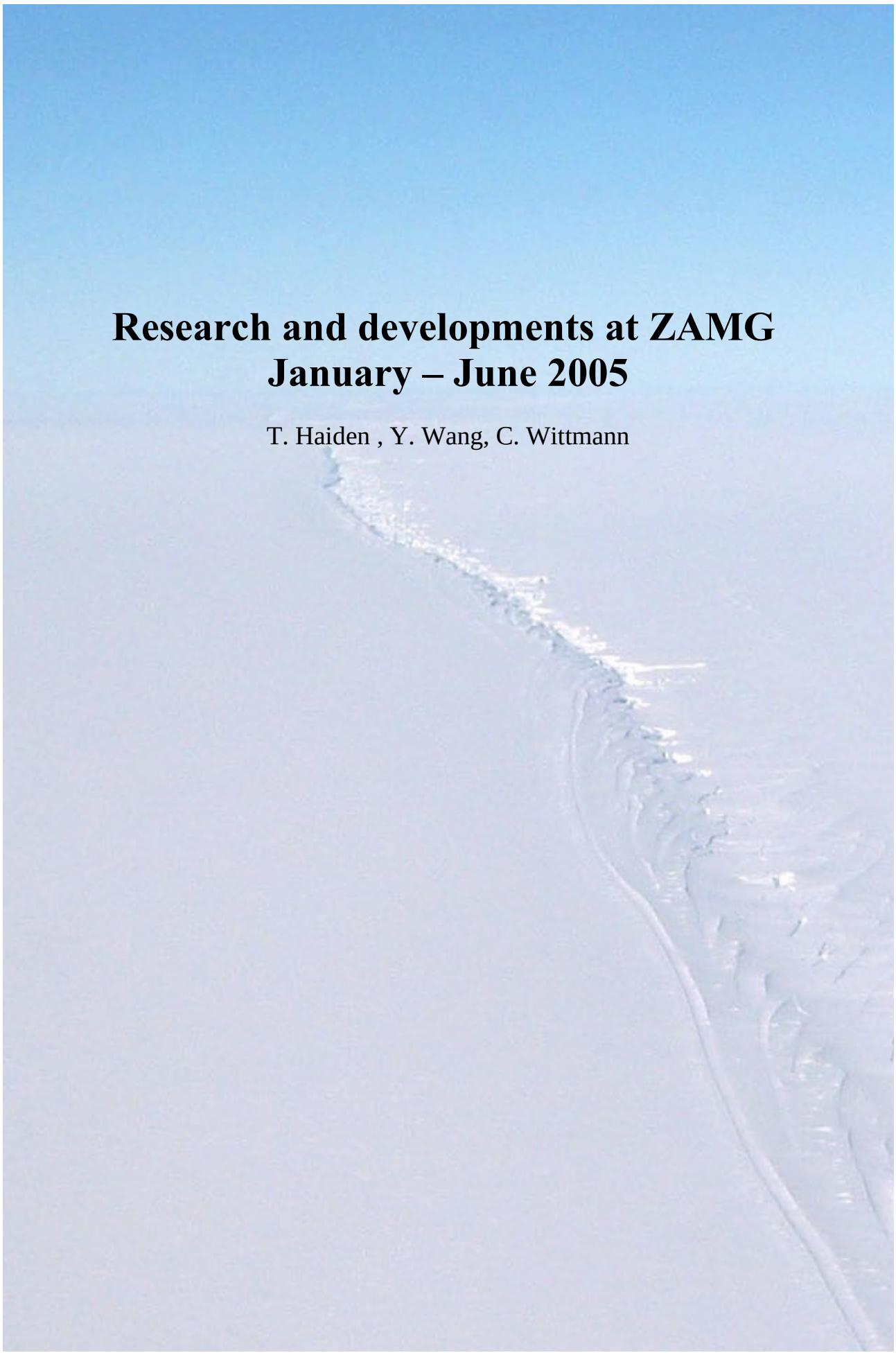
# Research and developments at ZAMG
# January – June 2005

T. Haiden , Y. Wang, C. Wittmann



## 1. Orographic precipitation (operational scheme vs. Lopez-scheme)

For a strong precipitation event in the Southern Alpine area in Austria during November 2000 a comparison between the operational precipitation scheme and Lopez-scheme was made. As shown in other case studies, there are several regions in the south of Austria (especially in Carinthia) which show a significant high percentage of cases where ALADIN (operational) tends to underestimate the precipitation amounts during southerly flows.

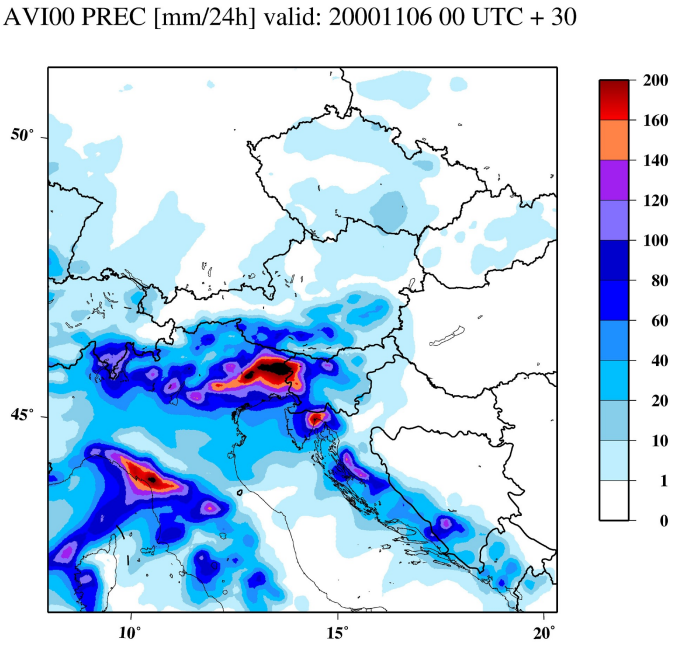



Figure 1 : ALADIN 24h precipitation forecast 20001106 06 – 20001107 06 UTC (operational scheme).

In comparison with the observed pattern (Figure 2) it can be seen that the operational scheme (Figure 1) shows a rather unrealistic precipitation pattern in some downwind areas, creating over-pronounced upslope precipitation amounts and significantly underestimated amounts on the lee side (Gail valley, Drau valley and the Klagenfurt bassin).

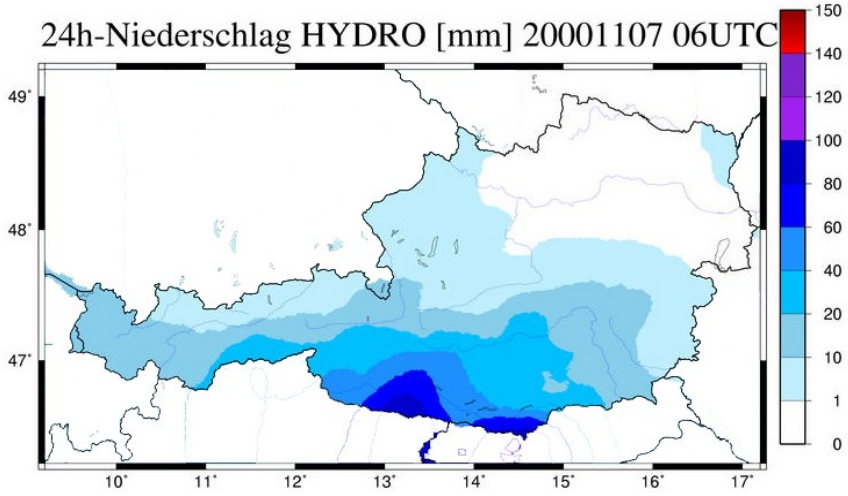



Figure 2: Observed 24h preci %pi tation for the period 20001106 06 – 20001107 06 UTC (interpolated hydrological station data).

In Figure 3, the pattern obtained with Lopez scheme is shown. Apart from the fact that the peak values in the upslope areas in Italy and Slovenia are reduced, it is particularly striking that the precipitation fields in the named regions on the down-wind side get closer to reality. So, for this present case, the advection of cloud water (and precipitable water) to lee side can be handled in a more realistic way with Lopez scheme, whereas the diagnostic scheme produces an overestimated and unrealistic downwind/upwind precipitation contrast.

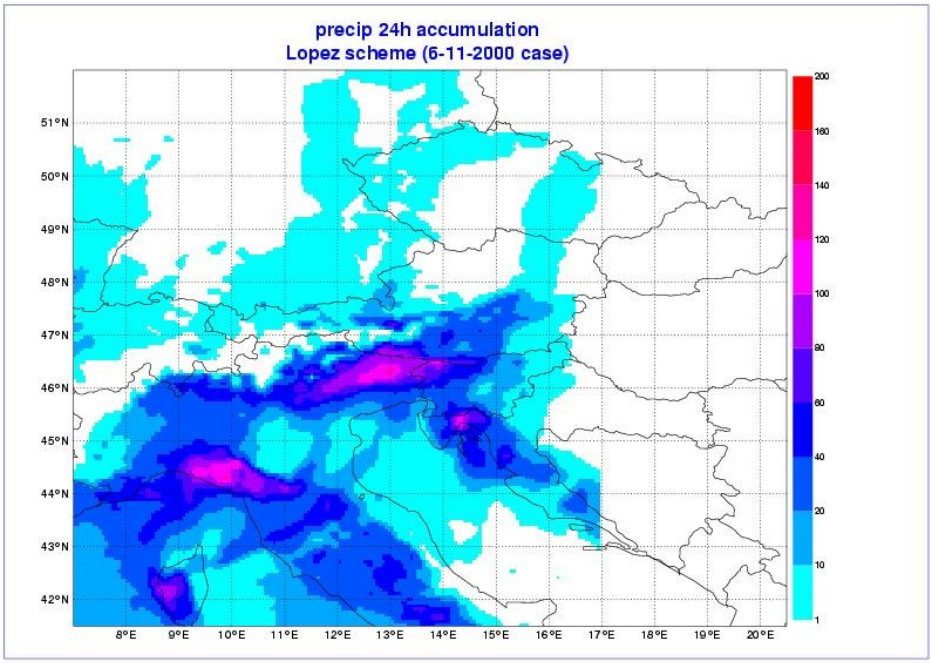



Figure 3: 24h precipitation forecast for the period 20001106 06 – 20001107 06 UTC (Lopez-scheme). By Yves Bouteloup, Météo-France.

*More information: christoph.wittmann @zamg.ac.at*

## 2. Development of the ALADIN Limited Area Ensemble Forecasting system LAEF

Efforts have been put on the development of different initial perturbation techniques, like breeding, ETKF (Ensemble Transform Kalman Filter) and ET (Ensemble Transform). Several experiments with breeding, coupled with control forecast as LBC (lateral boundary condition) and with ARPEGE EPS members as LBCs, and directly downscaling the ARPEGE EPS forecast have been carried out. The performance of the different methods and different LBCs has been investigated for the 2 weeks period of the Lothar Storm. Some results are encouraging. The above mentioned ETKF and ET methods have been implemented at ZAMG. The first results of ETKF and ET are being studied.

*More information: wang@zamg.ac.at*

## 3. Study on ALADIN physical parametrization over complex topography

Several physical parametrization schemes in ALADIN have been tested over mountainous area, which are Lopez microphysics scheme, modified Kann-Fritsch deep/shallow convection, prognostic TKE scheme. The focus has been put on the precipitation forecast. One of the most intense rainfall episodes during the Mesoscale Alpine Programme, MAP IOP2b (19-20 Sept. 1999) was used for all the experiments. The preliminary conclusion of this case study are summarized in the following:

(1) In general, all the simulations have recognized the major features of the mesoscale structure, but many disagreements with the observations exist, especially in the region with complex topography.

(2) The statistical verification scores of the experiments show that the Lopez microphysics scheme together with the modified Kann-Fritsch deep convection scheme bring the most benefits on the ALADIN precipitation forecasts over complex mountainous area.
(3) Some spurious strong precipitation on the wind ward side of the mountain has been removed by the Lopez scheme. There are also some signs for improvement of the rainfall forecast on the lee side of the mountain.
(4) In the valley region, like Po valley, it is difficult to find any improvement. In the regions of steep mountain like Lago Maggiore area, all the schemes generalize the rainfall well compared with the observations.
(5) The modified Kann-Fritsch convection scheme alone doesn't improve the forecast, but it makes the convection more organized than the Bougeault scheme.
(6) The prognostic TKE parametrization has little impact on the precipitations for the MAP IOP2b case.
(7) Longer time step lets less interaction between dynamics and physics in the model, which impacts on the precipitation forecast.

*More information: wang@zamg.ac.at*

## 4. Development of the ALADIN-based nowcasting system INCA

The analysis and nowcasting system INCA uses ALADIN forecasts (00 Z, 12 Z) as a basis for improved forecasts issued on a high temporal frequency (15min for precipitation, 1 hour for other fields) and high spatial resolution (dx=1km, dz=100m). For temperature, humidity, and wind, 3D ALADIN forecast fields serve as a background on which corrections derived from comparison with observations are superimposed. In the case of precipitation and cloudiness, the forecast obtained by extrapolation methods is merged asymptotically with the ALADIN precipitation forecast. Major developments during the first half-year of 2005 include the kinematic downscaling of the ALADIN wind field from 9.6 to 1 km, using a relaxation algorithm under the constraint that wind observations at stations are (nearly) reproduced. The downscaling procedure is operationally producing a 3D wind field analysis and forecast every hour. Also under development is a visibility routine based on ALADIN humidity and cloudiness forecasts combined with MSG satellite data (fog product).

*More information: thomas.haiden@zamg.ac.at*

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