Relating Forest Damage Data to the Wind Field from High Resolution RCM Simulations: Case study of Anatol Passing Sweden in December 1999

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The storm Anatol 3rd of December 1999
In December 1999 three severe storms, nicknamed Anatol, Lothar and Martin, passed over Europe. Together they caused 170 deaths, and vast damage to forests, infrastructure, and further impacted upon society at a total cost over 180 bn Euro.

The first storm, Anatol, passed over southern Scandinavia causing vast damage to the forests in Denmark. In Denmark, more than 1 year of timber production was lost. Likewise, locally the forests in Scania, the southernmost province of Sweden, were uprooted and totally destroyed. In total 5 million cubic metre timber were damaged in southern Sweden (Nilsson et al., 2004). Observations of maximum wind speed at Falsterbo, in Scania, rated Anatol the most violent storm since 1967.

Wind intensity – forest damage

In December 1999, the centre of the low-pressure system developed west of Ireland on the 2nd of December, passed Scotland, and further deepened over Jylland, Denmark on the 3rd at 1900 UTC with an associated core pressure of 953 hPa. The radiosounding shows a strong low-level jet in the 700-900 hPa layer. During the evening the system moved in over southern Sweden (Fig. 1) before fading over Latvia and Russia the next day.

Conclusions

The simulated maximum wind speed generally reaches above 30 m s\(^{-1}\) in Scania except at the northern boundary. In the eastern part the simulated maximum winds peak at 33 m s\(^{-1}\) approximately where the station "S" is located. The time evolution of the wind field simulated with CRCM (Poster B to the right) is very similar to the HIRLAM reanalysis (Fig. 1). Simulated maximum winds captures observations in realistic manner although the peak wind in point observations (Fig. 3) is underestimated by up to about 5 m s\(^{-1}\). Standard deviation of the wind indicates the maximum wind speed variability which has some connection with the topographical features of the region as well as with forest damage areas.

Future work

A more detailed analysis of the time evolution of the wind field with the focus on the exchange of momentum between different levels in relation to orography. With high resolution initial and boundary data one or two of the nesting steps can be omitted. This should further improve the result.

Simulation of the January 2005 hurricane Gudrun, that passed over a forested part of the country and destroyed 70 million cubic metre timber, will enable us to analyse the relationship between maximum winds and windthrow in more detail.

References
Goyette, S., G. Brunasse, and M. Beniston, 2001: Application of a non-hydrostatic nested CRCM including a gust parameterisation (Goyette et al., 2001; 2003).