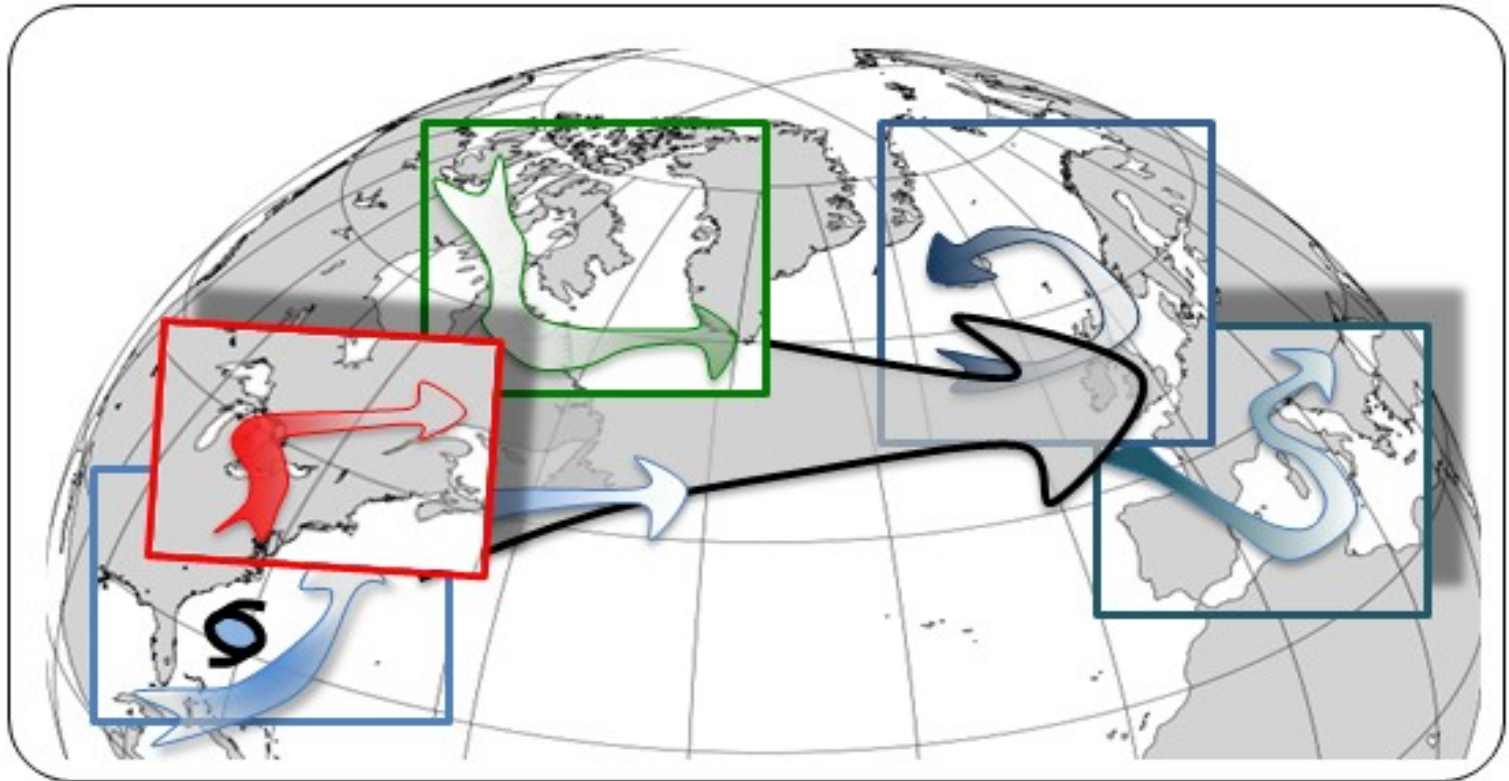


NAWDEX – Weather discussion

29 September 2016, Keflavik, Iceland



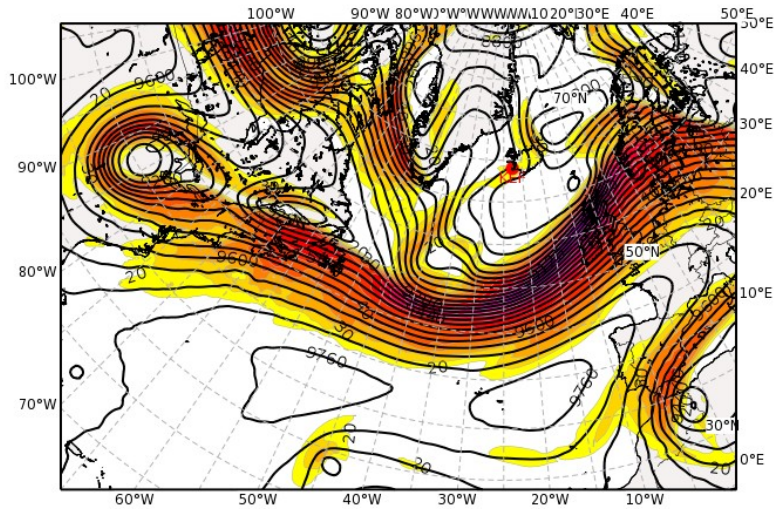
Agenda

- Current synoptic situation and forecast until Monday
- HALO flight plan for Saturday (Andreas, Florian, Pila)
- Additional soundings from the Azores/Atlantic ships
- HALO/Falcon flight plans for Sunday (Christian K., Jim)
- Outlook

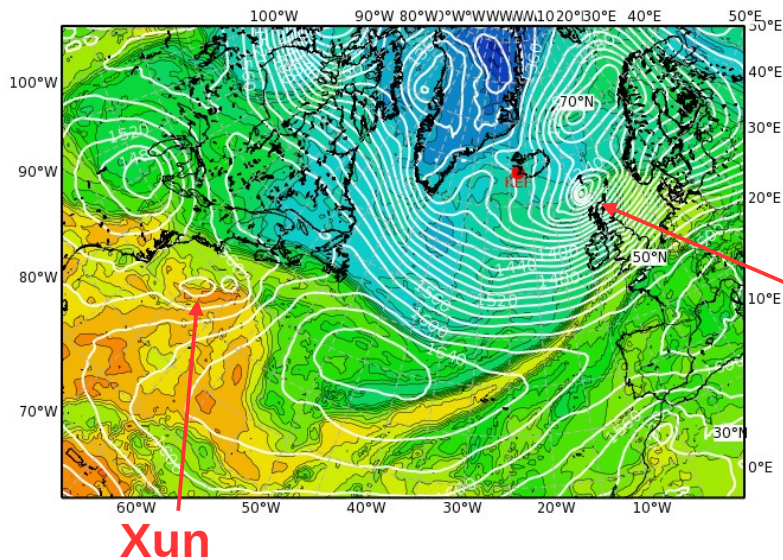
Current synoptic situation and forecast until Monday

Analysis – 29 Sep 2016, 00 UTC

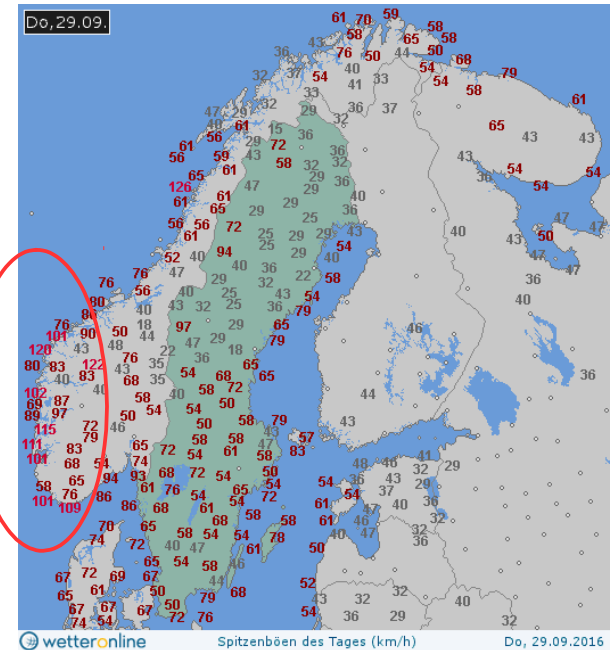
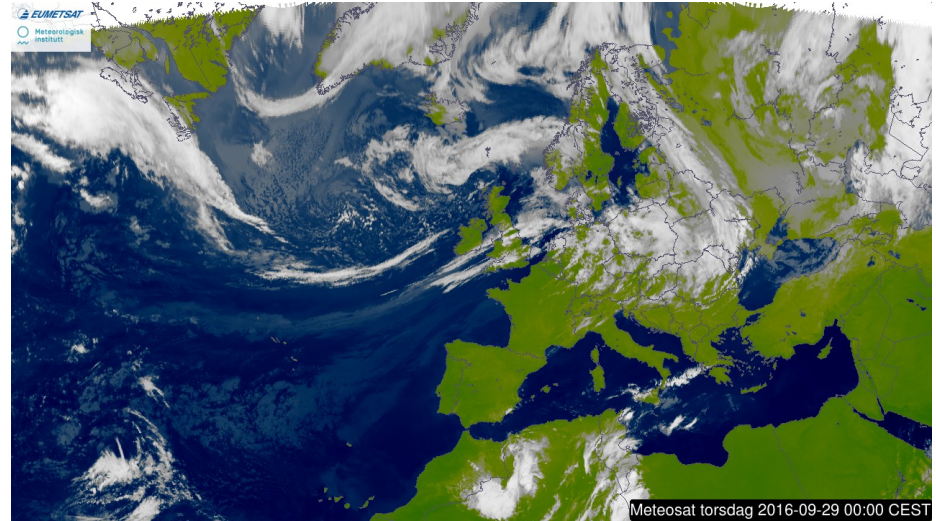
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Thu, 29 Sep 2016, 00 UTC (step 000 h from Thu, 29 Sep 2016, 00 UTC)



Equivalent Potential Temperature (degC) & Streamlines at 850 hPa
Valid: Thu, 29 Sep 2016, 00 UTC (step 000 h from Thu, 29 Sep 2016, 00 UTC)

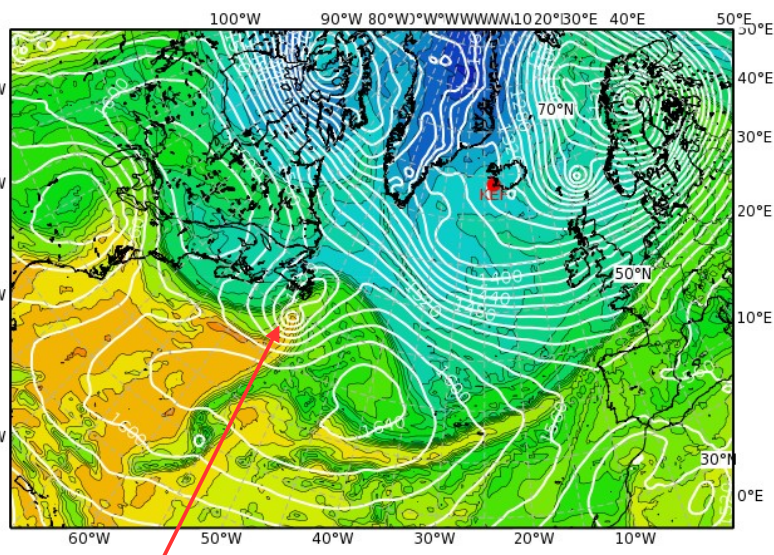
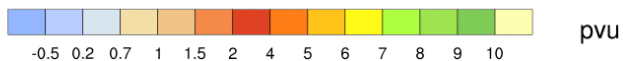
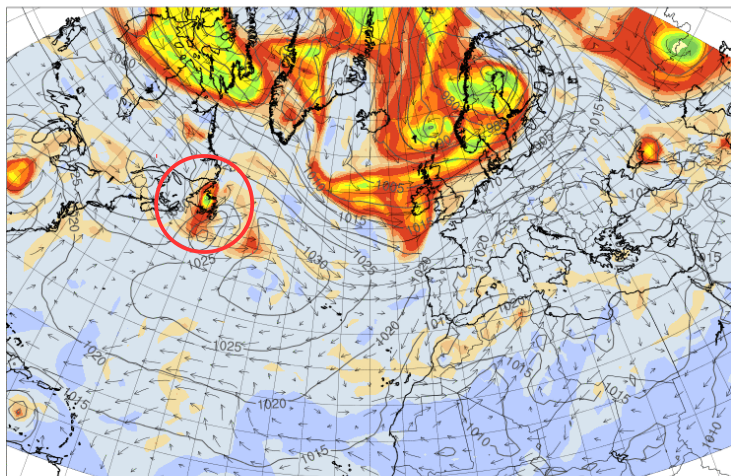


Z300, SAT
THE850



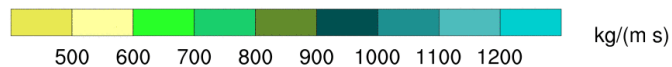
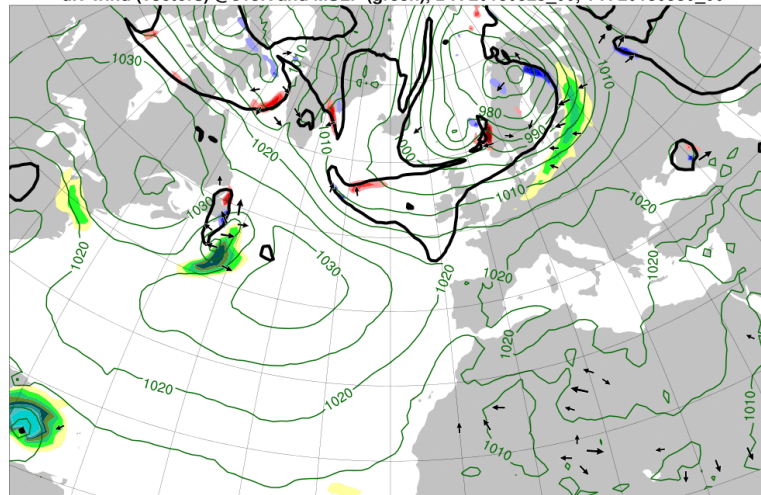
Forecast – Fri, 30 Sep 2016, 00 UTC

PV@315K at 20160930_00



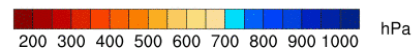
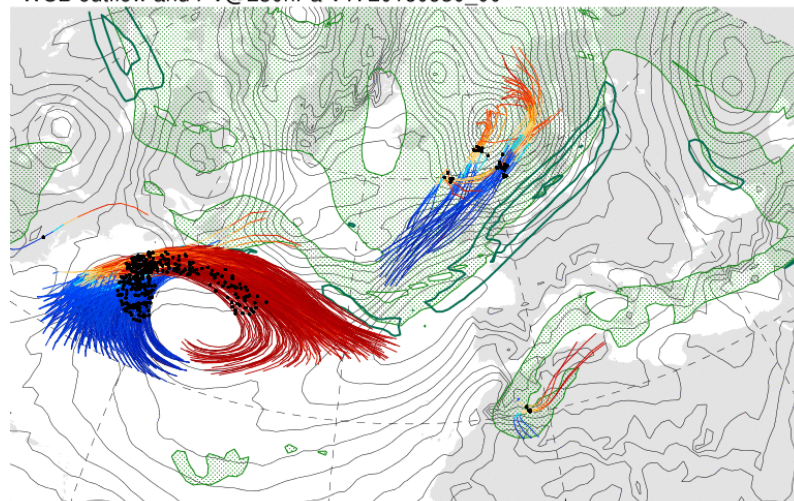
Xun

2 PVU (black), PV adv by div wind (shading),
div wind (vectors) @315K and MSLP (green), BT: 20160929_00, VT: 20160930_00



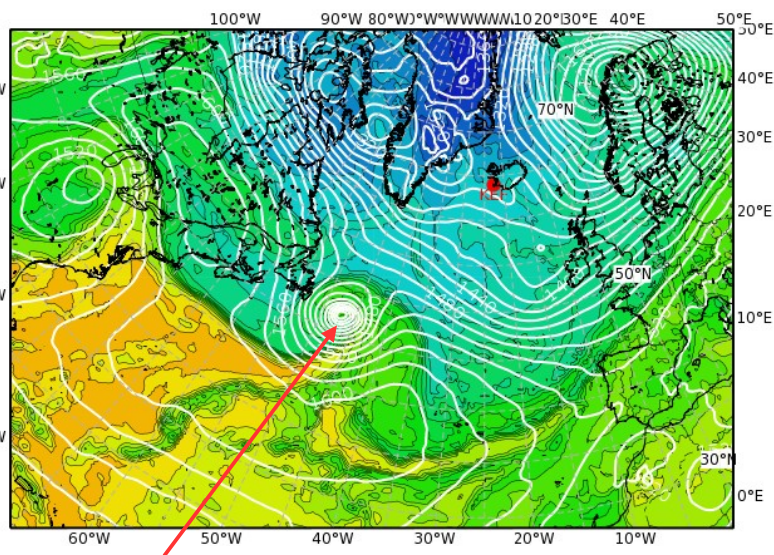
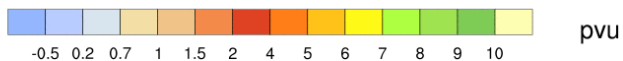
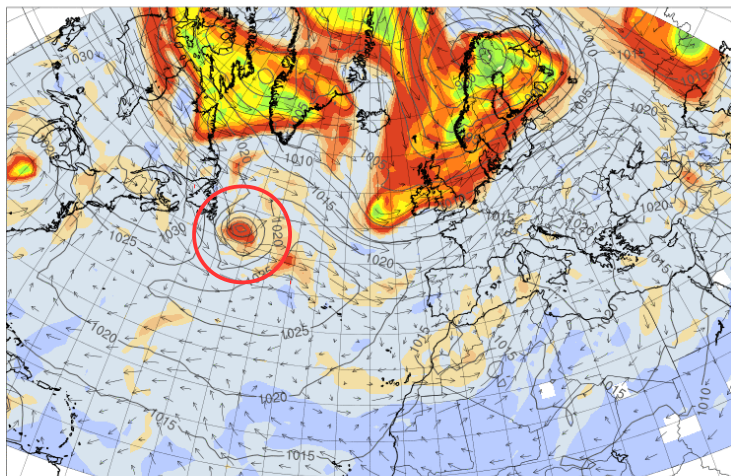
Trajectory start and SLP VT: 20160928_00

WCB outflow and PV@250hPa VT: 20160930_00



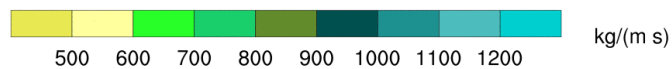
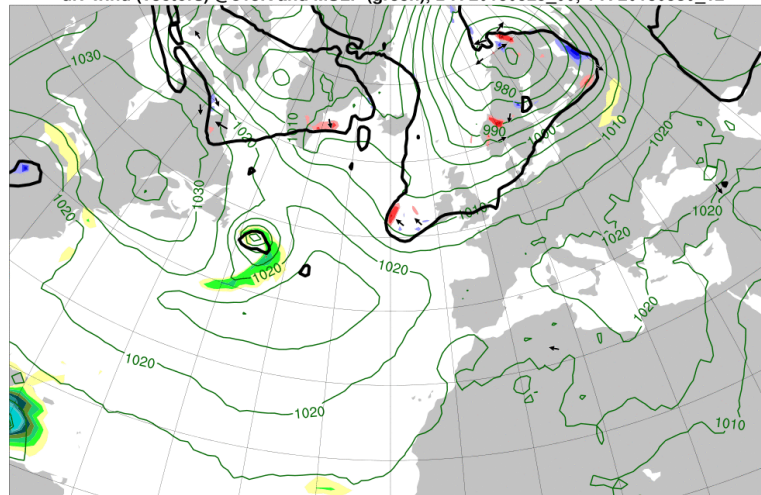
Forecast – Fri, 30 Sep 2016, 12 UTC

PV@315K at 20160930_12



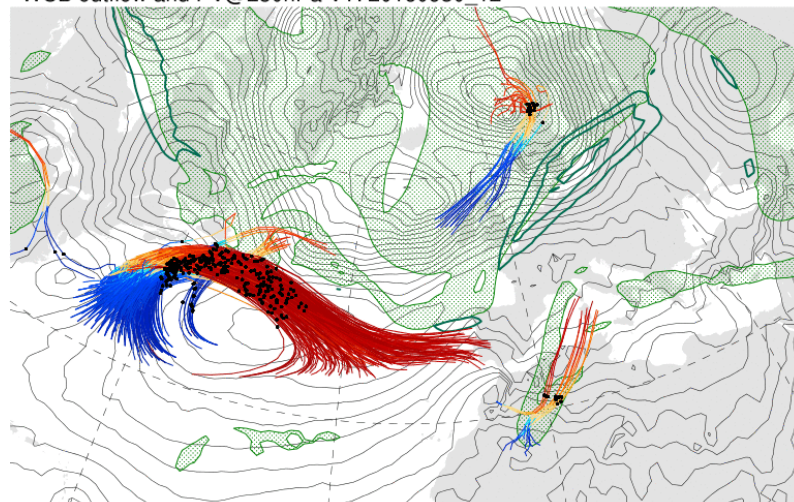
Xun

2 PVU (black), PV adv by div wind (shading),
div wind (vectors) @315K and MSLP (green), BT: 20160929_00, VT: 20160930_12



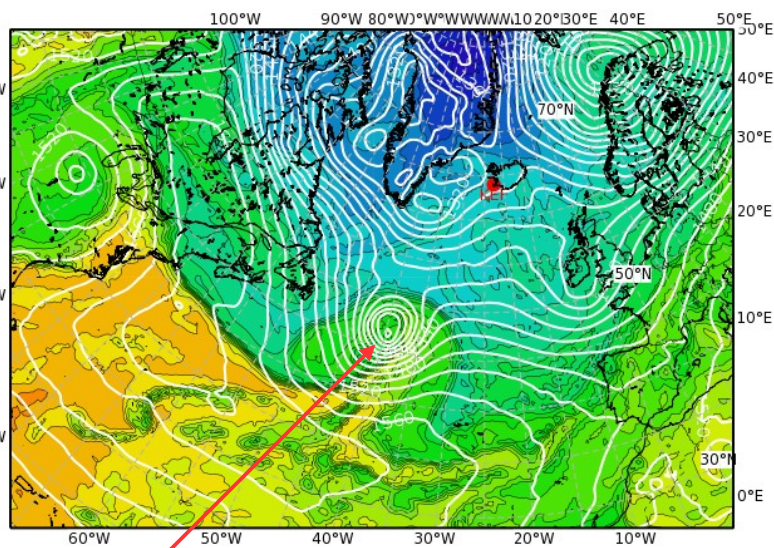
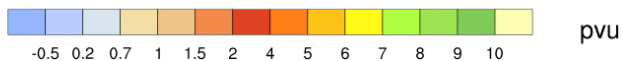
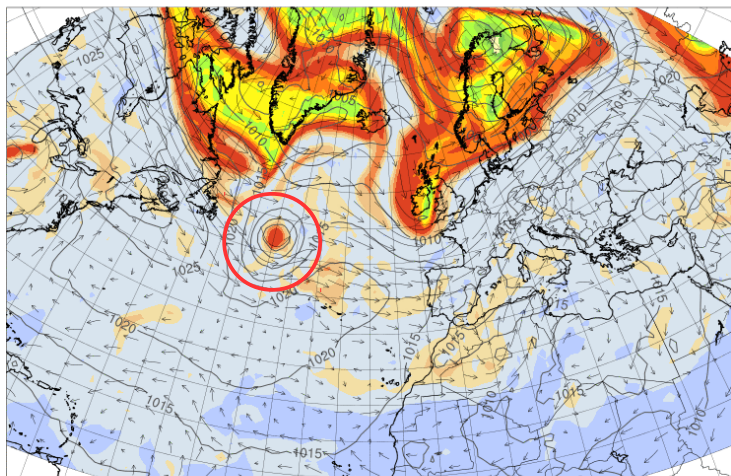
Trajectory start and SLP VT: 20160928_12

WCB outflow and PV@250hPa VT: 20160930_12



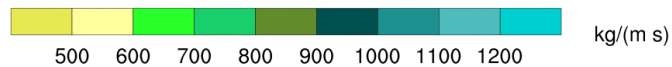
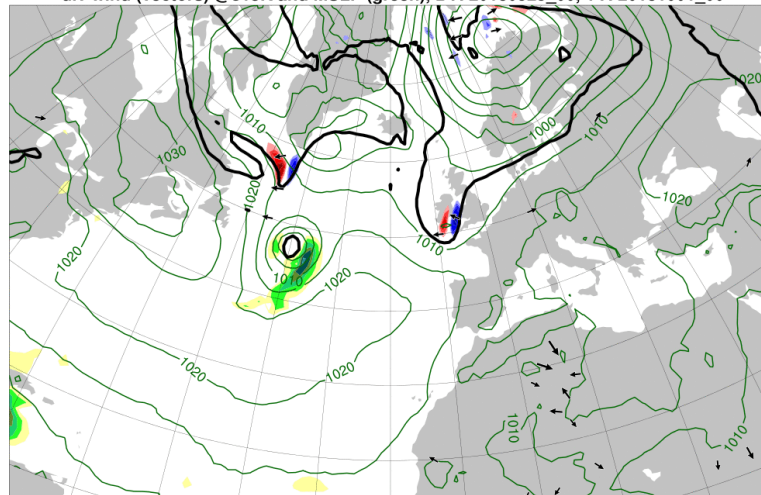
Forecast – Sat, 01 Oct 2016, 00 UTC

PV@315K at 20161001_00

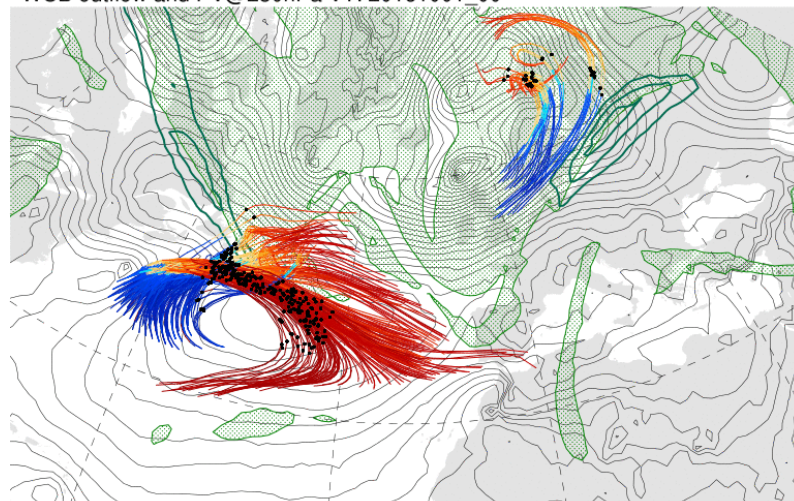


Xun

2 PVU (black), PV adv by div wind (shading),
div wind (vectors) @315K and MSLP (green), BT: 20160929_00, VT: 20161001_00

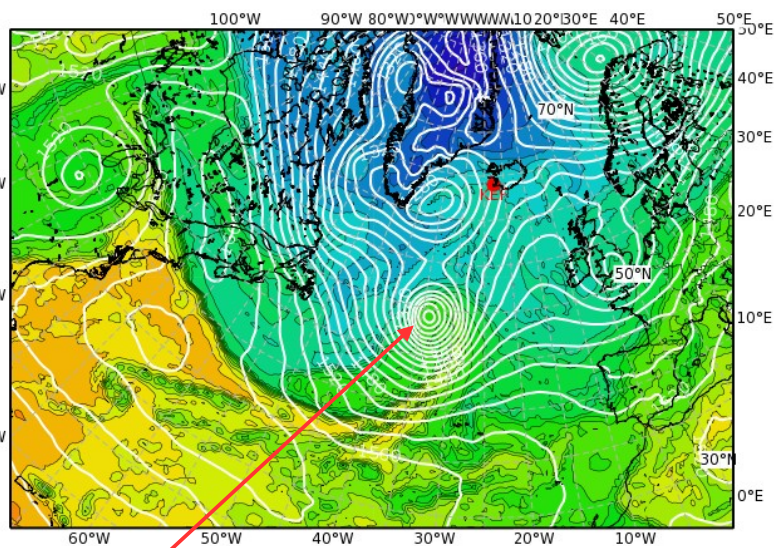
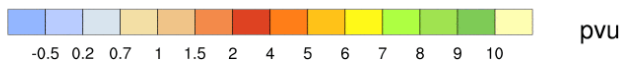
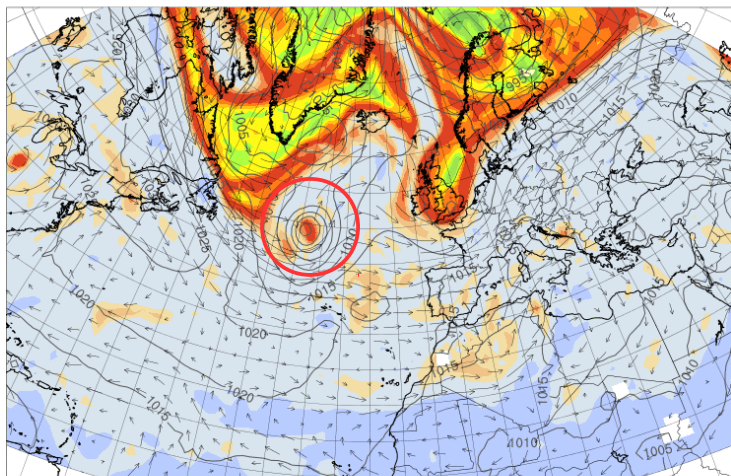


Trajectory start and SLP VT: 20160929_00
WCB outflow and PV@250hPa VT: 20161001_00



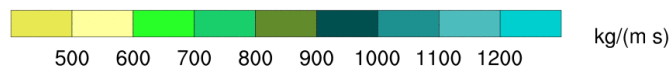
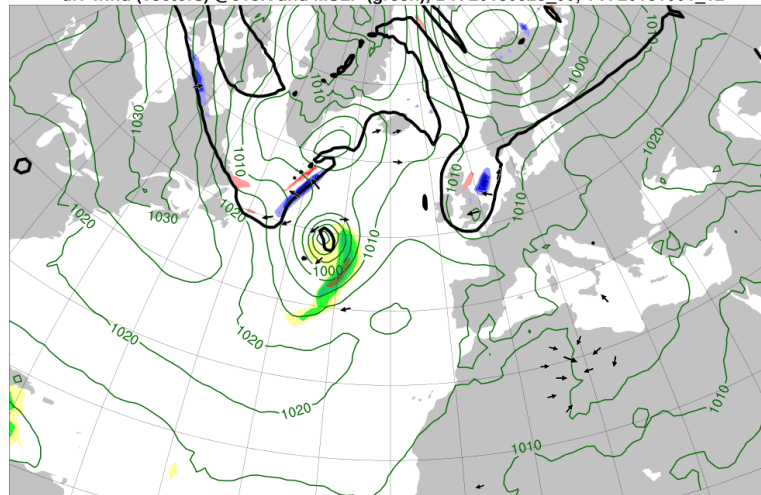
Forecast – Sat, 01 Oct 2016, 12 UTC

PV@315K at 20161001_12

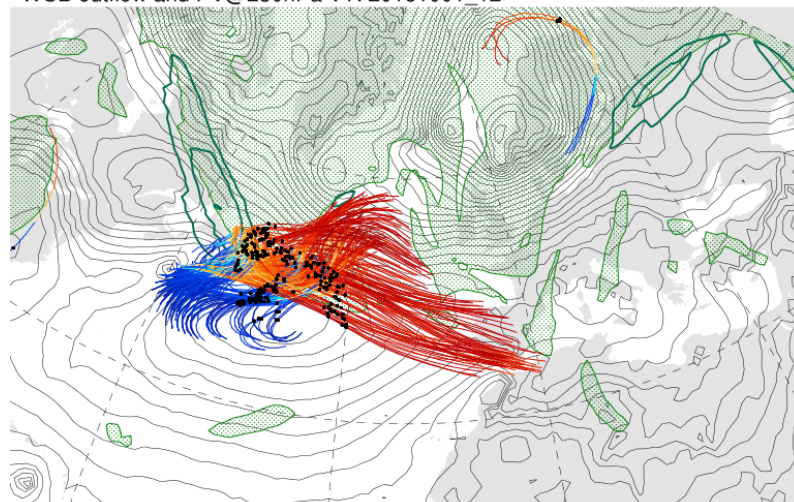


Xun

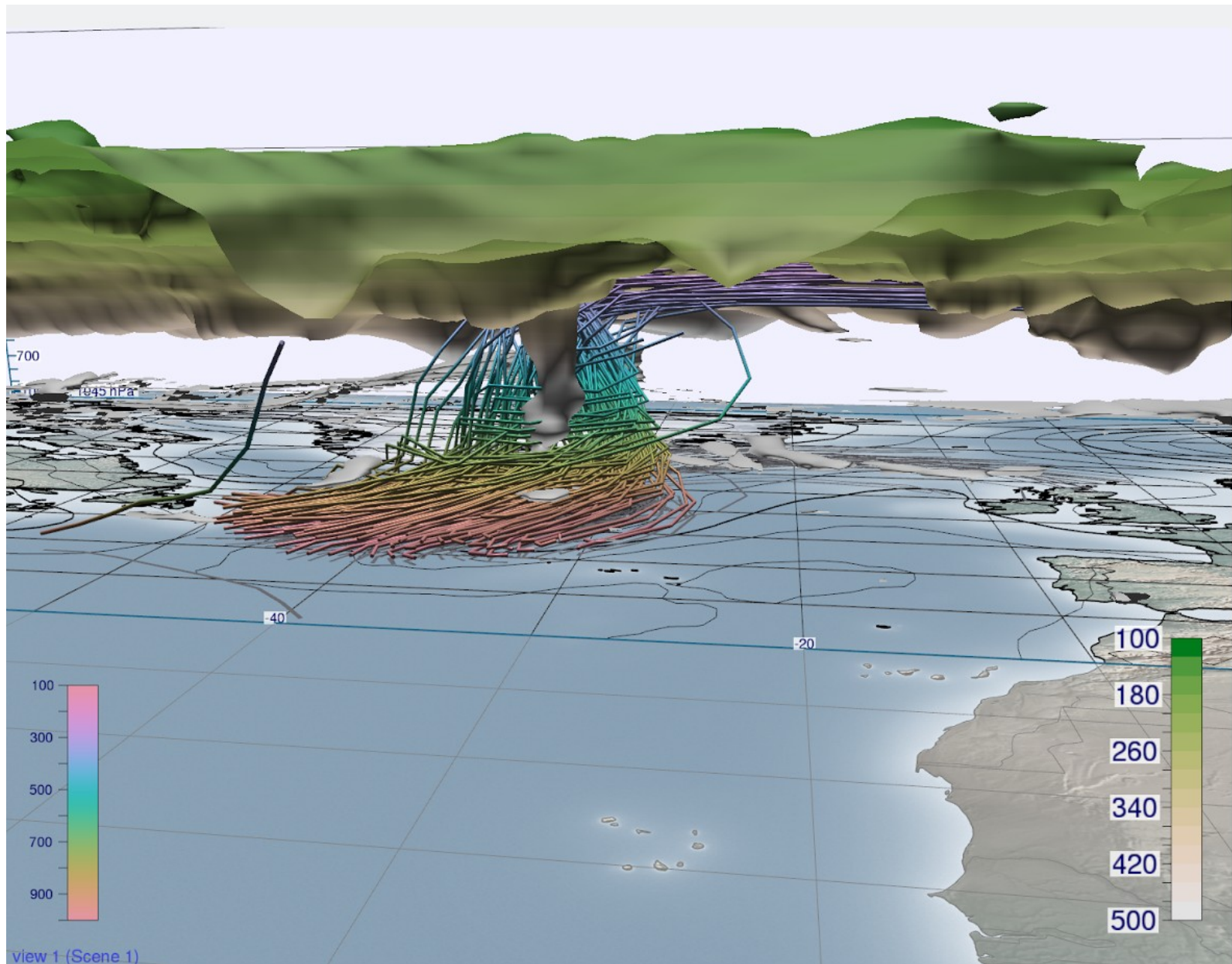
2 PVU (black), PV adv by div wind (shading),
div wind (vectors) @315K and MSLP (green), BT: 20160929_00, VT: 20161001_12

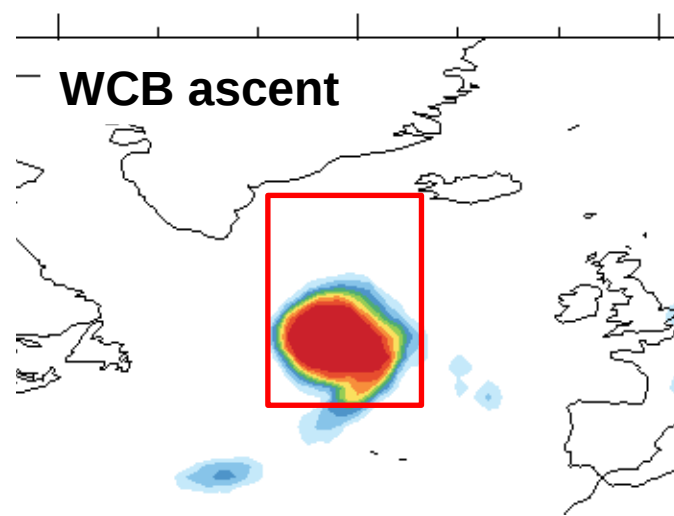
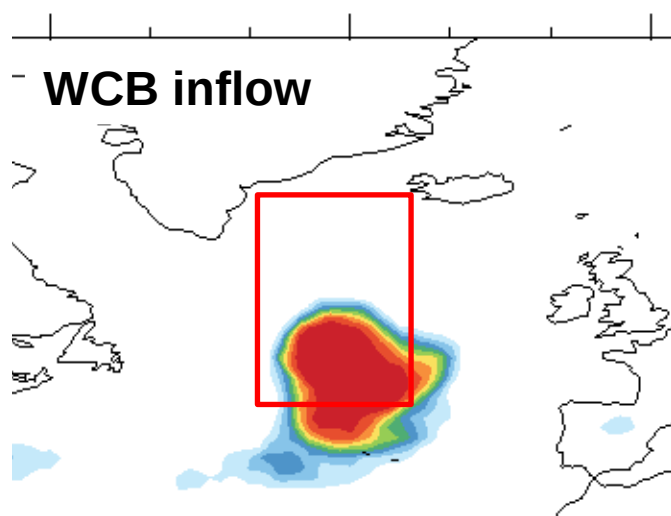
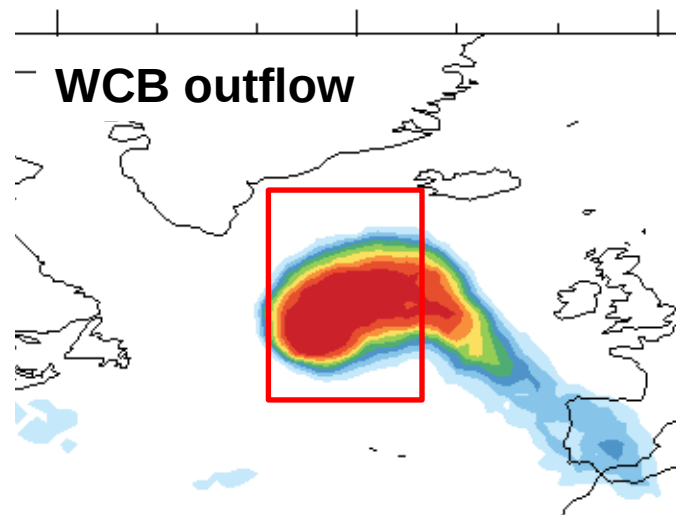
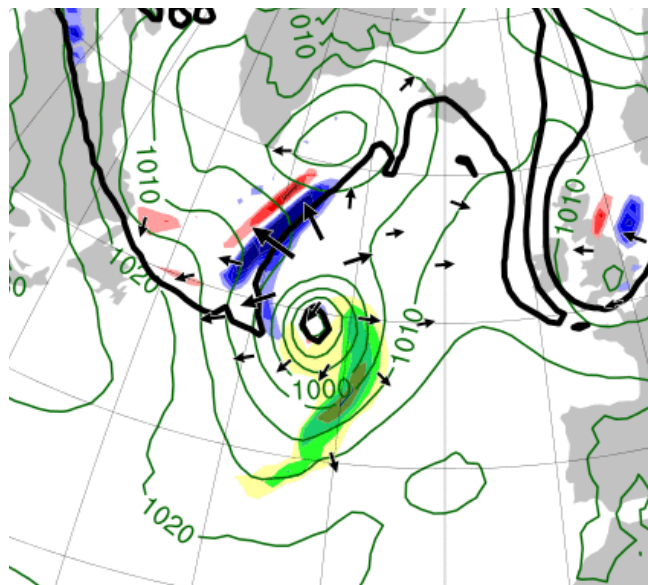


Trajectory start and SLP VT: 20160929_12
WCB outflow and PV@250hPa VT: 20161001_12



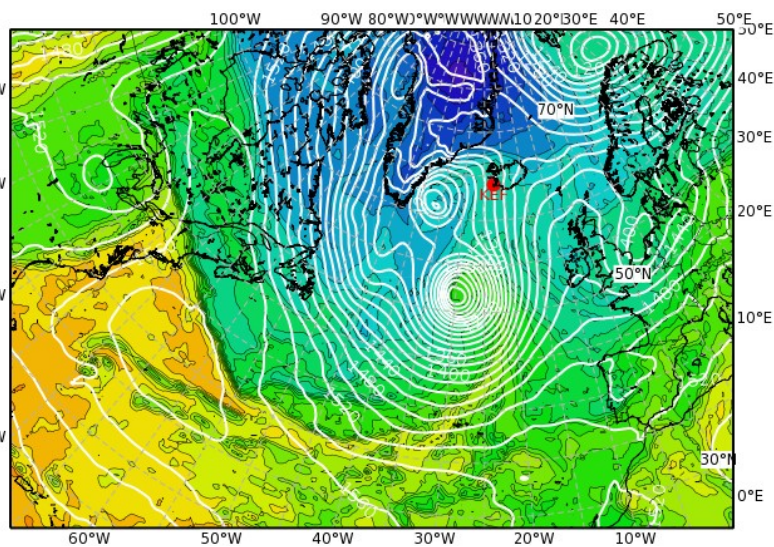
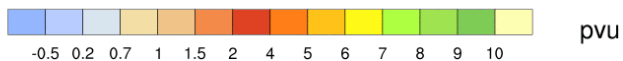
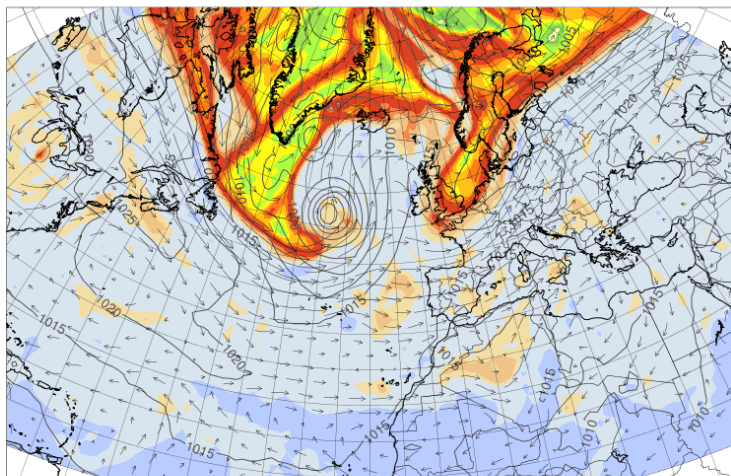
Forecast – Sat, 01 Oct 2016, 12 UTC



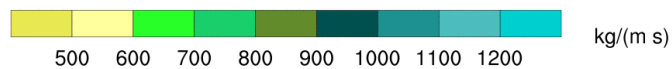
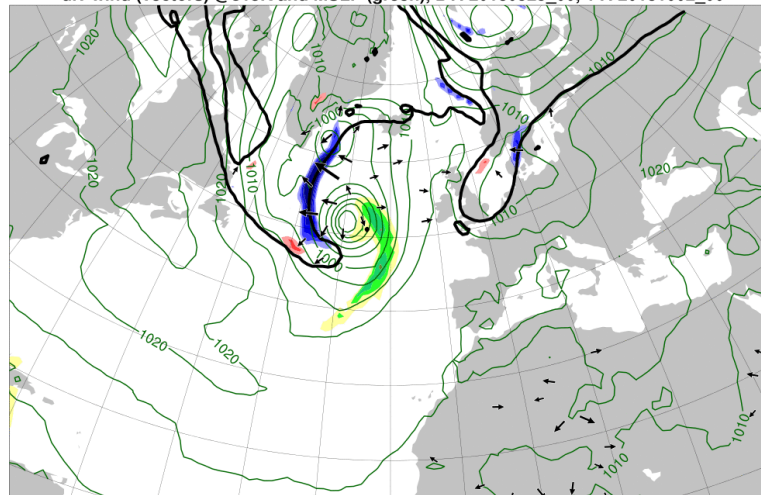


Forecast – Sun, 02 Oct 2016, 00 UTC

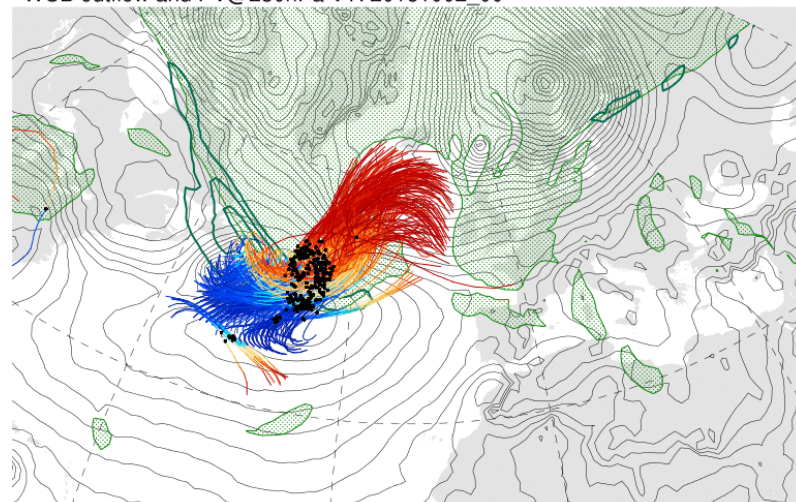
PV@315K at 20161002_00



2 PVU (black), PV adv by div wind (shading),
div wind (vectors) @315K and MSLP (green), BT: 20160929_00, VT: 20161002_00

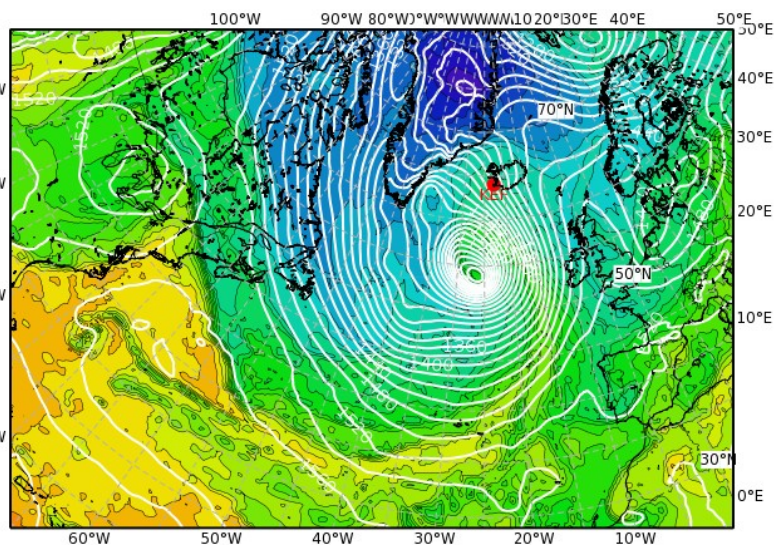
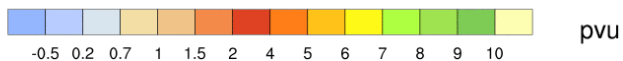
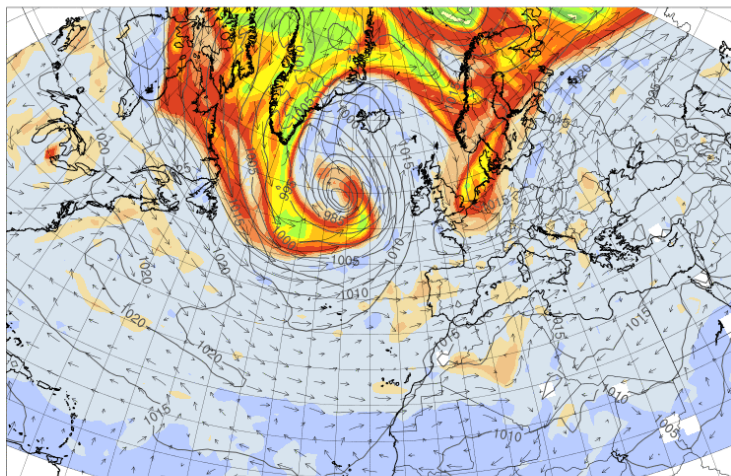


Trajectory start and SLP VT: 20160930_00
WCB outflow and PV@250hPa VT: 20161002_00

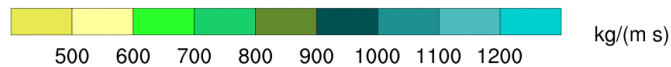
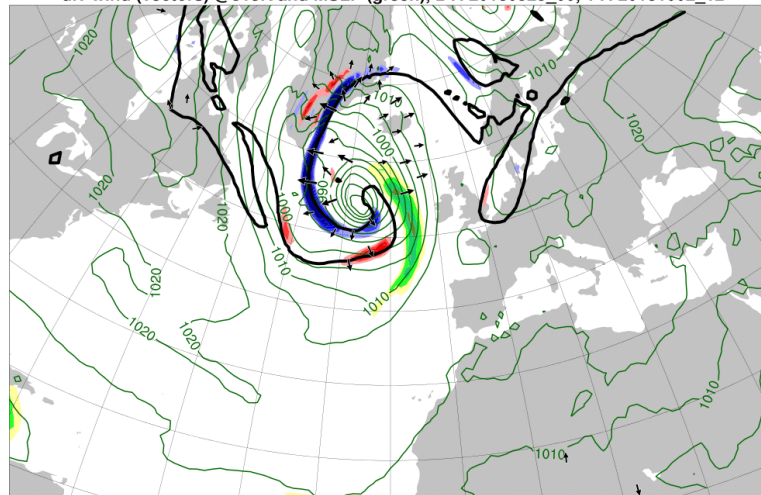


Forecast – Sun, 02 Oct 2016, 12 UTC

PV@315K at 20161002_12

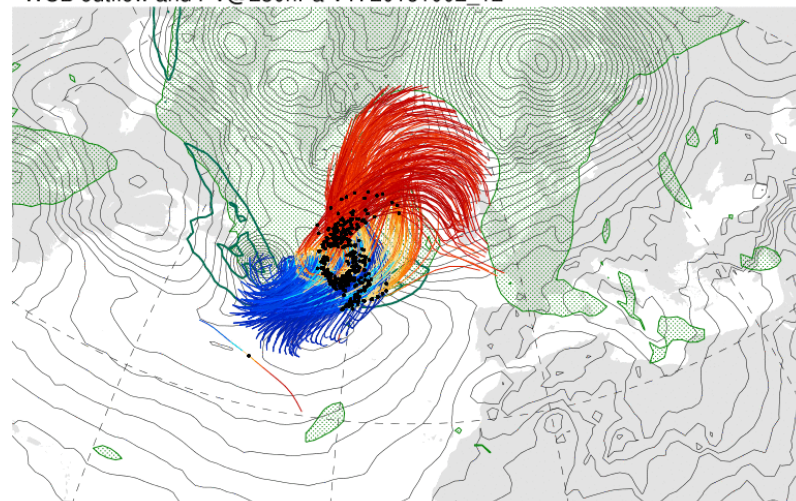


2 PVU (black), PV adv by div wind (shading),
div wind (vectors) @315K and MSLP (green), BT: 20160929_00, VT: 20161002_12



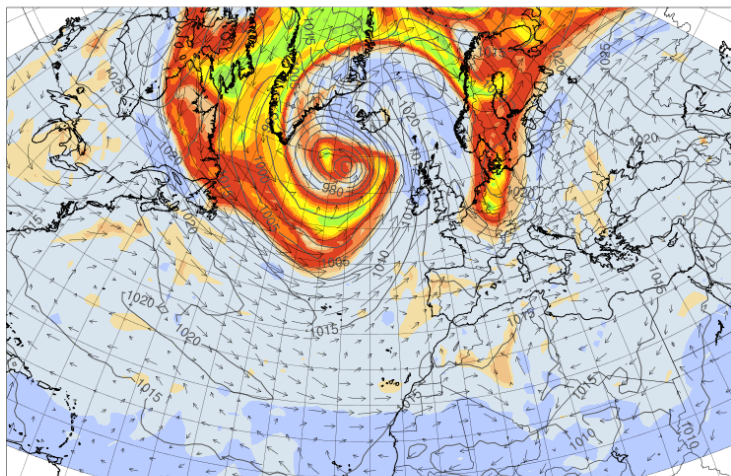
Trajectory start and SLP VT: 20160930_12

WCB outflow and PV@250hPa VT: 20161002_12

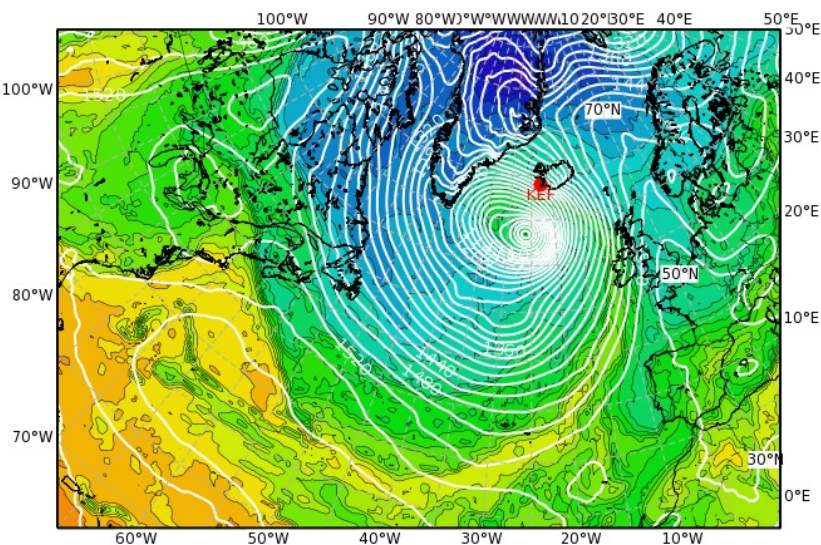
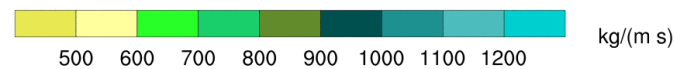
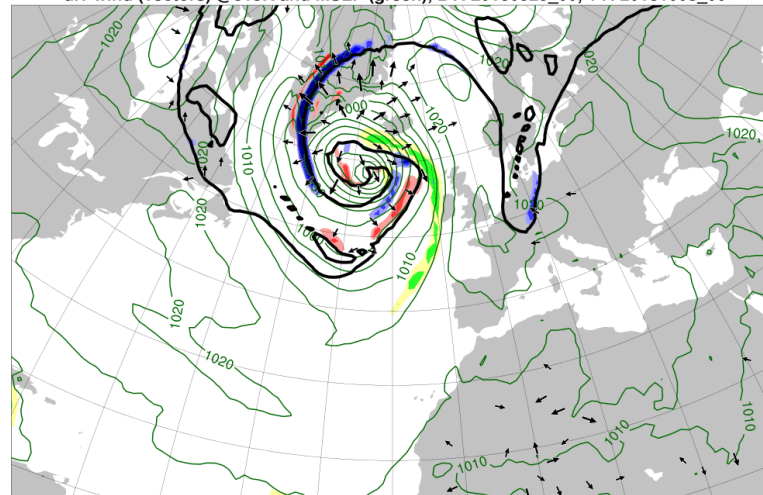


Forecast – Mon, 03 Oct 2016, 00 UTC

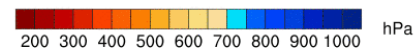
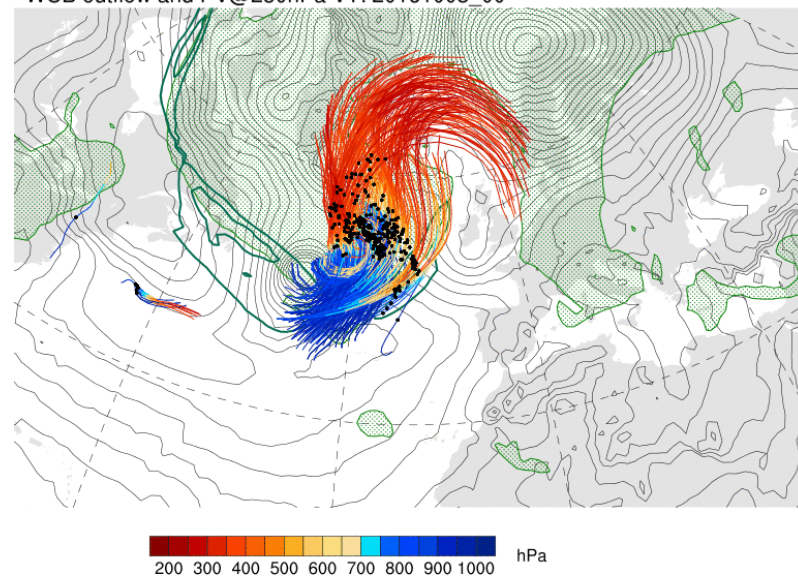
PV@315K at 20161003_00



2 PVU (black), PV adv by div wind (shading),
div wind (vectors) @315K and MSLP (green), BT: 20160929_00, VT: 20161003_00

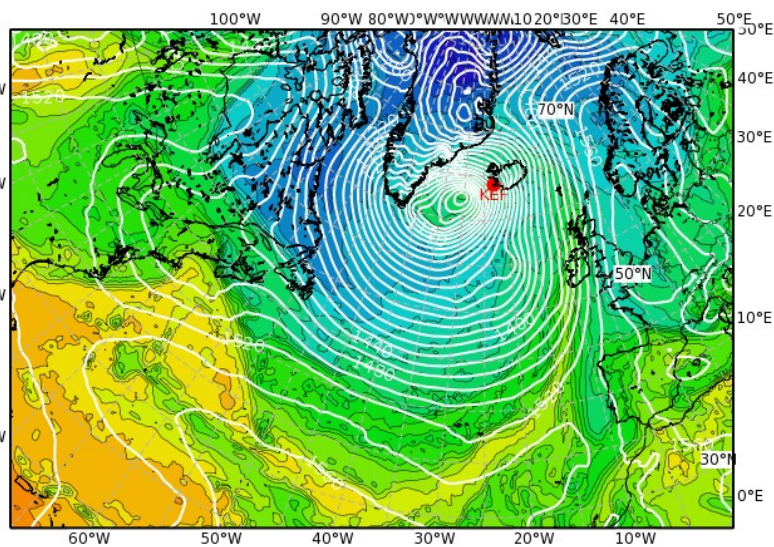
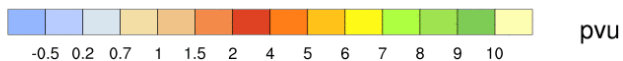
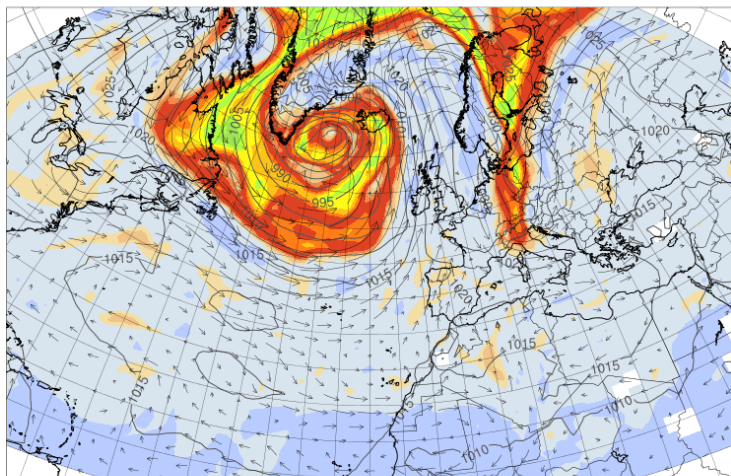


Trajectory start and SLP VT: 20161001_00
WCB outflow and PV@250hPa VT: 20161003_00

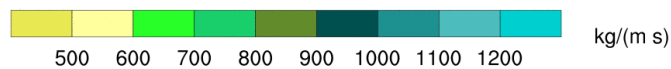
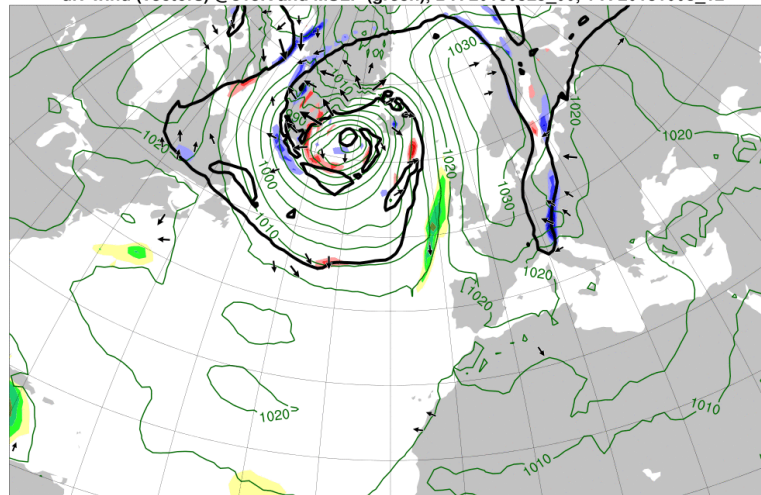


Forecast – Mon, 03 Oct 2016, 12 UTC

PV@315K at 20161003_12

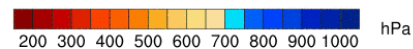
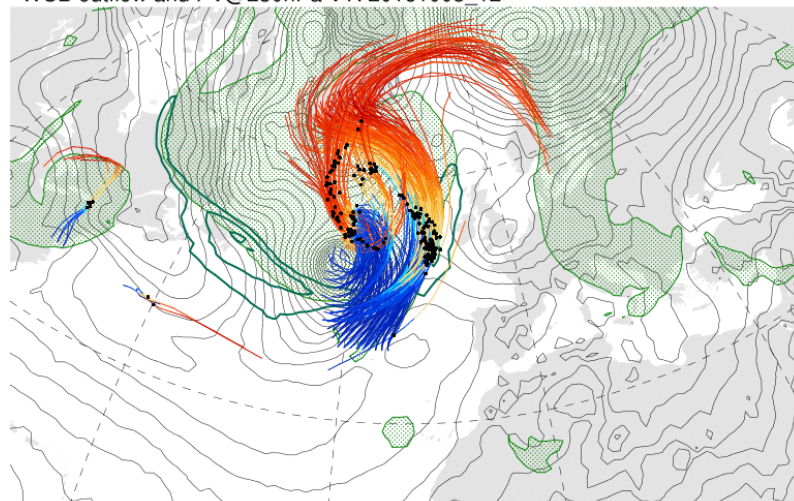


2 PVU (black), PV adv by div wind (shading),
div wind (vectors) @315K and MSLP (green), BT: 20160929_00, VT: 20161003_12



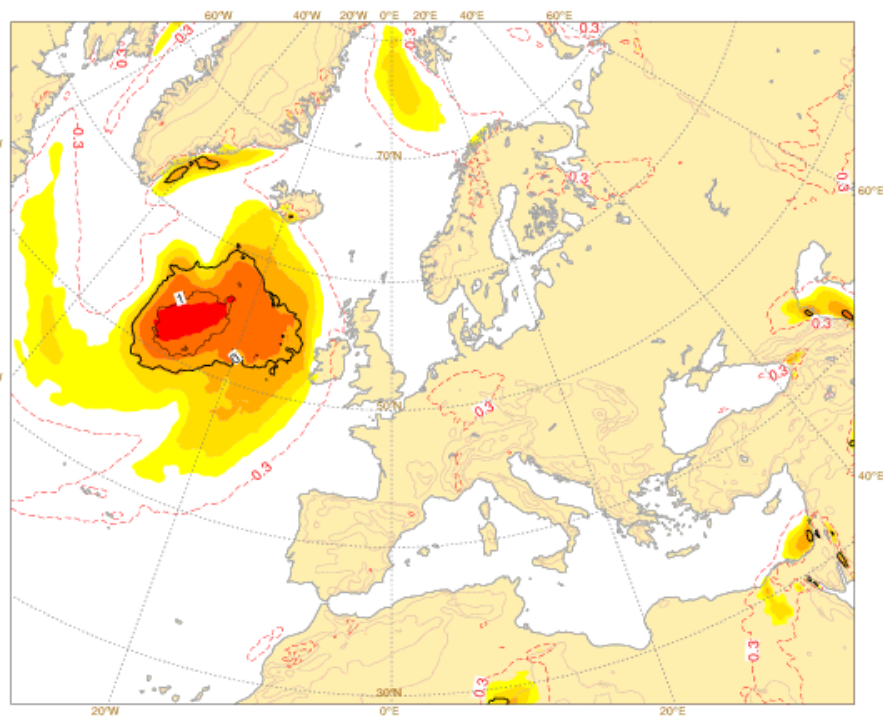
Trajectory start and SLP VT: 20161001_12

WCB outflow and PV@250hPa VT: 20161003_12

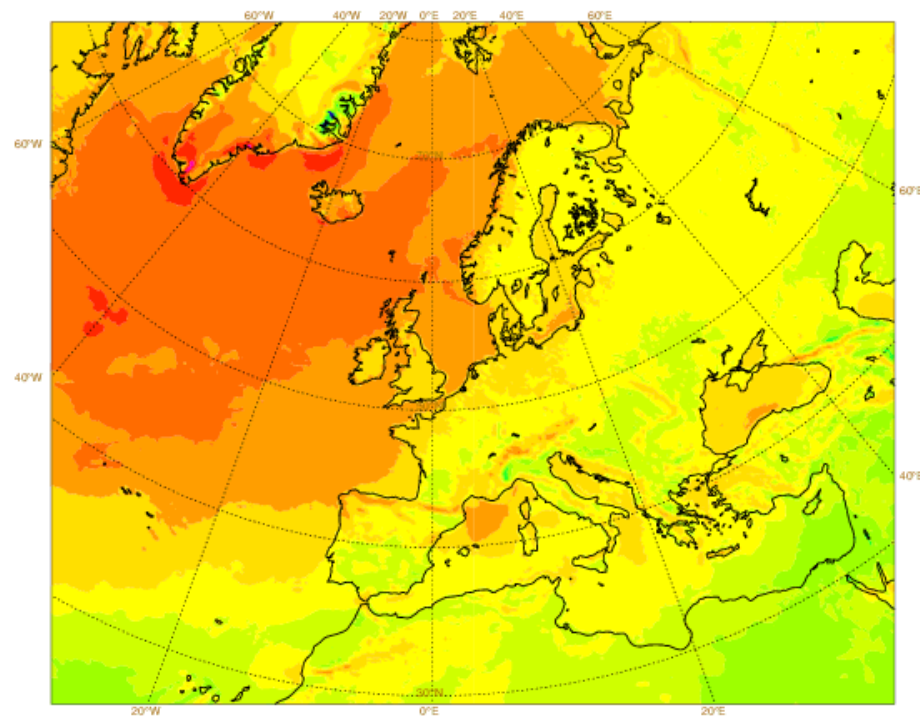
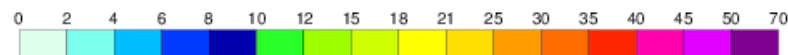


EFI wind for Sun 02/00Z to Mon 03/00Z

Thu 29 Sep 2016 00UTC @ECMWF t+72-96h VT: Sun 02 Oct 2016 00UTC - Mon 03 Oct 2016 00UTC
Extreme forecast index and Shift of Tails (black contours 0,1,2,5,8) for 10m wind gusts



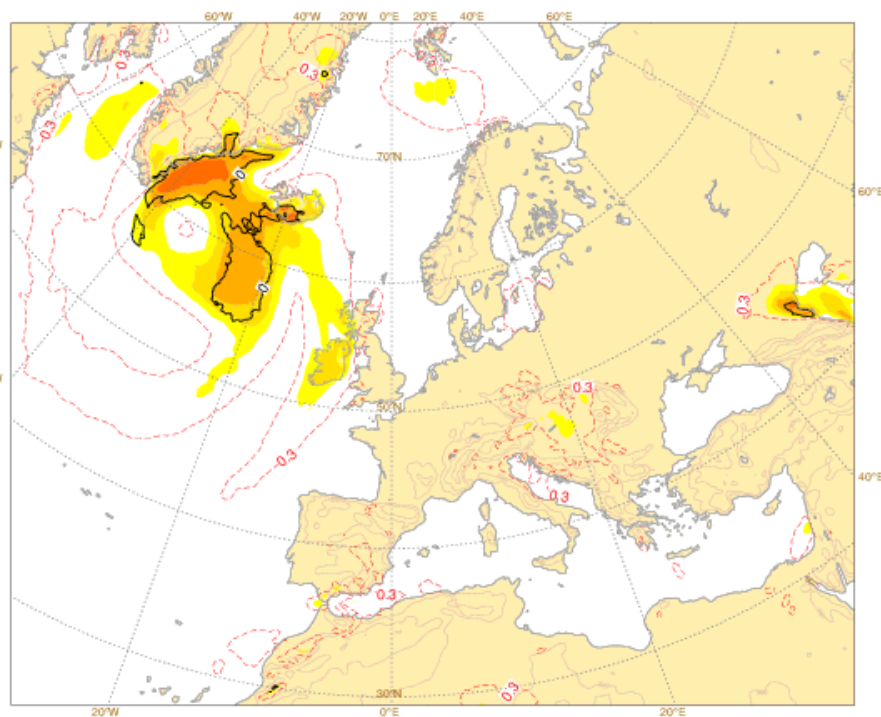
Mon 26 Sep 2016 00UTC @ECMWF VT: Sun 02 Oct 2016 00UTC - Mon 03 Oct 2016 00UTC 72-96h
10m wind gusts (in m/s) Model climate Q99 (one in 100 occasions realises more than value shown)



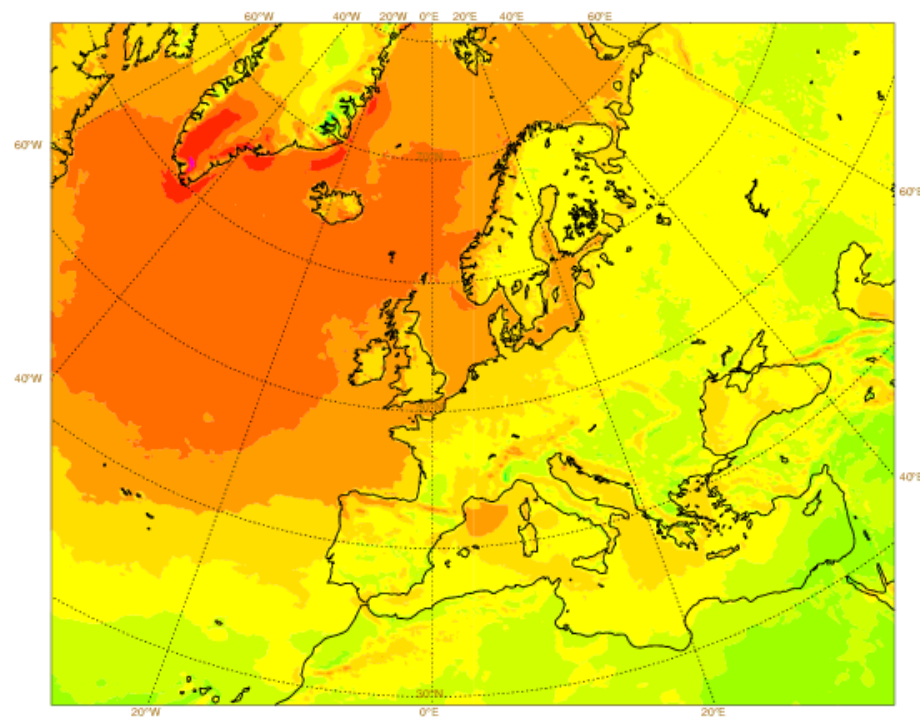
BT29/00Z

EFI wind for Mon 03/00Z to Tue 03/00Z

Thu 29 Sep 2016 00UTC @ECMWF t+96-120h VT: Mon 03 Oct 2016 00UTC - Tue 04 Oct 2016 00UTC
Extreme forecast index and Shift of Tails (black contours 0,1,2,5,8) for 10m wind gusts



Mon 26 Sep 2016 00UTC @ECMWF VT: Mon 03 Oct 2016 00UTC - Tue 04 Oct 2016 00UTC 96-120h
10m wind gusts (in m/s) Model climate Q99 (one in 100 occasions realises more than value shown)



BT29/00Z

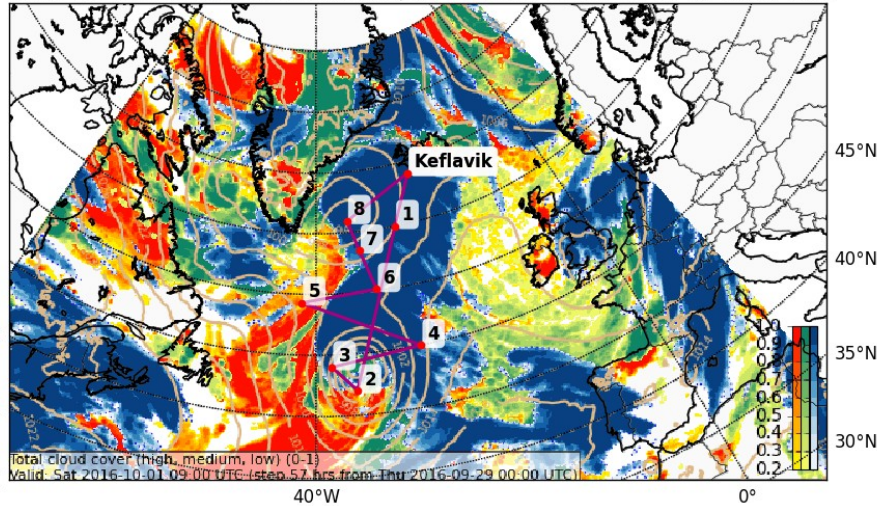
IOP6: HALO flight Saturday 1 Oct

Flight Plan for Sat (1. October)

Valid time: 09 UTC

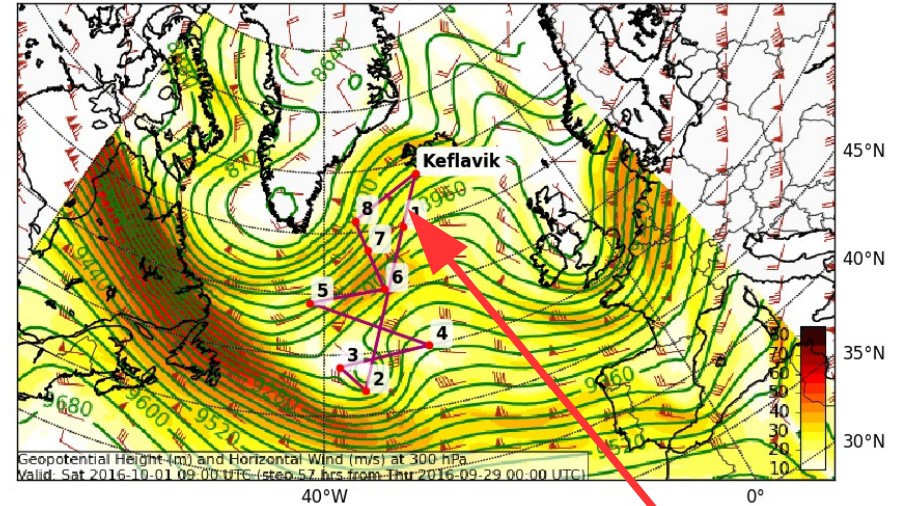
Cloud Cover (0-1) (Total Cloud Cover)

Valid: Sat 2016-10-01 09:00 UTC (step 57 hrs from Thu 2016-09-29 00:00 UTC)



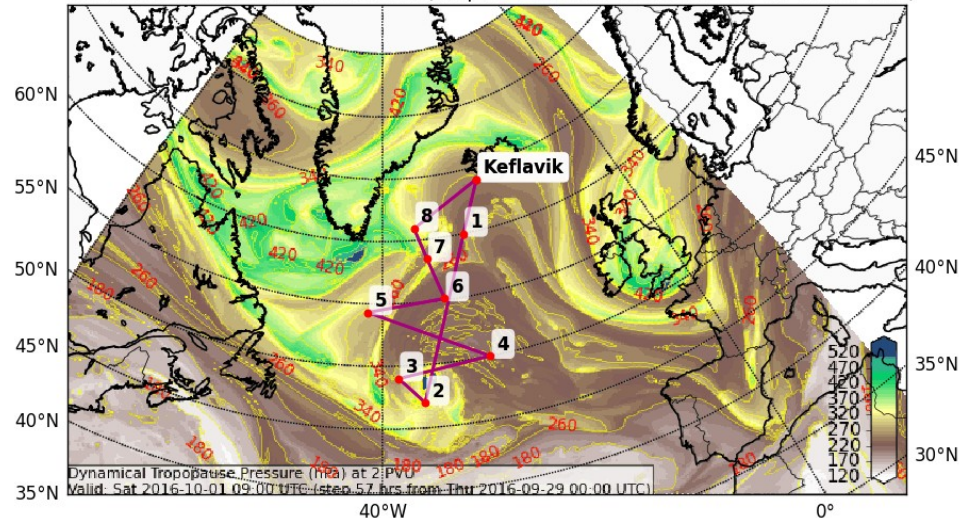
Geopotential Height (m) and Horizontal Wind (m/s) (Wind Speed 10-85 m/s) at 300 (hPa)

Valid: Sat 2016-10-01 09:00 UTC (step 57 hrs from Thu 2016-09-29 00:00 UTC)



Dynamical Tropopause (Pressure (hPa)) at 2000 (10^{-3} PVU)

Valid: Sat 2016-10-01 09:00 UTC (step 57 hrs from Thu 2016-09-29 00:00 UTC)

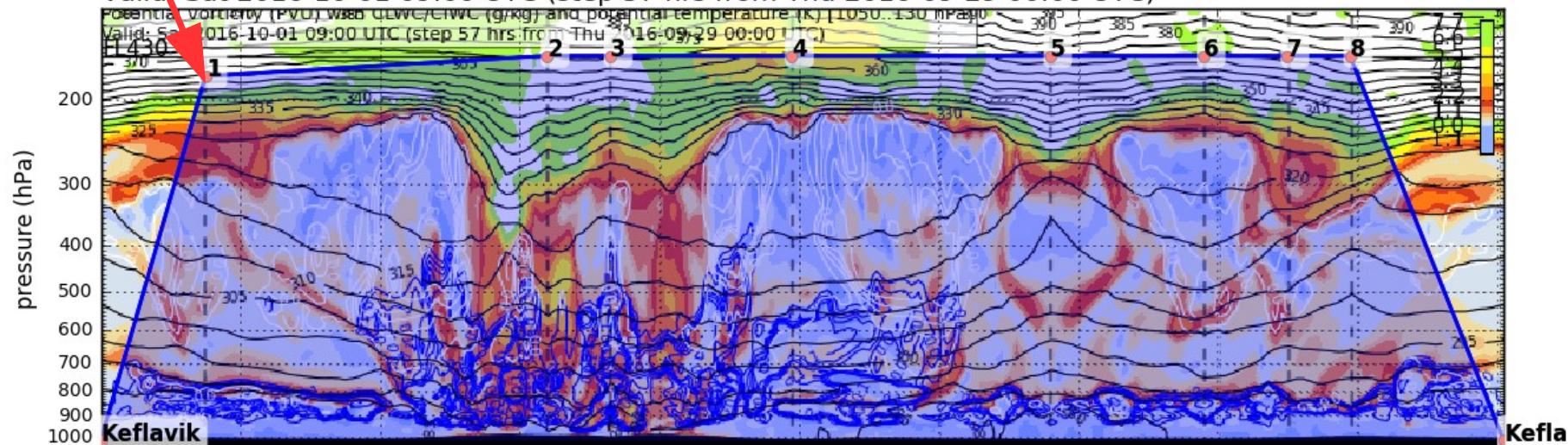


rise from FL410 to FL430

Valid time: 09 UTC

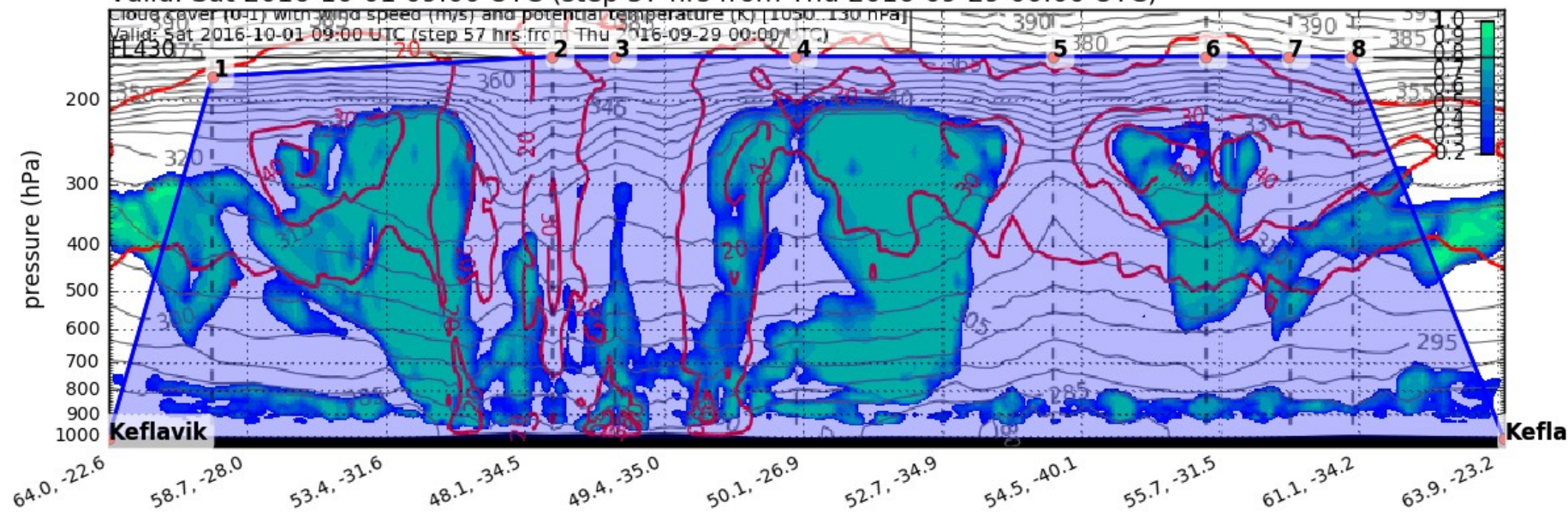
Potential Vorticity (PVU) Vertical Section (Northern Hemisphere)

Valid: Sat 2016-10-01 09:00 UTC (step 57 hrs from Thu 2016-09-29 00:00 UTC)



Cloud Cover (0-1) and Wind Speed (m/s) Vertical Section

Valid: Sat 2016-10-01 09:00 UTC (step 57 hrs from Thu 2016-09-29 00:00 UTC)

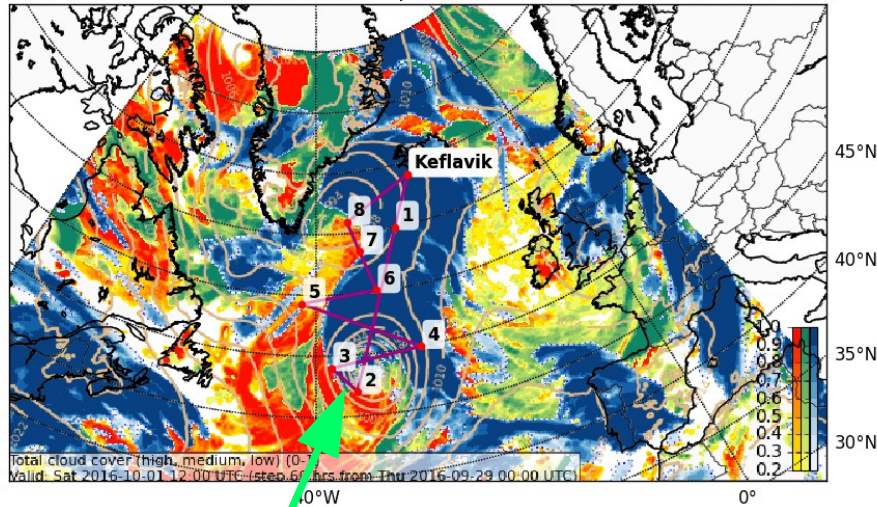


Flight Plan for Sat (1. October)

Valid time: 12 UTC

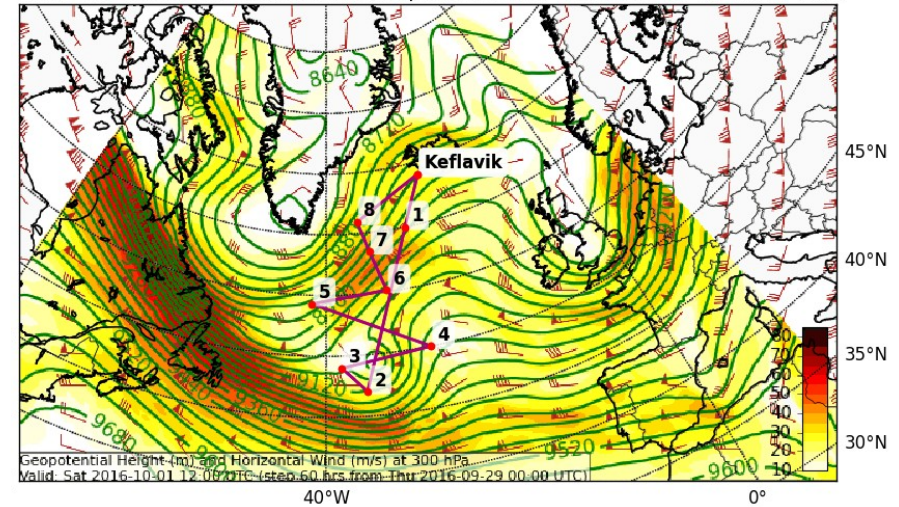
Cloud Cover (0-1) (Total Cloud Cover)

Valid: Sat 2016-10-01 12:00 UTC (step 60 hrs from Thu 2016-09-29 00:00 UTC)



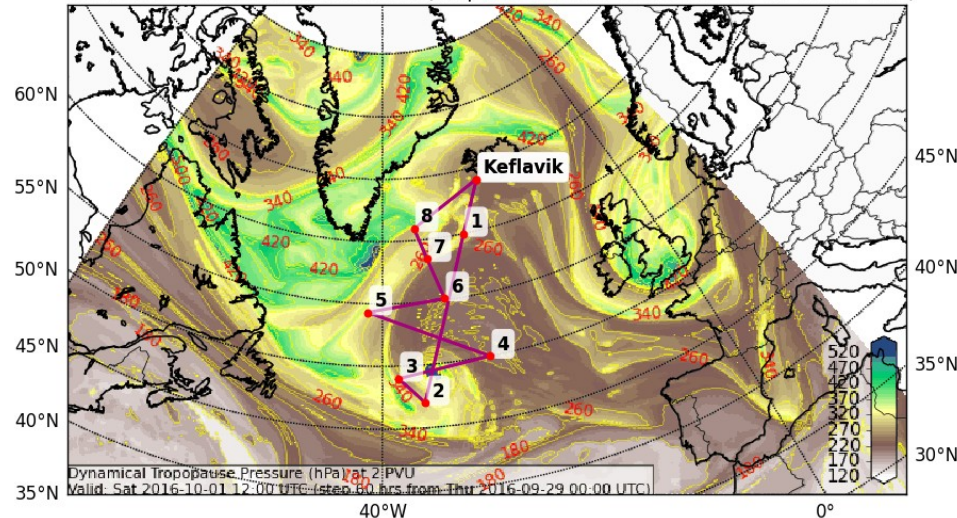
Geopotential Height (m) and Horizontal Wind (m/s) (Wind Speed 10-85 m/s) at 300 (hPa)

Valid: Sat 2016-10-01 12:00 UTC (step 60 hrs from Thu 2016-09-29 00:00 UTC)



Dynamical Tropopause (Pressure (hPa)) at 2000 (10^{-3} PVU)

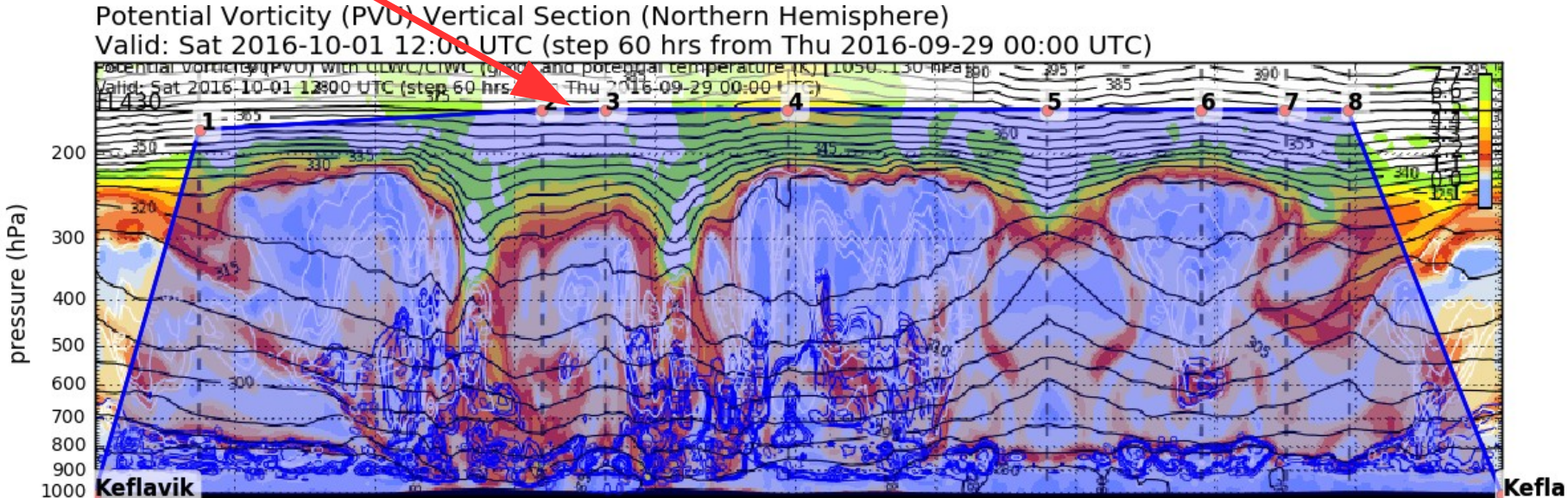
Valid: Sat 2016-10-01 12:00 UTC (step 60 hrs from Thu 2016-09-29 00:00 UTC)



arrival at
southernmost point:
~11:15 UTC

Measure temp. & moisture structure in PV-anomaly

Valid time: 12 UTC



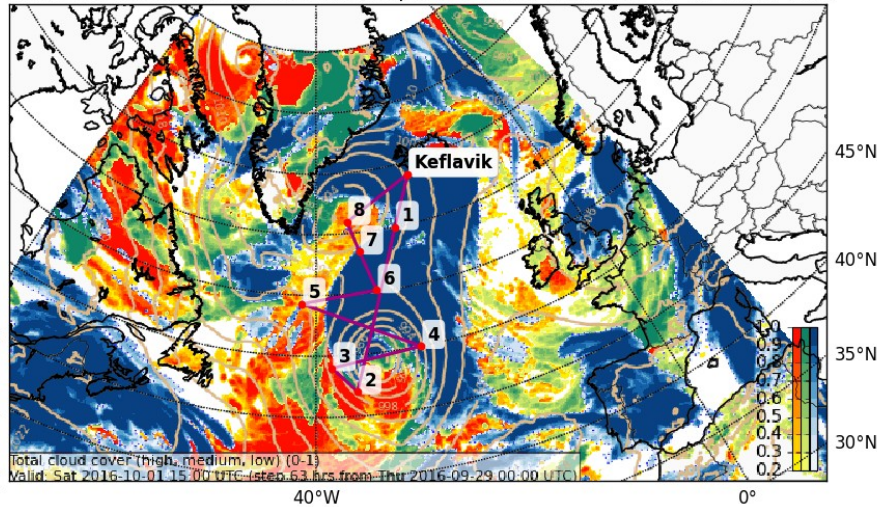
64.0, -22.6 58.7, -28.0 53.4, -31.6 48.1, -34.5 49.4, -35.0 50.1, -26.9 52.7, -34.9 54.5, -40.1 55.7, -31.5 61.1, -34.2 63.9, -23.2

Flight Plan for Sat (1. October)

Valid time: 15 UTC

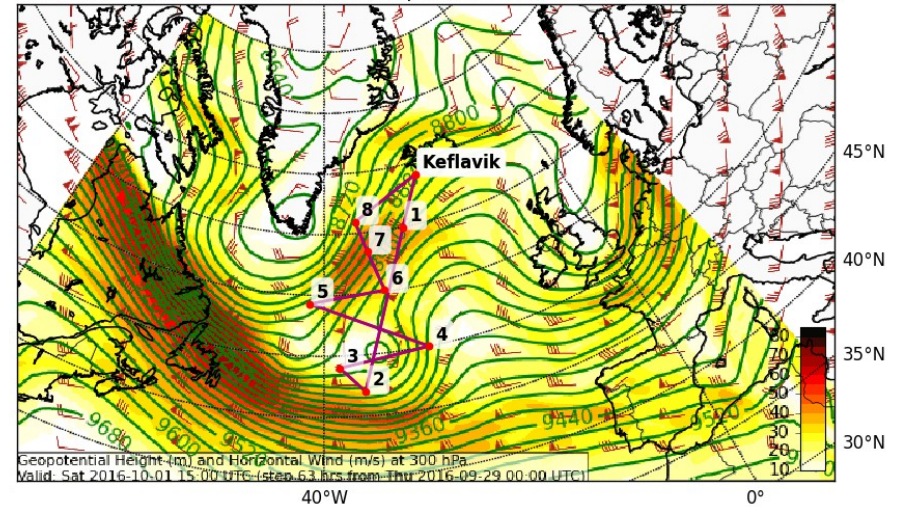
Cloud Cover (0-1) (Total Cloud Cover)

Valid: Sat 2016-10-01 15:00 UTC (step 63 hrs from Thu 2016-09-29 00:00 UTC)



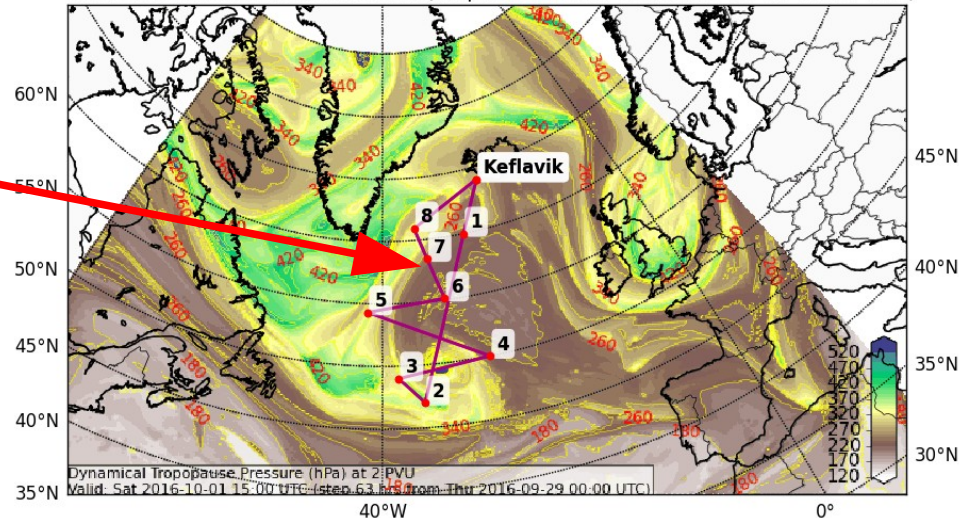
Geopotential Height (m) and Horizontal Wind (m/s) (Wind Speed 10-85 m/s) at 300 (hPa)

Valid: Sat 2016-10-01 15:00 UTC (step 63 hrs from Thu 2016-09-29 00:00 UTC)

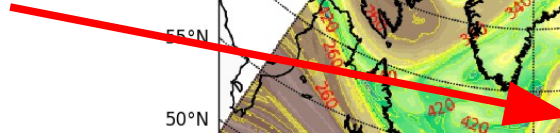


Dynamical Tropopause (Pressure (hPa)) at 2000 (10^{-3} PVU)

Valid: Sat 2016-10-01 15:00 UTC (step 63 hrs from Thu 2016-09-29 00:00 UTC)

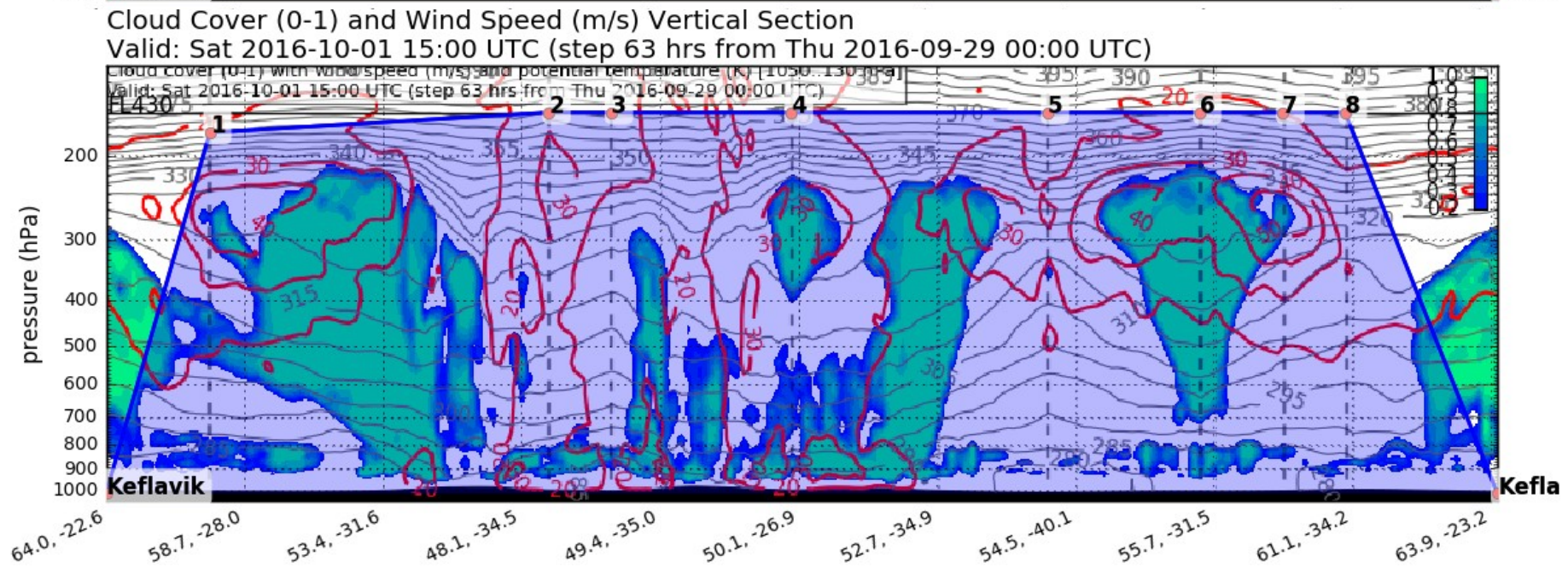
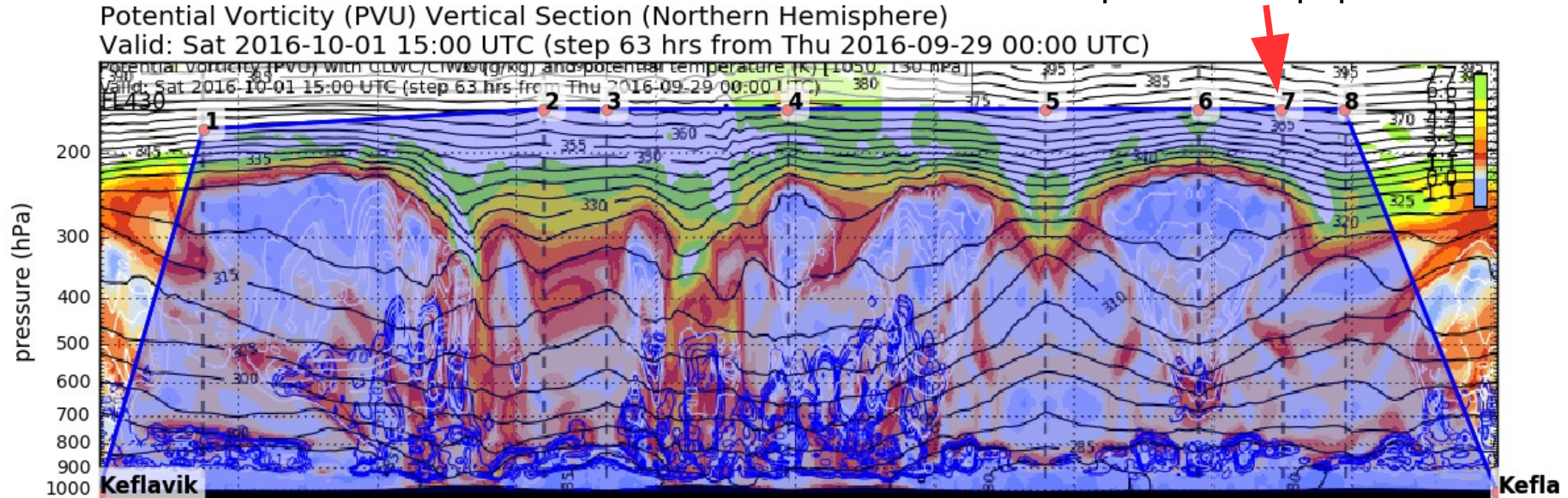


Satellite overpass at
15:01 UTC



Valid time: 15 UTC

Measure moisture structure in tropopause level and high wind speeds in tropopause fold



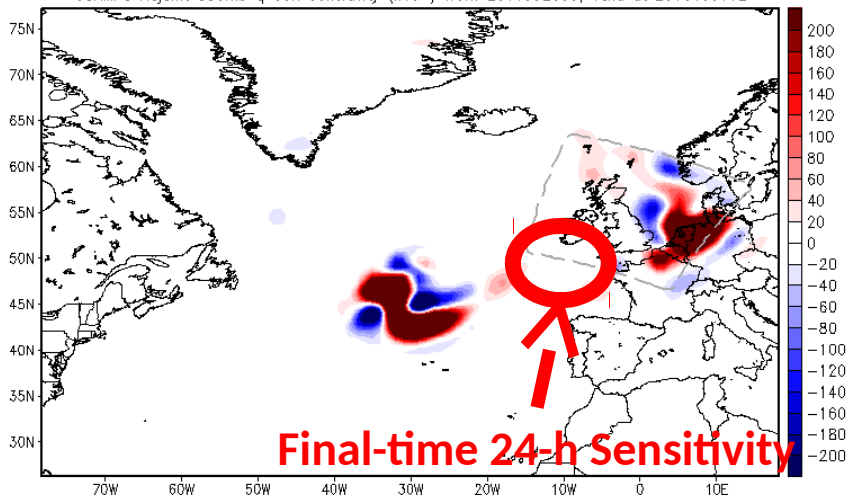
Additional soundings

COAMPS Sensitivity (24h) Valid 12Z 1 Oct (Saturday)

Sensitivity centered on mid-Atlantic low. 00Z sondes from Azores?

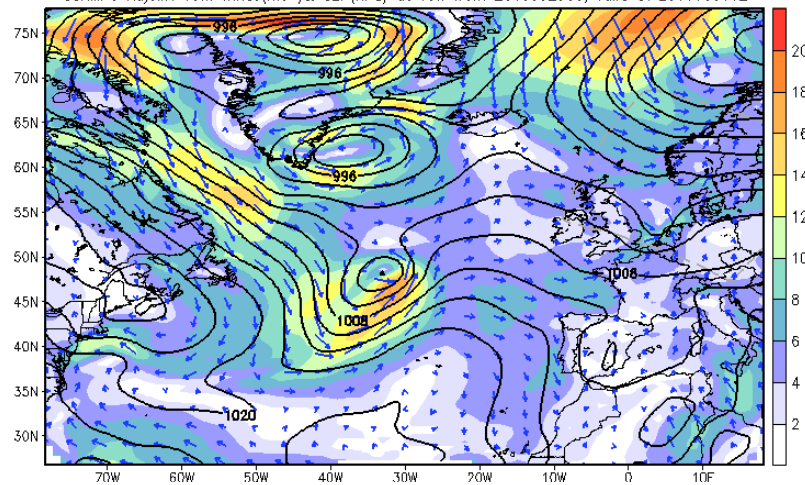
850 Q Sensitivity valid 12Z 1 OCT

COAMPS Adjoint 850mb q 60h Sensitivity ($\times 10^{-2}$) from 2016092900, valid at 2016100112



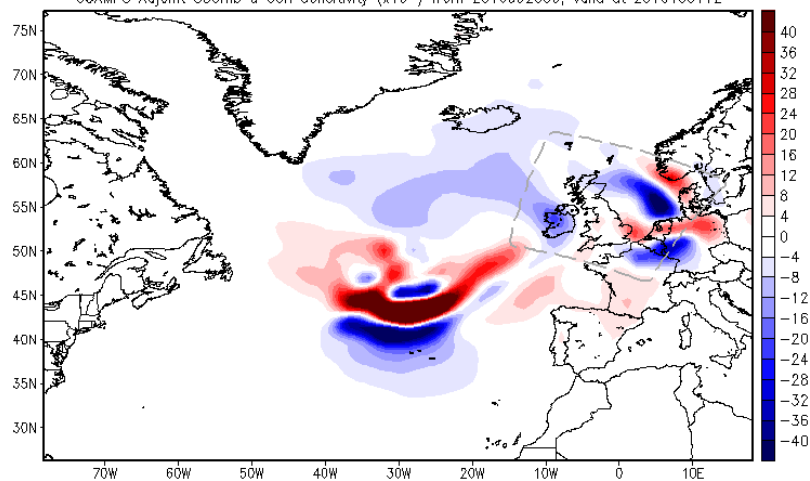
SLP, 10-m winds valid 12Z 1 OCT

COAMPS Adjoint 10m Winds(ms^{-1}) & SLP(hPa) at 60h from 2016092900, valid at 2016100112



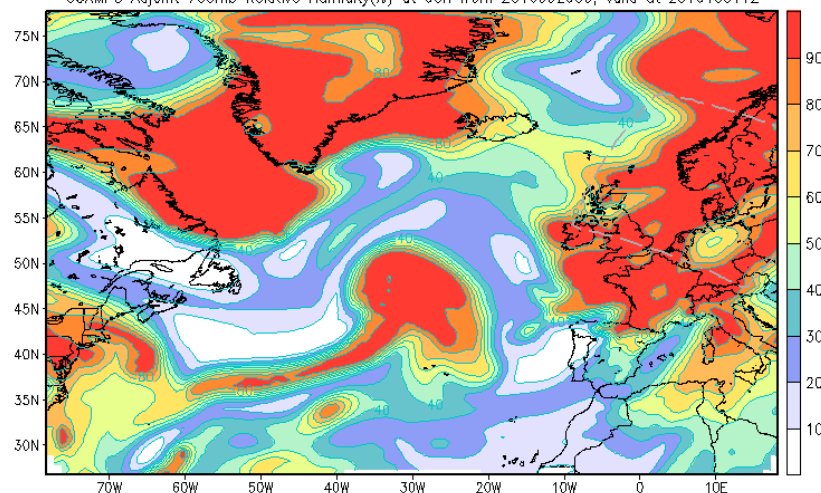
850 U Sensitivity valid 12Z 1 OCT

COAMPS Adjoint 850mb u 60h Sensitivity ($\times 10^{-2}$) from 2016092900, valid at 2016100112



700 RH valid 12Z 1 OCT

COAMPS Adjoint 700mb Relative Humidity(%) at 60h from 2016092900, valid at 2016100112

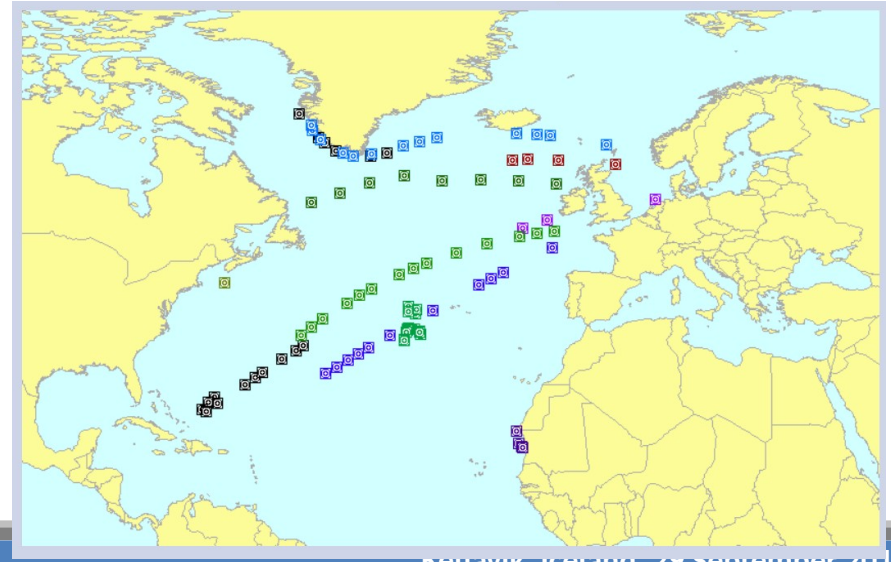
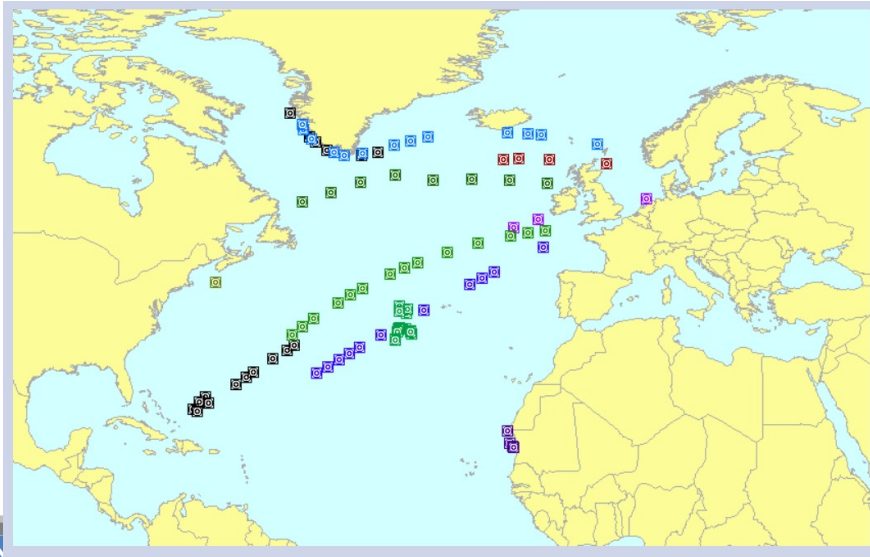
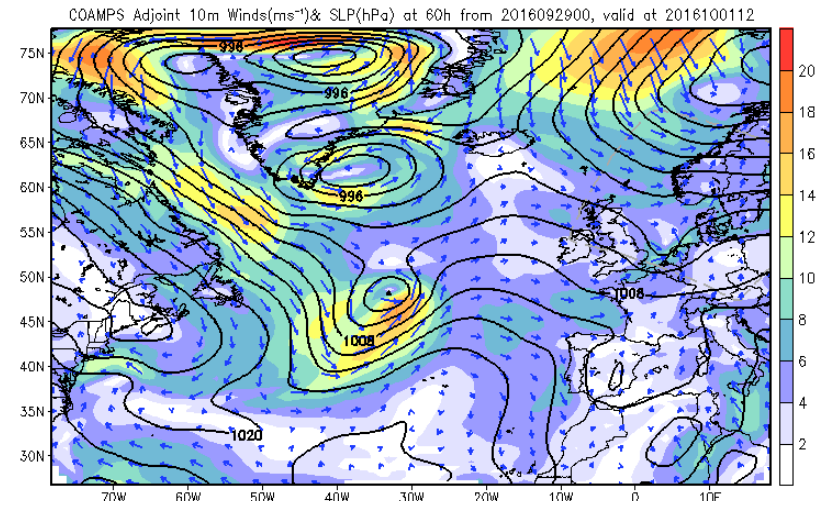
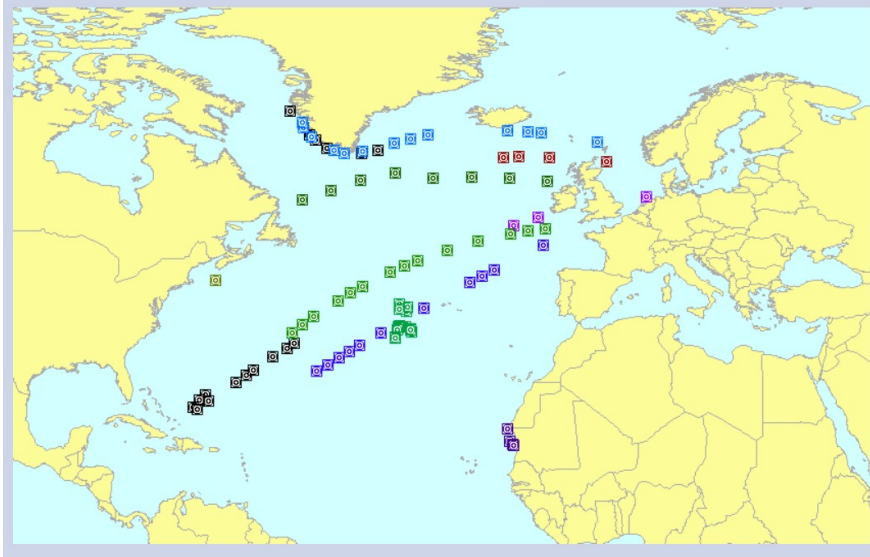


Location of final-time 24-h Sensitivity

COAMPS Sensitivity (48h) Valid 12Z 1 Oct (Saturday)

Radiosondes from ships

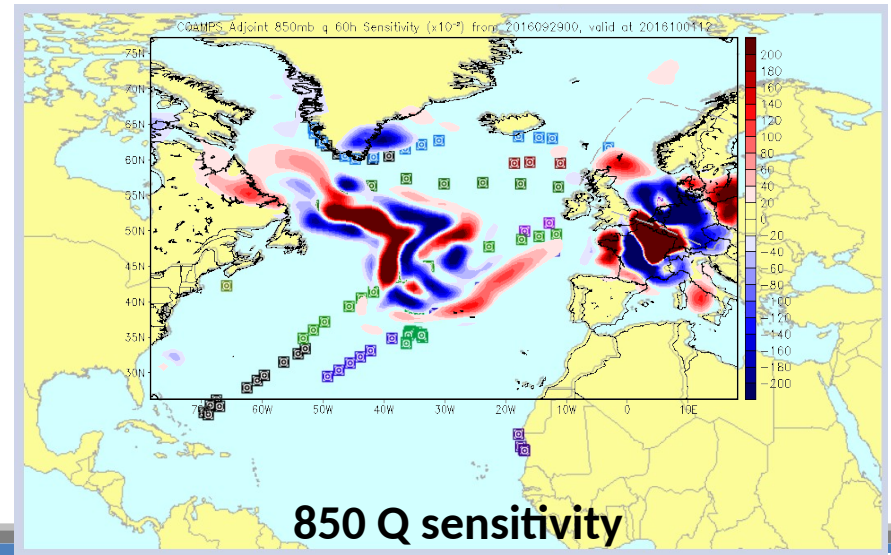
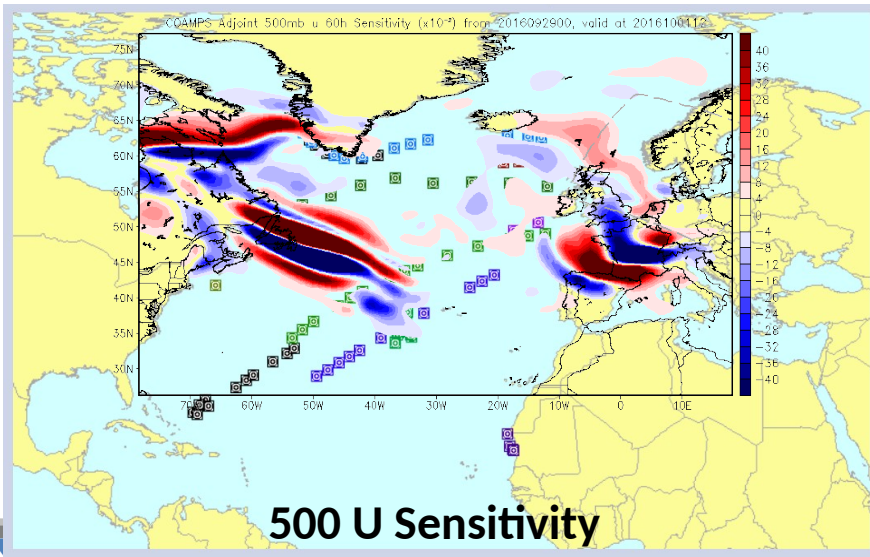
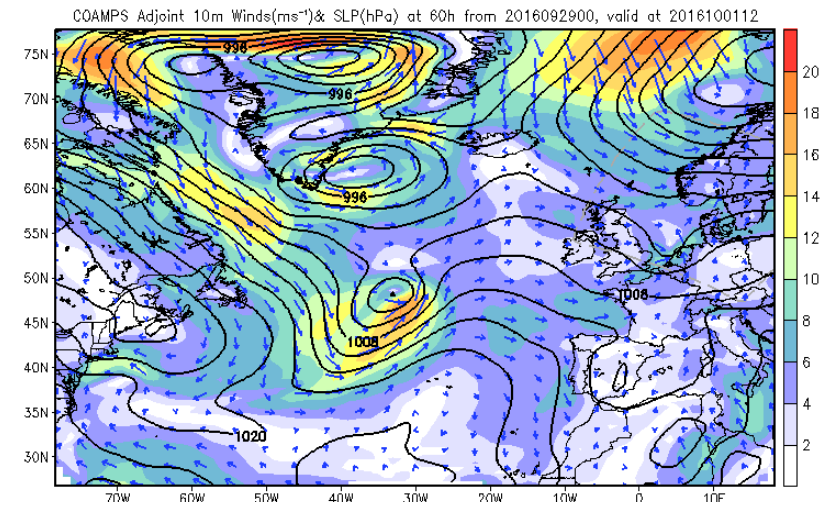
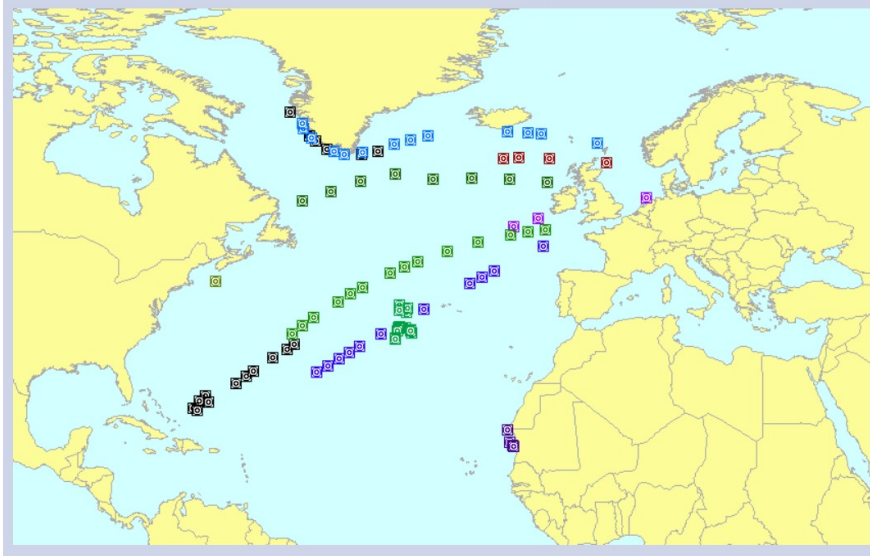
SLP, 10-m winds valid 12Z 1 OCT



COAMPS Sensitivity (48h) Valid 12Z 1 Oct (Saturday)

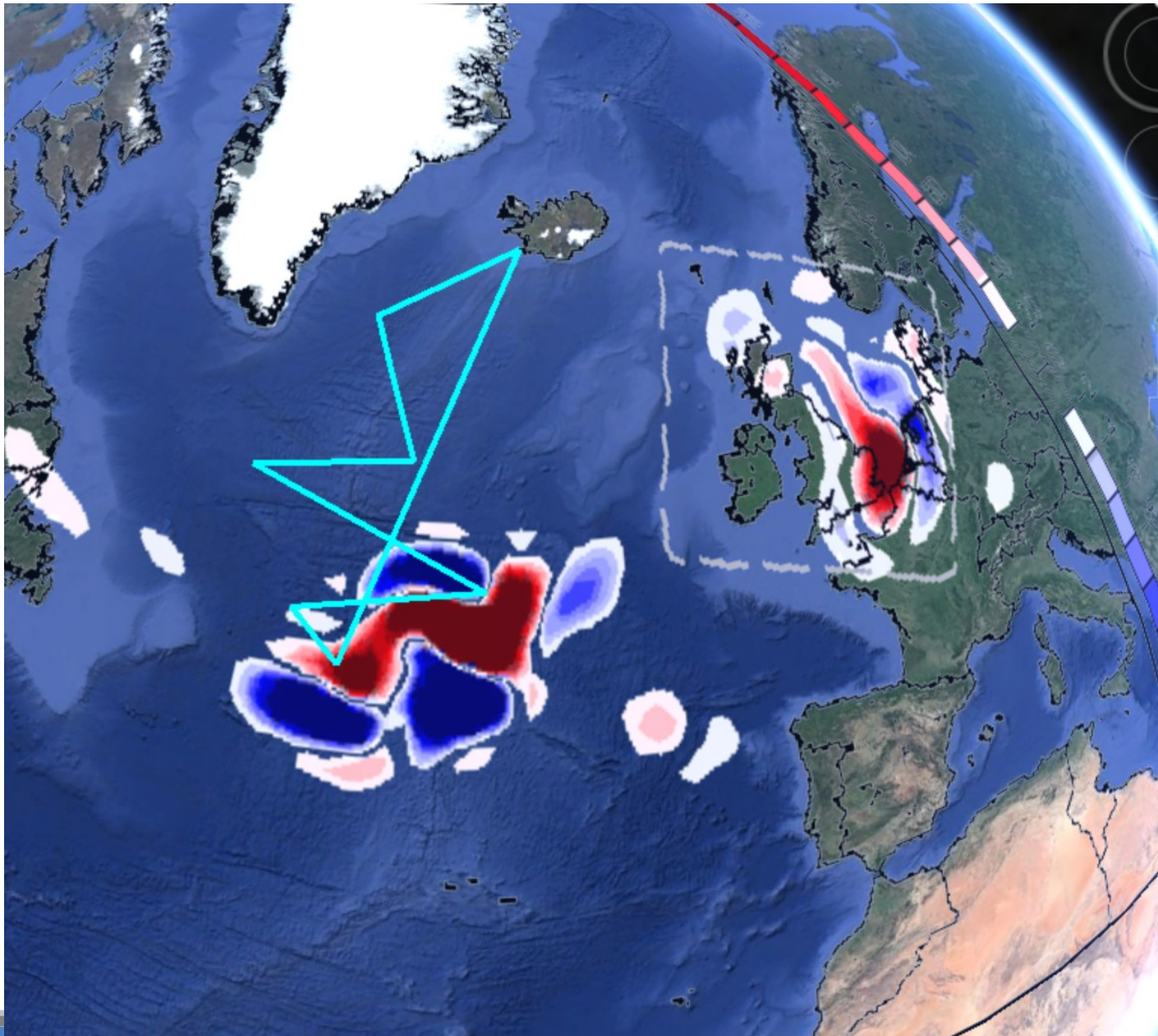
Radiosondes from ships

SLP, 10-m winds valid 12Z 1 OCT



COAMPS Sensitivity (24h) Valid 12Z 1 Oct (Saturday)

500-mb Water Vapor Sensitivity (to 24-h Rainfall Forecast over UK)

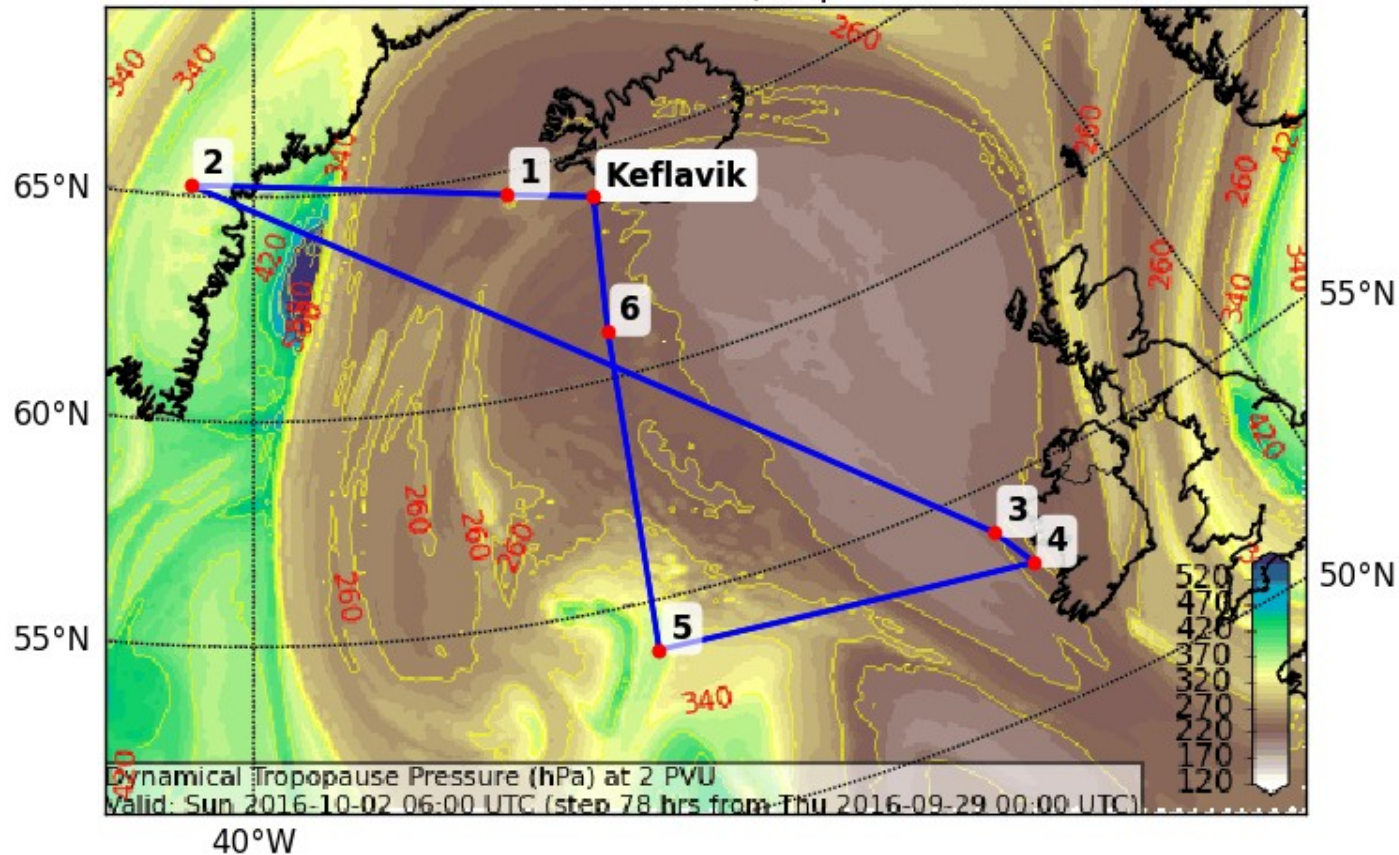


IOP7: HALO flight Sunday 2 Oct

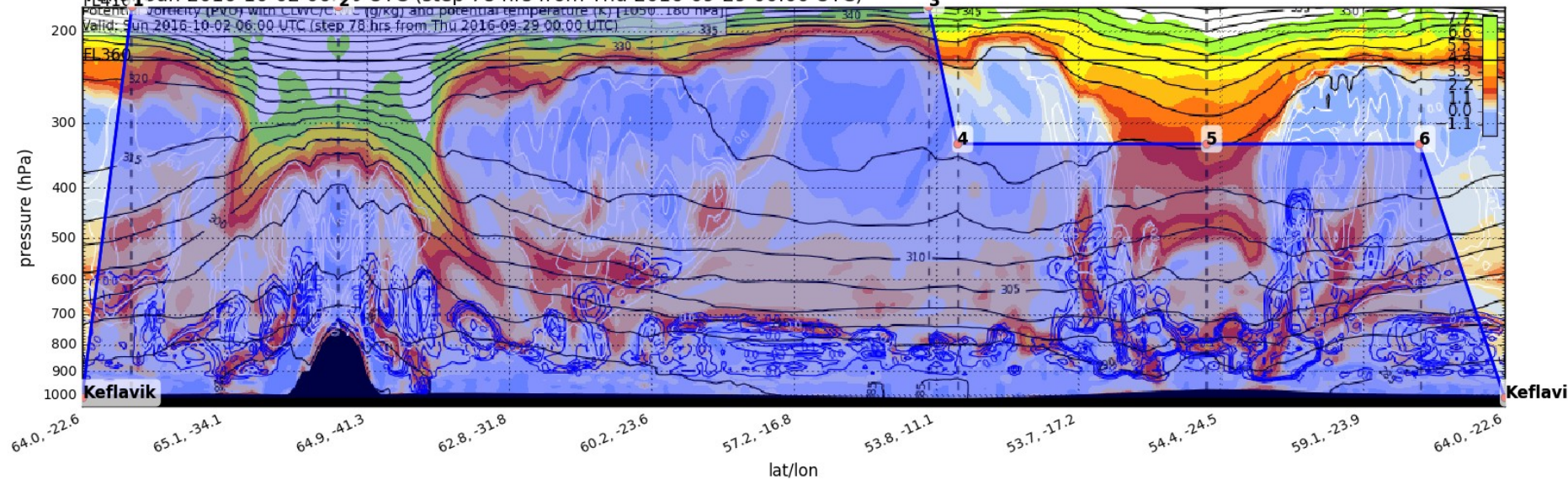
Draft Objectives for IOP7 on Sunday 2 Oct 2016

- Sample the WCB outflow associated with the rapid cyclogenesis observed in IOP6 on Sat
 - Observe structure of 2 upper level jets and tropopause features incl. tropopause folds and finescale structure
 - Observe depth and variability of humidity in the ascending branch
 - Compare and contrast observations of the cyclone in differing phases of development (i.e., early rapid development stage on Sat and mature phase on Sun), and what are the implications for the WCB outflow
 - Sample regions around a cyclone that has relatively low intensity predictability (and higher position predictability)

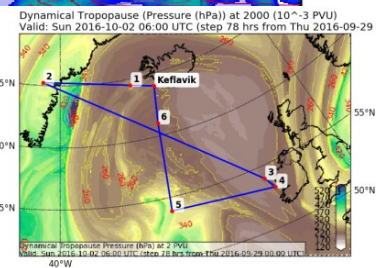
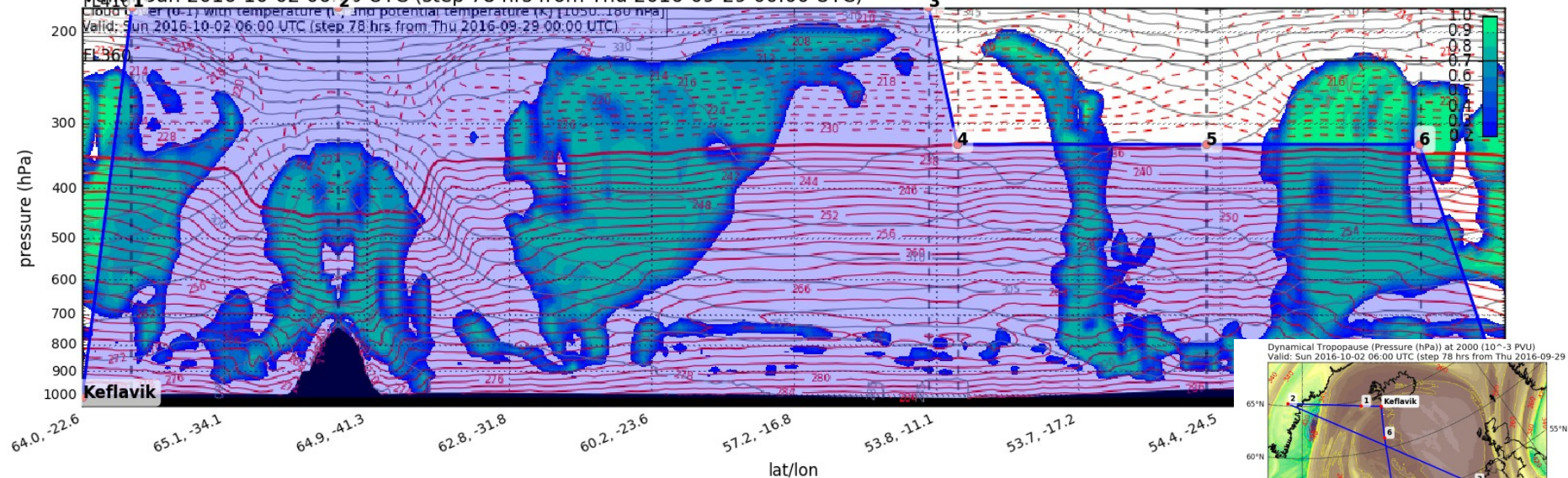
Dynamical Tropopause (Pressure (hPa)) at 2000 (10^{-3} PVU)
Valid: Sun 2016-10-02 06:00 UTC (step 78 hrs from Thu 2016-09-29 00:00 UTC)



Potential Vorticity (PVU) Vertical Section (Northern Hemisphere) Valid: Sun 2016-10-02 06:00 UTC (step 78 hrs from Thu 2016-09-29 00:00 UTC)



Cloud Cover (0-1) Vertical Section Valid: Sun 2016-10-02 06:00 UTC (step 78 hrs from Thu 2016-09-29 00:00 UTC)

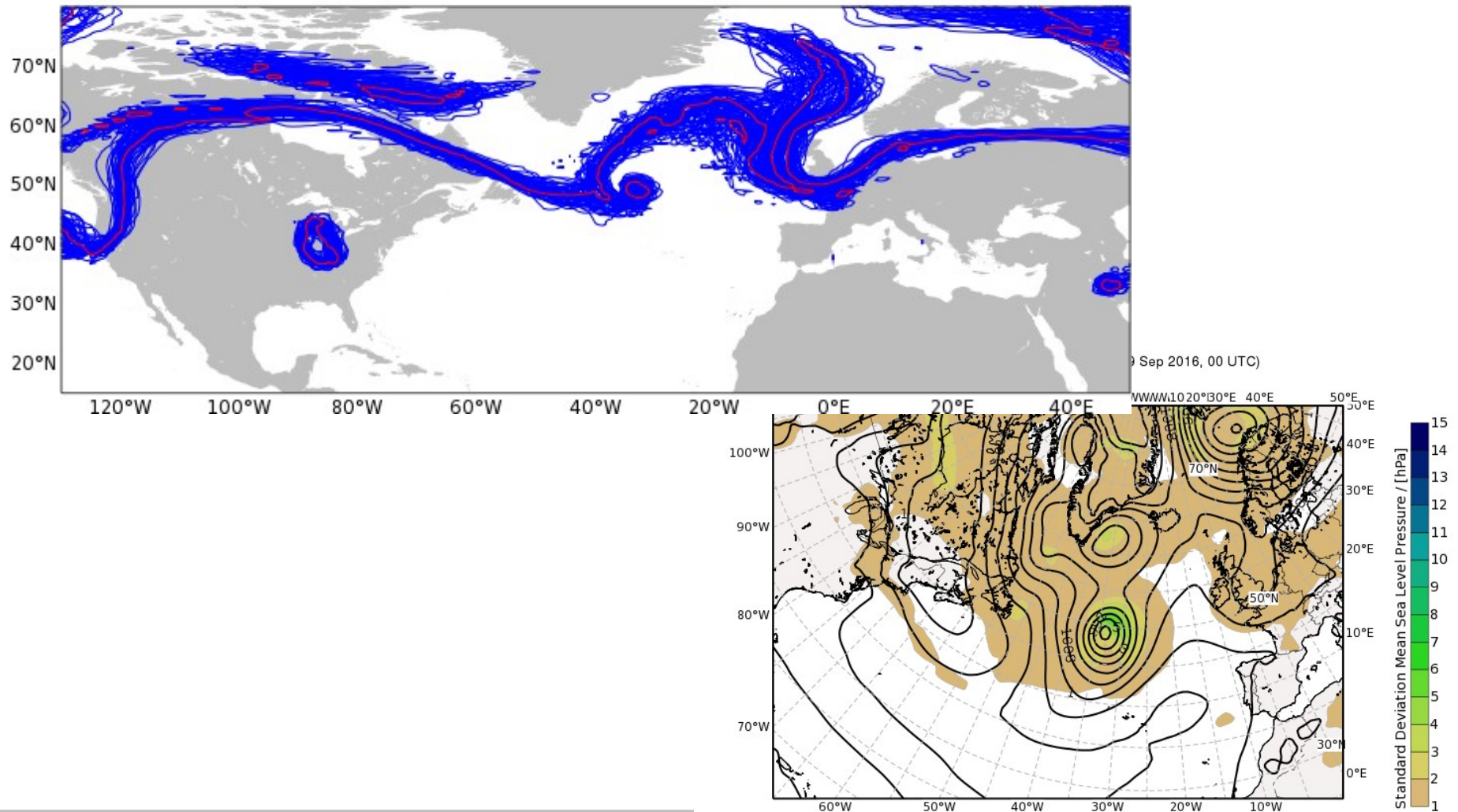


Outlook

Outlook Sat 01/12Z to Thu 06/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 29/00Z)

Sat 01/12Z

ECMWF ENSEMBLE FC
BT: 20160929 00UTC, VT: 20161001 12UTC
blue: perturbed, red: control



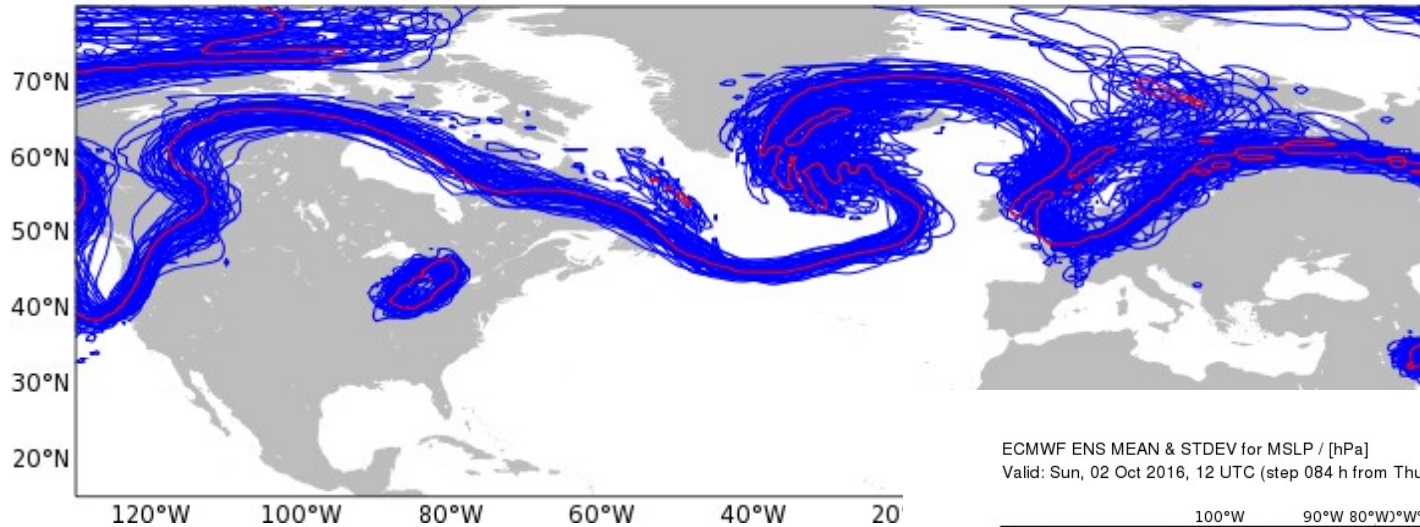
Outlook Sat 01/12Z to Thu 06/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 29/00Z)

Sun 02/12Z

ECMWF ENSEMBLE FC

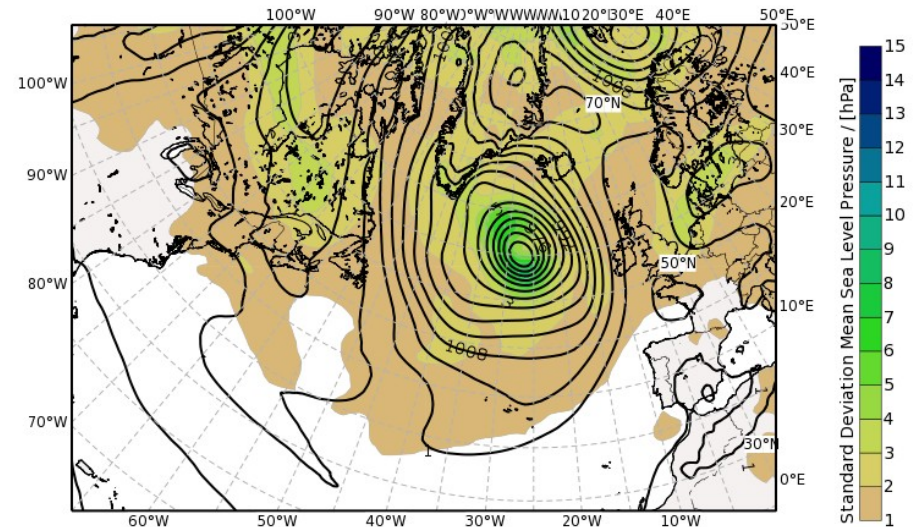
BT: 20160929 00UTC, VT: 20161002 12UTC

blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

Valid: Sun, 02 Oct 2016, 12 UTC (step 084 h from Thu, 29 Sep 2016, 00 UTC)



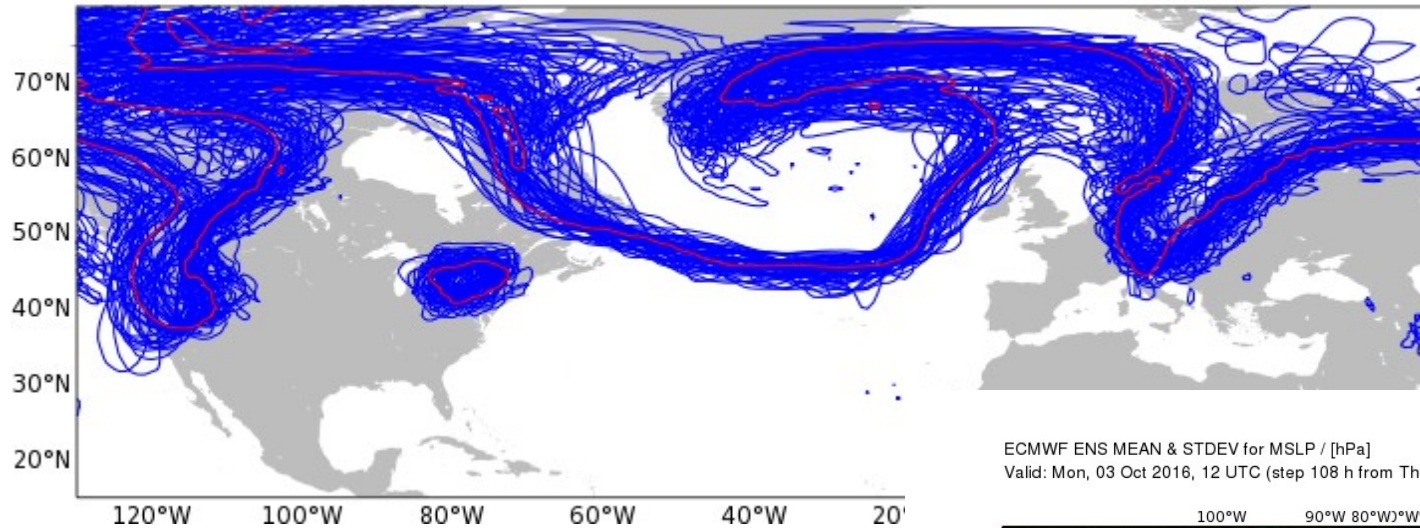
Outlook Sat 01/12Z to Thu 06/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 29/00Z)

Mo 03/12Z

ECMWF ENSEMBLE FC

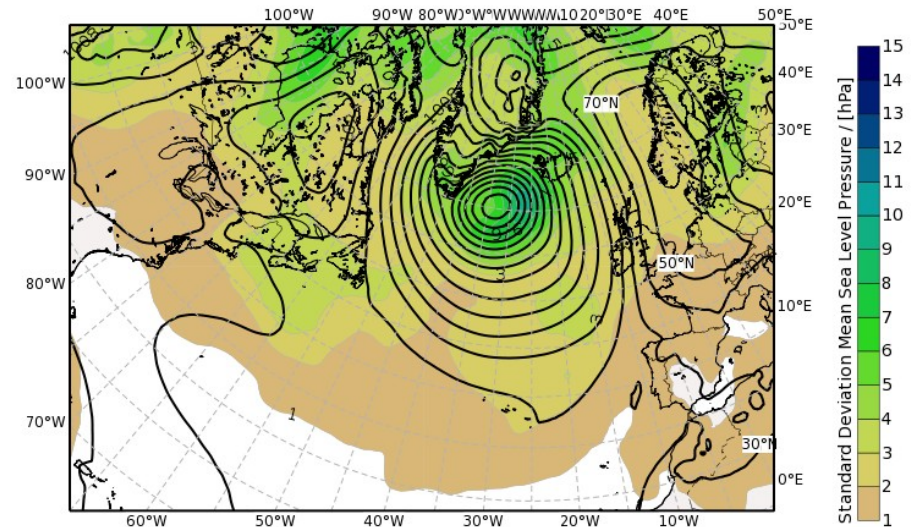
BT: 20160929 00UTC, VT: 20161003 12UTC

blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

Valid: Mon, 03 Oct 2016, 12 UTC (step 108 h from Thu, 29 Sep 2016, 00 UTC)



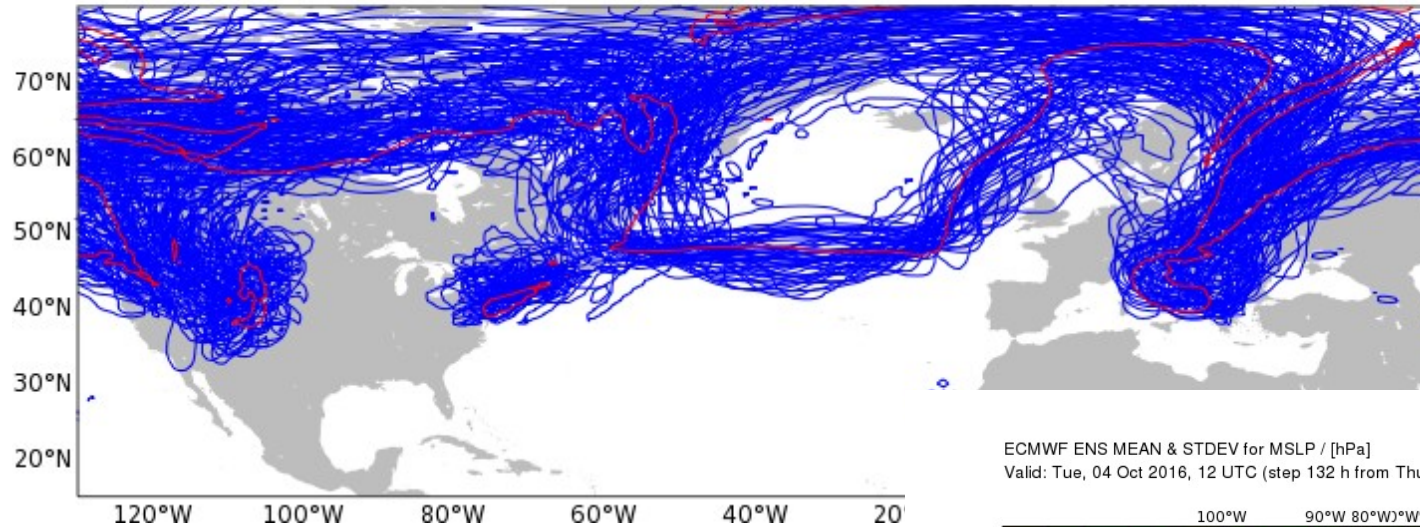
Outlook Sat 01/12Z to Thu 06/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 29/00Z)

Tue 04/12Z

ECMWF ENSEMBLE FC

BT: 20160929 00UTC, VT: 20161004 12UTC

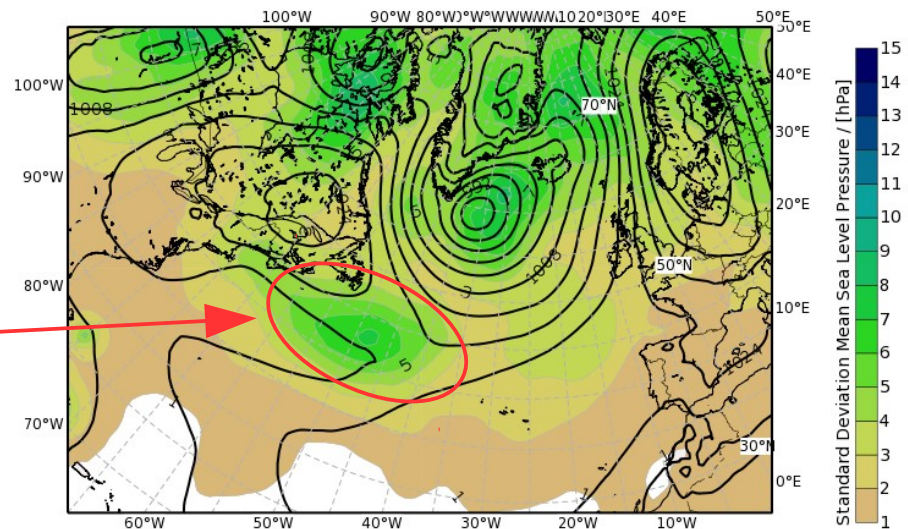
blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

Valid: Tue, 04 Oct 2016, 12 UTC (step 132 h from Thu, 29 Sep 2016, 00 UTC)

**New cyclone
development**



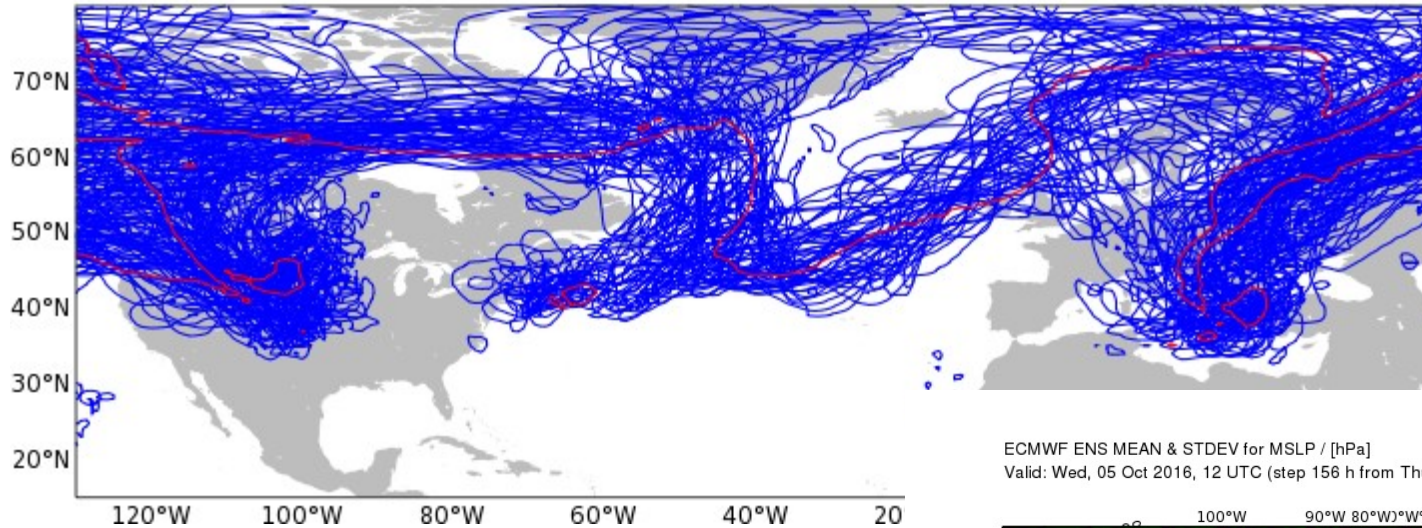
Outlook Sat 01/12Z to Thu 06/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 29/00Z)

Wed 05/12Z

ECMWF ENSEMBLE FC

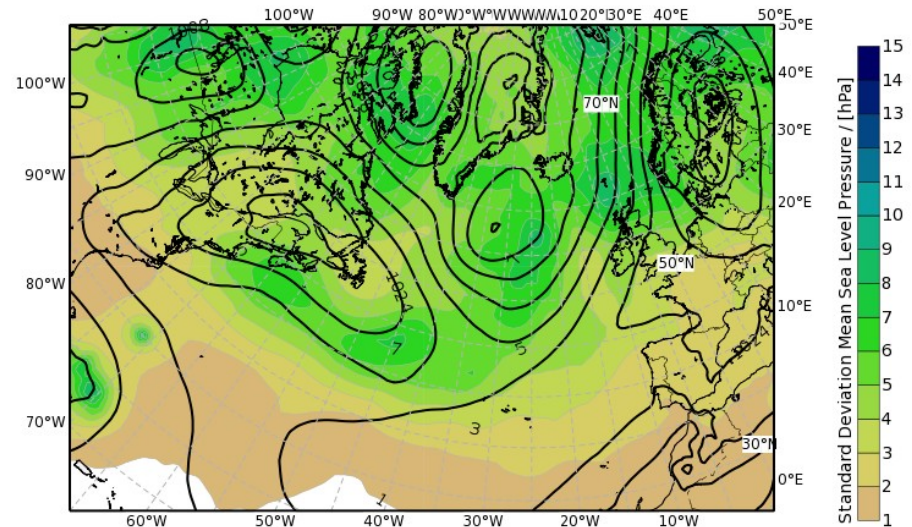
BT: 20160929 00UTC, VT: 20161005 12UTC

blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

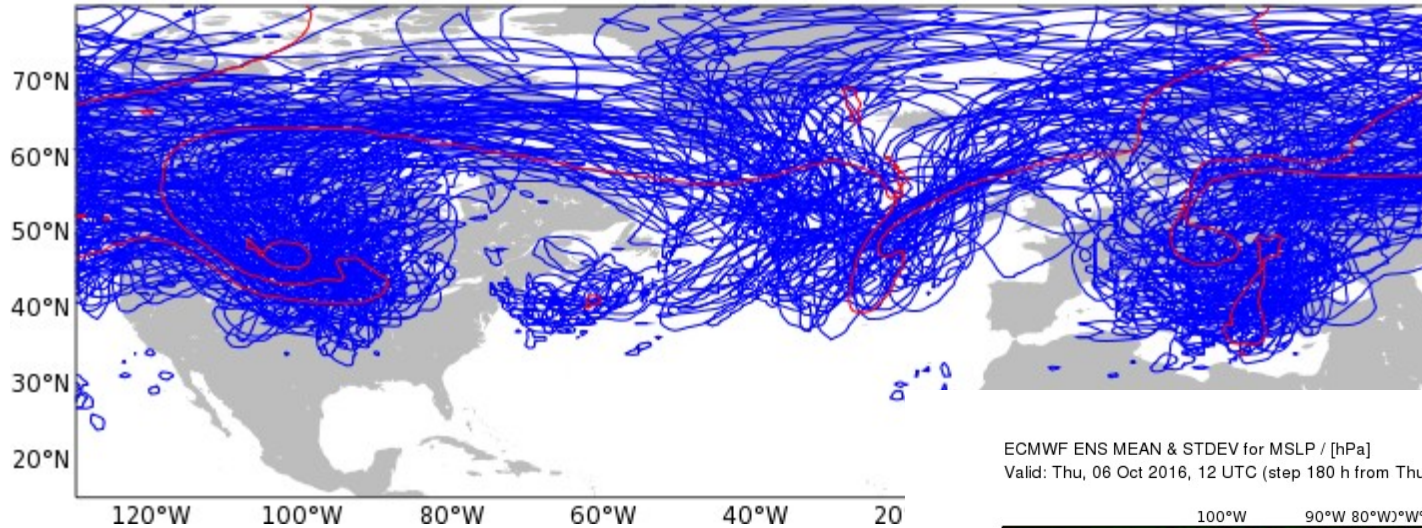
Valid: Wed, 05 Oct 2016, 12 UTC (step 156 h from Thu, 29 Sep 2016, 00 UTC)



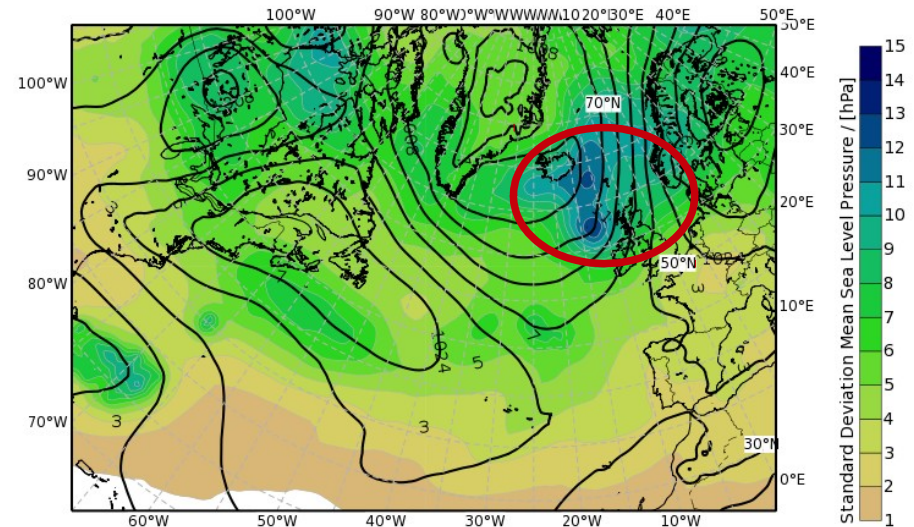
Outlook Sat 01/12Z to Thu 06/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 29/00Z)

Thu 06/12Z

ECMWF ENSEMBLE FC
BT: 20160929 00UTC, VT: 20161006 12UTC
blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]
Valid: Thu, 06 Oct 2016, 12 UTC (step 180 h from Thu, 29 Sep 2016, 00 UTC)



About 50% of members of both EC and GFS show strong cyclone development near Iceland on Wed-Thu

Summary

- HALO flight on Saturday, take-off 9:30 UTC
- HALO/Falcon flights on Sunday, take-off tbd

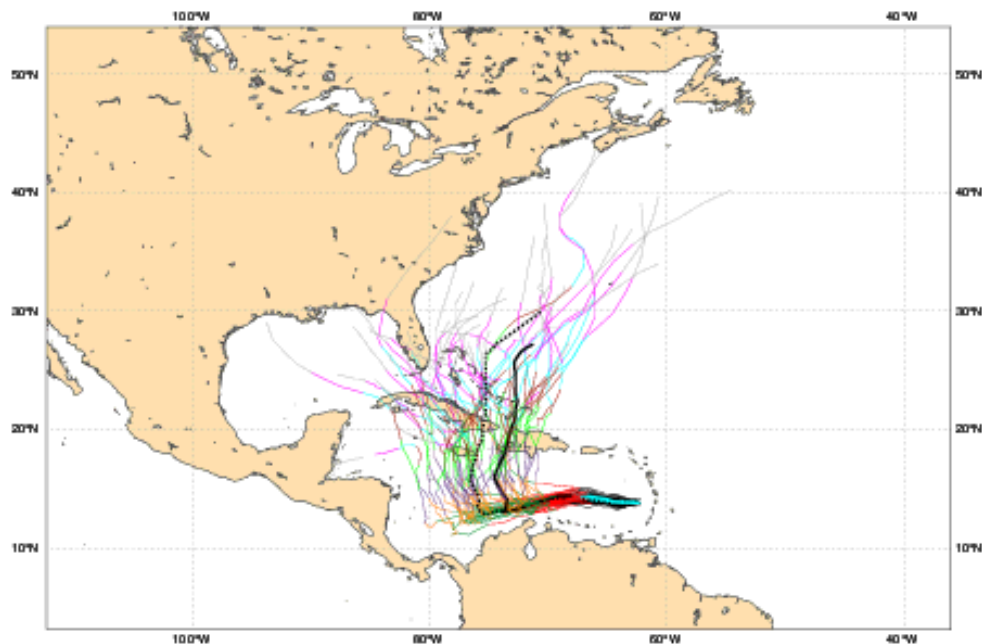
TC Matthew track forecast BT 29/00Z

Date 20160929 00 UTC @ECMWF

Individual trajectories for **MATTHEW** during the next 240 hours

tracks: **thick solid**=HRES; **thick dot**=CTRL; **thin solid**=EPS members [coloured]

0-24h 24-48h 48-72h 72-96h 96-120h 120-144h 144-168h 168-192h 192-216h 216-240h



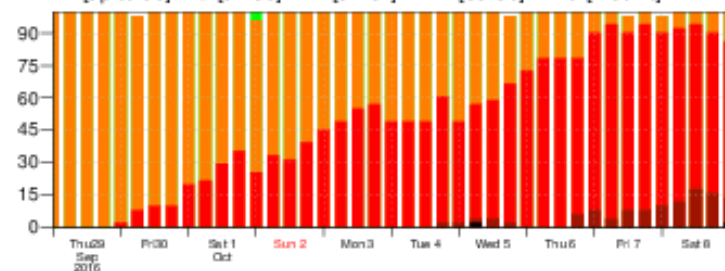
List of ensemble members numbers forecast Tropical Cyclone

Intensity category in colours: **TD**[up to 33] **TS**[34-63] **HR1**[64-82] **HR2**[83-95] **HR3**[> 95 kt]

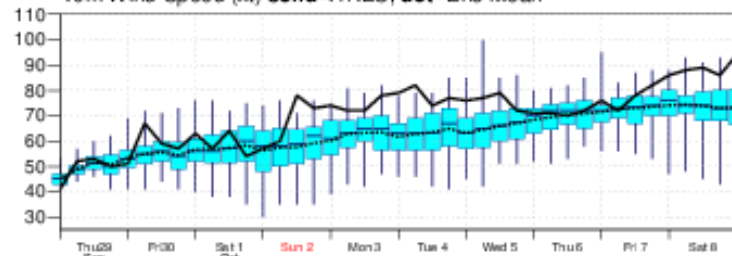
+024 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +048 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +072 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +096 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +120 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +144 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +168 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +192 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +216 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +240 h - hr: 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

Probability (%) of Tropical Cyclone Intensity falling in each category

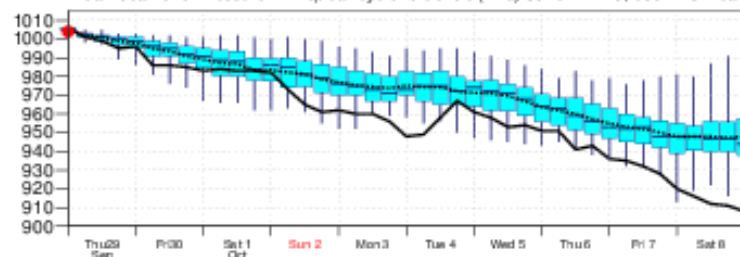
TD[up to 33] **TS** [34-63] **HR1**[64-82] **HR2** [83-95] **HR3** [> 95 kt]



10m Wind Speed (kt) **solid**=HRES; **dot**=Ens Mean



Mean Sea Level Pressure in Tropical Cyclone Centre (hPa) **solid**=HRES; **dot**=Ens Mean



BT29/00Z