Use of ECMWF - EPS Forecasts for Risk management at the Avalanche Services in Austria

Michael Staudinger, Avalanche Warning Centre Salzburg. michael.staudinger@land-sbg.gv.at

Weather services provide Austrian avalanche services with observational data, meteorological forecasts and probabilities for the different parameters that concern avalanche activities. Avalanche warning centres combine these data with their own nivological observation, maintenance and control system.

Two different time scales are involved with the avalanche forecast and consulting:

During low risk periods the avalanche services hand out warnings for a short time range. In these cases situations warnings for tourist activities are published on a day to day basis.

In cases of high danger and therefore extreme risk not only backcountry skiers, but also normal tourists using main traffic connections across the Alps are concerned. Necessary measures of the authorities range from the closure of ski runs to the evacuation of whole villages or resort areas. Evacuation actions under these circumstances have to be planned well in advance due to the limited availability for visible helicopter flight conditions.

Therefore different scenarios for mid-term planning of the evacuation measures have to be evaluated. Meteorological forecasts for time periods up to day +7 improved considerably in the last years and can be used for risk management considerations. Ensemble Forecasts e.g. of the European Medium Range Weather forecast Centre consider the uncertainty of the initial condition of a given weather situation and show 32 different solutions for the most important meteorological parameters. This proofed to be a very helpful tool to determine the probabilities for different synoptic developments over the Alps under the extreme conditions of the 1998/99 winter.

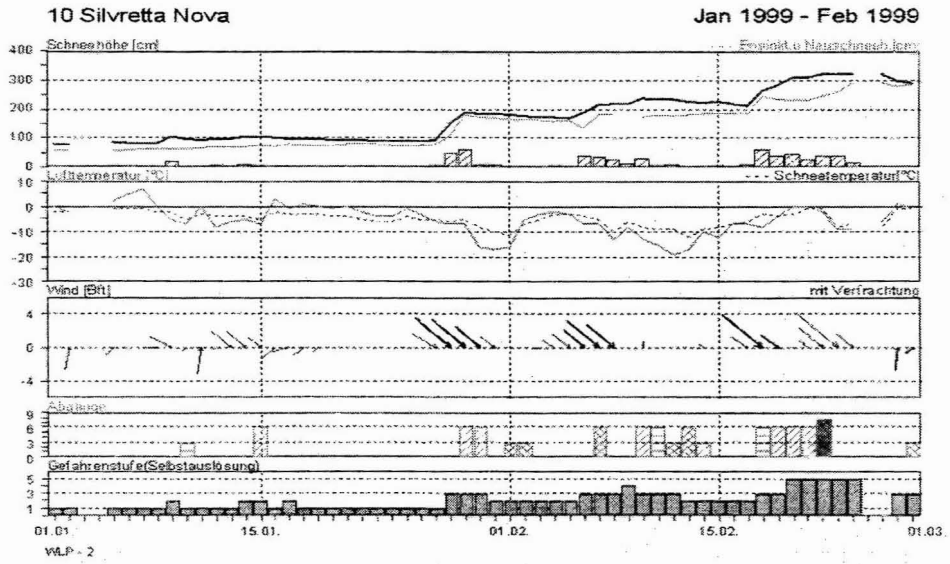

Fig.1 Development of snow cover, temperature, wind and avalanche activities at Silvretta (near Galtür)

The Winter 1998/1999

The winter period 1998/1999 and especially February 1999 was in many parts of the Austrian Alps unusual concerning some of the weather elements, but proofed to be extreme when certain combination of parameters were considered together.

As a result avalanche conditions were comparable to the catastrophic winter seasons 1951 1954, and 1970. As in these years dozens of casualties occurred within a few days.

Most avalanche accidents occurred during the second half of February, when a parts of a village in the western part of Tyrol were wept out by a powder snow avalanche and the main north – south traffic highway connection in Mid Austria was closed for several days due to large avalanche damages.

Fig 1. shows the development of the nivological relevant parameters in February in an altitude of 2000m in Vorarlberg, near the site where the accidents of Galtür and Valzur happened. Towards the 23rd of February total snow height rose to nearly 320cm, the sum of accumulated fresh snow reached within a 10 day period 274 cm.

The temperature in snow and the atmosphere rose from the 18th of February onwards from –12° towards –2° with an advection of maritime air masses from northwest and dropped with the passage of a cold front after the 23rd. Wind speeds at this partly sheltered site were low, but snow erosion and therefore enhanced avalanche risk had been observed around the 22nd of February.

Comparison to EPS forecasts

The starting point of the 15th February for ensemble members for the western regions of Austria show mostly a general warming for the period of the 21st to the 24th of February and a subsequent cooling after the 24th. (Fig. 2)

Precipitation in these days does not exceed 3mm in the 12 h intervals, even if a few of the members go as far as 8mm for 12h periods.

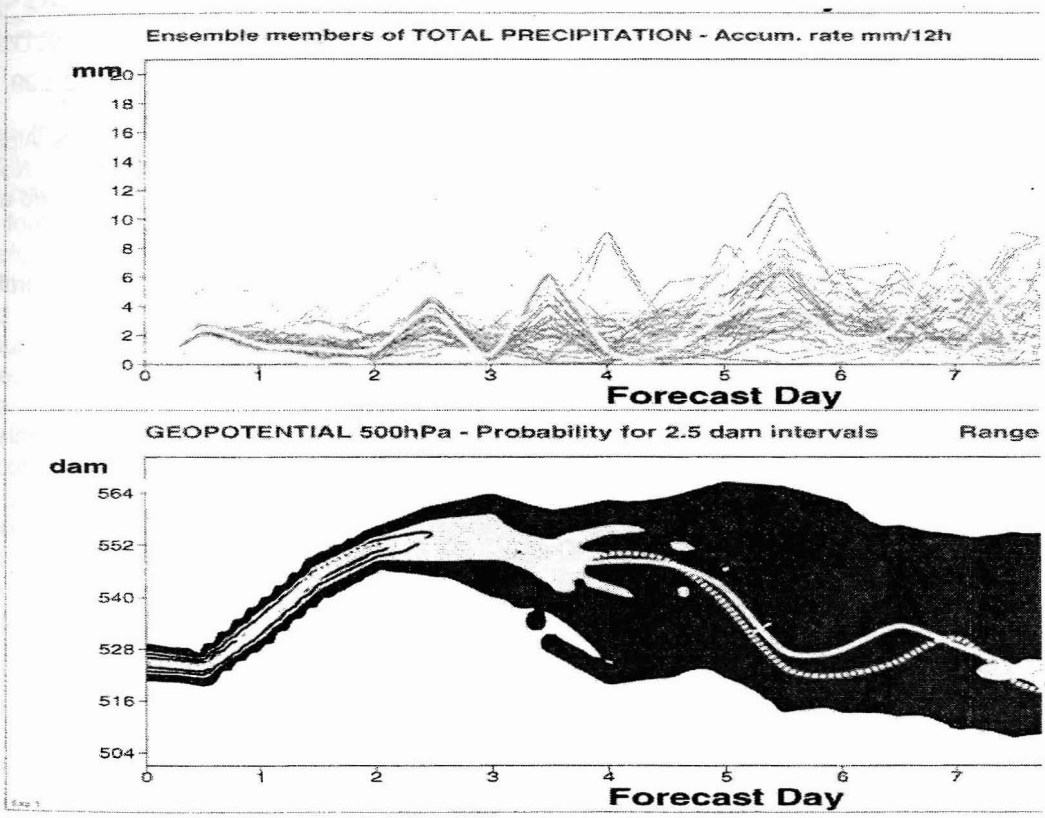

Fig. 2: Development of precipitation, temperature, geopotential, Austria/West, 15.2.1999 +8 days

If the clusters are considered for the 168h range the 15th of February 12h situation gives a slightly anticyclonic westerly flow for the 22nd of February for the operational run, but cluster 1 and cluster 3 show already a trough over Central Europe with a more or less pronounced cyclonic flow over the Alps as a possibility not to be neglected. (Fig. 3)

A significant synoptical change, that exceeded considerably the variations from the day before was to be observed from the 17th February onward, when the ECMWF model got more into phase with the actual cooling, that was to be observed with a cold front passage around the 23rd of February. A

deepening trough was lying now in the forecasts and later on in reality over Poland and the northern parts of the Alps were in the left exit region of the jet stream. Both temperature and precipitation become more realistic from this day on and forecasted daily sums of precipitation exceed 12 mm for the 23rd (day 6) and the two days after. (Fig. 4)

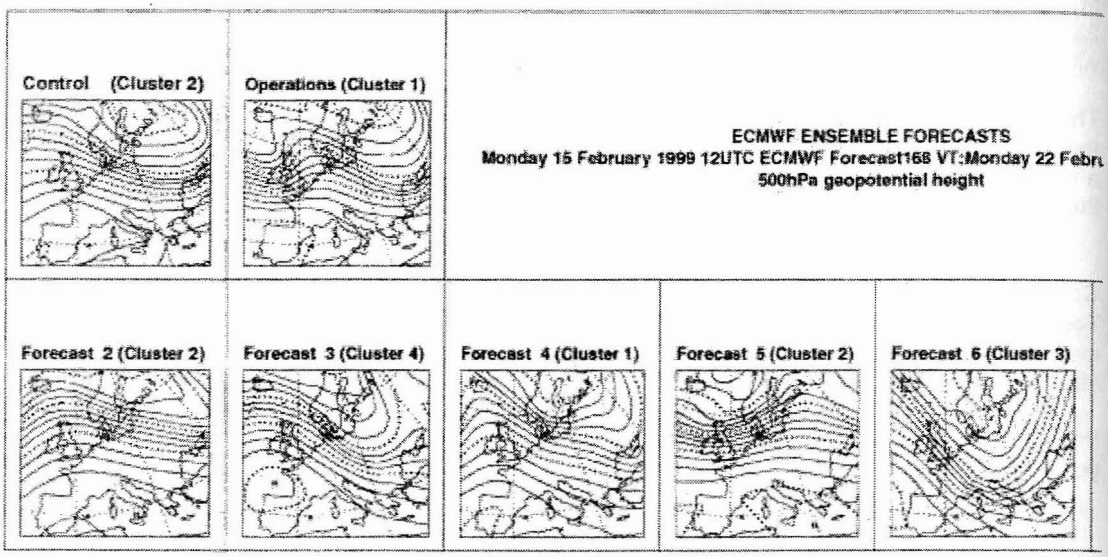

Fig.3: Clusters of 500hPa distribution for Central Europe. Starting day 15.2.99, forecast for 22.2.99

The phase from 23/00 to 15 UTC was characterised by intensive Stau clouds in the whole Alpine mountain area and by the propagation and superimposition of a comma cloud spiral from the North Sea across the Alps. At 23/15 UTC (Fig. 5), the merging and interaction between the Stau cloud and the cloud spiral provided some very precipitation intensive features.

At that point warnings were given to the community of avalanche services, that conditions concerning temperature and snowfall would further deteriorate in possibly extreme scenarios.

Fig. 5 Satellite (IR + weather features) for 22.2.1999 15:00 Central Europe

Conclusions

Despite the sudden changes from day –8 to day –6 the use of the EPS products helped forecasters considerably to develop scenarios of probability in the mid range forecast for applications that require complex combinations of parameters as a meteorological input.