

Synoptic Analysis

Ahead of a deep, upper-level trough, the former tropical cyclone Karl merges with an extratropical low pressure system over the central North Atlantic. This merging of the two systems results in an explosively deepening midlatitude cyclone (referred to as “ex-Karl”). Intense warm conveyor belt (WCB) ascent on the eastern flank of ex-Karl lifts the tropopause north of the cyclone centre. The cyclonically ascending branch of the WCB contributes to the formation of an upper-level PV hook and an LC2-type breaking of the upstream trough. The stratospheric branch of the LC2 wave breaking and the subtropical ridge to the south form a remarkable tropopause fold that reaches down to the boundary layer. The HALO aircraft documented the structure of ex-Karl and of its surrounding air masses during NAWDEX IOP 4.

The flow in downstream regions is characterized by a trough that extends from Iceland to the Mediterranean and a high amplitude ridge over Scandinavia.

Forecast Day 1 (Tuesday, 27/09/2016)

The LC2-type wave breaking associated with ex-Karl continues on Tuesday. An east-west elongated tropospheric PV streamer extends from the Faroe Islands to the southern tip of Greenland. Likewise, a stratospheric PV streamer extends from the central North Atlantic to North Scotland. This stratospheric PV streamer is predicted to break apart. The breaking process will likely result in a west-east elongated upper-level cut-off to the south of Iceland. On the eastern flank of this upper-level cut-off and downstream of ex-Karl, a relatively small low pressure system develops north of Scotland. This low pressure system intensifies to less than 990 hPa and is located between Iceland and Norway on the following day.

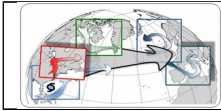
The cut-off process to the south of Iceland is likely related to upper-level diabatic outflow associated with a baroclinic wave that develops ahead of an upper-level trough over the central North Atlantic. Though this baroclinic wave develops in a relatively moist environment, it does not intensify significantly. At upper levels, a weak downstream ridge amplifies. This ridge and its associated jet streak will be located to the south of Iceland on Wednesday.

Forecast Day 2 (Wednesday, 28/09/2016)

The baroclinic wave that started to develop on the previous day, intensifies weakly over the central North Atlantic ahead of an upper-level trough. On its southern flank and in the warm sector of this baroclinic wave, moist air masses are transported eastward. This moisture transport is potentially enhanced through moisture injection from the former tropical cyclone Lisa. Until Thursday, the region of strongest moisture transport reaches the Norwegian coast. Here, the lifting of air masses will result in heavy precipitation.

Forecast Outlook

After several consecutive days of high cyclone activity, the synoptic activity will likely cease over the central and eastern North Atlantic on Thursday and Friday. However, several forecast scenarios predict the develop of a new midlatitude low pressure system over the western North Atlantic at the end of this week. This system is expected to intensify rapidly on Saturday and Sunday over the central North Atlantic. Warm-conveyor belt outflow of this system will likely be located in the Icelandic region on Sunday/Monday.



Scientific discussion

- On Tuesday, the DLR-Falcon and the UK FAAM BAE 146 will perform coordinated flights into the region of the upper-level cut-off. DLR-Falcon will sample the upper-level winds, whereas the UK FAAM BAE 146 will focus on the properties of a bent-back warm front to the south of the cut-off system.
- On Tuesday afternoon, HALO will investigate the tropopause structure during the cut-off process, low-level moisture transport over the Atlantic, as well as the tropopause structure of the cut-off system itself. In particular, the low-level moisture transport is of big interest as this is a sensitive region for the heavy precipitation over Northern Europe in the following days.
- All activities will be supported by additional radiosoundings from the Azores, the UK, Norway and Sweden. Radiosondes will be launched 6-hourly from regions with high moisture flux.
- A gravity wave IOP is planned for Tuesday and Wednesday. Additional radiosoundings will be launched from Keflavik.
- The DLR-Falcon will perform Lidar calibration flights over Iceland on Wednesday.