



Synoptic Analysis: Wednesday 21 September 2016: mission

- As during the last days, a large-scale trough remains stationary over Greenland and Iceland, and a frontal zone extends from Newfoundland to Iceland and further poleward to Svalbard.
- A frontal wave cyclone, in the morning located at about 55N/20W, strongly intensifies while moving towards the south of Iceland.
- The cyclone is associated with strong WCB activity, with ascending air along the leading edge of the upper-level trough. In the afternoon the WCB outflow is centered over Iceland and the ascent just to the south of Iceland. The low PV in the WCB outflow erodes the trough over Iceland.
- Mission in the afternoon: Falcon measures the tropopause structure and flies along and across the jet. HALO has a coordinated leg with Falcon, and additionally measures the WCB ascent in the warm sector south of Iceland.

Forecast Day 1-2 Thursday 22, Friday 23 September 2016

- On Thursday, 22 September the Icelandic cyclone reaches its mature stage and becomes quasi-stationary near Iceland.
- North of Newfoundland (52N, 50W) another frontal wave cyclone develops, and continuous warm-air advection from the subtropics maintains the strong frontal zone. The new Newfoundland cyclone subsequently propagates eastward and toward Iceland along the persistent baroclinic zone and strongly intensifies on Friday.
- The cyclone is associated with strong WCB activity. On Friday the WCB inflow is located west of Portugal and the Bay of Biscay, the WCB ascent west of the British Isles and Ireland, and the WCB outflow between Iceland and Norway.
- Model consistency: The cyclogenesis of the Friday cyclone is consistent for BT 18/12Z to 21/00Z, the inflow and ascent region of the WCB shift only marginally. However, the WCB outflow region remains uncertain, but there is a tendency that a strong anticyclonic WCB outflow branch is favored.

Forecast Outlook

- On Saturday and Sunday 24-25 September the Friday cyclone becomes again stationary near Iceland and replaces the former Wednesday cyclone. Strong moisture transport in the wake of the cyclone affects the British Isles and Northern Europe, with the potential for heavy precipitation and strong winds.
- Another cyclone forms on the continuously strong baroclinic zone near Newfoundland ("downstream cyclone") and propagates eastward. In the subtropical Atlantic (30N, 58W) tropical storm Karl intensifies initially as a tropical system, recurves and also moves into the midlatitudes.
- Very strong WCB activity is associated with Ex-TC Karl and the "downstream cyclone". Strong ridge amplification, and strengthening of the wave guide is consistently predicted south of Iceland, reaching high isentropic levels (340K). This is most likely due to the strong outflow of the WCB ascending in the region where tropical and polar air masses merge at lower levels, resulting in very pronounced negative PV advection at upper levels and a strong enhancement



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of the tropopause PV gradient.

- Consequently, an extremely strong jet with 300-hPa winds potentially exceeding 90 m s^{-1} develops over the Atlantic on Monday.
- Downstream of the diabatically amplified upper-level trough, an elongated PV streamer over western Europe leads to strong moisture transport along its leading edge and heavy precipitation in the Alpine region on Monday.
- The subsequent evolution of the downstream cyclone and Karl are very uncertain, with either and/or both of the systems having the potential to strongly deepen and to reach Iceland during Tuesday-Thursday 27-29 September. Today a third scenario emerged, with Karl reaching the British Isles as a relatively weak system, but explosively intensifying over the North Sea and becoming a severe winter storm, that affects the North Sea and Baltic Sea region.

Scientific discussion

- Flights Friday/Saturday 23/24 September:
 - Detailed (but preliminary) flight plan for HALO: Measure WCB ascent (coordinated leg with FAAM aircraft) and some outflow between Iceland and the British Isles. Additionally, it was decided to plan a mission with Falcon during the evening to measure WCB outflow.
 - Fly on Saturday to capture WCB outflow in a Lagrangian sense (recapture the same air observed during the WCB ascent on Friday)? One-day forward trajectory calculations from the HALO track show that some Lagrangian matches are possible, but overall the flow situation is not ideal to do this from Iceland. Or skip Saturday flight because the situation looks more promising on Monday, and it is easier for flight planning (day off can be set to Saturday)? A lot of support for option to skip Saturday flight.