Geophysical Research Abstracts, Vol. 7, 07659, 2005
SRef-ID: 1607-7962/gra/EGU05-A-07659

Application of a mesoscale meteorological model to investigate general flow structures caused by topographic structures in storm situations

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Contrary to small scale storm events like thunder storms or rather convective processes in general, winter storms are affecting large areas. An analysis of sounding data of stations in southern Germany shows, that a slightly stable to stable thermal stratification is prevailing at such strong wind events. Therefore, convective processes can be neglected and the wind field will be modified mainly by the interaction with the ground. To consider both, the synoptic impulse as well as the processes in the boundary layer, simulations with the mesoscale model KAMM2 are performed to investigate especially the influence of the orography on the wind field.

Measured data and theoretically calculated values with linear flow theory, available for simple topographic structures like smooth hills or valleys, is compared with the model results to evaluate the model output. Various modifications for the case of strong wind simulations were necessary to optimize the model runs and will be presented.

To consider the different behaviour of the wind due to the kind of topographic form, idealised topographic basic-structures were defined and its impact on the wind field were analysed separately. Simulations over real Terrain were also performed, so that the general conclusions of the simulations with the idealised topography can be confirmed.

The results can be used to provide more precise data for future or historic storm events to construction engineers than it is provided i.e. by the European Standard on wind actions. The advantage of a mesoscale model is its manageability of steep terrain. Also for agriculture, critical sites can be estimated. In correlation with a statistical loss

model, the predicted damages can be proved by simulating historical storm events, for which insurance data is available.