



## **A dynamical analysis of the impact of targeted observations**

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The impact of targeted observations on forecasts for Northern Europe is presented. The targeted data consists of dropsondes from four flights conducted between Iceland and Greenland during the Greenland Flow Distortion Experiment in February and March 2007. The sonde data was sent to the global telecommunications system, enabling it to be assimilated into operational 12Z forecasts. Later, hindcast studies were performed to assess the impact of the targeted observations on the forecast. These used the Met Office 4D-VAR data assimilation scheme with a 48km grid and the Unified Model over the North Atlantic European domain with a 24km grid.

Here we focus on the case with greatest impact on downstream forecasts. Targeted sondes were released over the Denmark Strait and Irminger Sea into a region that total-energy singular vectors (from ECMWF) predicted to be sensitive to initial condition errors. The impact from the targeted sondes moved from the target region (where the sondes were released) with a developing polar low, into the verification region over Scandinavia. This resulted in a small forecast improvement at short lead times of 7%, measured in terms of total energy. It is shown that the improvement was caused by the modification of the position of a tropopause fold and its associated circulation, which was forcing the development of the polar low. It is shown that it is possible to increase the impact from targeted observations using two methods. Firstly, reducing the dropsonde observation error variance gives the targeted data increased weighting during the assimilation process, and results in an increase in average forecast improvement of a few percent. Secondly, assimilating all dropsondes, even if released close together, doubles the maximum forecast improvement. Together these methods resulted in a forecast improvement due to the inclusion of targeted sondes of 17%.