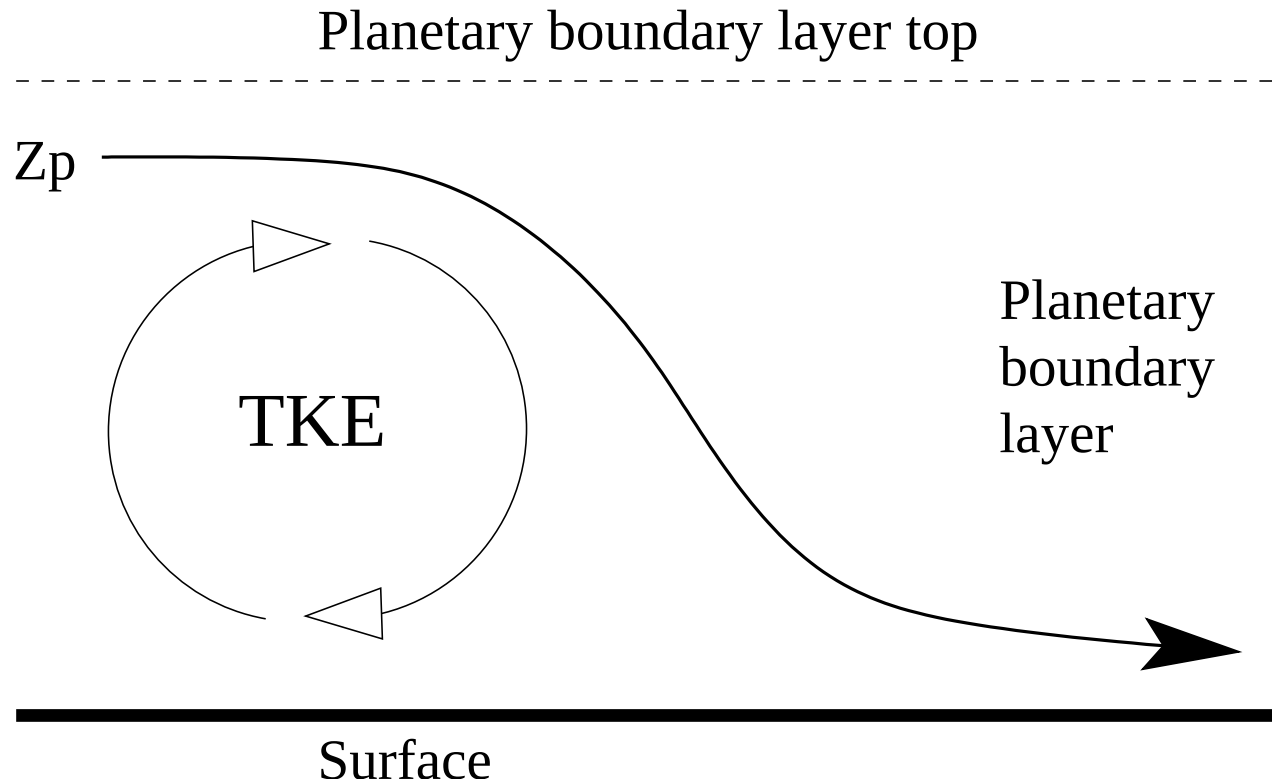


How are the gusts estimated?



We use a method based on considerations of TKE, buoyancy and mean wind in the PBL (Brasseur, 2001) to estimate wind gusts in MM5

How are the gusts estimated?



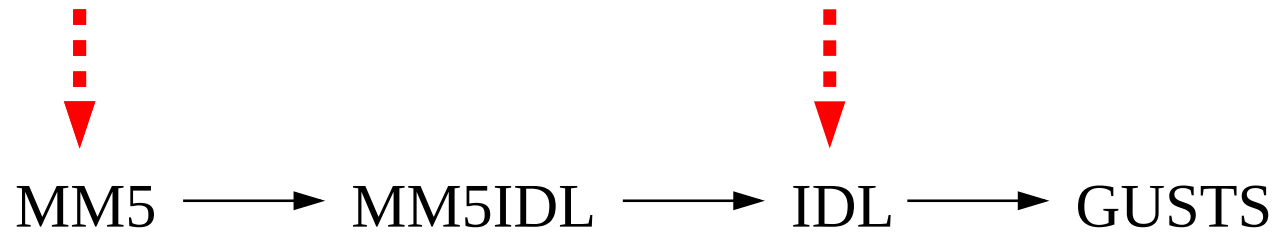
$$\frac{1}{Z_p} \int_0^{Z_p} TKE(z) dz \geq \int_0^{Z_p} g \frac{\Delta\theta_v(z)}{\Theta_v(z)} dz,$$

Mean TKE vs. buoyancy

How is the method implemented?

Horiz. res. 9, 3 and 1 km
Boundary cond. ECMWF
40 vert. levels, ETA PBL

Post-processing with
gust prediction method

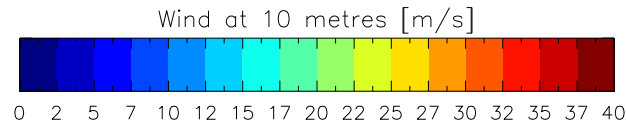


Interface between MM5
and IDL. Available at
<http://www.os.is/~or/rev>
(Rögnvaldsson and
Rögnvaldsson, 2004)

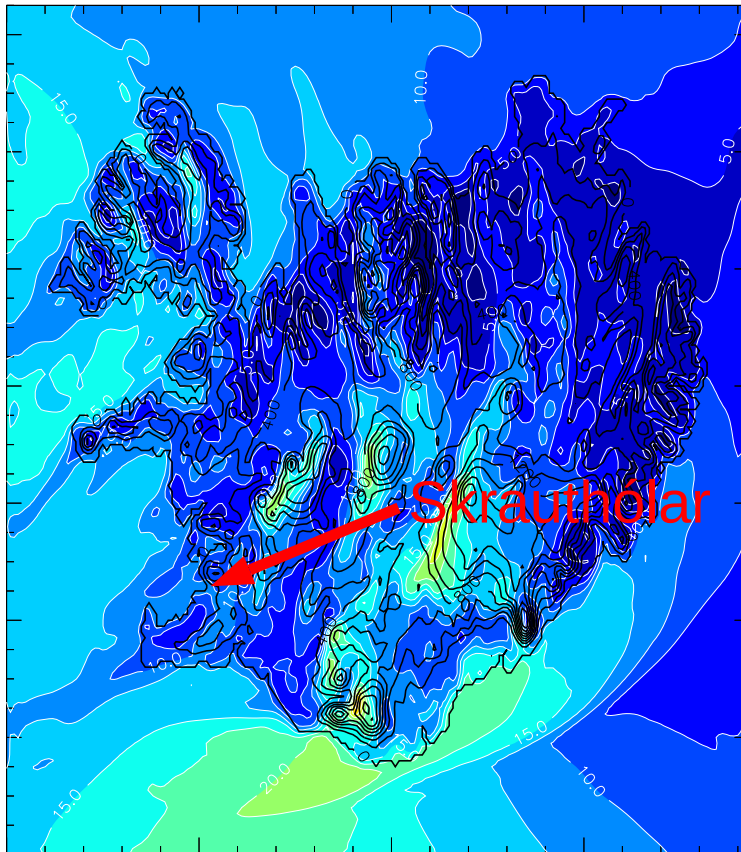
Estimated wind gust and
upper and lower bounds
at MM5 output times

Poster 3.42, today

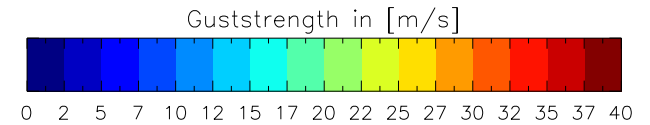
Easterly winds



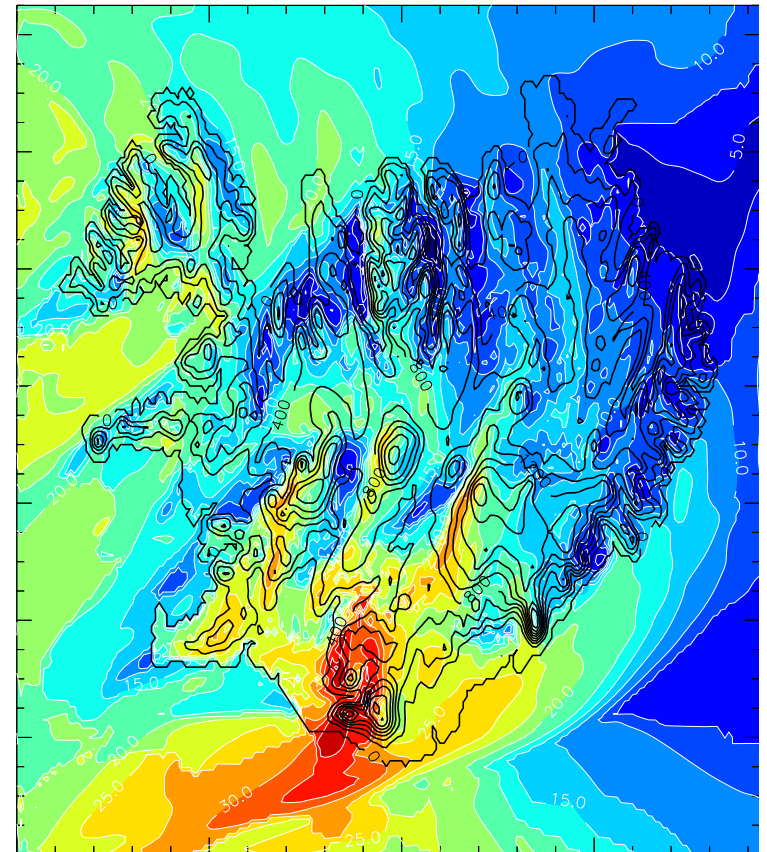
2005-03-23_15:00



Sim. mean wind at 10 m

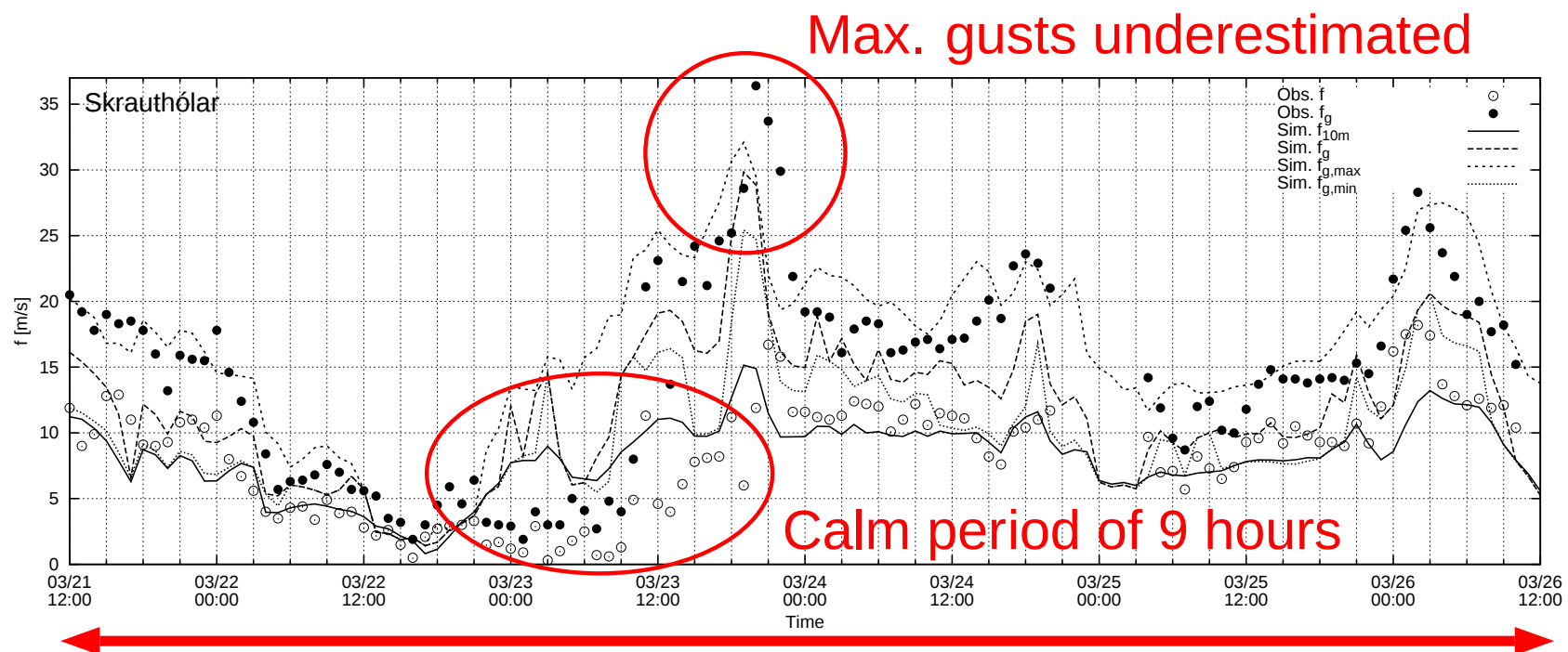


2005-03-23_15:00



Sim. surface gusts

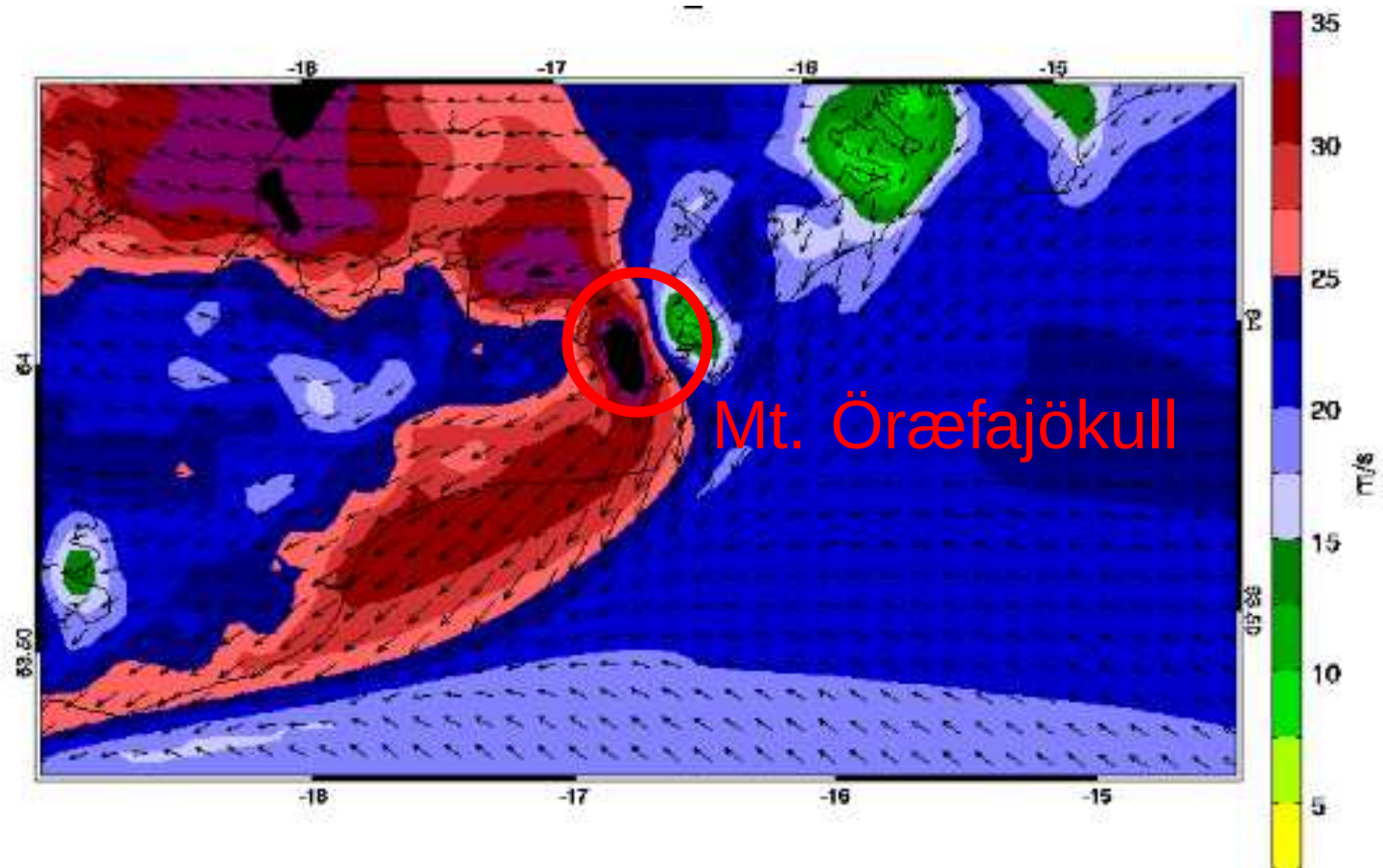
Wind at Skrauthólar



6 days

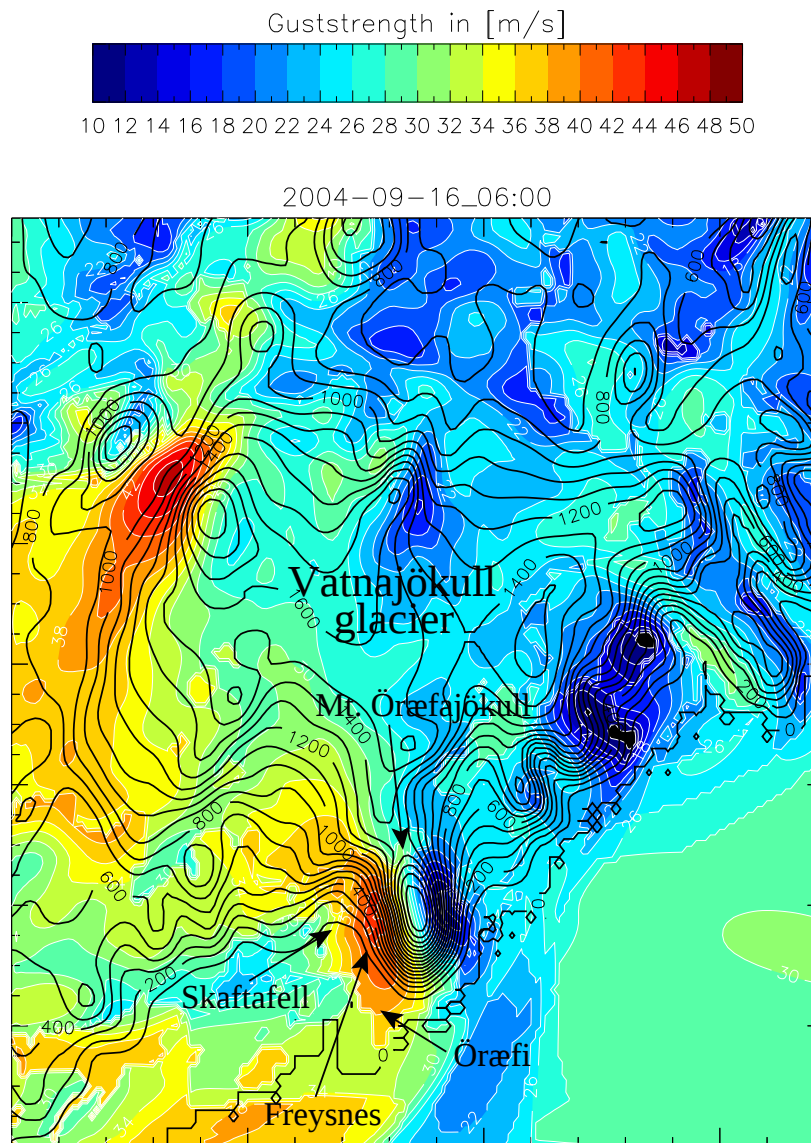
Obs. f	○
Obs. f_g	●
Sim. f_{10m}	—
Sim. f_g	- - -
Sim. $f_{g,max}$	· · ·
Sim. $f_{g,min}$	· · · · ·

Easterly windstorm in SE-Iceland



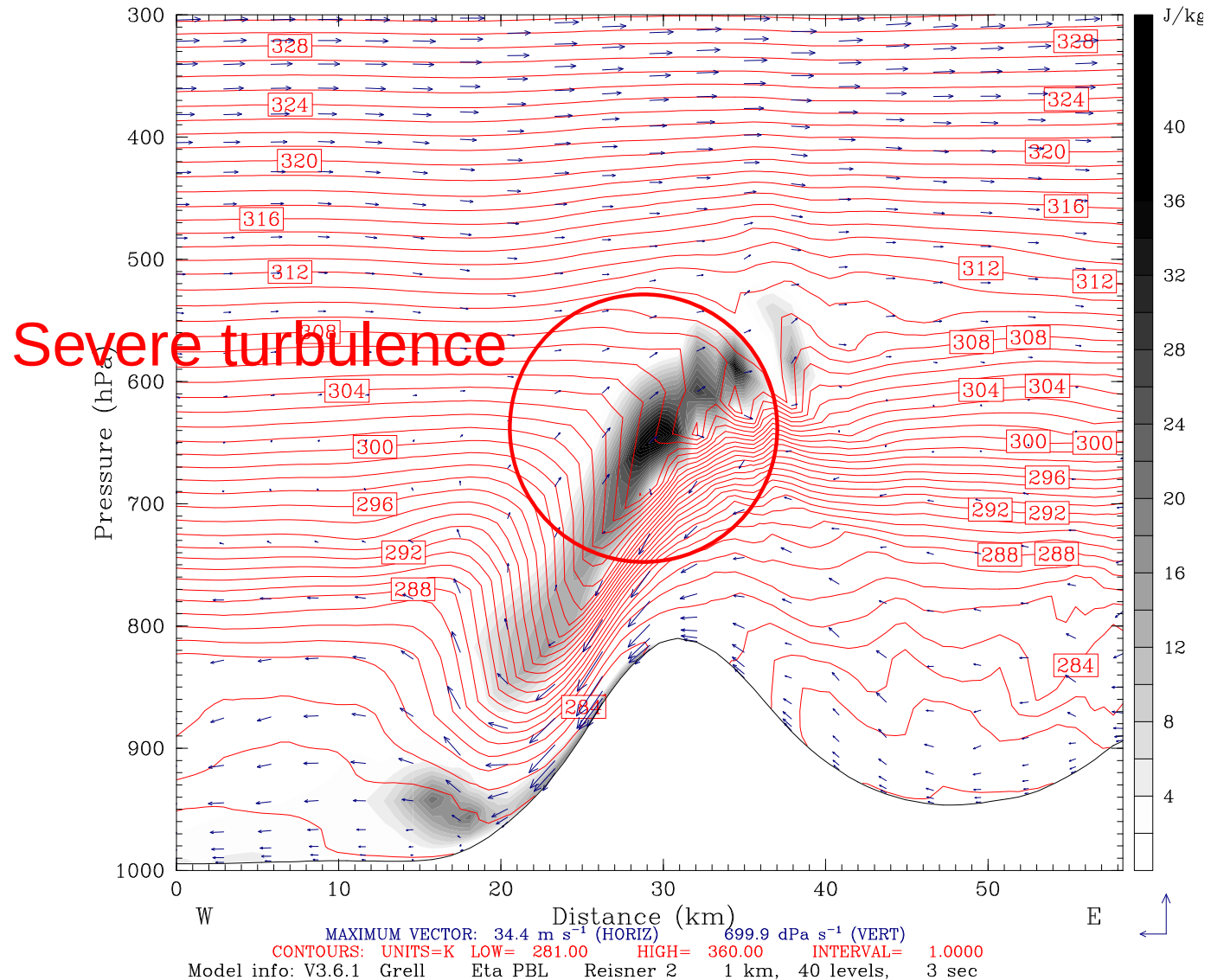
Estimated wind at 10 m from the operational HRAS-system, running MM5 at 9 km horiz. res.

Estimated guststrength



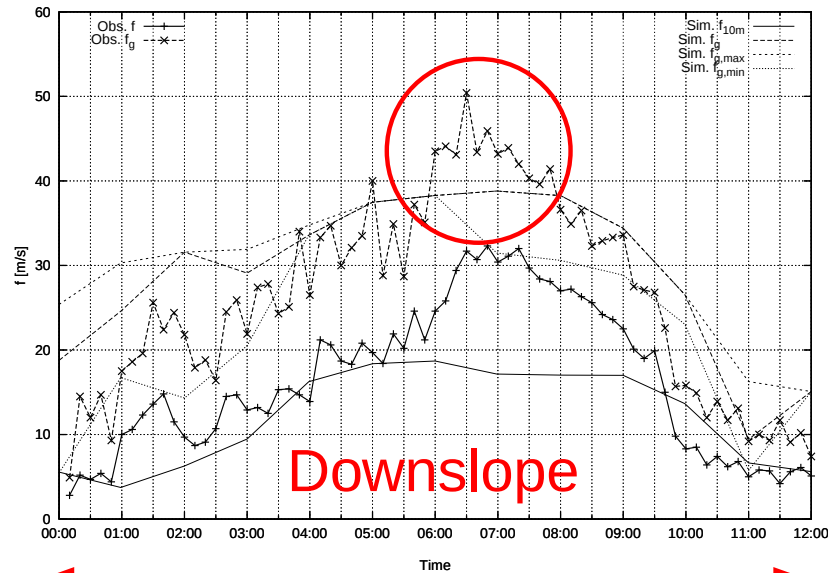
1 km res.

Breaking mountain wave



Wind at Skaftafell and Öræfi

Skaftafell

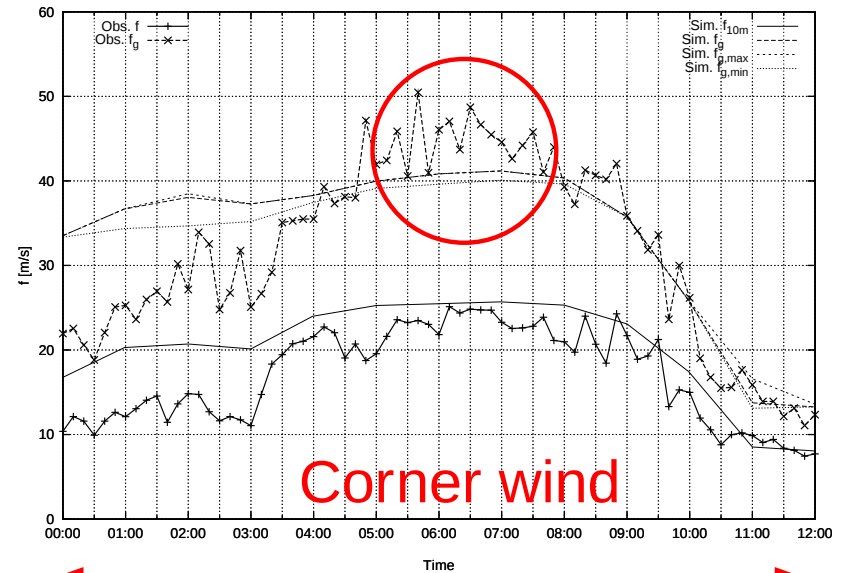


Downslope

12 hours

Obs. f —+—
Obs. f_g --x--

Öræfi

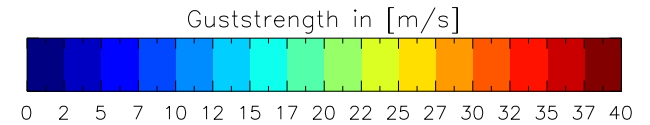
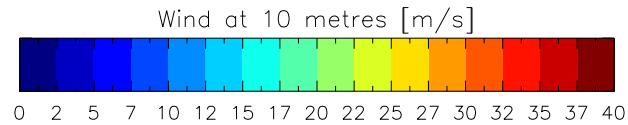


Corner wind

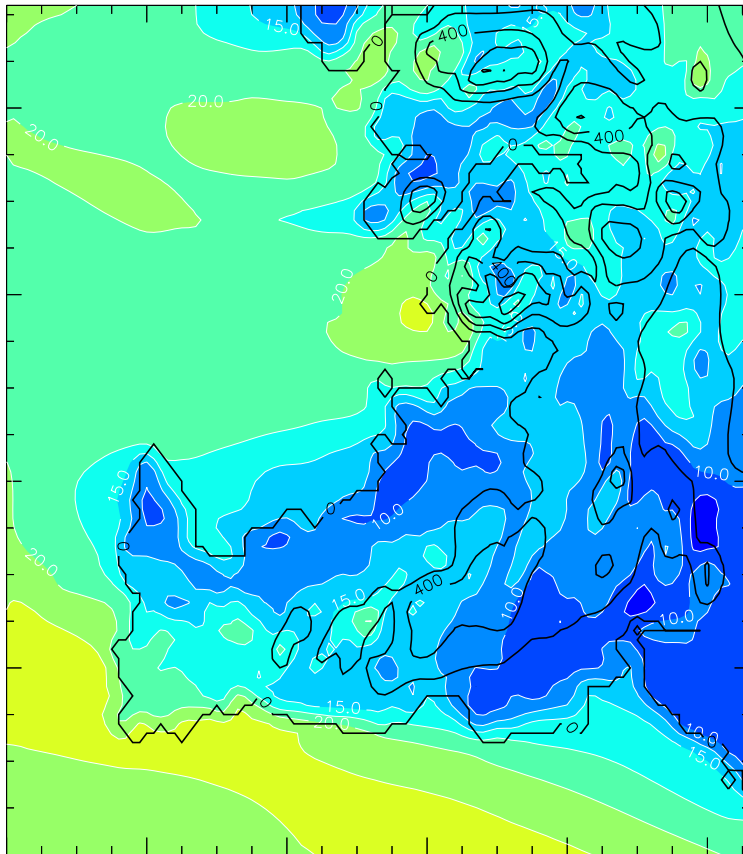
12 hours

Sim. f_{10m} —
Sim. f_g - - -
Sim. $f_{g,max}$ - - -
Sim. $f_{g,min}$. . .

Easterly winds

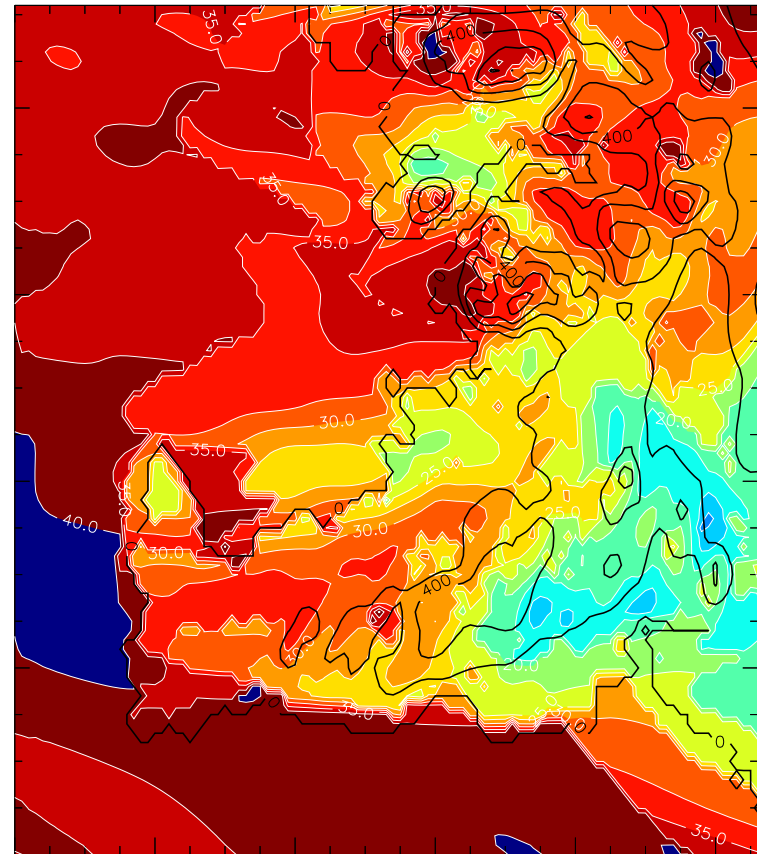


2005-01-13_23:00



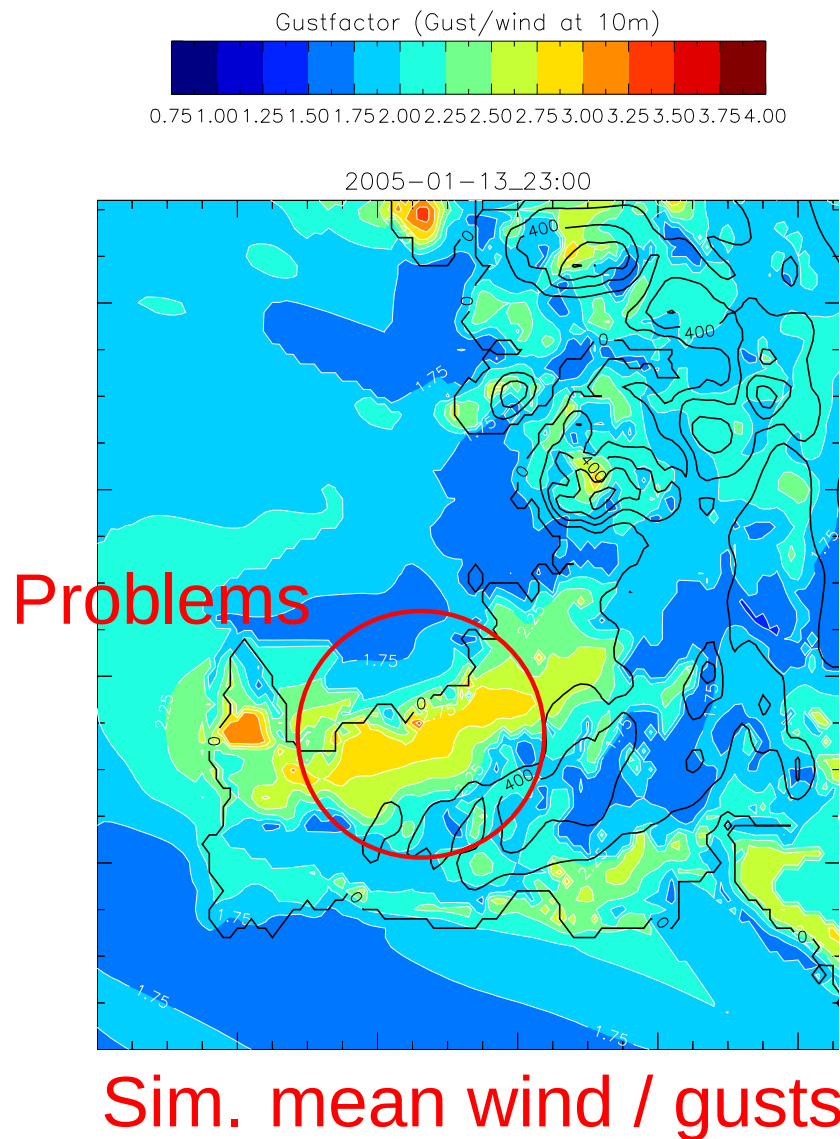
Sim. mean wind at 10 m

2005-01-13_23:00

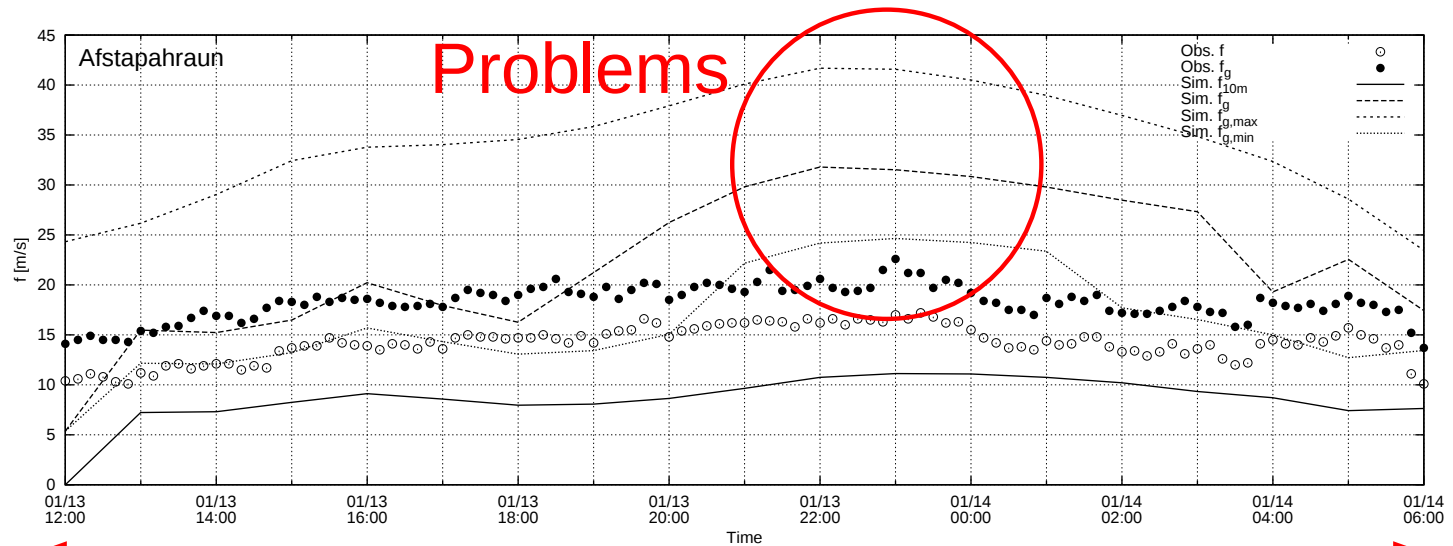
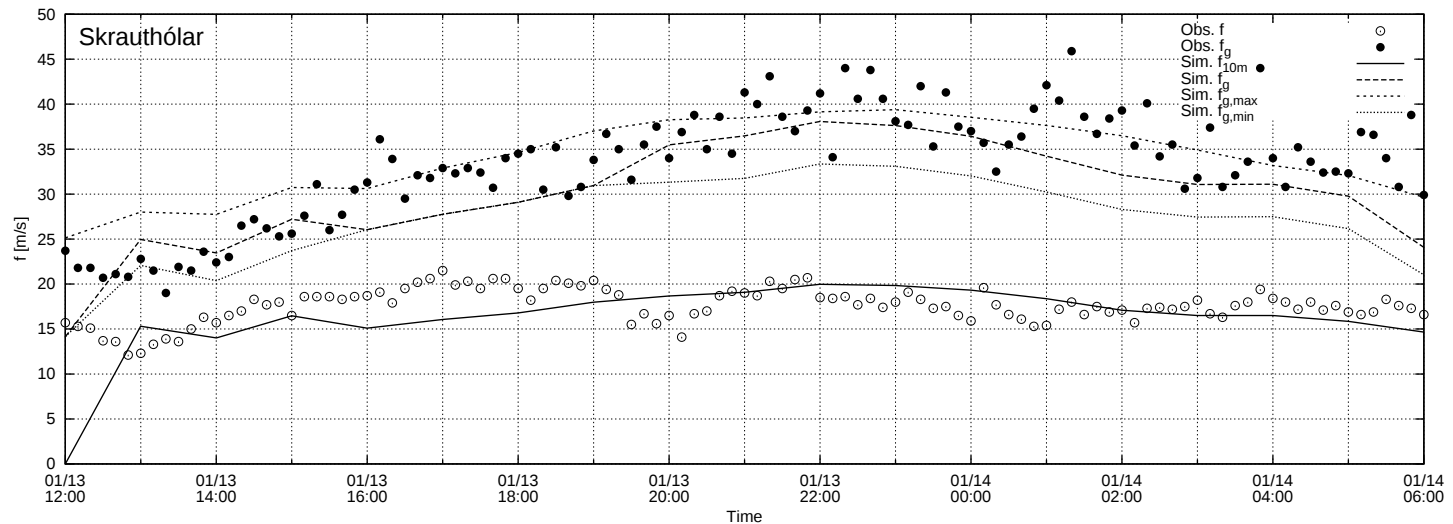


Sim. surface gusts

Easterly winds



Wind- and guststrength



Problems

18 hours

Summary and main conclusions

- Gusts are estimated in MM5 with the method of Brasseur (2001), using IDL and MM5IDL (which is freely available).
- The method appears to work quite well, in particular when mean winds are correctly reproduced
- Maximum gusts in downslope windstorms and even corner winds are underestimated
- Gusts appear to be systematically overestimated in mountain wakes, presumably due to excessive TKE.

Things to be done...

- A different PBL scheme might reduce the TKE and thus reduce the excessively strong gusts in the mountain wakes
- Test higher vertical resolution
- Improve the performance in relation with maximum gusts in downslope windstorms