A polar low which occurred in October 1993 over the Norwegian Sea is investigated from an observational and a numerical point of view.

This polar low has several unique features: it developed early in the season, it lasted for about 3 days, and its trajectory was such that it passed over weather stations, so that « conventional » observations of the low are available. The conditions of the polar low formation, development and decay are investigated using a double approach: satellite data from several instruments are used together to document the mesoscale structure of the low, and two versions of a Limited Area Model (LAM) are run to investigate the dynamics of the low. Model fields are compared to quantities derived from TOVS, SSM/I and satellite radar altimeter data. In spite of a better spatial resolution of the models, humidity and surface wind speeds are less organized in the simulations than in satellite retrievals. The number of vertical levels, especially for the lowest layers of the atmosphere, appears to be an essential component for a good simulation of the trajectory of the low. There is however a good overall agreement between modelled and satellite-derived fields, and the good quality of the simulations allows inferences about the essential physical and dynamical processes taking place during the formation and development of the polar low. We find that the polar low was the result of favourable flow conditions at the surface, in the form of a shallow arctic front established south of the ice edge, together with an upper-level PV anomaly setting the stage for a positive interaction. Later on, the strong surface sensible and latent heat fluxes contributed to the extensive vertical development. This study demonstrates the usefulness of the approach adopted here which relies not only on simulations but also on observations to get a very complete description of such disturbances.

KEYWORDS: polar low lifecycle, satellite observations, numerical simulation, PV thinking