	NAWDEX 2016 Weather summary	Date: 04 October 2016 Author: A. Schaefer, B. Crezee, J.Riboldi

Synoptic analysis

A frontal wave exhibiting Diabatic Rossby Wave (DRW) characteristics develops explosively off the coast of Newfoundland and moves very rapidly from 55W, 40N to 30W, 60N during the day of Tuesday 04 October. The system promotes a meridional export of subtropical moisture to Iceland and the North Atlantic, which occurs also in the form of a very broad WCB. Very rapid ridgebuilding, associated with divergent diabatic outflow, occurs downstream of the cyclone in the direction of Scandinavia, where a broad blocking anticyclone is established.

The flow pattern over Europe evolves during the next days to a typical “Rex blocking” configuration: a broad anticyclone over Scandinavia and the North Atlantic, supported by a very strong negative PV anomaly, and a low pressure system over central Europe, supported by two PV cut-off at upper levels over the Carpathians and the Pyrenees.

Forecast Day 1 (Wednesday 5 Oct)

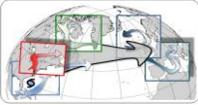
At 00 UTC the frontal wave cyclone has reached its minimum MSLP at 960hPa and starts gradually to fill. It is located during this time to the East of Greenland, at 35W, 60N: the strong pressure gradient between this low and the 1045hPa anticyclone centred over Norway leads to gale winds over Keflavik, especially during the morning and the afternoon. Moisture transport is very strong and an associated WCB brings heavy precipitations to Keflavik. A pronounced jet streak, almost perfectly meridionally aligned on 25W, sits above Iceland with wind speeds > 60 m/s and drives the WCB outflow to cover almost totally the latitudinal band between 60 and 70N over the Atlantic.

Ridgebuilding by the frontal wave cyclone reaches by the end of the day very high latitudes, above 75N, and joins with the pre-existing ridge above Scandinavia to cover the whole North Atlantic region.

Forecast Day 2 (Thursday 6 Oct)

The “frontal wave cyclone” keeps weakening while it remains stationary near the East coast of Greenland. The cyclone is at this time embedded in a broad PV streamer over Greenland, that extends further south. Early on Wednesday a Tropopause Polar Vortex (TPV), originated from a broad PV filament stretching from the pole towards Canada, moves from Hudson bay towards the southern tip of Greenland, at the rear flank of the aforementioned streamer. The TPV, a minimum in 2 PVU at the cold side of the jet, is accompanied by a weak maximum of theta at 2 PVU on the warm side of the jet. Meridional moisture transport is still significant but weakens during the day, as well as WCB activity on the eastern flank of the PV streamer. Conditions in Keflavik remain still windy and rainy.

Forecast Day 3 (Friday 7 Oct)

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The deterministic ECMWF forecast shows the “frontal wave” cyclone becoming a weak low with minimum central pressure > 1000 hPa at this time. The PV streamer, now with the embedded TPV cited above, is associated with a region of ascent and to a weak divergent outflow at 320K, although very few ascending trajectories meet the standard for the definition of a WCB (ascent of more than 600hPa in 48 hours). However, many members of the ECMWF Ensemble show the possibility of a stronger low and the prosecution of a stronger WCB activity at the eastern flank of the PV streamer. This situation may be relevant for potential future investigations with the NAWDEX aircrafts.

The interplay of the cut-off low over the Pyrenees, moving towards the Mediterranean, and the cut-off over Central Europe leads to heavy rain over a broad area encompassing France, Italy, the Balkans and the Alpine region. This merging is promoted by the Scandinavian blocking anticyclone, that induces a strong easterly flow over Central Europe and advects the cut-off low westward.

Forecast Outlook

The situation over Iceland and the North Atlantic remains similar during the following days, with the development of another frontal wave cyclone between 40 and 50N. The flow over Europe is blocked and constrained by the big blocking anticyclone over Scandinavia. Persistence of the circulation pattern can lead to heavy precipitation events over various regions of Europe.

Hurricane Matthew, a cat. 4 tropical cyclone, impacts the Caribbeans on Tuesday and moves northward during the following days. The deterministic run sees it moving parallel to the East Coast and eventually interacting with an upper-level PV streamer east of Newfoundland on Sunday 10th October. This evolution would lead to very strong WCB activity and ridgebuilding in the direction of Iceland and to a sudden increase in forecast uncertainty, highlighted by the Ensembles. The system can potentially become object of study during the following week and remains monitored.

Scientific discussion

- The intensification of the “DRW-frontal wave” cyclone in the Atlantic is associated with strong latent heat release, significant divergent outflow and meridional moisture transport and is therefore interesting for the objectives of the campaign.
- Iceland remains under the influence of a PV streamer located at the west, that promotes continuous southerly flow rich in subtropical moisture. Forcing for ascent over the North Atlantic is present but relatively weak.
- The synoptic situation over Europe evolves towards a blocking pattern until the end of the forecast period. Significant uncertainty is anyway present due to the presence of a TPV and, on the long range, on the potential impact of the extratropical transition of hurricane Matthew. The situation remains also conducive to high impact weather over various regions of Europe.