P8.11 CASES OF EXTREME OROGRAPHIC PRECIPITATION IN ICELAND

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1. INTRODUCTION

On 10 January 2002, a new Icelandic precipitation record of 293 mm in 24 hours was set at Kvísker, Southeast-Iceland. (Fig. 1) The previous record was 243 mm that were observed in the same place on 1 October 1979. The 2002 record is greater than the corresponding records in

- Norway (230 mm in November 1940)

- Denmark (169 mm in July 1931)

- Britain (279 mm in July 1955)

- Faeroe Islands (182 mm in September 1998)

and only slightly less than the newly set record for

Germany (312 mm in August 2002)

Here, the two extreme events are described by weather maps showing the most relevant atmospheric parameters and the trajectories of the airmasses that produced the extreme precipitation.

2. THE 1979 RECORD

At 9 UTC on 1 October 1979, a 24 hour accumulated precipitation of 243 mm was observed at Kvísker. Figure 2 shows a composite mean of the situation of the atmosphere during this period. The figure shows that at relatively barotropic vortex is situated to the southwest of Iceland and Southeast-Iceland is embedded in southeasterly flow in the lower as well as upper troposphere. There are strong winds at 925 hPa and they are at least partly due to a low level temperature gradient. The simulated precipitation field does not indicate extreme precipitation in Iceland.

The trajectories (Fig. 4) indicate that the airmass has been advected rapidly from about 53°N and 15°W to Iceland in 24 hours. The advection is almost parallel at low and middle tropospheric levels.

3. THE 2002 RECORD

At 9 UTC on 10 January 2002, a 24 hour acumulated precipitation of 293 mm was observed at Kvísker. Figure 3 shows a composite mean of the atmospheric situation during this period. At both upper and lower tropospheric levels there is a trough south of S-Greenland and a relatively high pressure southeast of Iceland and Iceland is embedded in strong southwesterly flow. There is a strong low level temperature gradient parallel to the flow and there is some advection of warm airmass towards Iceland at 850 hPa. There are high values of simulated precipitation extending from South-Iceland towards southwest.

The trajectories (Fig. 5) indicate that the airmass has been advected rapidly from 40-45°N and 40°W to Iceland in only 24 hours. The advection is almost parallel at low and middle tropospheric levels.

4. DISCUSSION

The two cases have in common very strong advection of air from relatively low latitudes and strong low level winds. The synoptic scale precipitation is much less in the 1979 case, suggesting that local orographic lifting may be of greater importance than in the 2002 case. Interestingly, the 1979 case features low level winds from the southeast and in this case the Kvísker weather station is upstream of the mountains, while in the 2002 case, the winds are from the southwest and Kvisker is immdediately downstream of the mountain ridge extending south of the 2119 m high glacier Öræfajökull. The 2002 case has been simulated with the MM5 numerical model

at 3km horizontal resolution and the results (not shown) indicate that precipitation was much greater in the mountains than at Kvísker, which is located at sea level. The strong low level flows that these two cases of extreme precipitation at the foot of Icelands highest mountain have in common underline the importance of stong low level winds to obtain high values of precipitation in mountainous regions (Ólafsson and Rögnvaldsson, 2004; de Vries and Ólafsson, 2003).

5. ACKNOWLEDGEMENTS

The weather charts are based on reanalysis from NCEP, acquired through NOAA/CDC and the trajectories are calculated with the NOAA HYSPLIT model using NCEP data from the CDC. Information on precipitation records has beeen obtained from the respective national weather services.

6. REFERENCES

de Vries, M., and H. Ólafsson, 2003: Precipitation across a mesoscale mountain ridge – The Reykjanes Experiment (REX). Proc. Int. Conf. Alpine Meteorol. (ICAM), Brig, CH, May 2003. 4 p.

Ólafsson, H. and Ó. Rögnvaldsson, 2004: Connection between the low-level airflow and the increase of precipitation with height. Amer. Meteorol. Soc., 11th Conf. Mount. Meteorol., Mt. Washington, USA, June 2004

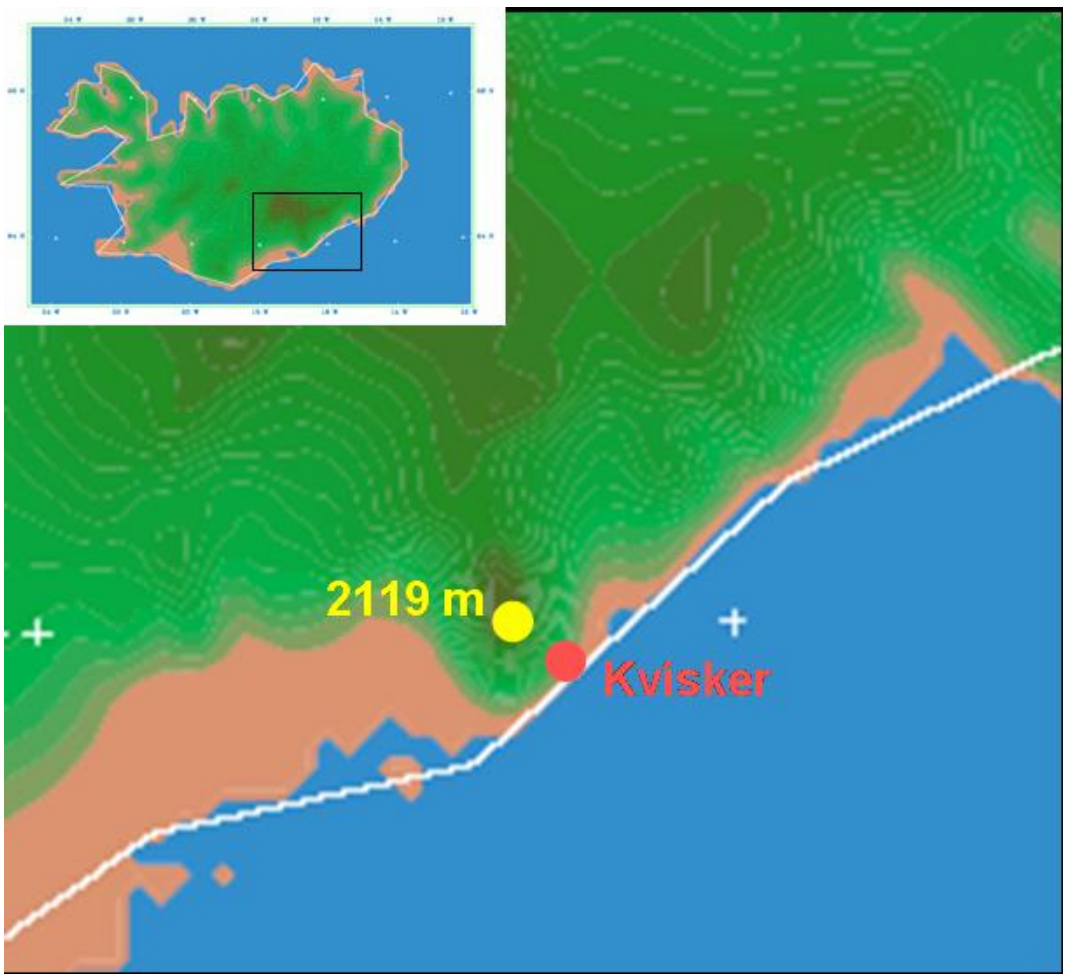
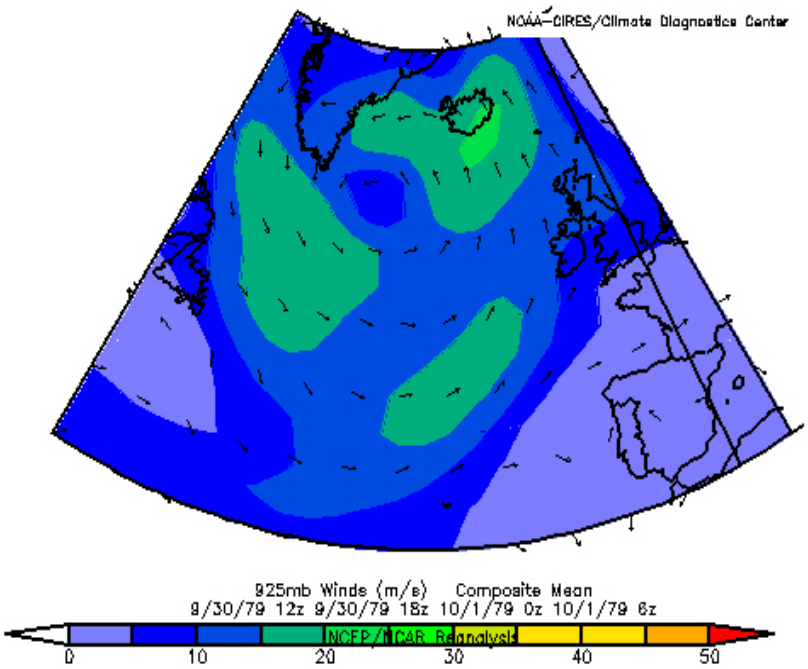


Figure 1. The location of Kvísker weather station, Southeast-Iceland.



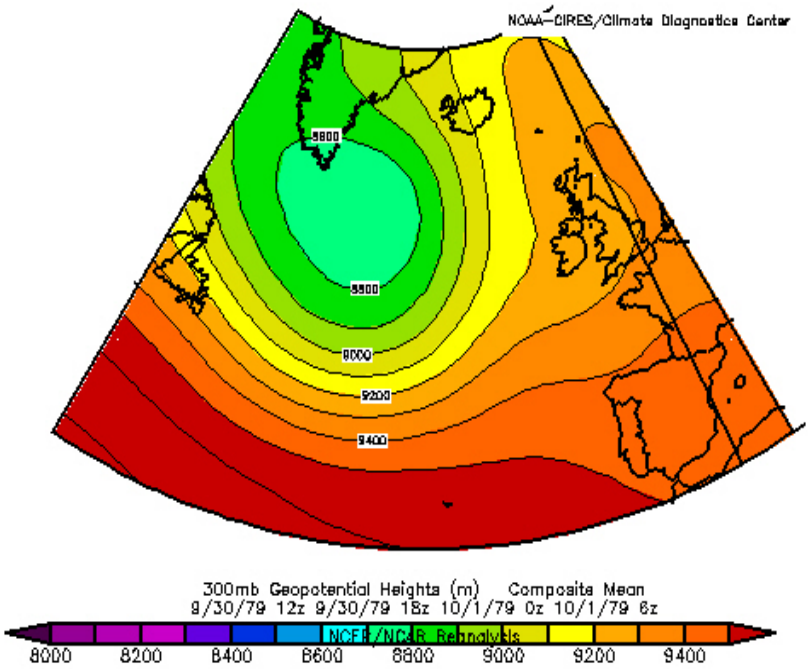
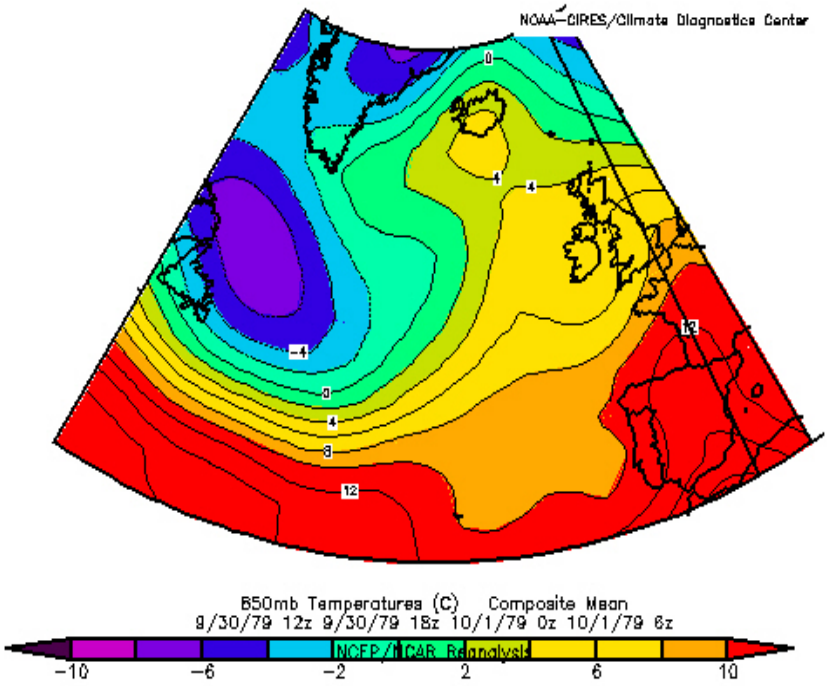


Figure 2. Composite mean winds at 925 hPa and geopotential at 300 hPa from 12 UTC on 30 September 1979 to 06 UTC on 1 October 1979



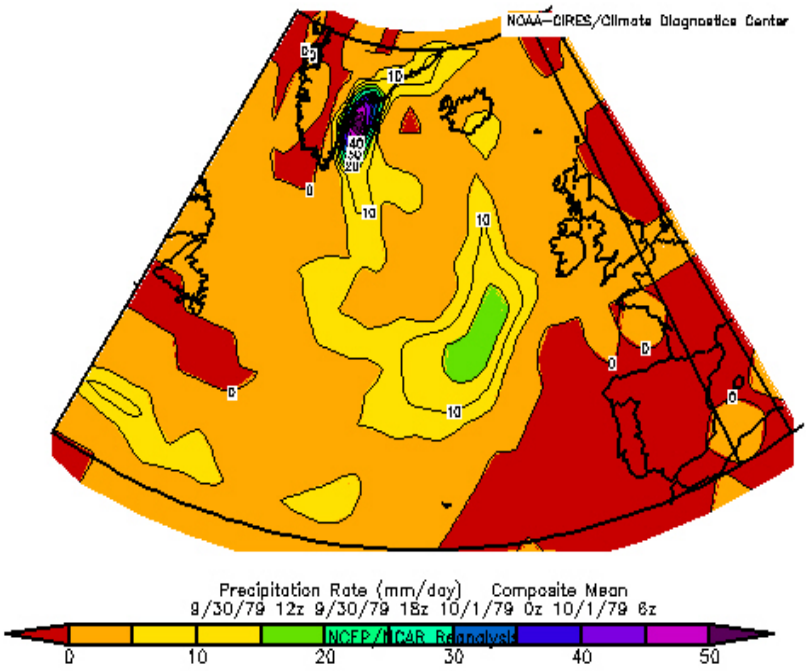


Figure 2 (cont.). Composite mean temperature at 850 hPa and precipitation rate from 12 UTC on 30 September 1979 to 06 UTC on 1 October 1979

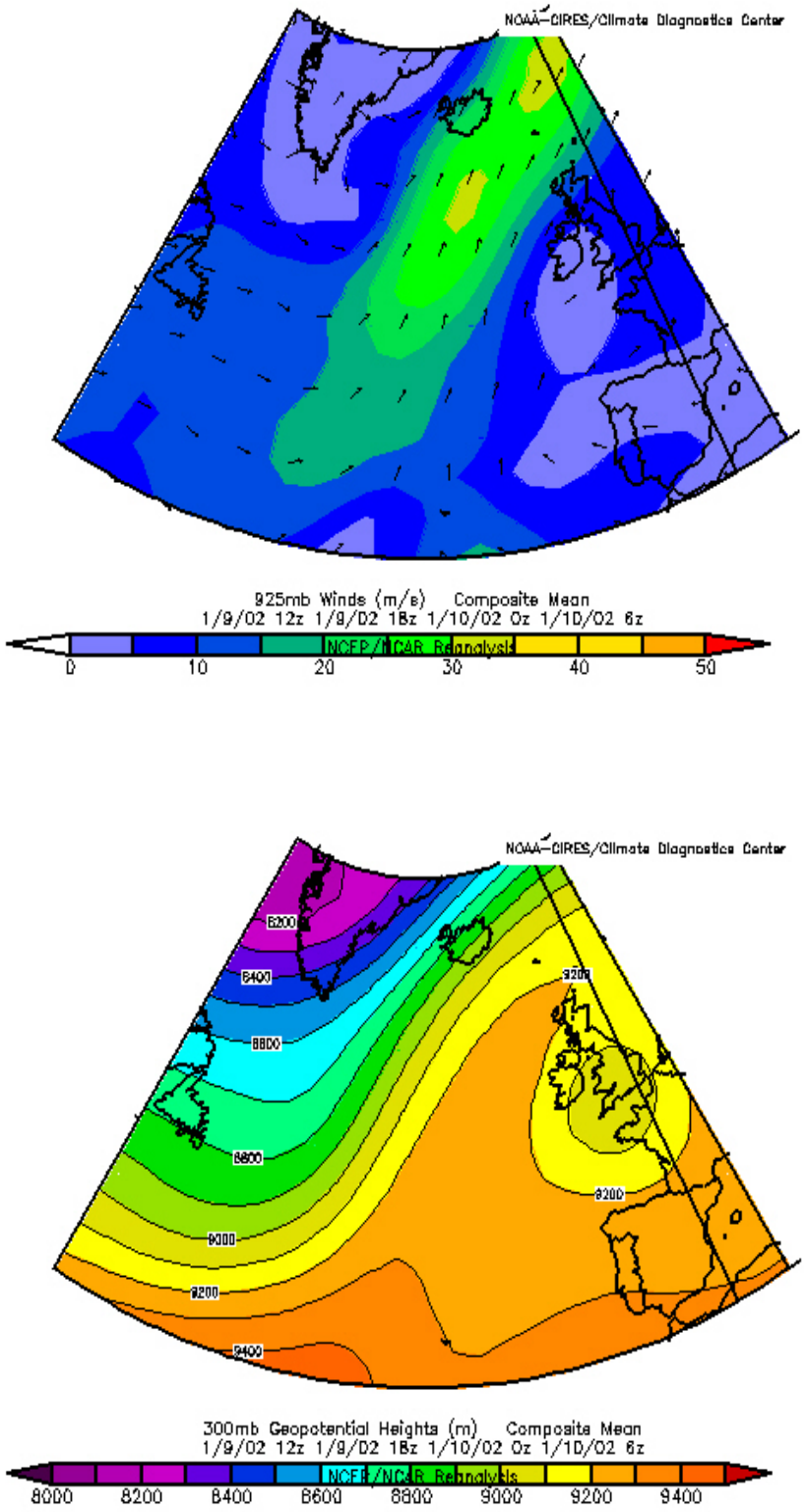


Figure 3. Composite mean winds at 925 hPa and geopotential at 300 hPa from 12 UTC on 9 January 2002 to 06 UTC on 10 January 2002

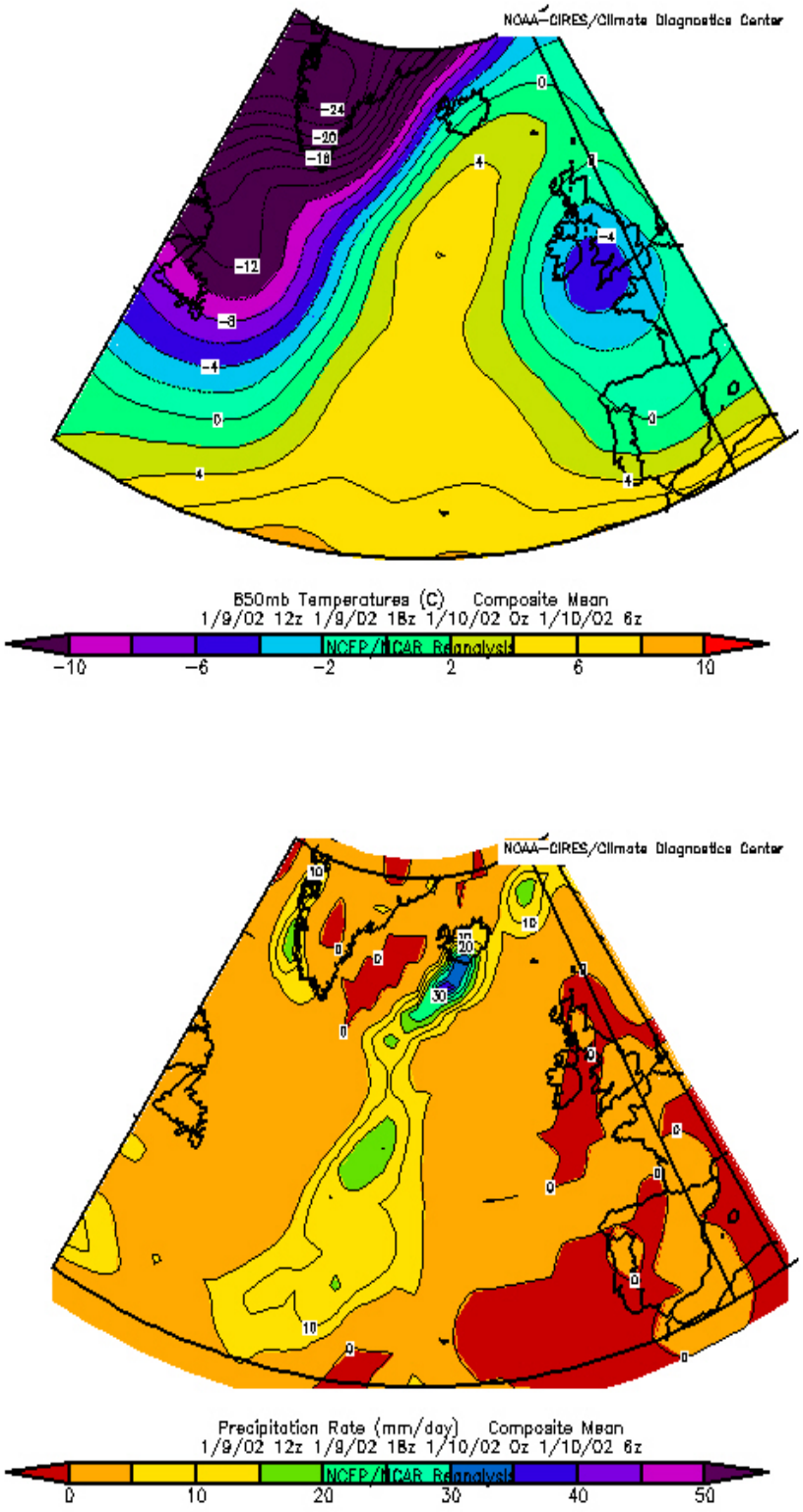


Figure 3 (cont.). Composite mean temperature at 850 hPa and precipitation rate from 12 UTC on 9 January 2002 to 06 UTC on 10 January 2002

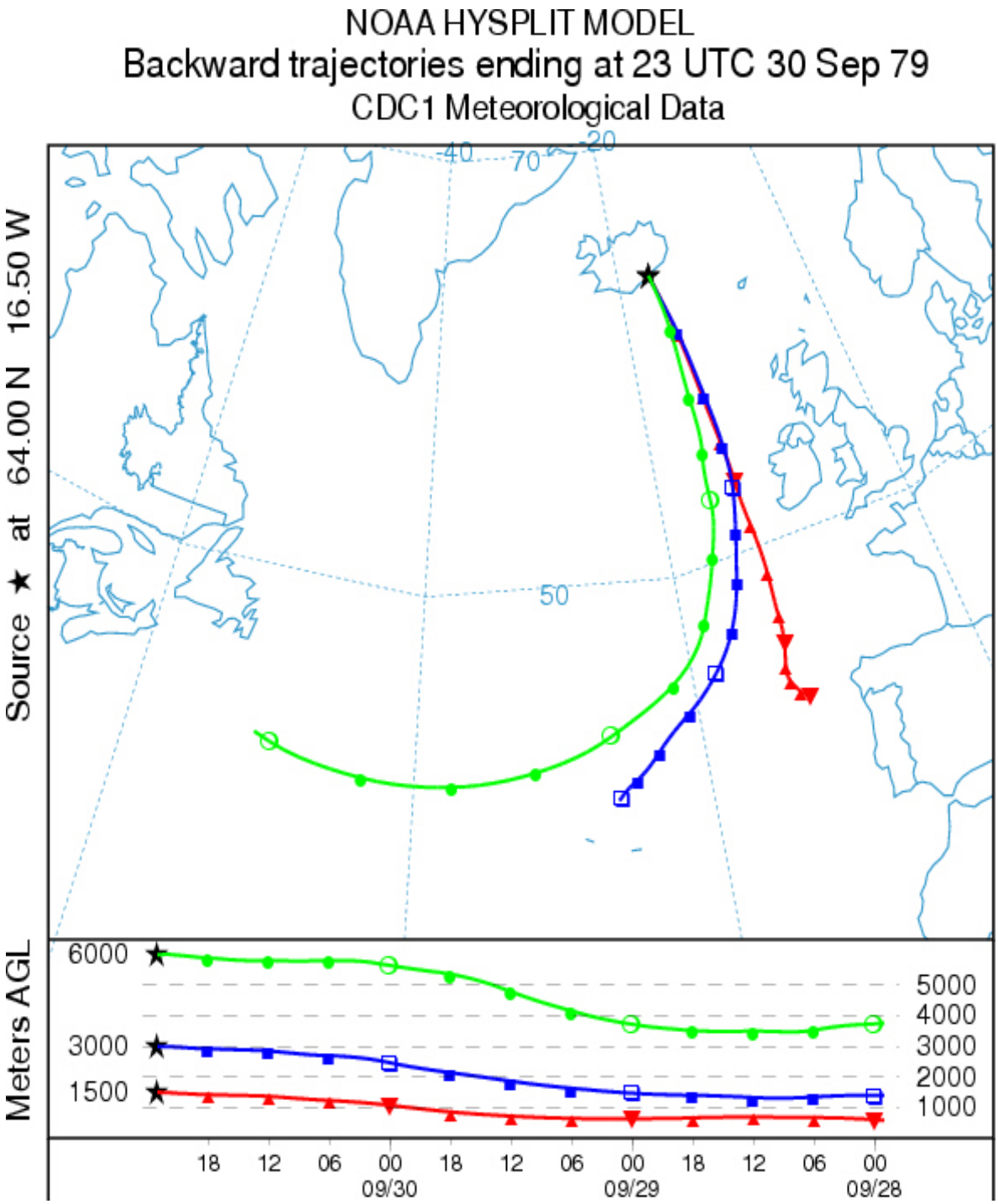


Figure 4. Three days trajectories ending over Southeast-Iceland at 00 UTC on 1 October 1979.

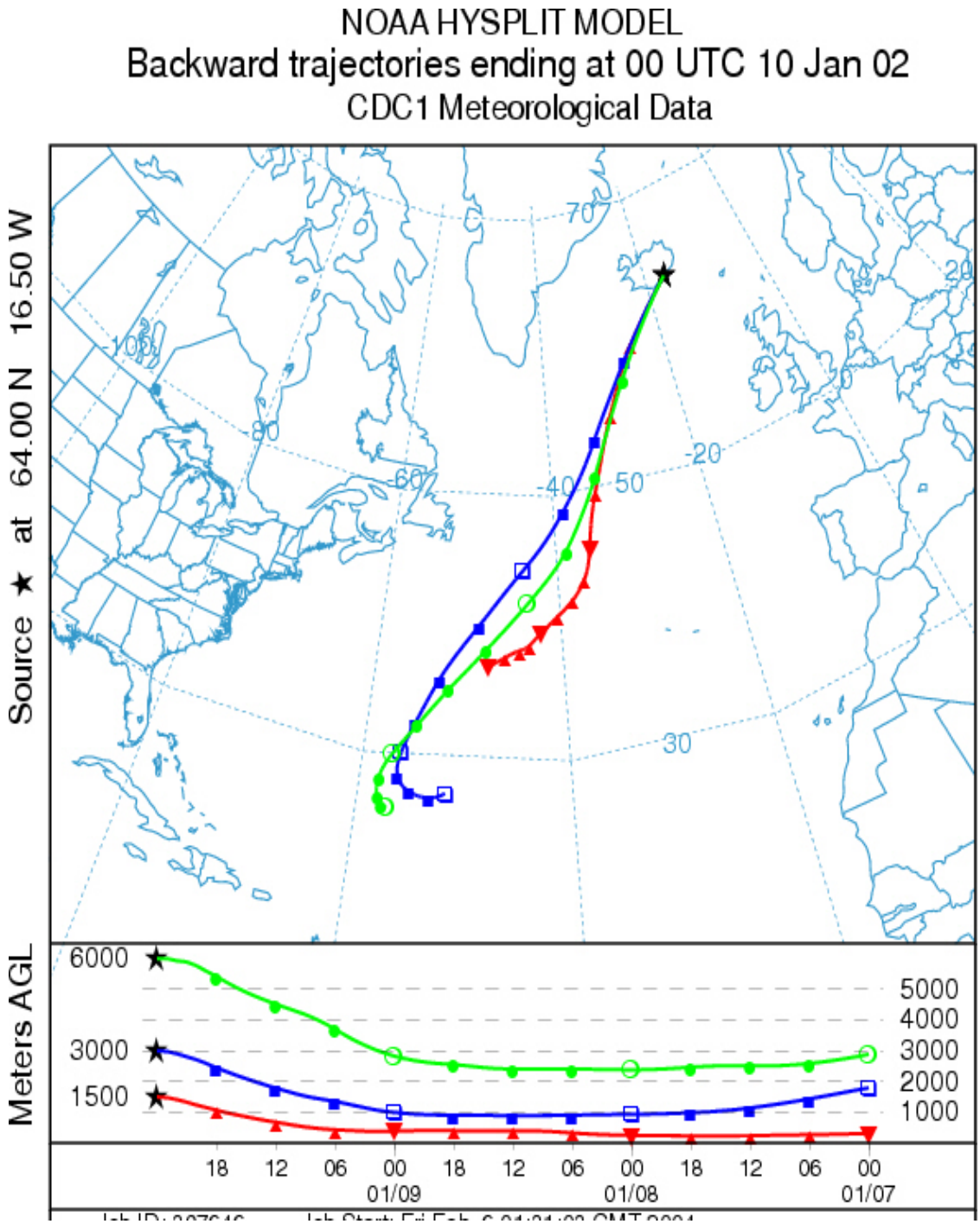


Figure 5. Three days trajectories ending over Southeast-Iceland at 00 UTC on 10 January 2002