NWP research in Austria

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1. Operational forecast system

Operational limited area weather forecasts in Austria are made using version AL12 of the ARPEGE/ALADIN modelling system. Horizontal resolution is 10 km, the number of levels in the vertical is 31 (increased to 37 in 03/2002), domain size is ~1300x1100 km, covering central Europe. The model is spectral, run in hydrostatic mode, with a semi-implicit, semi-Lagrangian advection scheme. Initial and boundary conditions are taken from the ALADIN-LACE run at CHMI in Prague, which in turn is coupled to the global ARPEGE model. A modified Bougeault-type scheme is used for deep convection, a first-oder closure for turbulent vertical transports, and the ISBA (Interaction Soil-Biosphere-Atmosphere) scheme is used to represent surface processes. Coupling frequency is 6 hours in both cases. Integrations up to +48 hours are performed twice a day. Hourly analyses of surface fields are produced based on regional synop observations using optimum interpolation. Point verification statistics and verification of areal precipitation are computed quasi-operationally.

2. Research

a. Diurnally forced convection over land

A common problem in many NWP models is the timing of convective precipitation related to the diurnal cycle over land. Models typically show a too early onset of locally forced deep convection and associated rainfall. This behaviour was confirmed by case studies of mountain convection in the Alps under conditions of negligible synoptic forcing, using radar data for verification (Haiden, 2001). Whereas considerable forecast skill was found with regard to mesoscale variability of precipitation, onset time was consistently underestimated. Part of the problem is attributed to the mostly diagnostic character of current deep convection schemes. Therefore a prognostic scheme, allowing for some ‘memory’ of the intensity of convective updrafts, is being tested (Gerard, 2001). Preliminary results indicate that the delayed onset of convection in the new scheme is on the order of 1 hour, which is not sufficient to completely remove the timing bias.

b. Orographic precipitation downscaling

The prediction of flash flooding requires very fine scale precipitation forecasts both in space (~1 km) and in time (10 min). Because of nonlinear catchment response, peak runoff may be significantly understimated if LAM-scale rainfall rates are assumed to be homogeneously distributed across the catchment. The effect of both dynamical downscaling and statistical downscaling is tested on selected MAP events using the hydrological model WaSiM-ETH. Besides providing insight into the precipitation-runoff process in alpine catchments this method also offers a means of verification for LAM precipitation forecasts. Ahrens et al. (2001) found that the ALADIN-VIENNA operational resolution (9.6 km) gives rather good results in these cases. Increasing the resolution to 4 km does not show systematic improvement.

c. Scale-dependence of nonhydrostatic effects

The ARPEGE/ALADIN system allows for a straightforward switch between hydrostatic and nonhydrostatic versions. Based on theoretical analyses and idealized experiments it is generally acknowledged that non-hydrostatic effects must be taken into account on a resolution of 10 km and below. However, little is known about the effects of non-hydrostatic dynamics on actual model skill over realistic topography, in a quasi-operational model setting. A study is under way to perform a systematic evaluation of such effects for model resolutions down to 2.5 km (Stadlbacher, 2001).

d. Statistical and dynamical adaptation

In Nov 2002, the 2nd SRNWP Workshop on Statistical and Dynamical Adaptation will be held in Vienna. Presentations are invited about research in NWP statistical adaptation (MOS, PPM, Kalman filtering), dynamical adaptation, and neural network methods. The program also includes research on the use of ensemble predictions in statistical/dynamical post-processing.

References

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