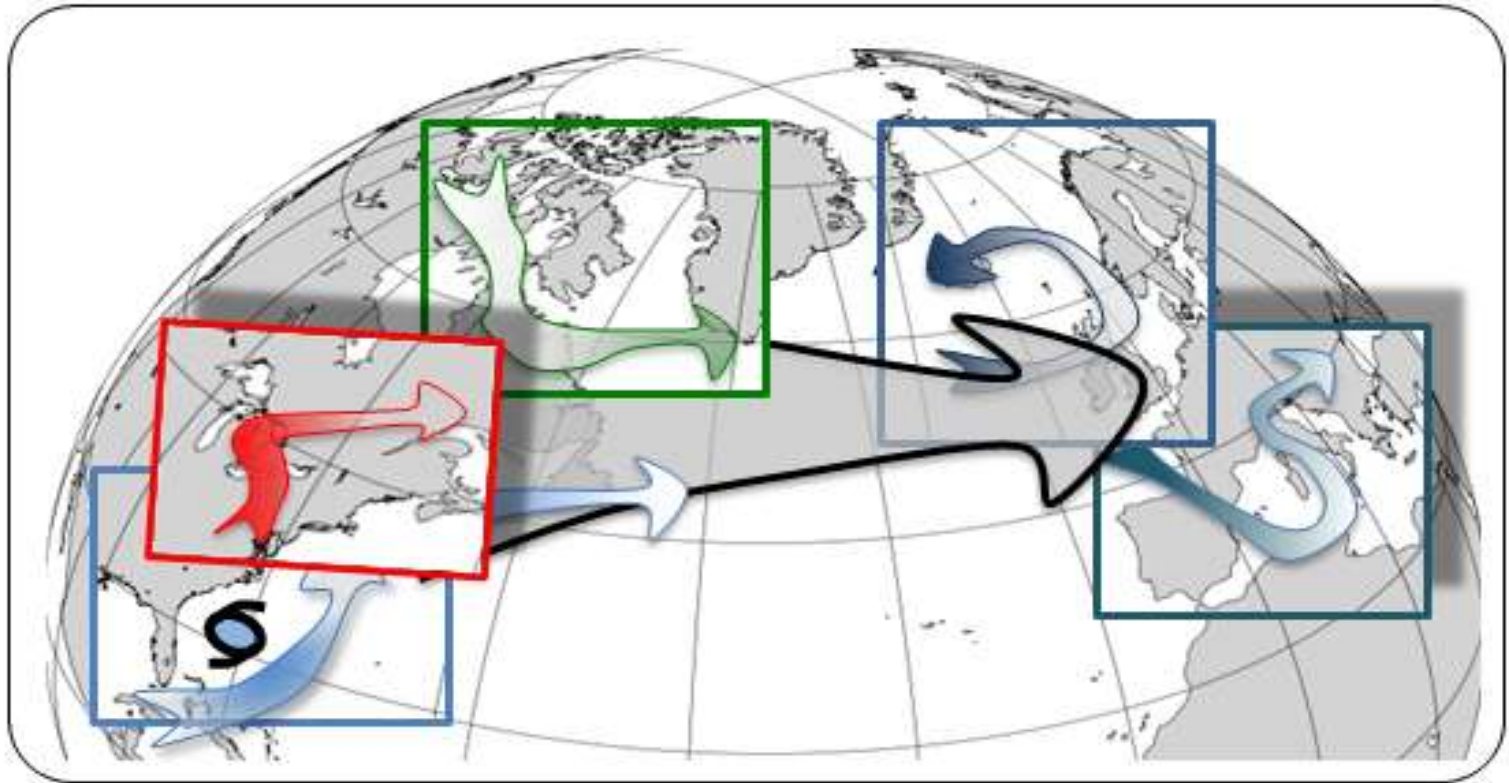


NAWDEX – Flight Planning Meeting

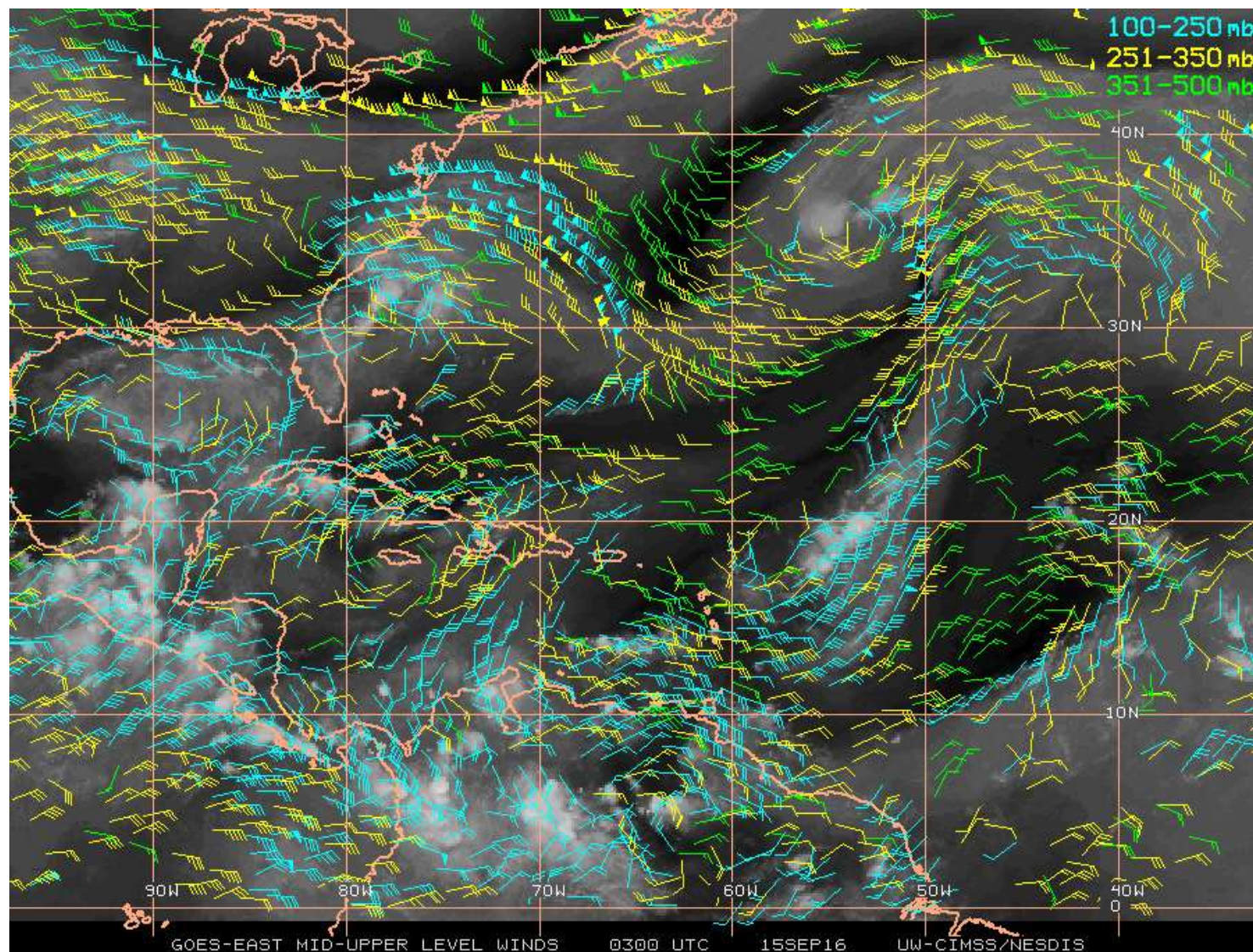
15 September 2016, online conference



Tasks and schedule

- **Plans for Halo and Falcon** transfer scheduled for **Saturday**
- Today's weather briefing
- Current situation
- Evolution on Saturday
- Uncertainty on Saturday
- **Decision about Dropsonde locations!**
- **Decision about additional sfc RASO times**
- Further outlook

TC Ian Track current situation 15 Sep



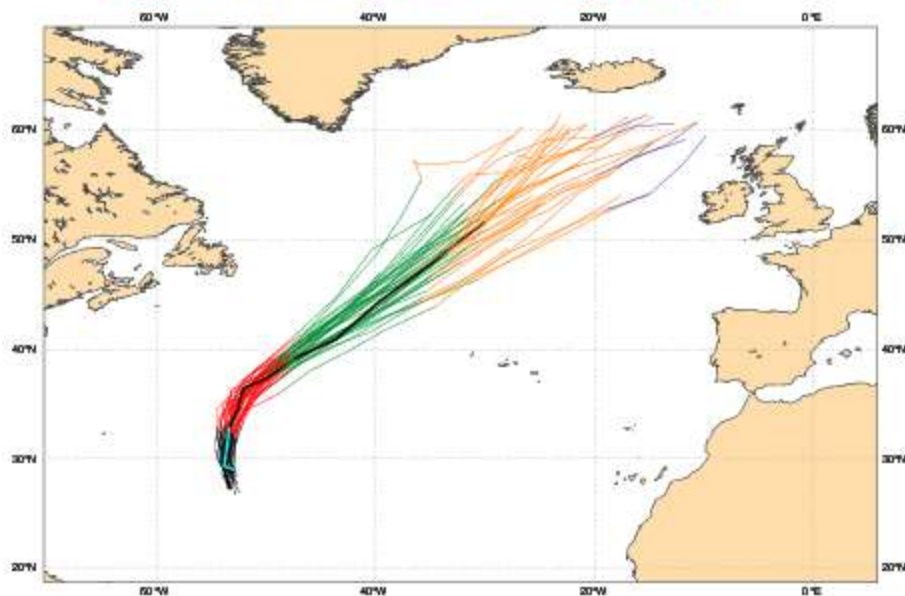
TC Ian Track forecasts 14/00Z

Date 20160914 00 UTC @ECMWF

Individual trajectories for **IAN** 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



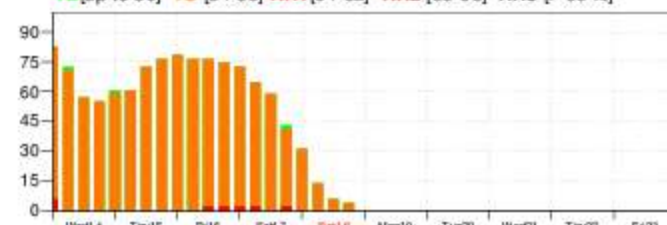
List of ensemble members numbers forecast Tropical Cyclone

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

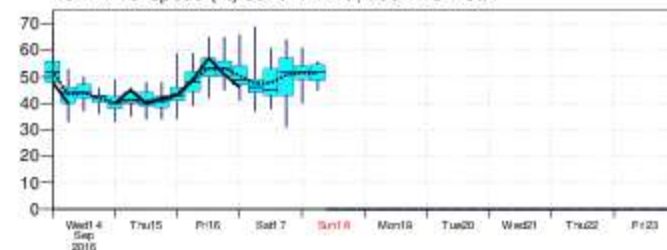
+024 h:	16	18	12	14	15	16	20	21	22	23	24	25	27	29	31	32	34	35	36	37	38	39	40	41	42	43	44	45	46	47	50	
+048 h:	10	12	14	15	17	18	20	21	22	23	24	25	27	29	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	50
+072 h:	10	12	14	15	17	18	20	21	22	23	24	25	27	29	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	50
+120 h:	10	12	14	15	17	18	20	21	22	23	24	25	27	29	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	50
+144 h:																																
+168 h:																																
+192 h:																																
+216 h:																																
+240 h:																																

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

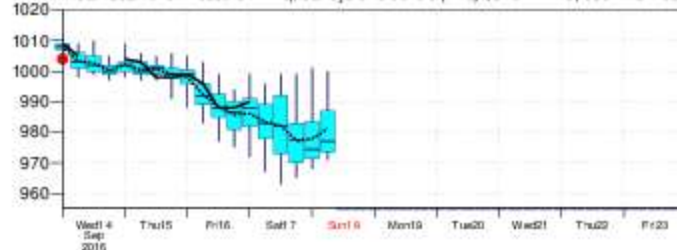
TD[up to 33] **TS**[34-63] **HR1**[64-82] **HR2**[83-95] **HR3**[> 95 kt]



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



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



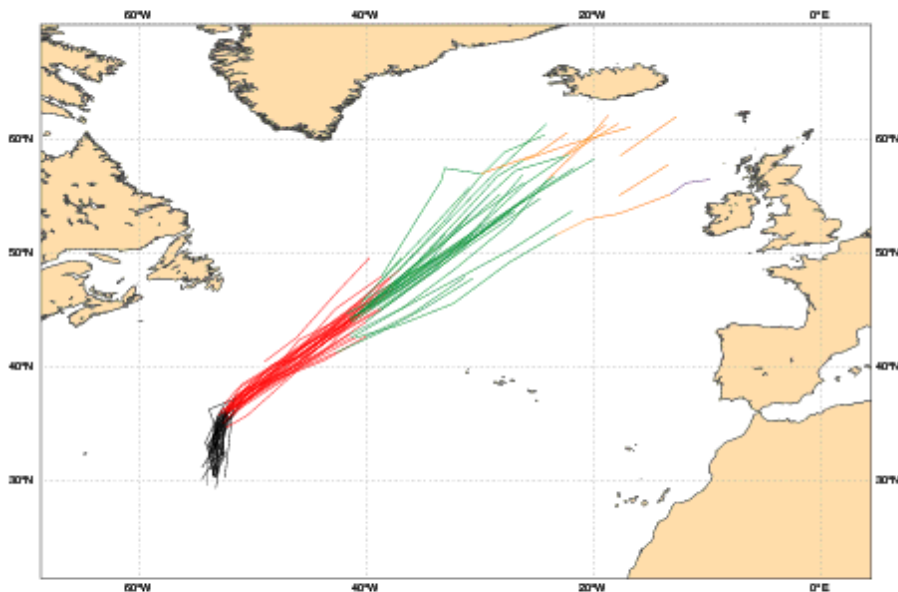
TC Ian Track forecasts 14/12Z

Date 20160914 12 UTC @ECMWF

Individual trajectories for **IAN** 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



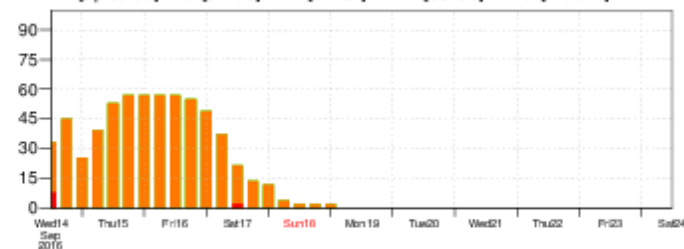
List of ensemble members numbers forecast Tropical Cyclone

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

+024 h :	04 05	09 10 11 12	14	16	19 20	23 24 25	28 29	31 32	35 36 37	39 40	43	46 47 48	50
+048 h :	04 05	09 10 11 12	14	16 17	19 20 21	23 24 25	28 29	31 32	35 36 37	39 40	43	46 47 48	50
+072 h :		09 10	12	16 17		23			35 36 37			47	50
+096 h :													50
+120 h :													50
+144 h :													
+168 h :													
+192 h :													
+216 h :													
+240 h :													

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

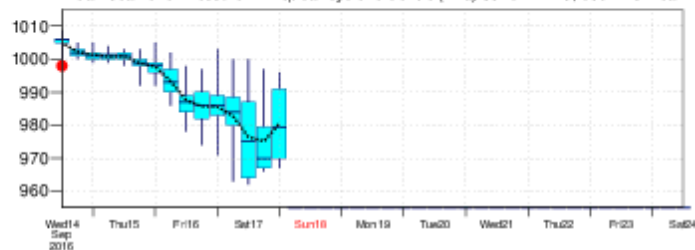
TD[up to 33] **TS** [34-63] **HR1**[64-82] **HR2** [83-95] **HR3** [> 95 kt]



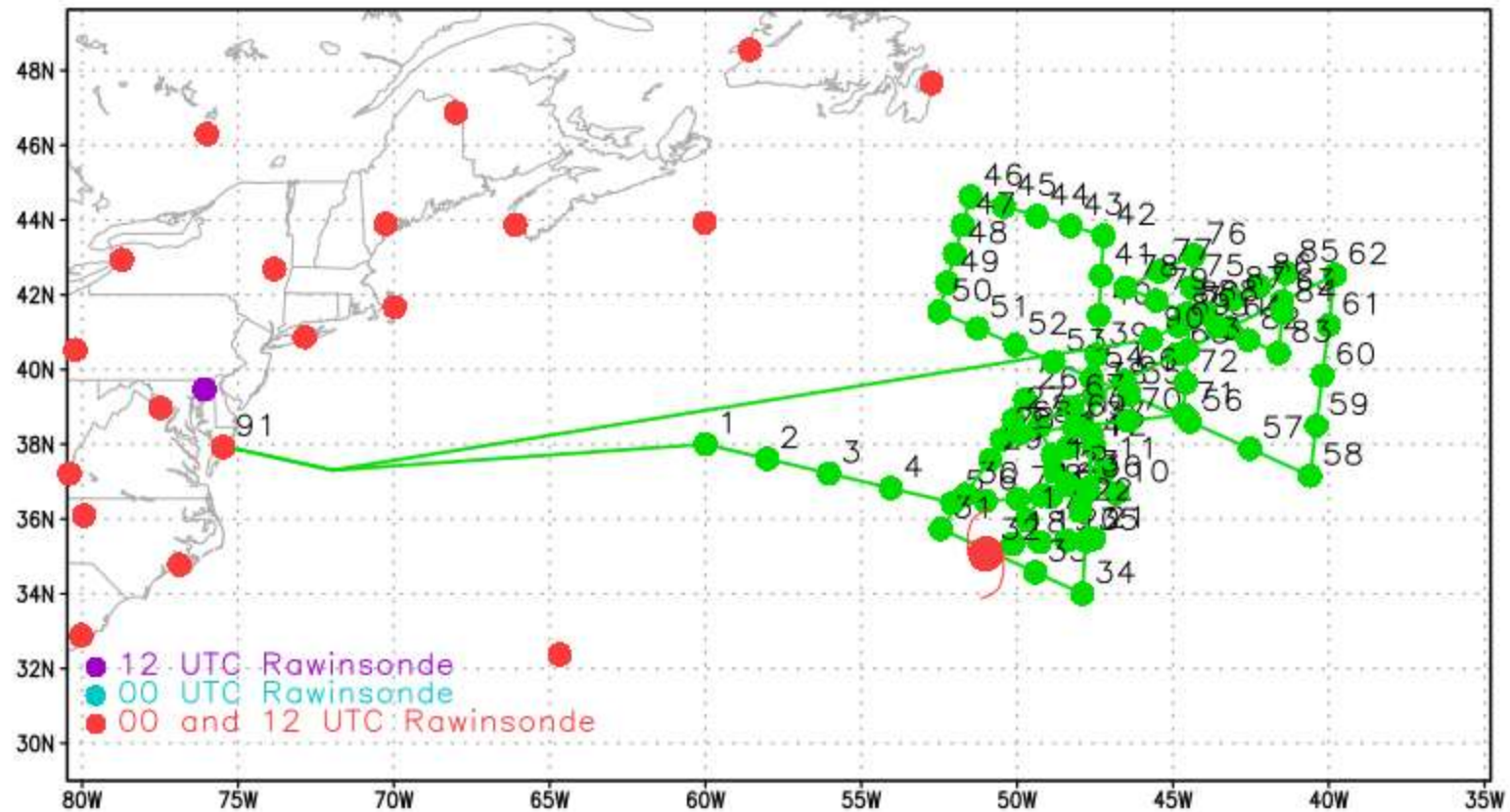
10m Wind Speed (kt) **solid**=HRES; **dot**=Ens Mean



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



Shout mission in Jan



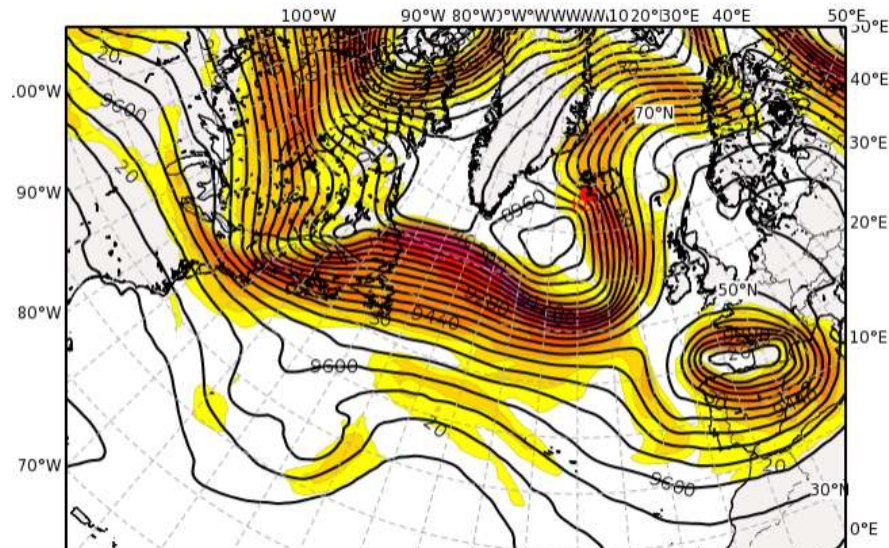
GrADS: IGES/COLA

2016-09-14-09:48

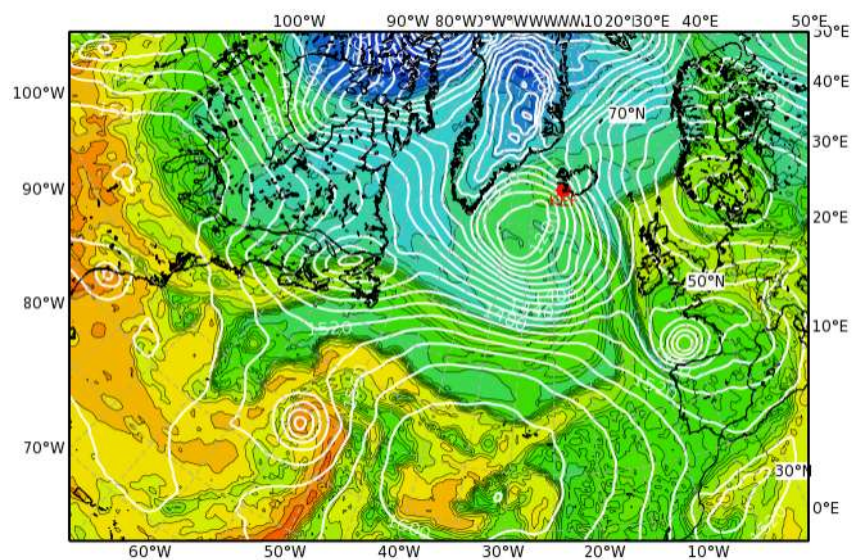
Analysis – 15 Sep 2016, 00 UTC

Z500, SAT
THE850, RH700

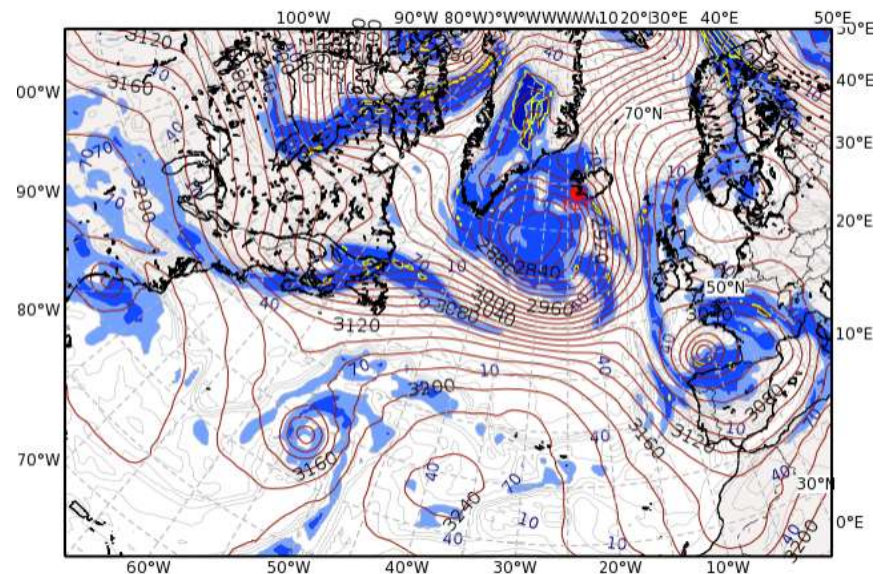
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Thu, 15 Sep 2016, 00 UTC (step 000 h from Thu, 15 Sep 2016, 00 UTC)



Equivalent Potential Temperature (degC) & Streamlines at 850 hPa
Valid: Thu, 15 Sep 2016, 00 UTC (step 000 h from Thu, 15 Sep 2016, 00 UTC)



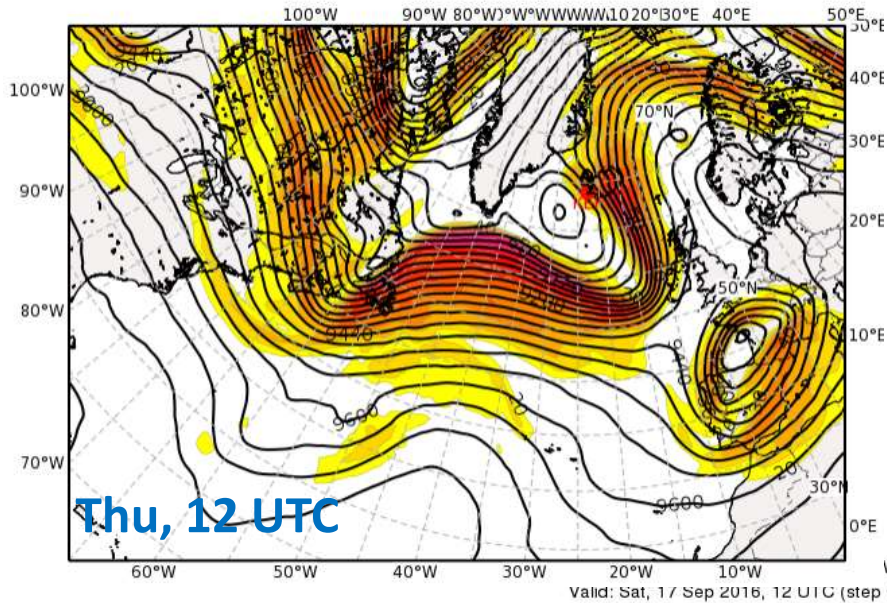
Valid: Thu, 15 Sep 2016, 00 UTC (step 000 h from Thu, 15 Sep 2016, 00 UTC)



Forecast until Sat, 17 Sep 2016

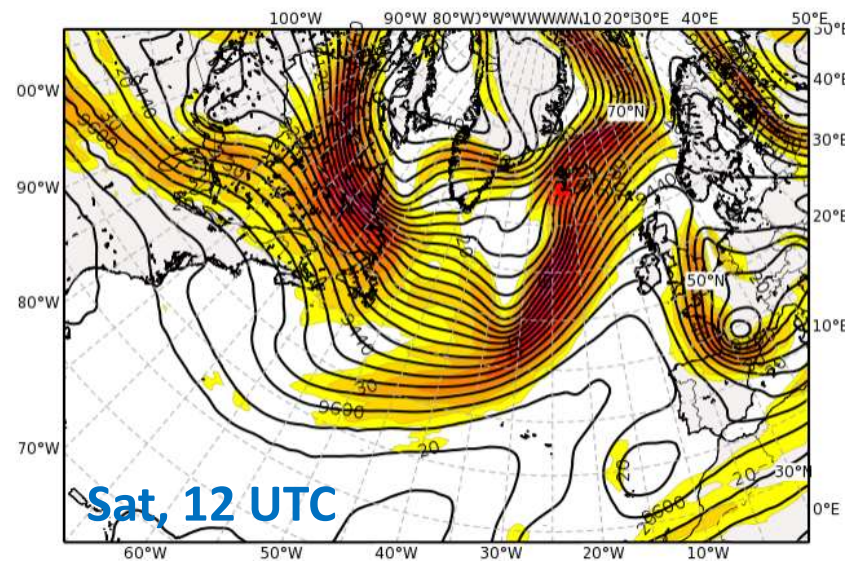
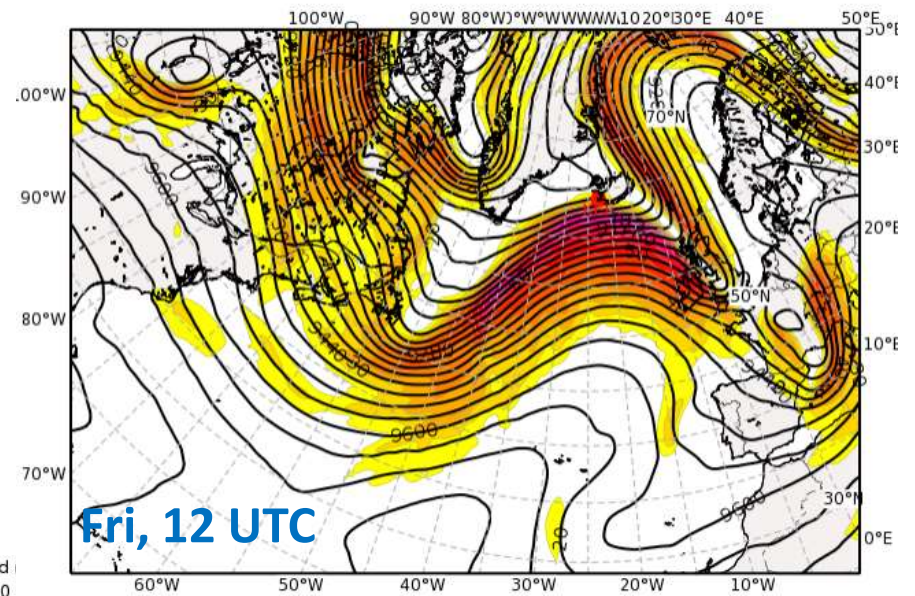
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa

Valid: Thu, 15 Sep 2016, 12 UTC (step 012 h from Thu, 15 Sep 2016, 00 UTC)



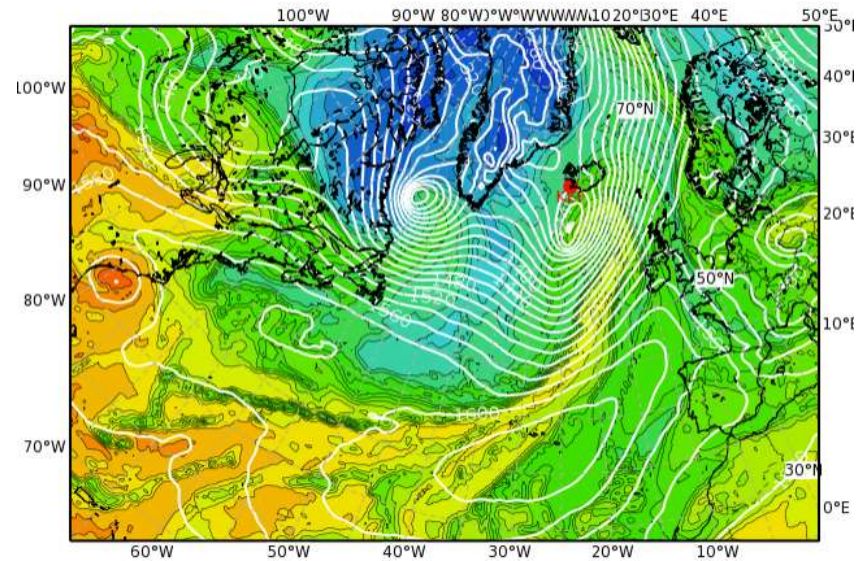
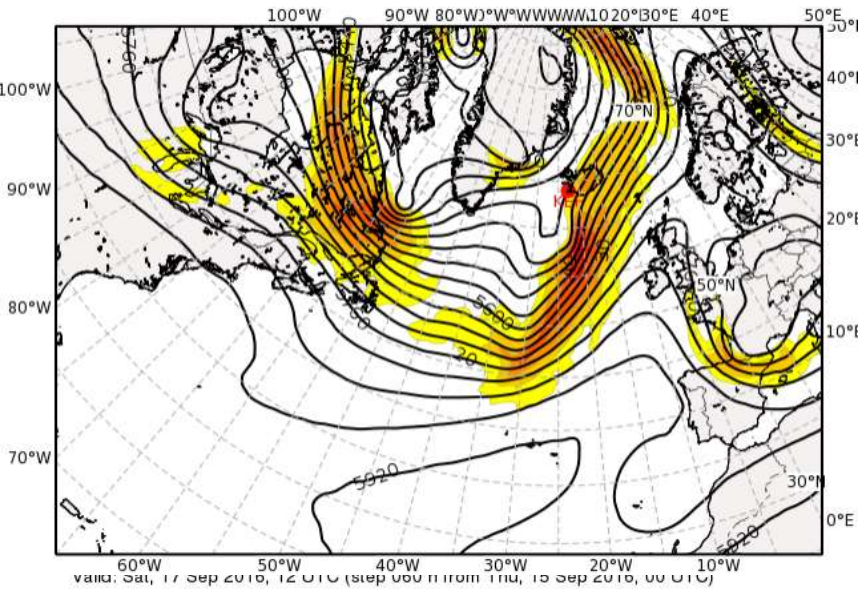
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa

Valid: Fri, 16 Sep 2016, 12 UTC (step 036 h from Thu, 15 Sep 2016, 00 UTC)



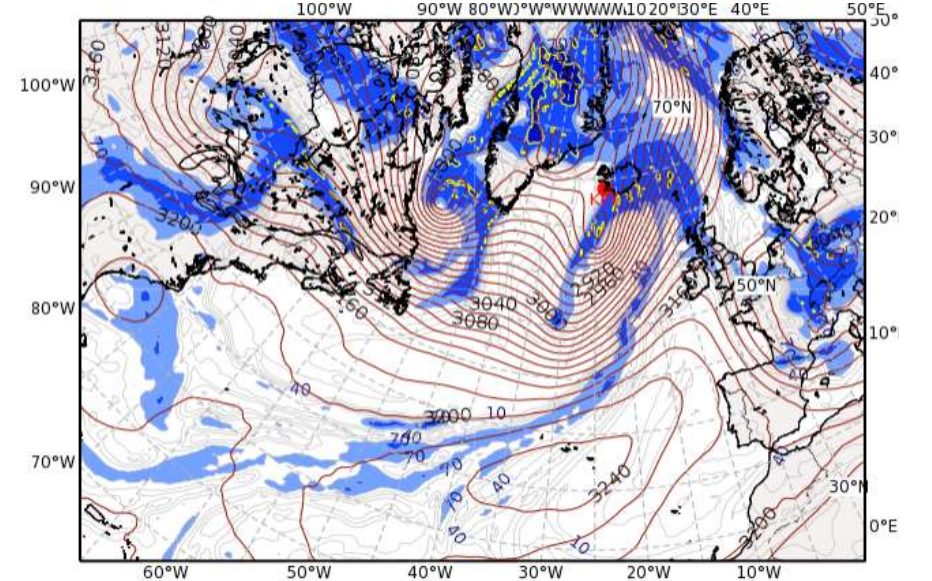
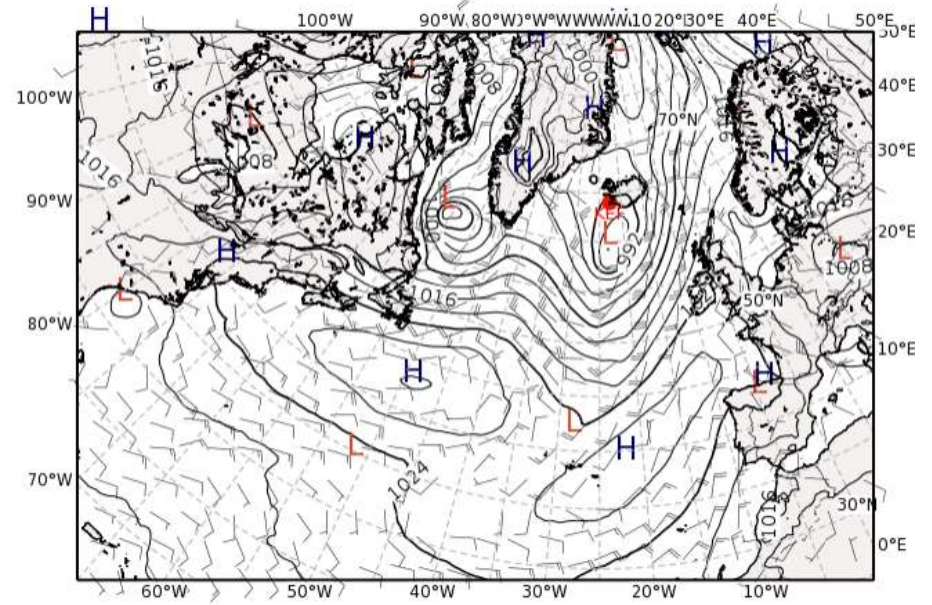
Forecast for Sat, 17 Sep 2016 12 UTC

Geopotential Height (m) & Horizontal Wind (m/s) at 500 hPa
Valid: Sat, 17 Sep 2016, 12 UTC (step 060 h from Thu, 15 Sep 2016, 00 UTC)



Z500, SLP THE850, RH700

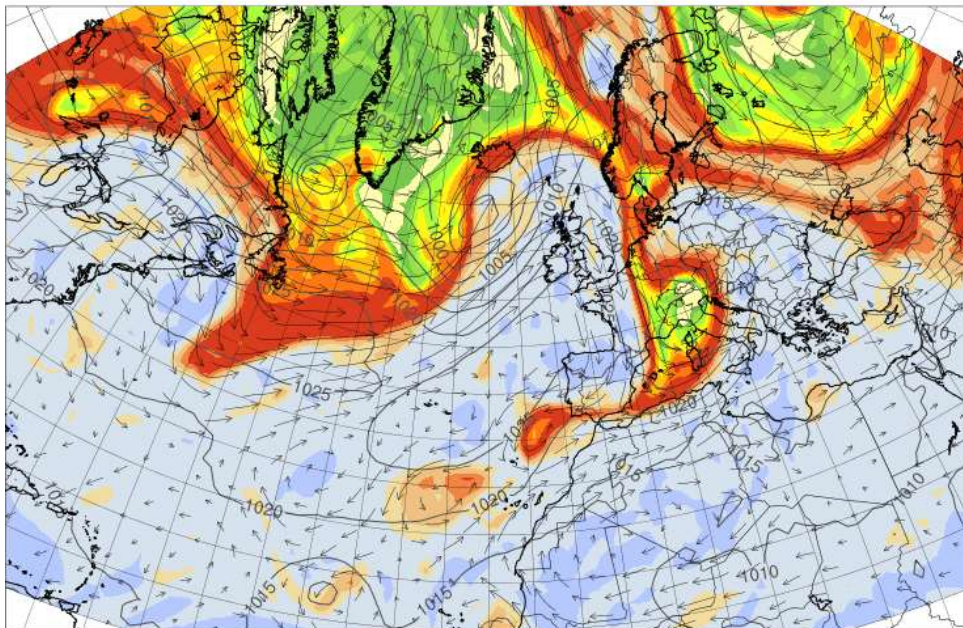
Mean Sea Level Pressure (hPa)
Valid: Sat, 17 Sep 2016, 12 UTC (step 060 h from Thu, 15 Sep 2016, 00 UTC)



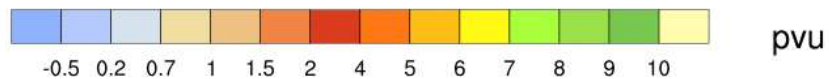
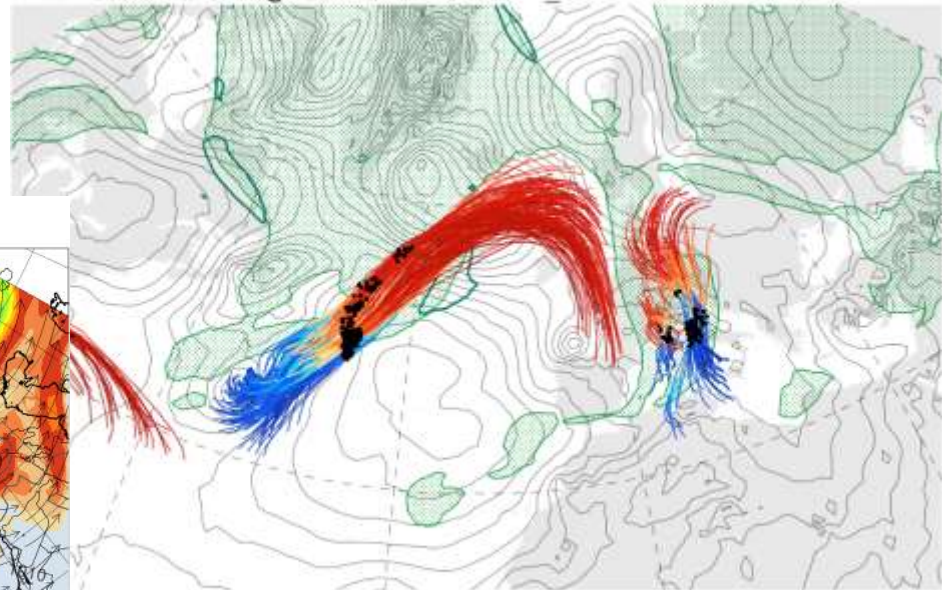
Forecast for Sat, 17 Sep 2016 12 UTC

BT14/00Z

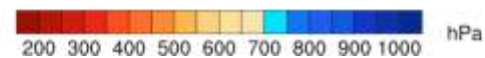
PV@330K at 20160917_12



Trajectory start and SLP VT: 20160915_12
WCB outflow and PV@250hPa VT: 20160917_12



pvu

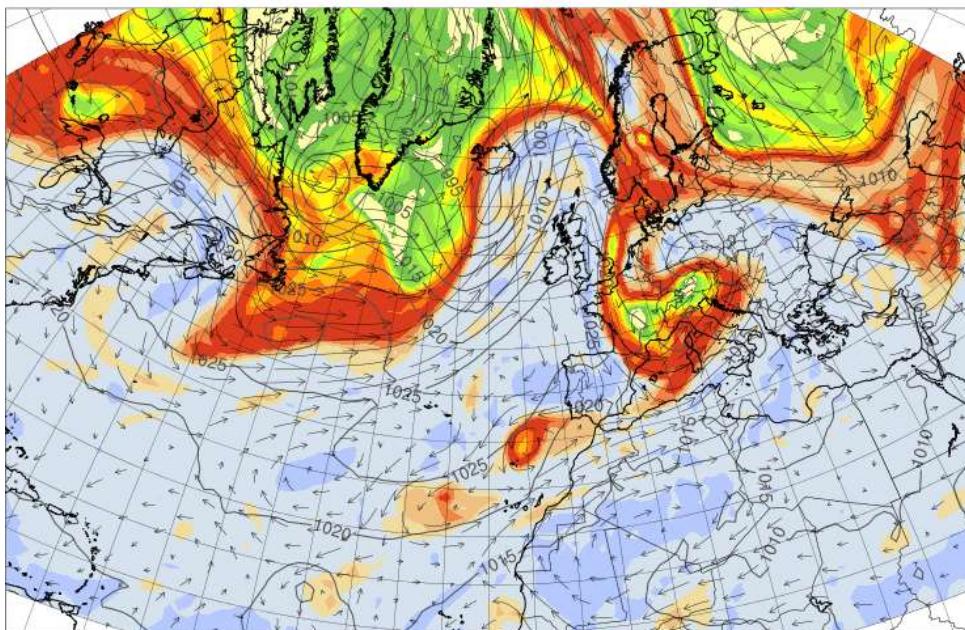


hPa

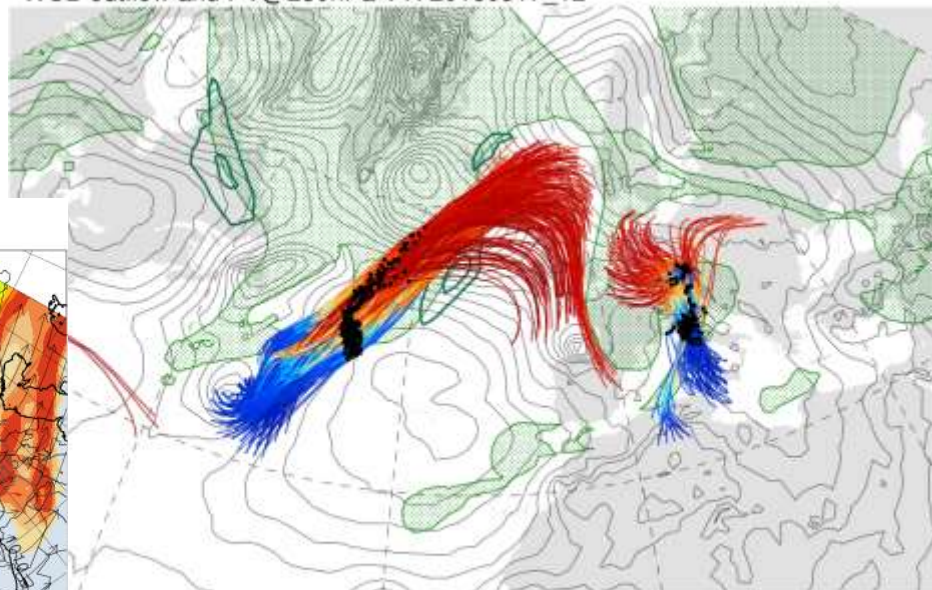
Forecast for Sat, 17 Sep 2016 12 UTC

BT14/12Z

PV@330K at 20160917_12



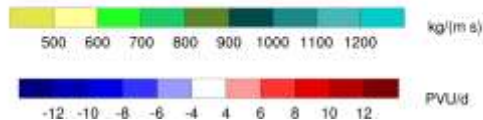
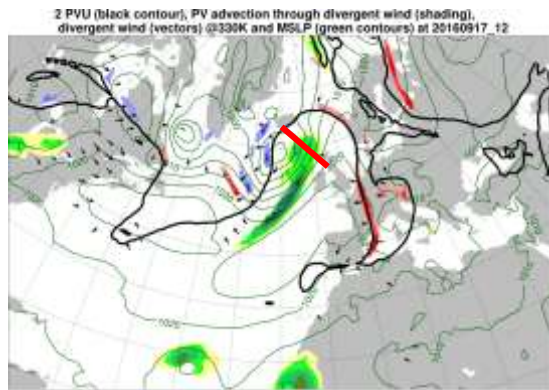
Trajectory start and SLP VT: 20160915_12
WCB outflow and PV@250hPa VT: 20160917_12



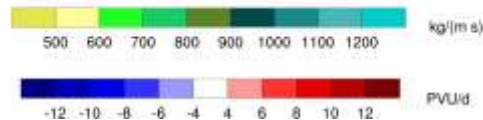
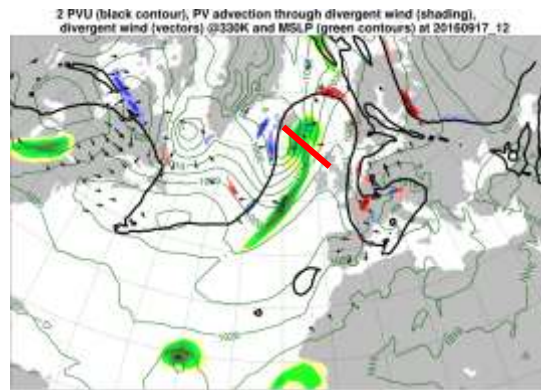
200 300 400 500 600 700 800 900 1000 hPa

-0.5 0.2 0.7 1 1.5 2 4 5 6 7 8 9 10 pvu

Overview model consistency Sat 17/12Z ECMWF Hres

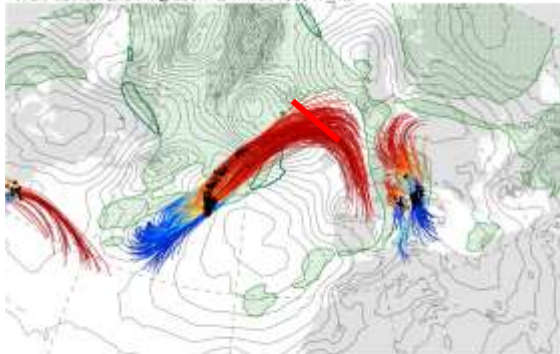


BT 14/00Z

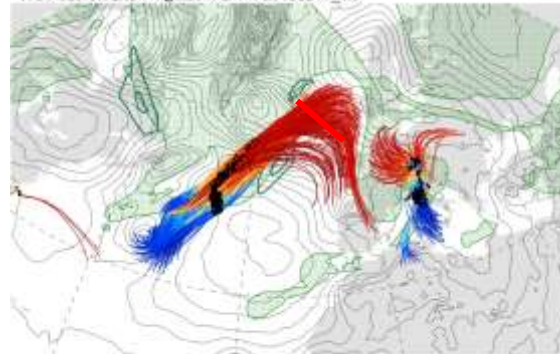


BT 14/12Z

Trajectory start and SLP VT: 20160915_12
WCB outflow and PV@250hPa VT: 20160917_12



Trajectory start and SLP VT: 20160915_12
WCB outflow and PV@250hPa VT: 20160917_12

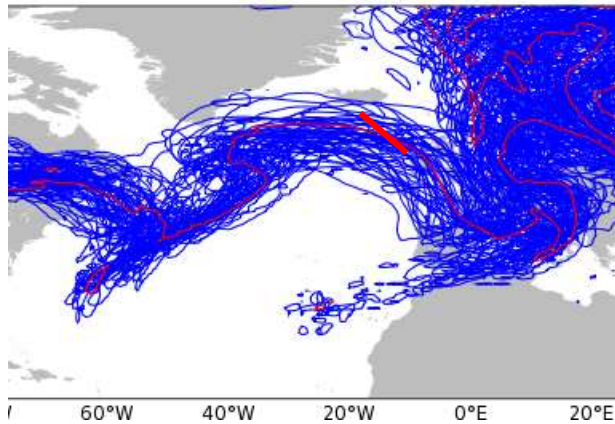


BT 15/00Z

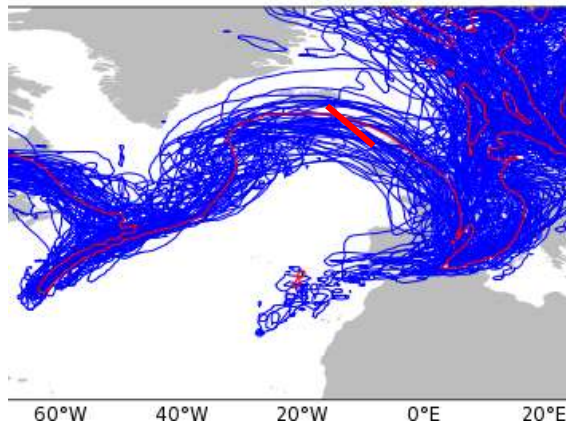
Overview model consistency Sat 17/12Z ECMWF Ensemble

JTC

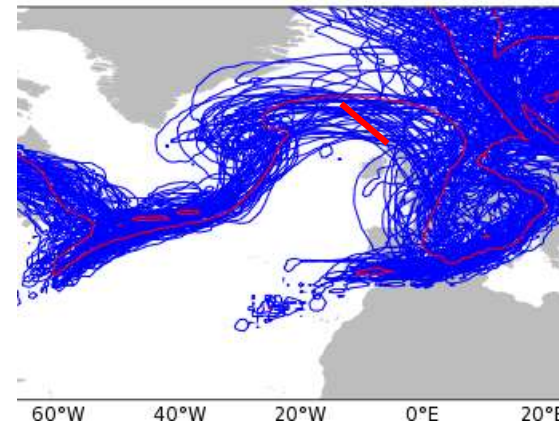
BT 12/12Z



BT 13/00Z

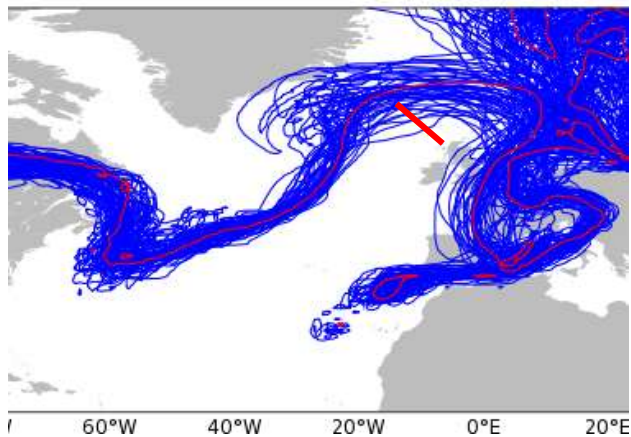


BT 13/12Z



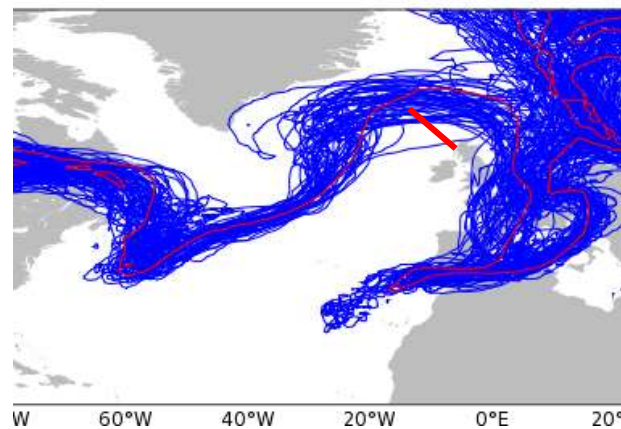
JTC

BT 14/00Z



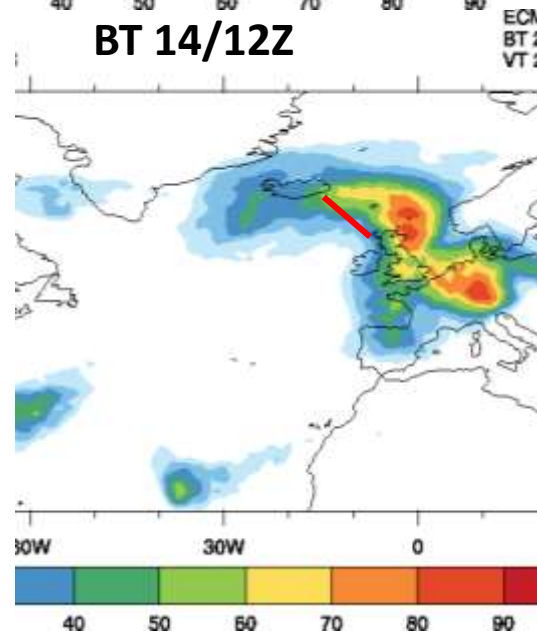
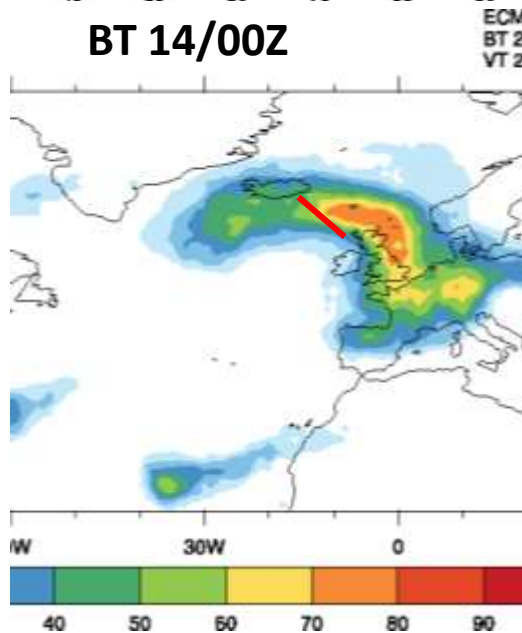
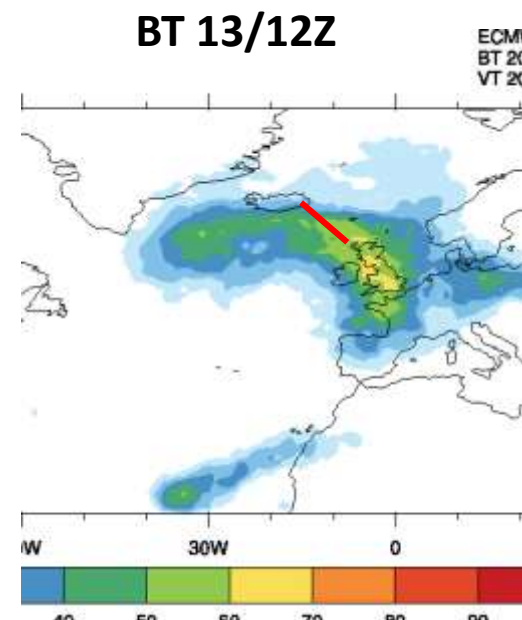
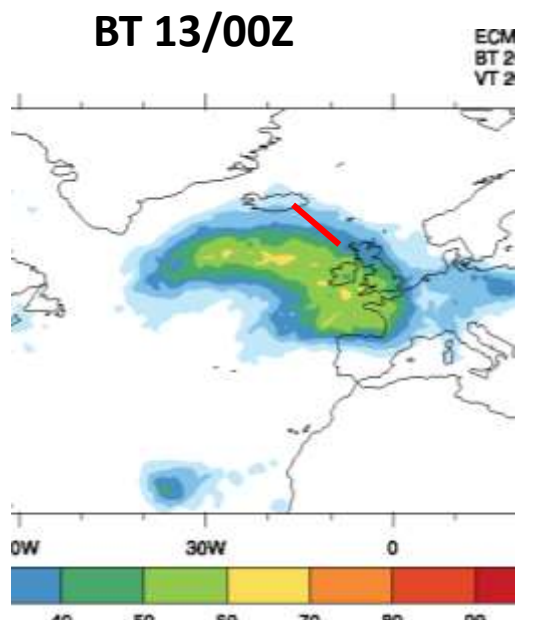
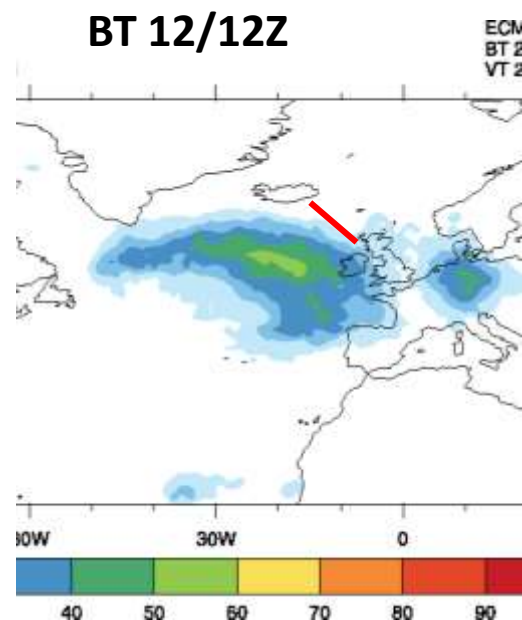
2UTC

BT 14/12Z



BT 15/00Z

Overview model consistency Sat 17/12Z ECMWF Ensemble

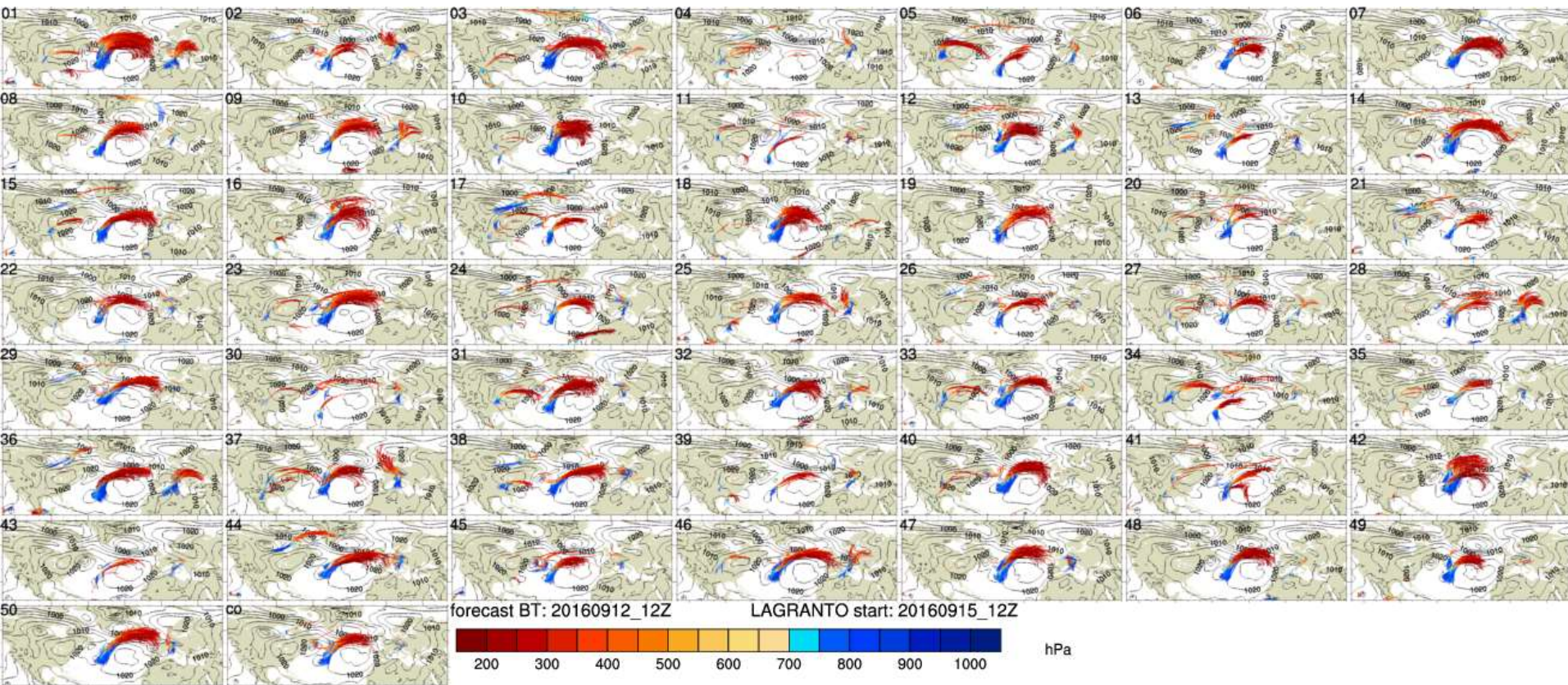


BT 15/00Z



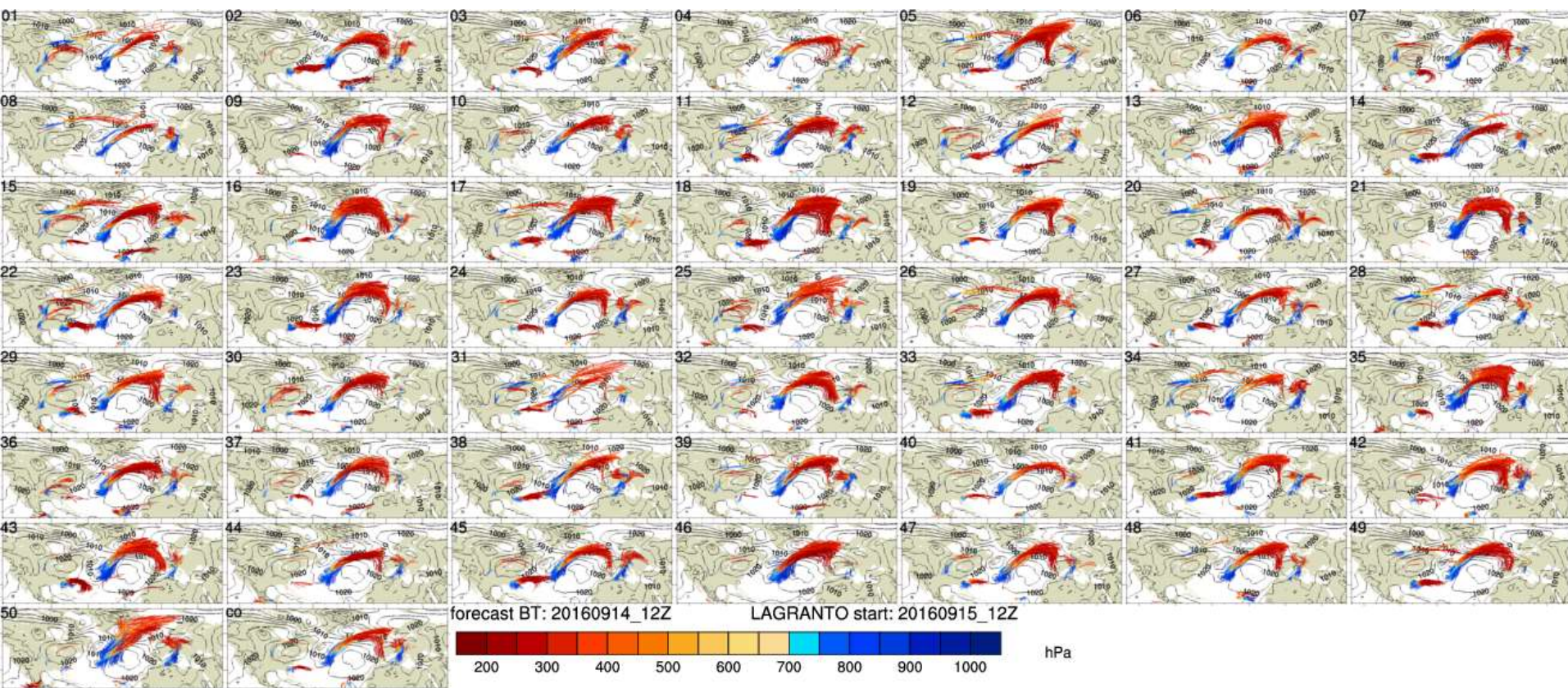
Overview model consistency Sat 17/12Z ECMWF Ensemble WCBs

BT12/12Z



Overview model consistency Sat 17/12Z ECMWF Ensemble WCBs

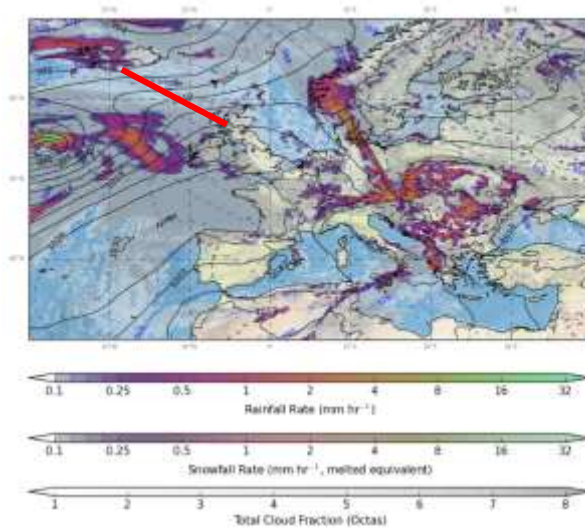
BT14/12Z



Overview model consistency Sat 17/12Z UKMO

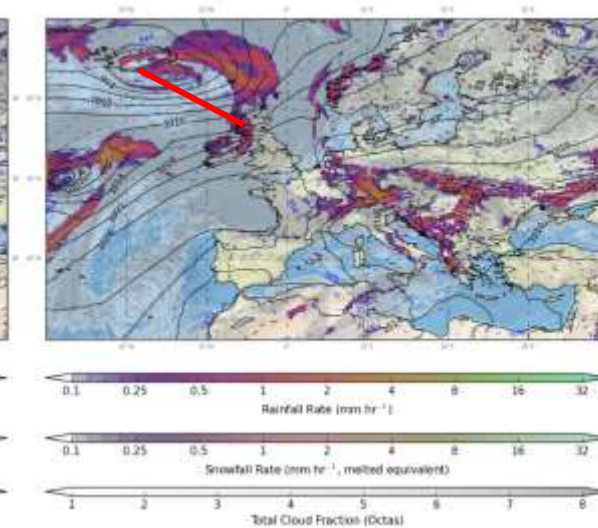
BT 12/12Z

Met Office Oper. Global: P_{prec} , 500hPa Thickness, Precip Rates, Cloud
2016/09/17 12Z T+120 from 2016/09/12 12Z



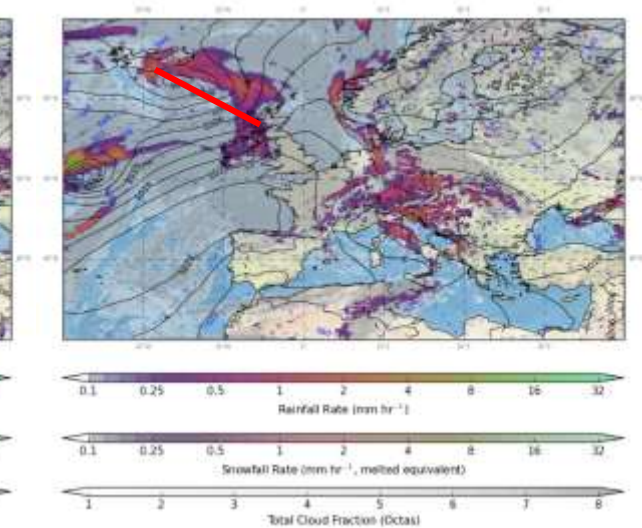
BT 13/00Z

Met Office Oper. Global: P_{prec} , 500hPa Thickness, Precip Rates, Cloud
2016/09/17 12Z T+108 from 2016/09/13 00Z



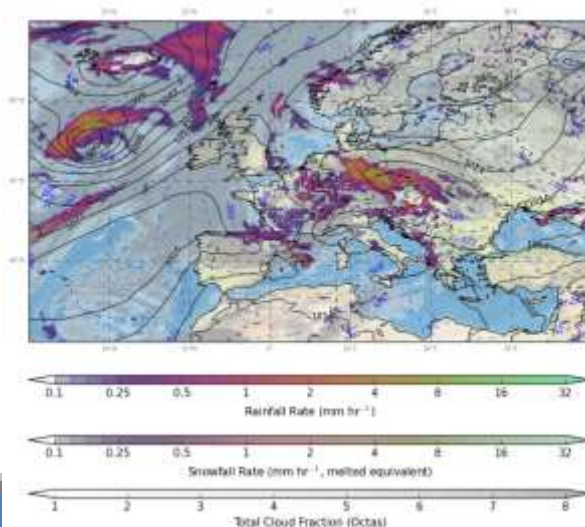
BT 13/12Z

Met Office Oper. Global: P_{prec} , 500hPa Thickness, Precip Rates, Cloud
2016/09/17 12Z T+96 from 2016/09/13 12Z



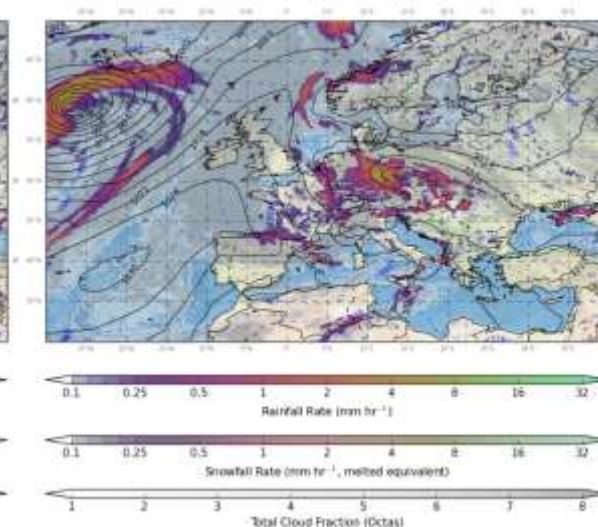
BT 14/00Z

Met Office Oper. Global: P_{prec} , 500hPa Thickness, Precip Rates, Cloud
2016/09/17 12Z T+84 from 2016/09/14 00Z



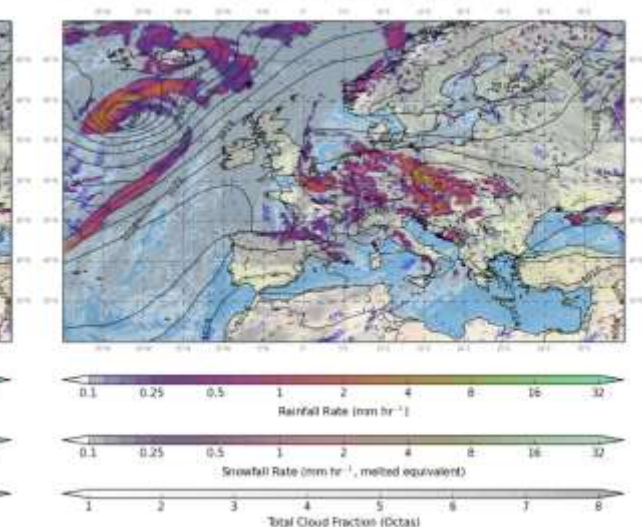
BT 14/12Z

Met Office Oper. Global: P_{prec} , 500hPa Thickness, Precip Rates, Cloud
2016/09/17 12Z T+72 from 2016/09/14 12Z



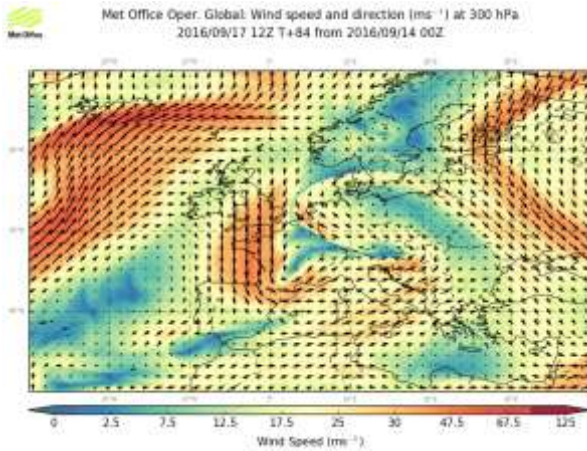
BT 15/00Z

Met Office Oper. Global: P_{prec} , 500hPa Thickness, Precip Rates, Cloud
2016/09/17 12Z T+60 from 2016/09/15 00Z

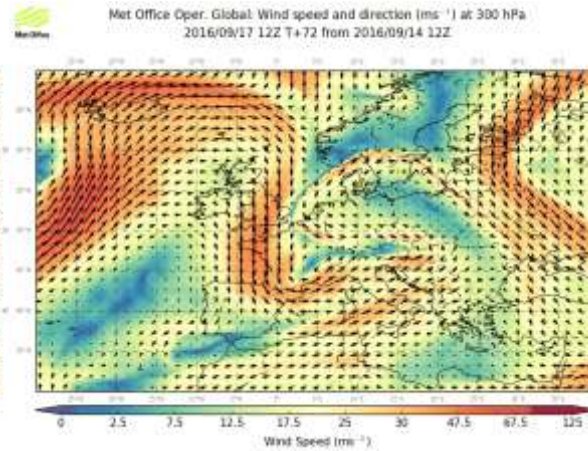


Overview model consistency Sat 17/12Z UKMO

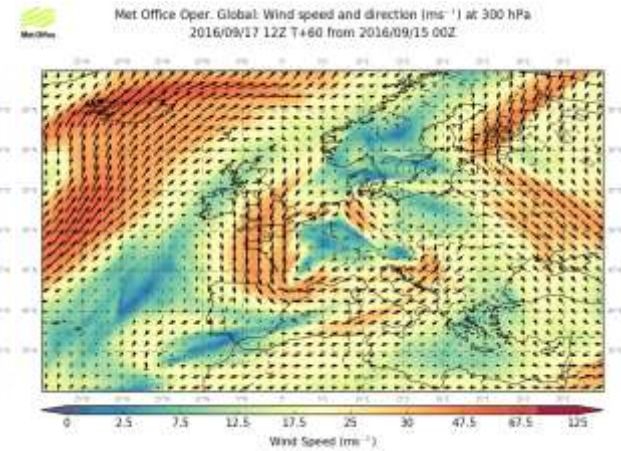
BT 14/00Z



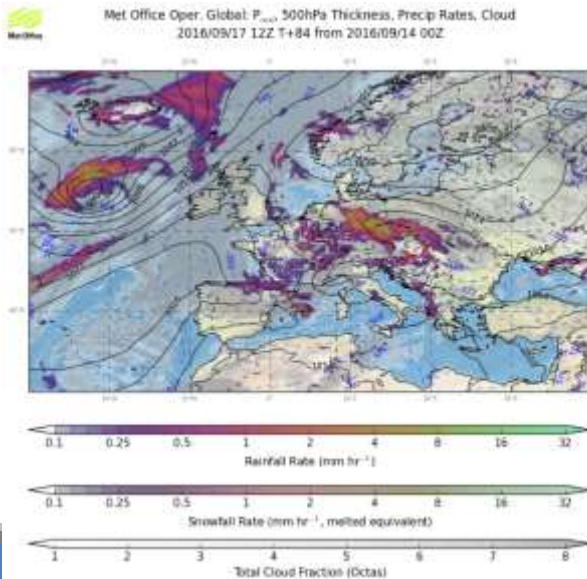
BT 14/12Z



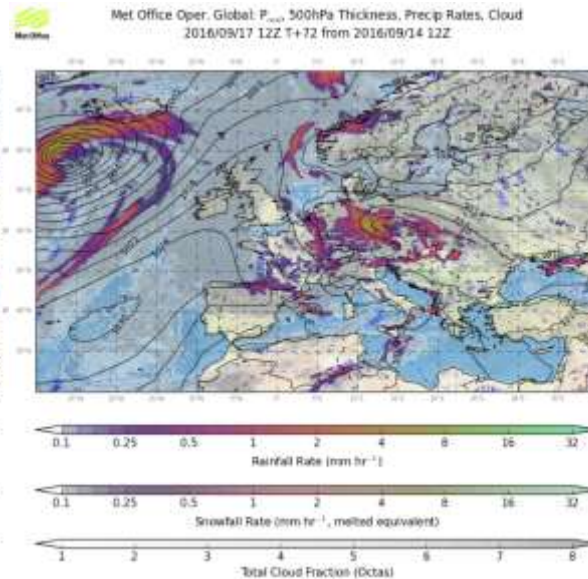
BT 15/00Z



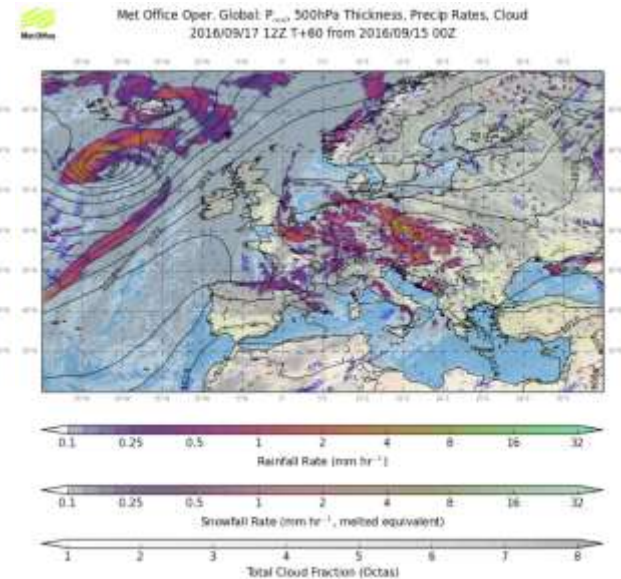
BT 14/00Z



BT 14/12Z

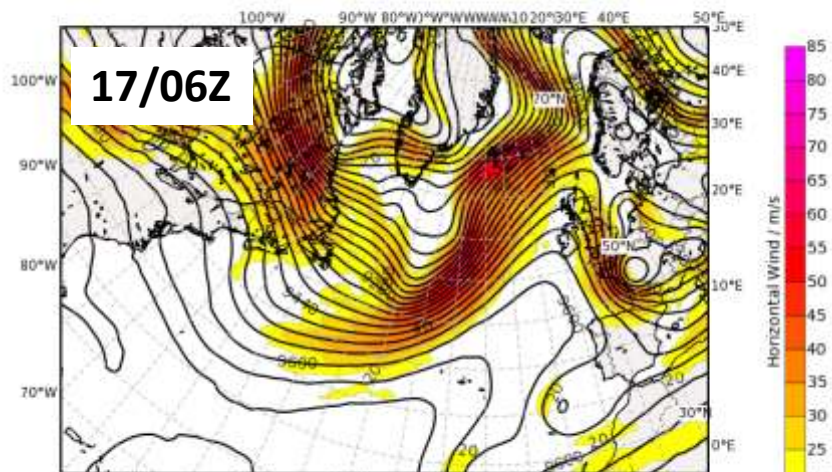


BT 15/00Z

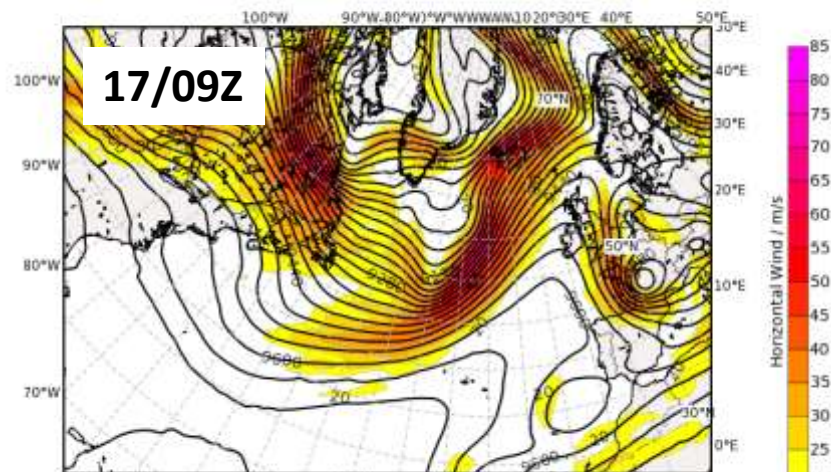


Outlook Sat 17/12Z : Z500 (based EC Hres 15/00Z)

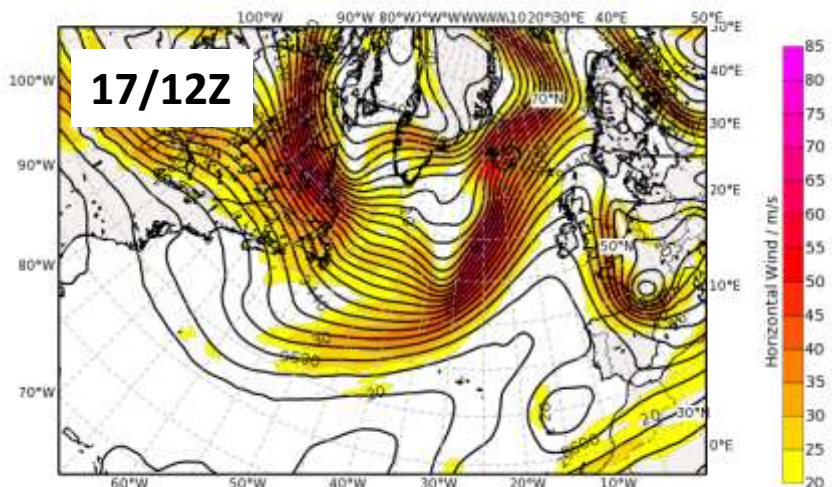
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Sat, 17 Sep 2016, 06 UTC (step 054 h from Thu, 15 Sep 2016, 00 UTC)



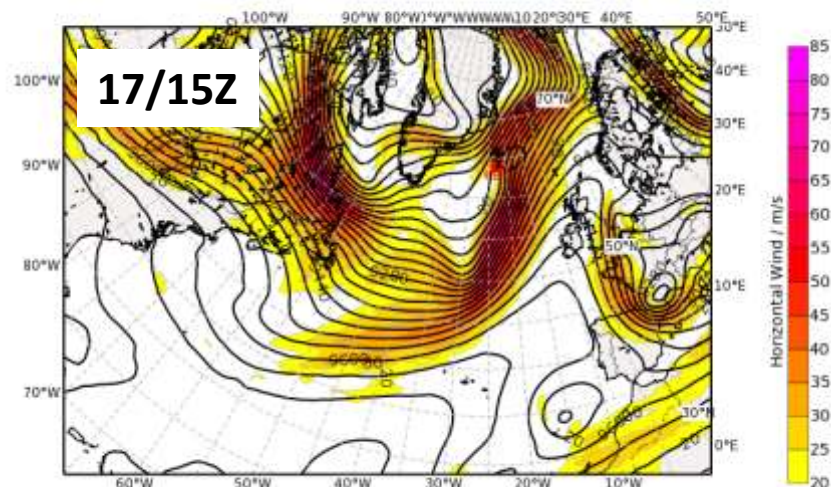
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Sat, 17 Sep 2016, 09 UTC (step 057 h from Thu, 15 Sep 2016, 00 UTC)



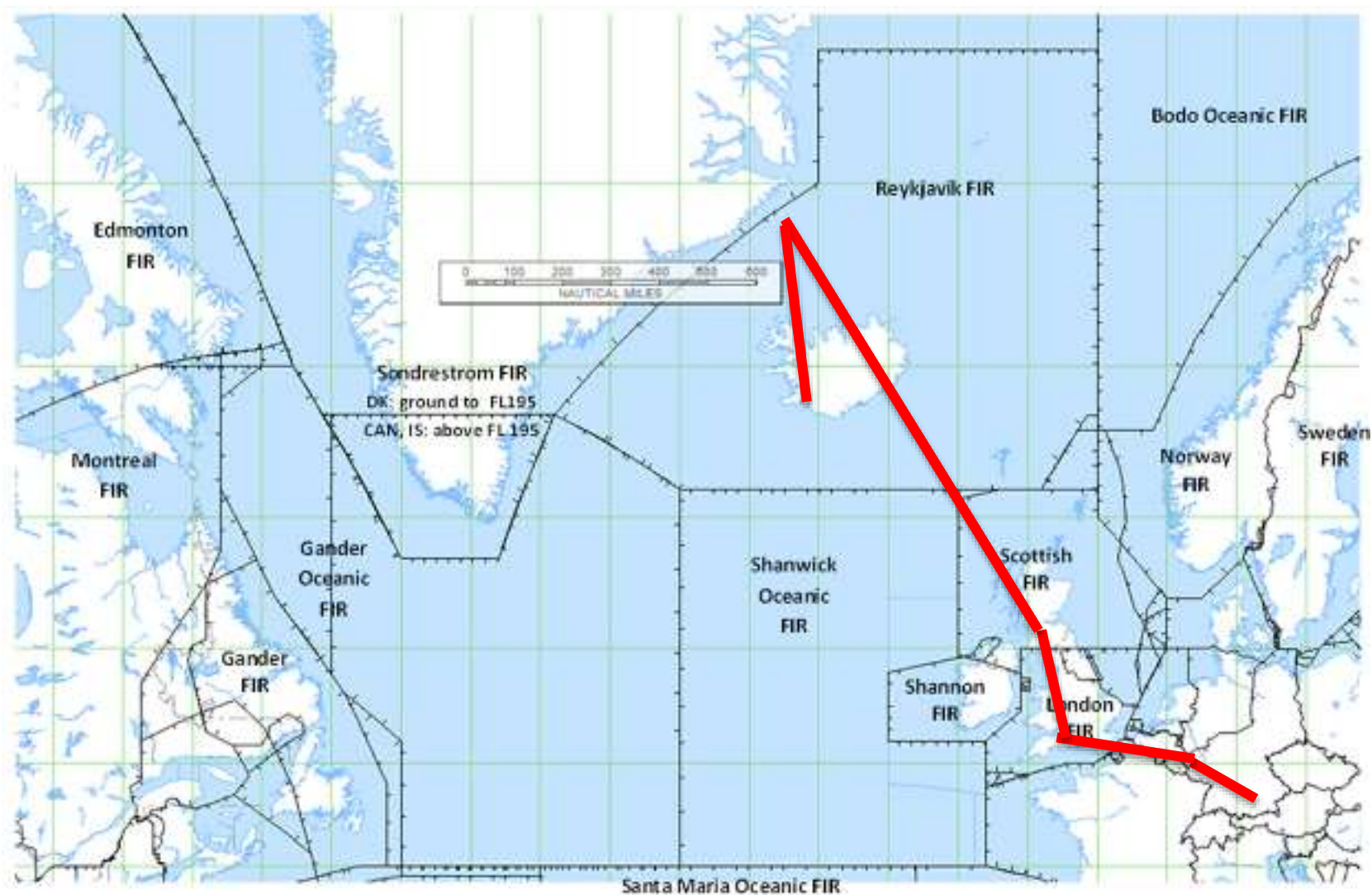
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Sat, 17 Sep 2016, 12 UTC (step 060 h from Thu, 15 Sep 2016, 00 UTC)



Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Sat, 17 Sep 2016, 15 UTC (step 063 h from Thu, 15 Sep 2016, 00 UTC)



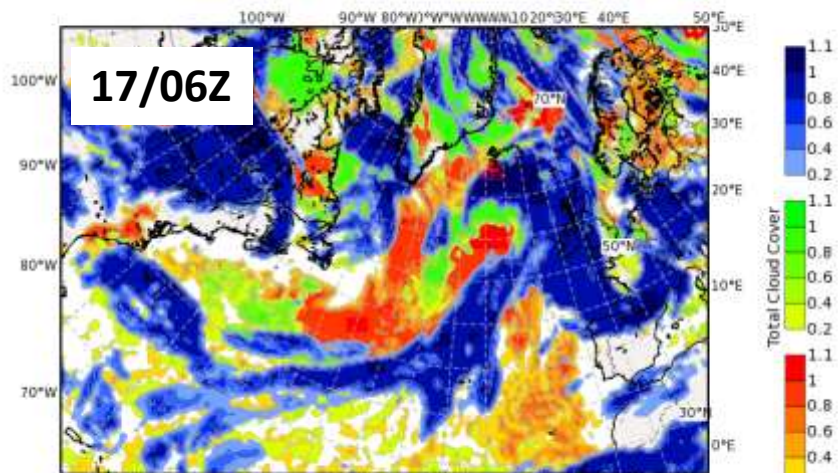
Flight route and Air spaces



Outlook Sat 17/12Z : Z500 (based EC Hres 15/00Z)

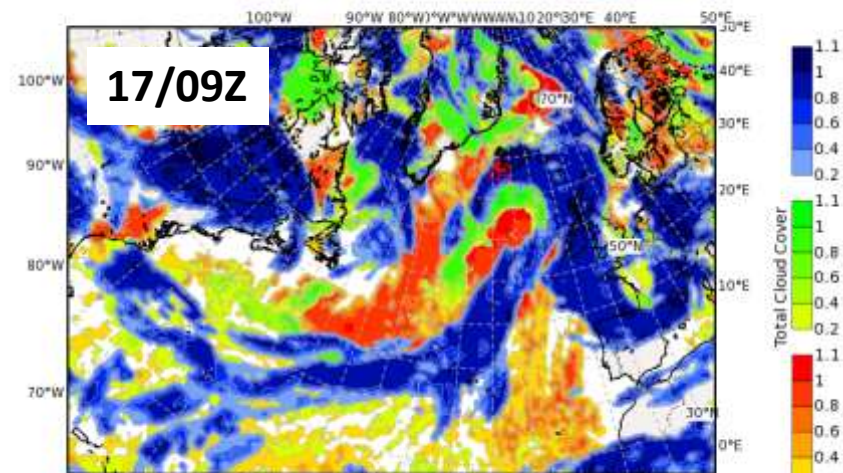
Total Cloud Cover

Valid: Sat, 17 Sep 2016, 06 UTC (step 054 h from Thu, 15 Sep 2016, 00 UTC)



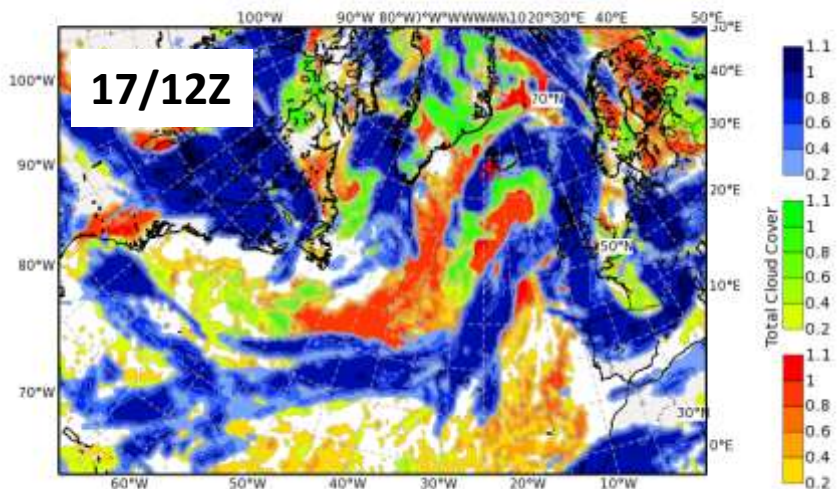
Total Cloud Cover

Valid: Sat, 17 Sep 2016, 09 UTC (step 057 h from Thu, 15 Sep 2016, 00 UTC)



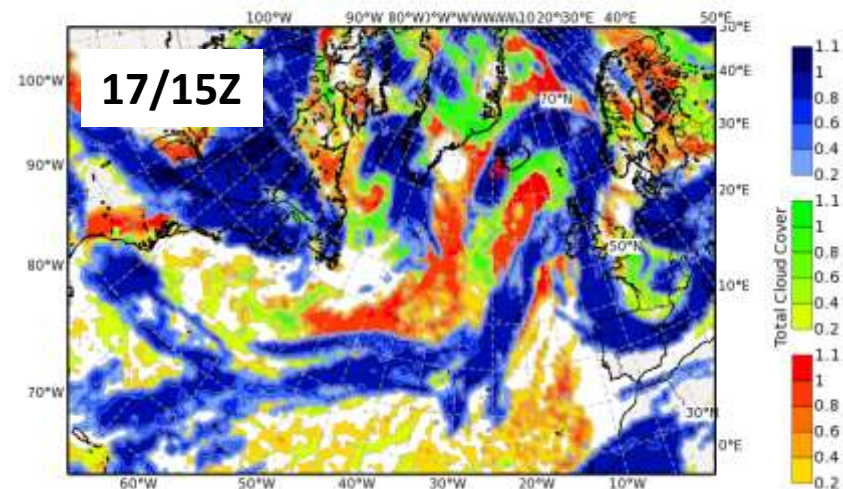
Total Cloud Cover

Valid: Sat, 17 Sep 2016, 12 UTC (step 060 h from Thu, 15 Sep 2016, 00 UTC)



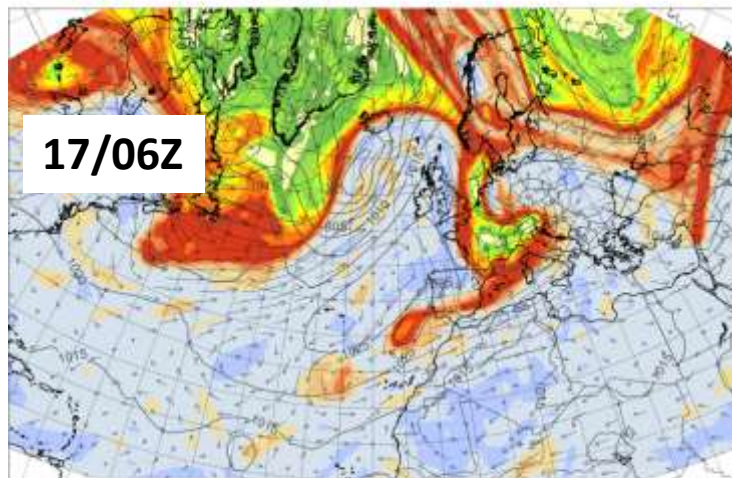
Total Cloud Cover

Valid: Sat, 17 Sep 2016, 15 UTC (step 063 h from Thu, 15 Sep 2016, 00 UTC)

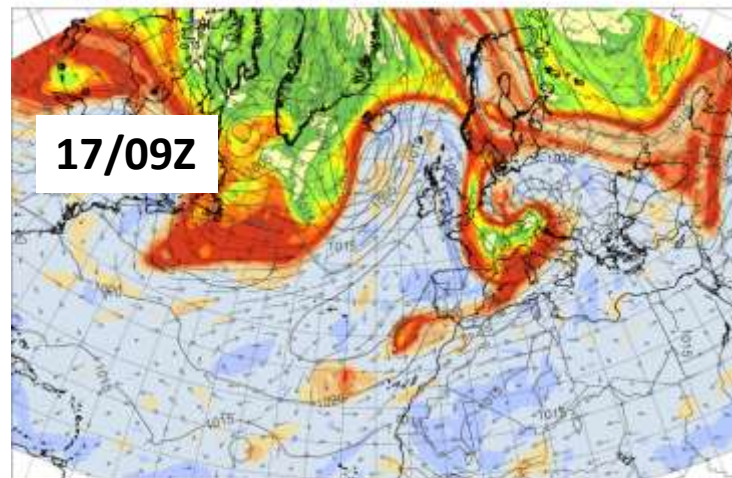


Outlook Sat 17/12Z : PV330K (based EC Hres 14/12Z)

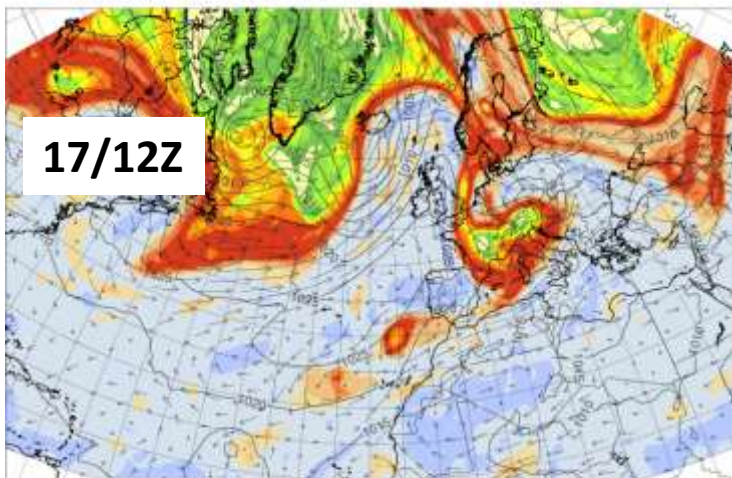
PV@330K at 20160917_06



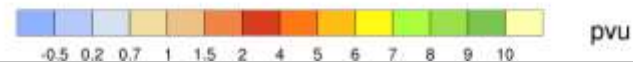
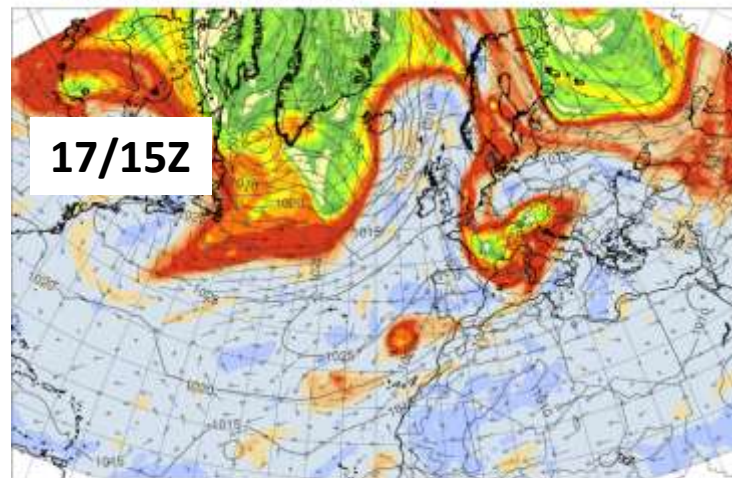
PV@330K at 20160917_09



PV@330K at 20160917_12



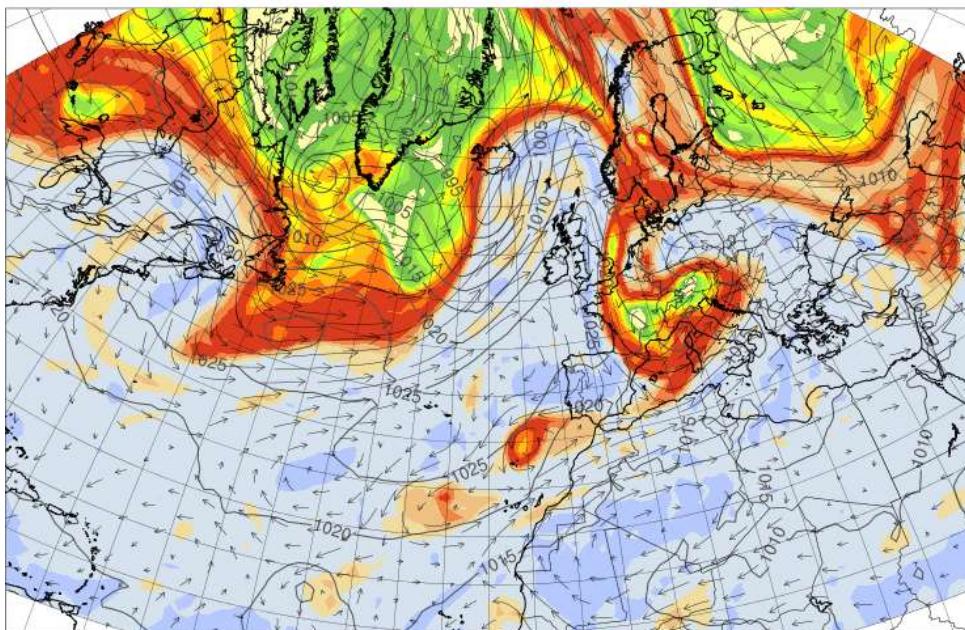
PV@330K at 20160917_15



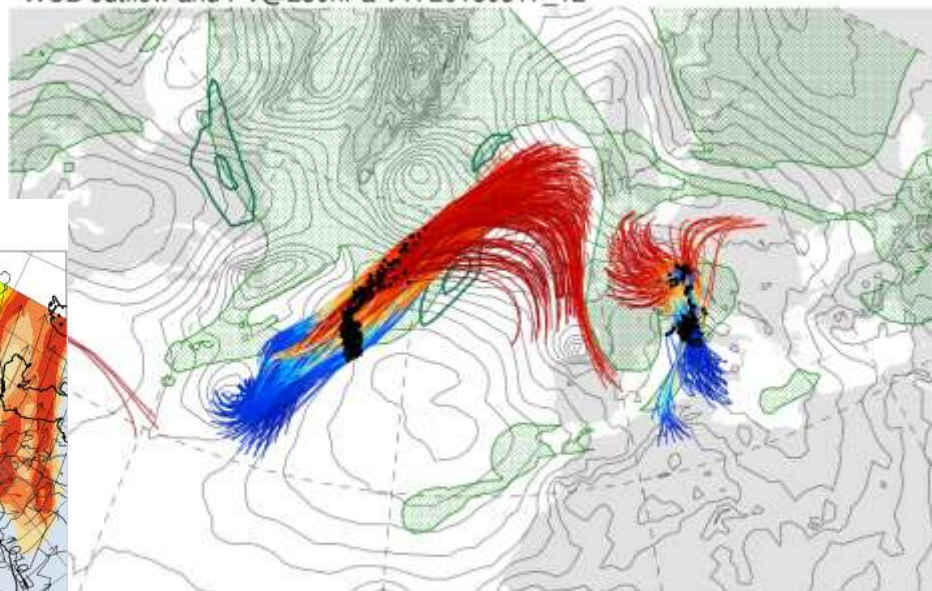
Forecast for Sat, 17 Sep 2016 12 UTC

BT14/12Z

PV@330K at 20160917_12



Trajectory start and SLP VT: 20160915_12
WCB outflow and PV@250hPa VT: 20160917_12



200 300 400 500 600 700 800 900 1000 hPa

-0.5 0.2 0.7 1 1.5 2 4 5 6 7 8 9 10

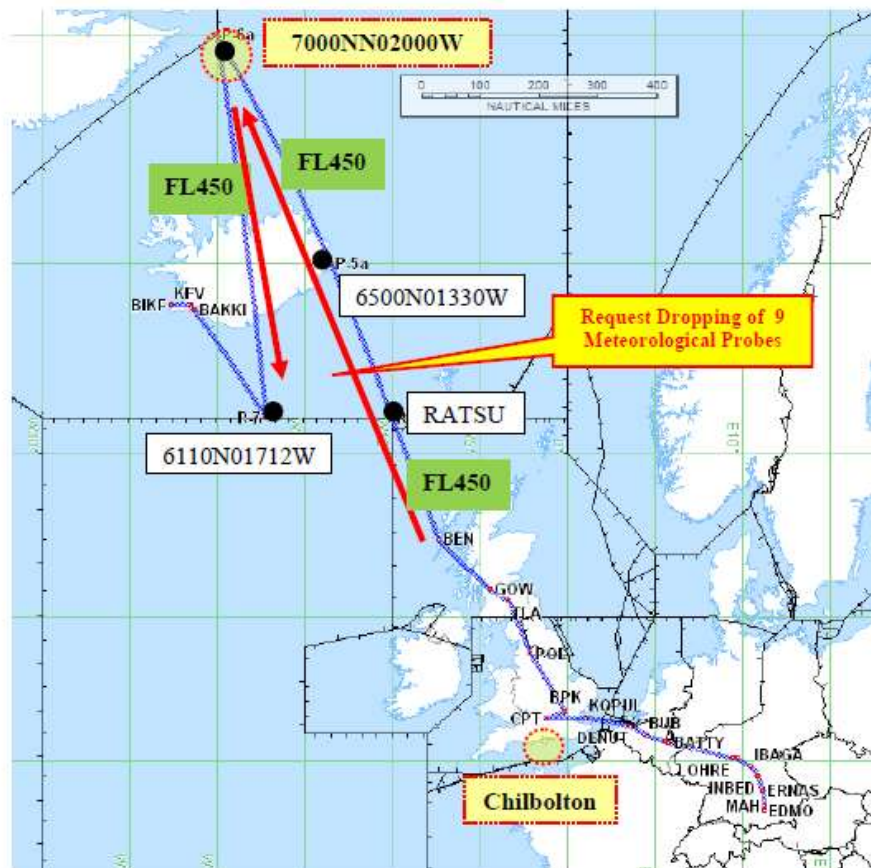
pvu

HALO Flight route and Air spaces

D-ADLR – Meteorological Research-Flight „NARVAL“ Project



Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft



Date of flight: **17-Sep-2016**

Callsign: **D-ADLR**

Type of Aircraft: **G550**

Departure Aerodrome: **EDMO**

Destination Aerodrome: **BIKF**

Takeoff Time: **0715 UTC**

Cruising-Level:

initially FL410

Planned Routing:

MAH UM726 ERNAS Y101 OSBIT UL984
LOHRE UL610 BATTY UL608 DENT
UL610 KOPUL DCT CPT Q295 BPK UN601
TLA UL602 GOW DCT BEN/N0460F450
DCT RATSU DCT 6500N01330W DCT
7000N02000W DCT 6110N01712W DCT
BAKKI B1 METIL G3 KFU

Remarks:

req. 2 "Holding Patterns" ovhd "Chilbolton"

at **FL410** - dimensions: ~ 25 x 12 NM

(see figure on next page)

req. 1 Circle (360°) @ 70N 20W

at **FL430**, duration 10 min

req. dropping of 9 MET Probes

on the routing **BEN - RATSU - 65N1330W -**

70N20W - 6110N01712W (not over land)

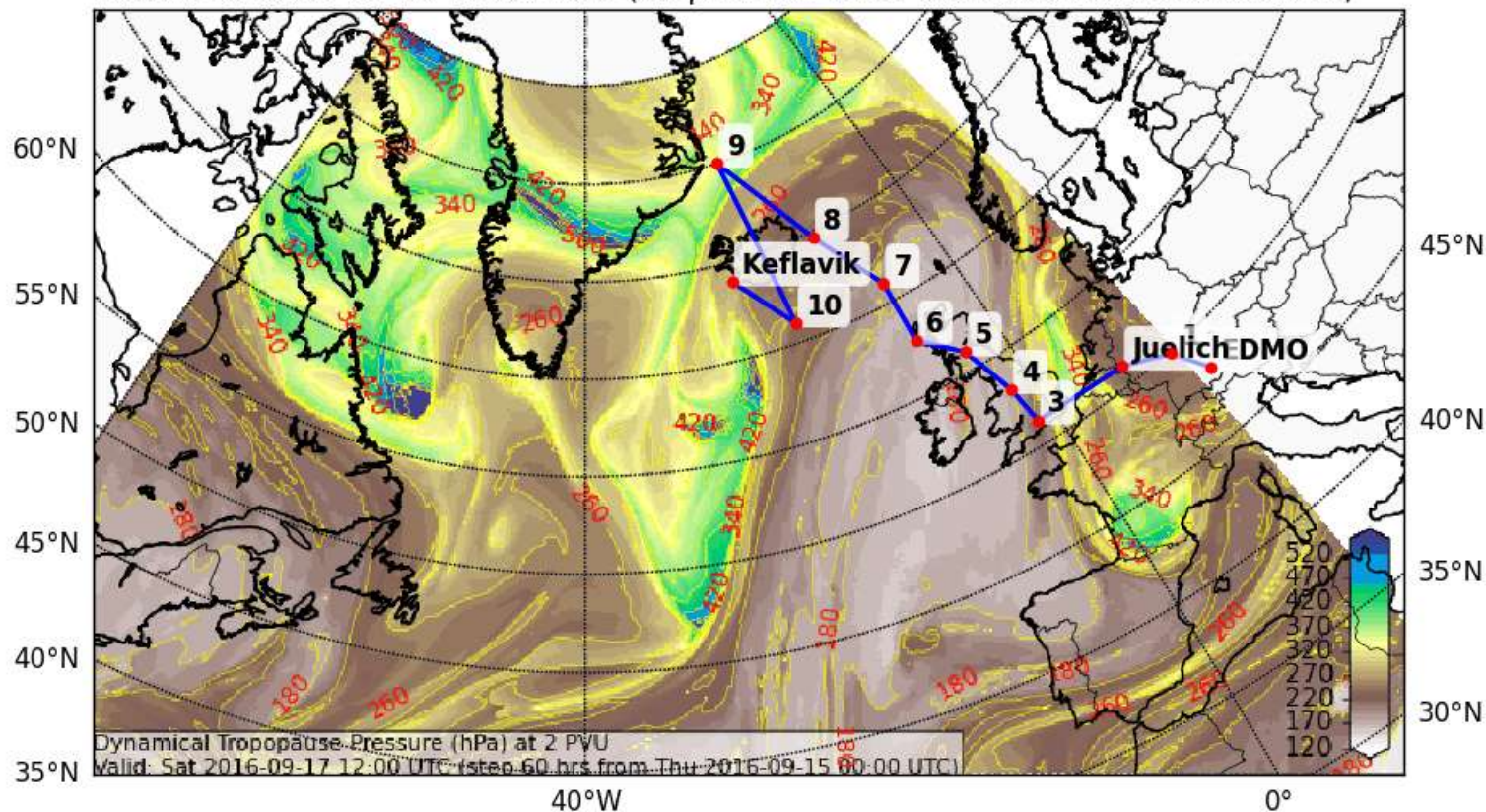
out of **FL450**

- Decision about RASO
- Decision about dropsondes

HALO Flight route and 2PVU pressure

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

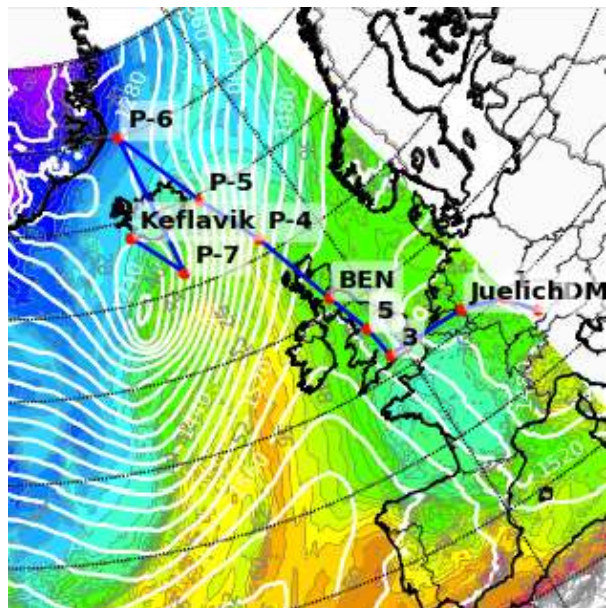
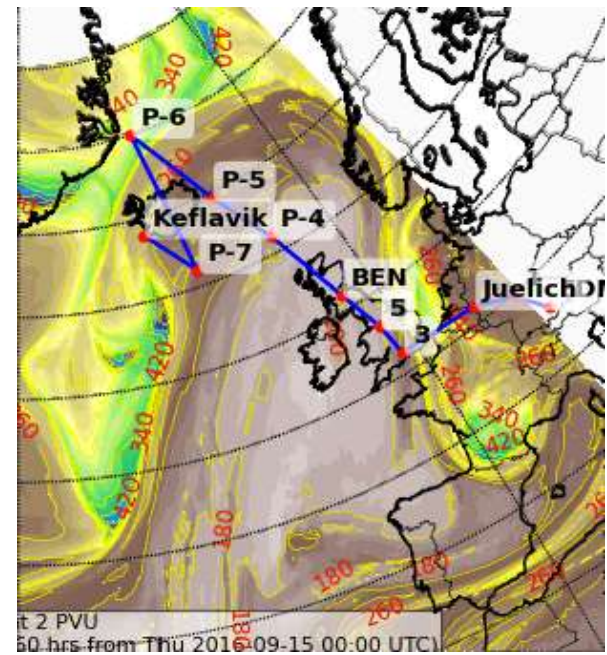
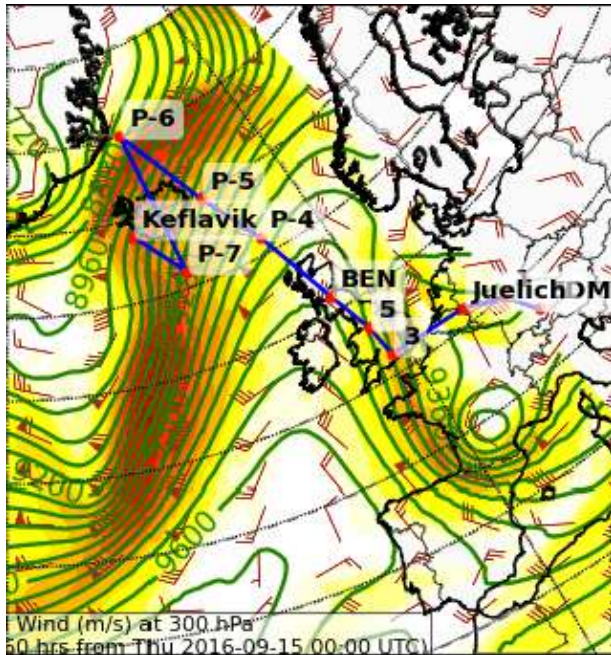
Valid: Sat 2016-09-17 12:00 UTC (step 60 hrs from Thu 2016-09-15 00:00 UTC)



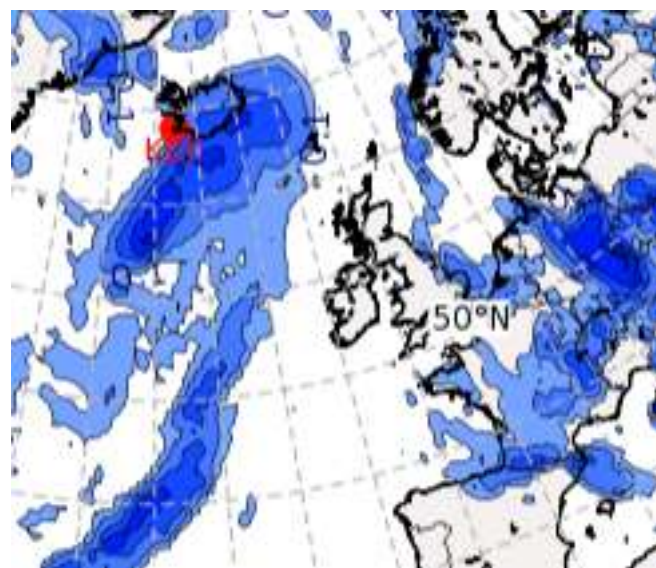
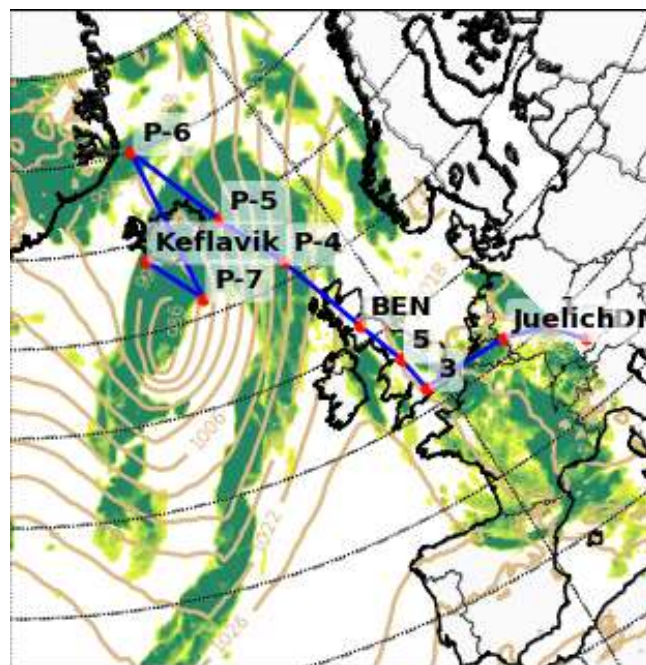
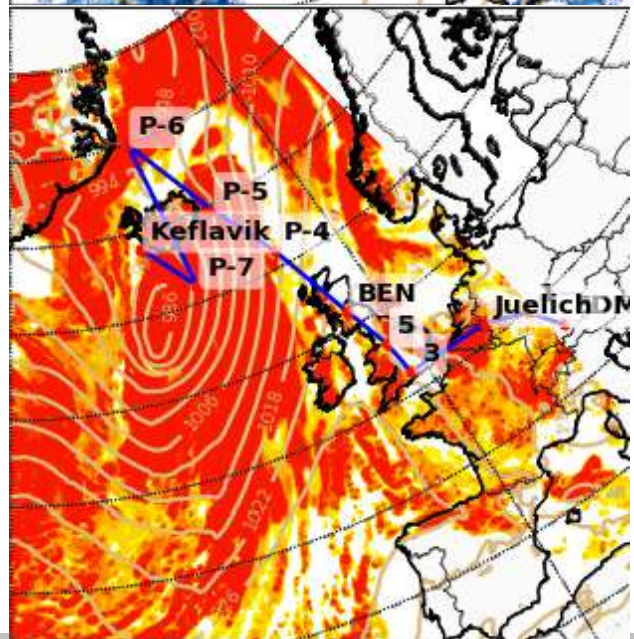
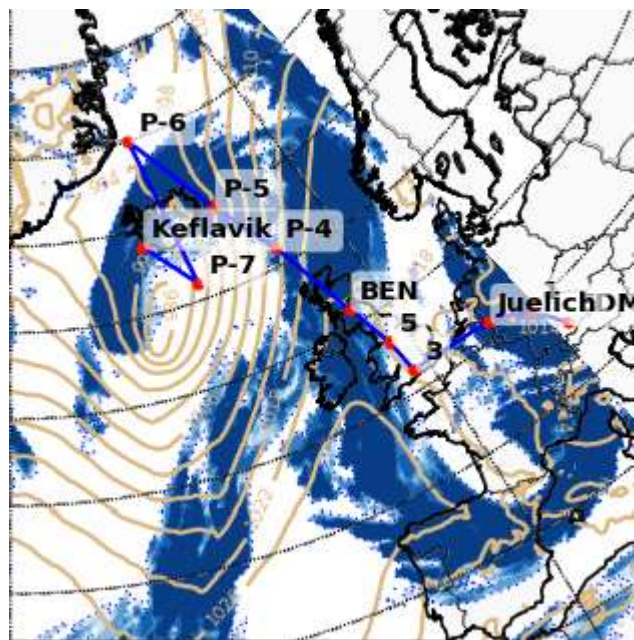
EPSG:77760320

- Decision about RASO
- Decision about dropsondes

Forecast for Sat, 17 Sep 2016 12 UTC



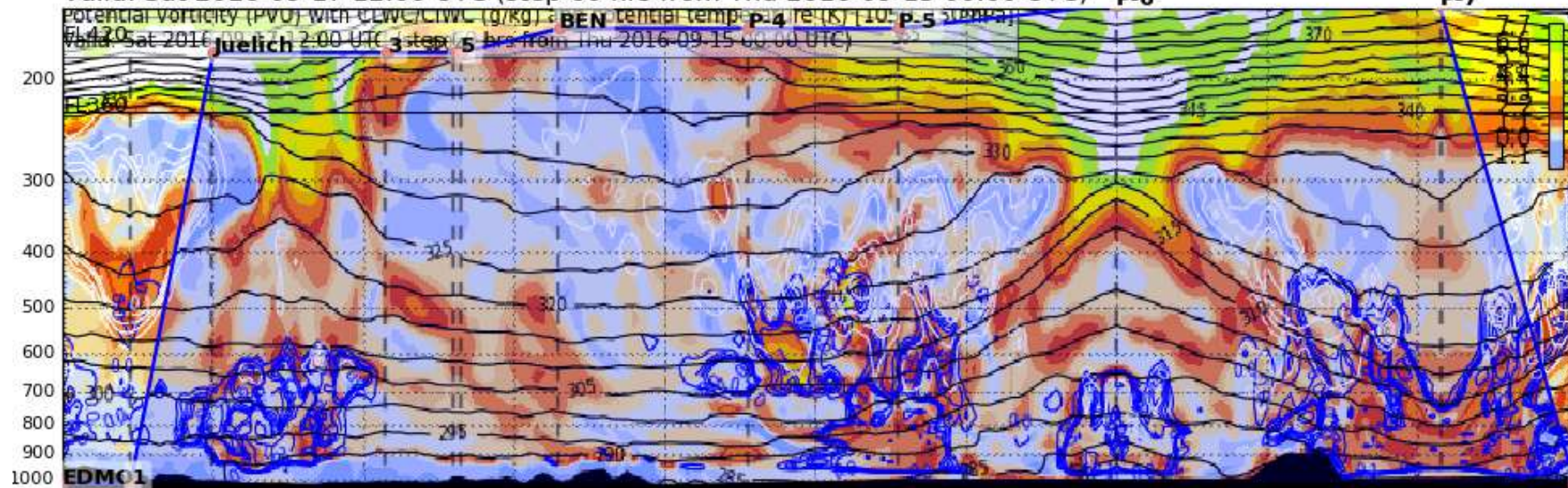
Forecast for Sat, 17 Sep 2016 12 UTC



Flight cross section for Sat, 17 Sep 2016 12 UTC

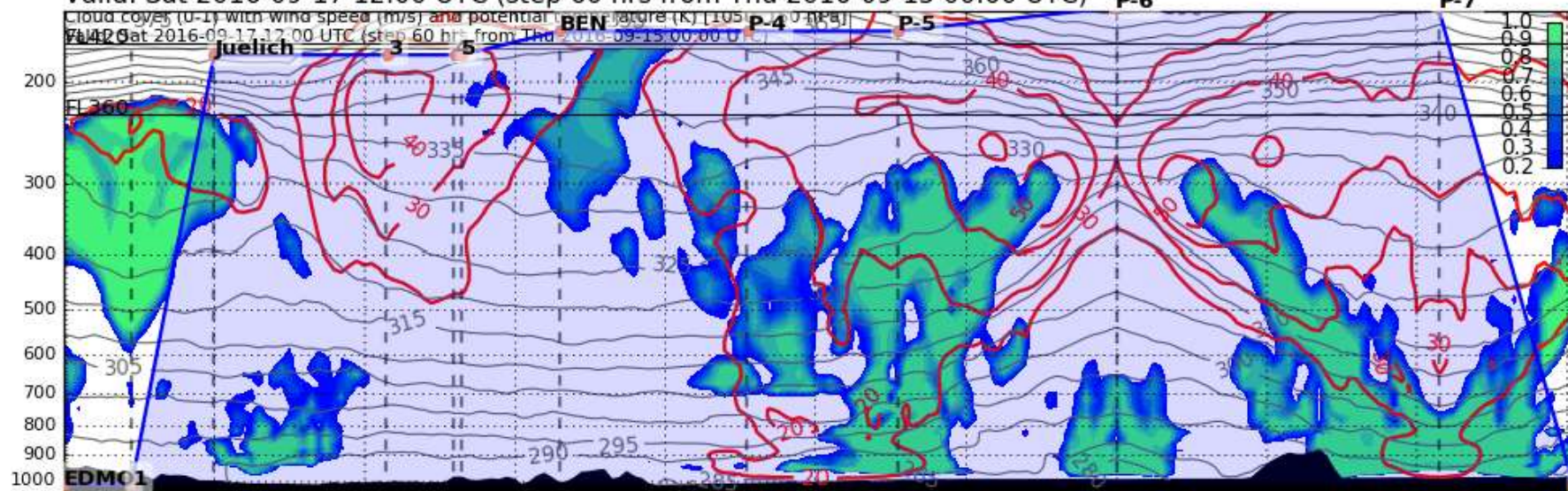
Potential Vorticity (PVU) Vertical Section (Northern Hemisphere)

Valid: Sat 2016-09-17 12:00 UTC (step 60 hrs from Thu 2016-09-15 00:00 UTC)



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

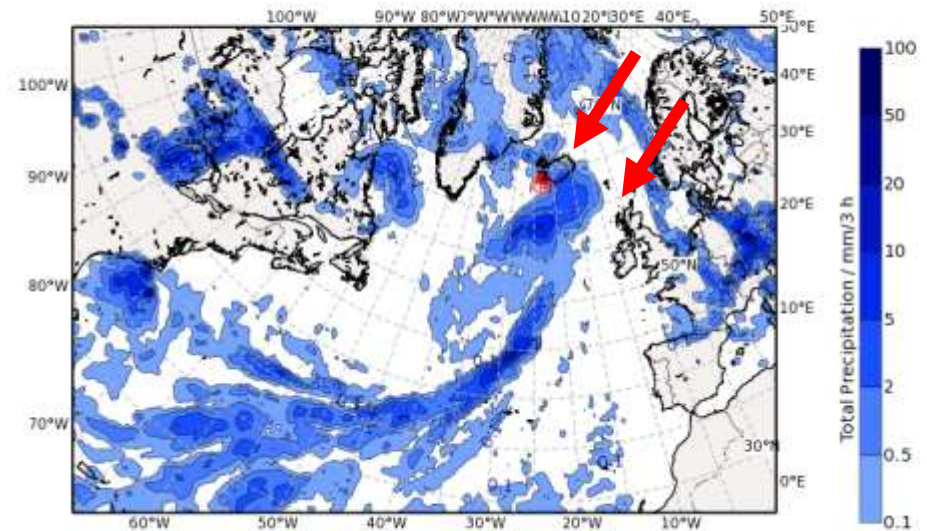
Valid: Sat 2016-09-17 12:00 UTC (step 60 hrs from Thu 2016-09-15 00:00 UTC)



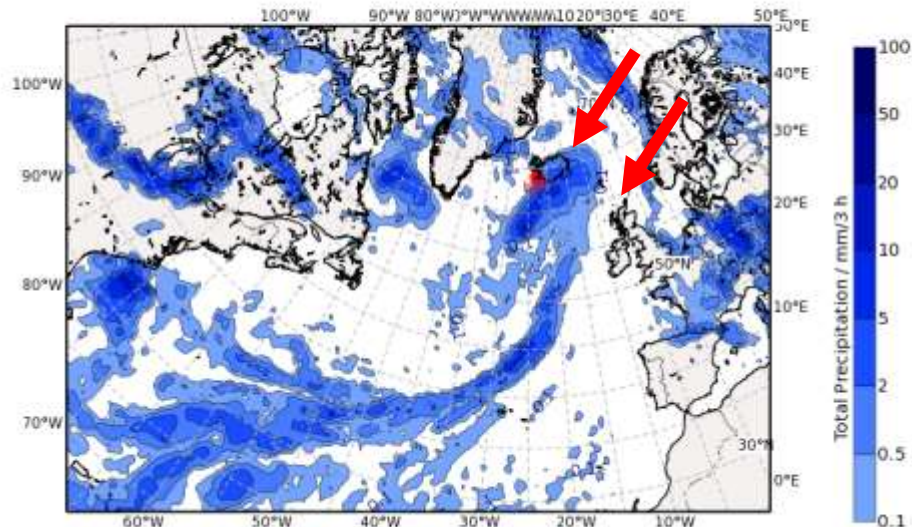
flight planning Sat 17/12Z: precipitation

BT15/00Z

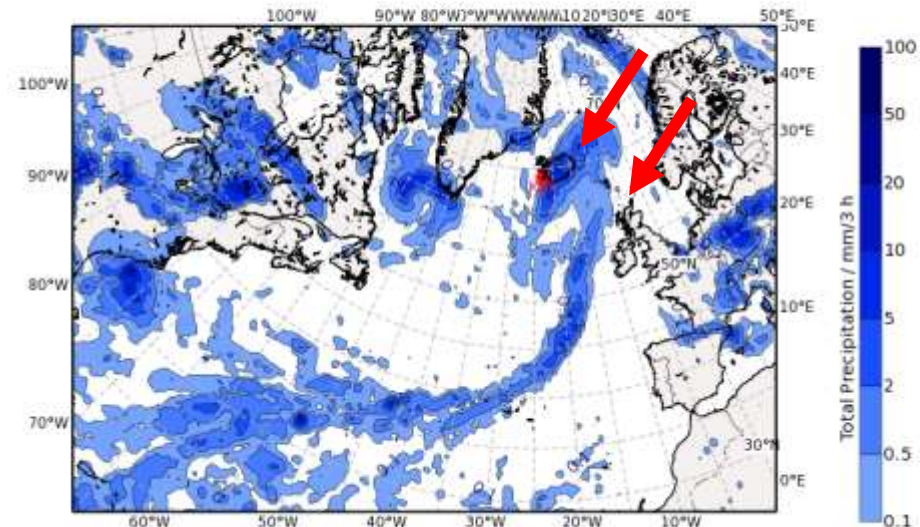
Total Precipitation, accumulated over 3 hours prior to valid time (mm)
Valid: Sat, 17 Sep 2016, 06 UTC (step 054 h from Thu, 15 Sep 2016, 00 UTC)



Total Precipitation, accumulated over 3 hours prior to valid time (mm)
Valid: Sat, 17 Sep 2016, 12 UTC (step 060 h from Thu, 15 Sep 2016, 00 UTC)



Total Precipitation, accumulated over 3 hours prior to valid time (mm)
Valid: Sat, 17 Sep 2016, 18 UTC (step 066 h from Thu, 15 Sep 2016, 00 UTC)



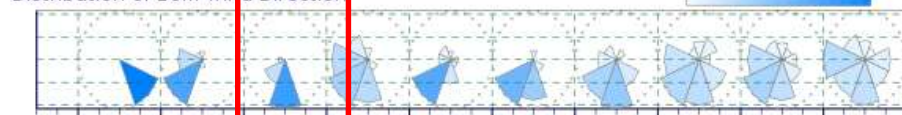
flight planning Sat 17/12Z: wave diagram southern Sea Point

Wave ENSgram

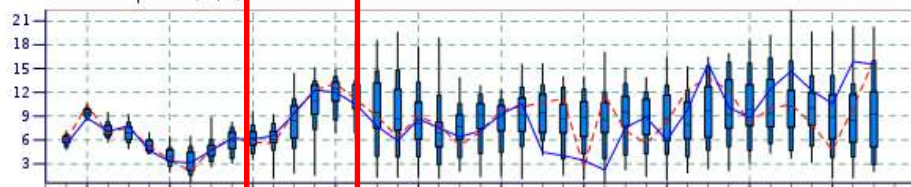
60.52°N 4.21°W (ENS sea point)

High resolution forecast and ENS distribution Wednesday 14 September 2016 12 UTC

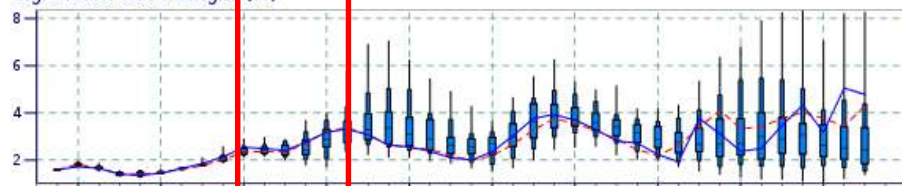
Distribution of 10m Wind Direction



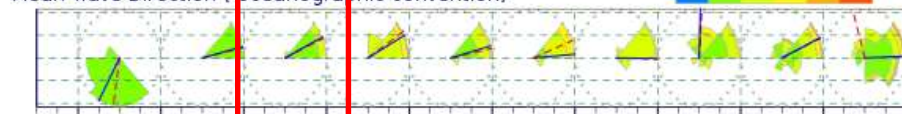
10m Wind Speed (m/s)



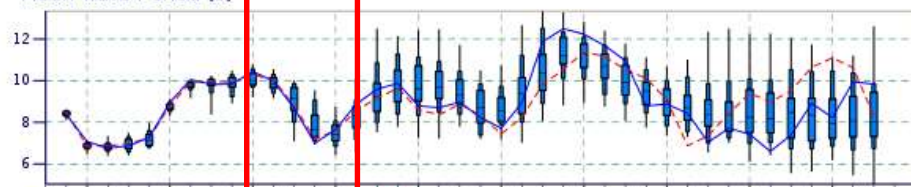
Significant wave height (m)



Mean Wave Direction (oceanographic convention)

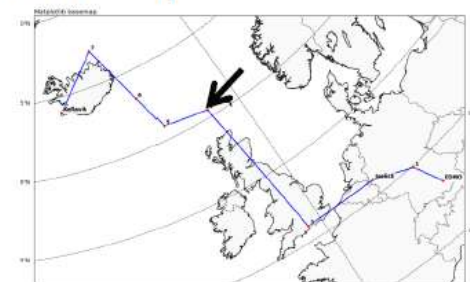


Mean Wave Period (s)



Wed 14 Sep Thu 15 Fri 16 Sat 17 Sun 18 Mon 19 Tue 20 Wed 21 Thu 22 Fri 23 Sat 24

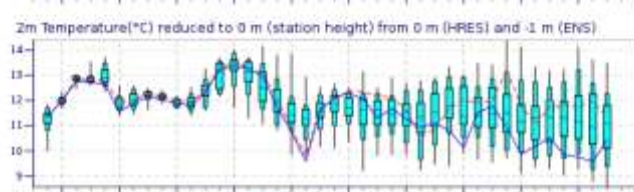
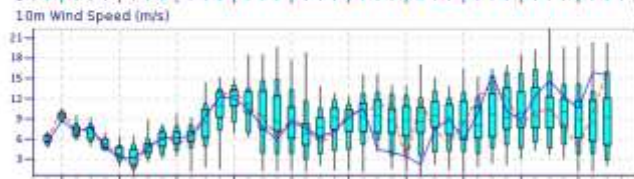
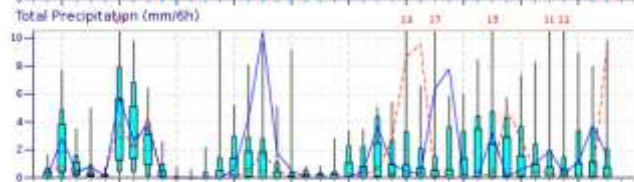
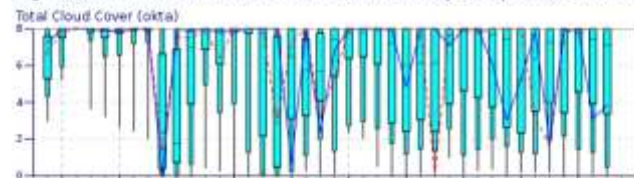
ECMWF ENS Meteogram
For K7 Buoy



ENS Meteogram

60.52°N 4.21°W (ENS sea point) 0 m

High Resolution Forecast and ENS Distribution Wednesday 14 September 2016 12 UTC



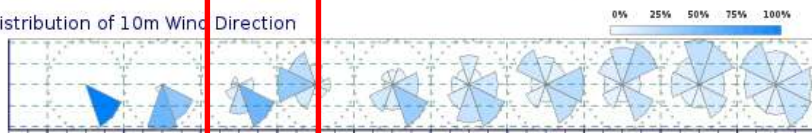
flight planning Sat 17/12Z: wave diagram northern Sea Point

Wave ENSgram

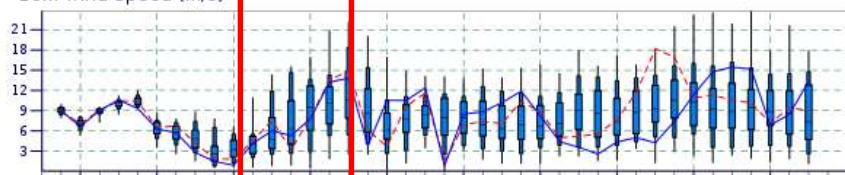
67.12°N 15.63°W (ENS sea point)

High resolution forecast and ENS distribution Wednesday 14 September 2016 12 UTC

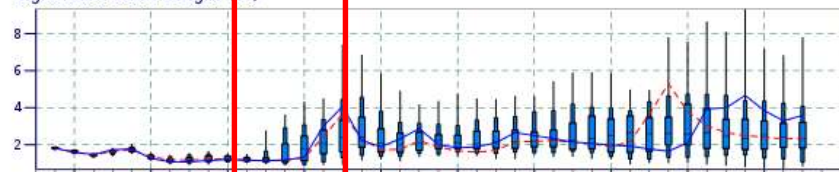
Distribution of 10m Wind Direction



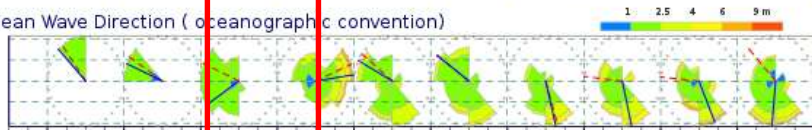
10m Wind Speed (m/s)



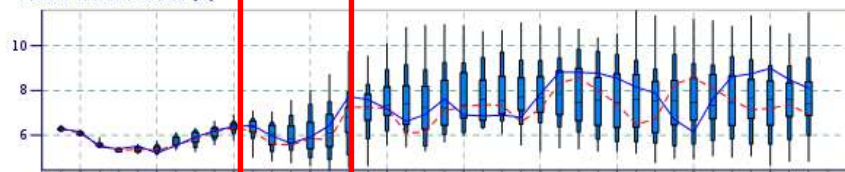
Significant wave height (m)



Mean Wave Direction (oceanographic convention)



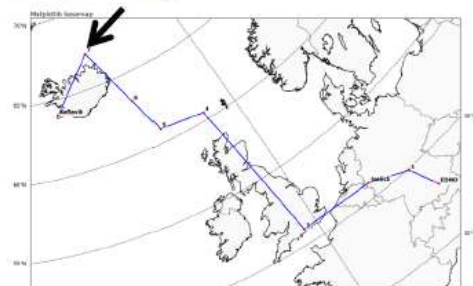
Mean Wave Period (s)



Wed14
Sep
2016

ECMWF ENS Meteogram

For K7 Buoy

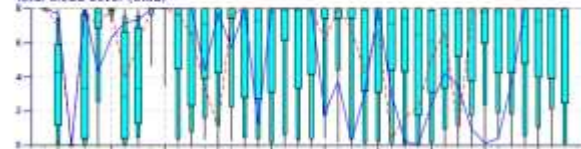


ENS Meteogram

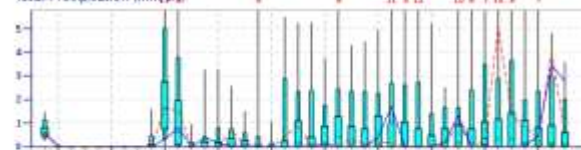
67.12°N 15.63°W (ENS sea point) 0 m

High Resolution Forecast and ENS Distribution Tuesday 13 September 2016 12 UTC

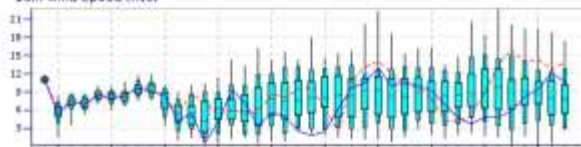
Total Cloud Cover (okta)



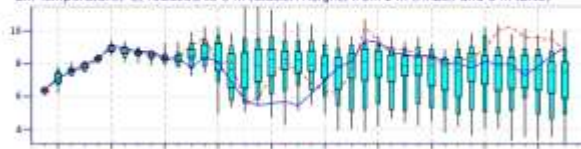
Total Precipitation (mm/6h)



10m Wind Speed (m/s)



2m Temperature(°C) reduced to 0 m (station height) from 1 m (HRES) and 5 m (ENS)



Tue13
Sep

flight planning Sat 17/12Z: uncertainty Z500 at sea points

ECMWF Ensemble forecasts

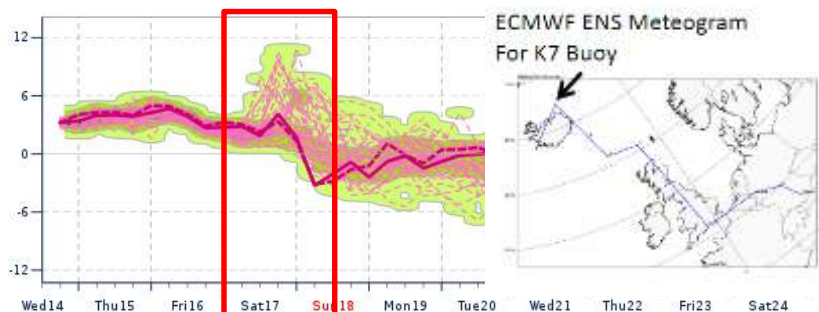
67.12°N 15.63°W (ENS sea point) 0 m

High Resolution Forecast and ENS Distribution

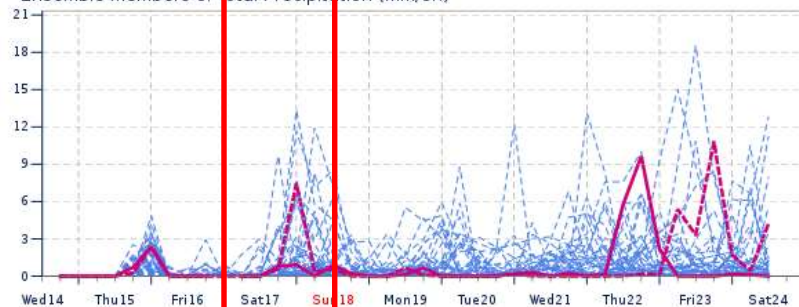
Wednesday 14 September 2016 12 UTC



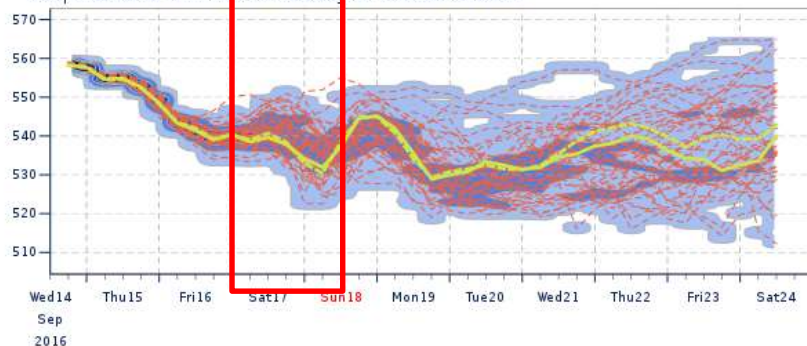
Temperature at 850 hPa - Probability for 1°C intervals



Ensemble members of Total Precipitation (mm/6h)



Geopotential at 500 hPa - Probability for 2.5dam intervals



ECMWF Ensemble forecasts

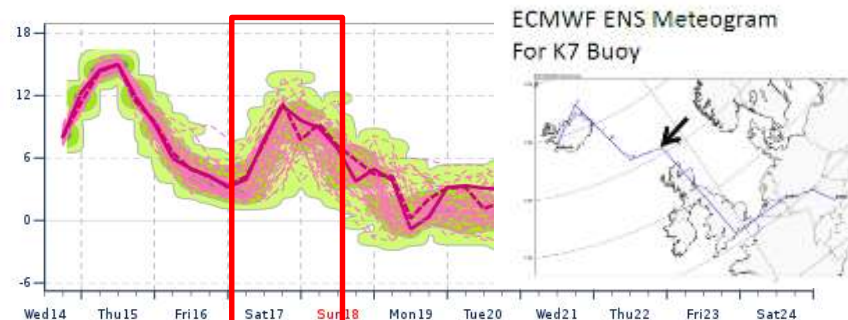
60.52°N 4.21°W (ENS sea point) 0 m

High Resolution Forecast and ENS Distribution

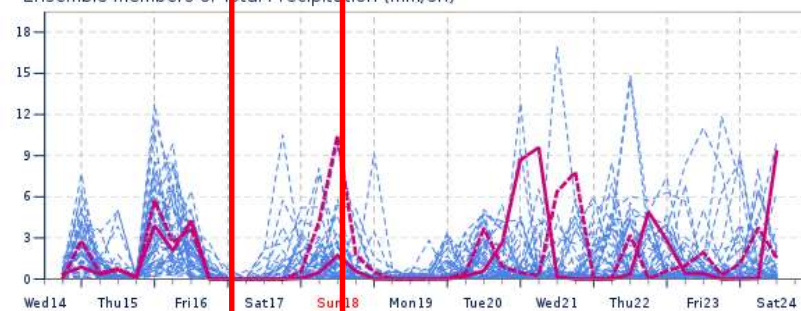
Wednesday 14 September 2016 12 UTC



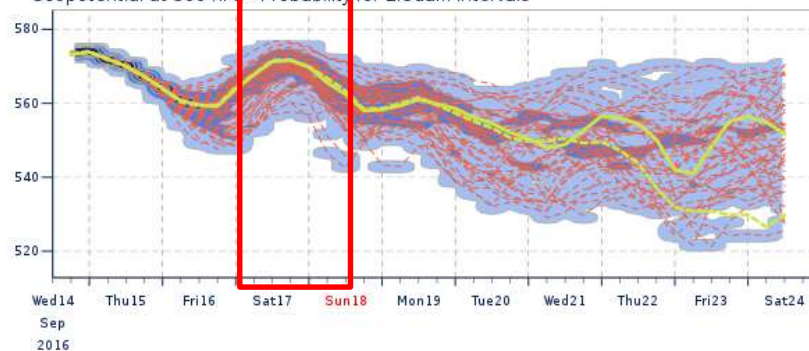
Temperature at 850 hPa - Probability for 1°C intervals



Ensemble members of Total Precipitation (mm/6h)

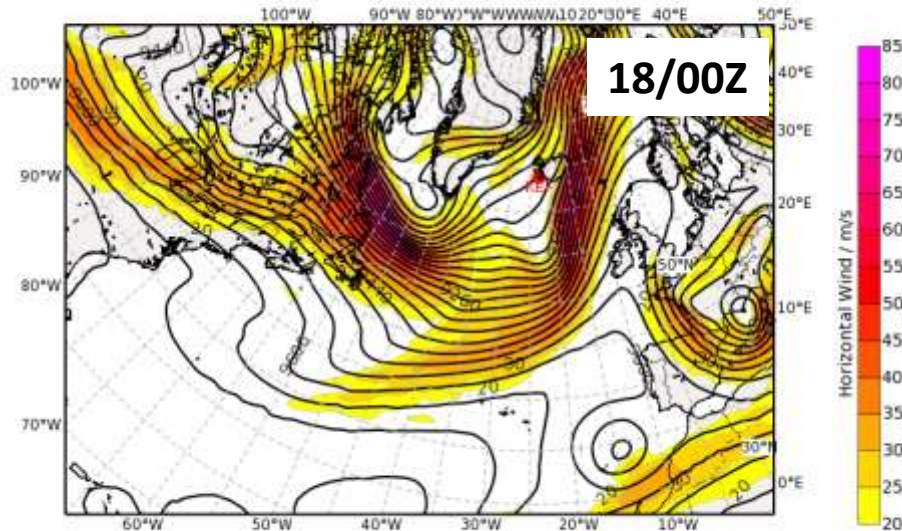


Geopotential at 500 hPa - Probability for 2.5dam intervals

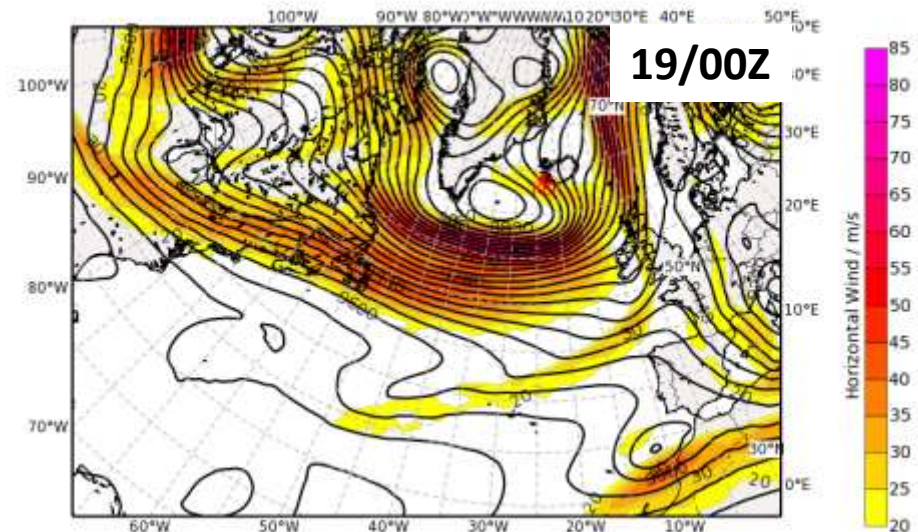


Outlook Sat 17/00Z to Wed 21/00Z : Z500 (based EC Hres 15/00Z)

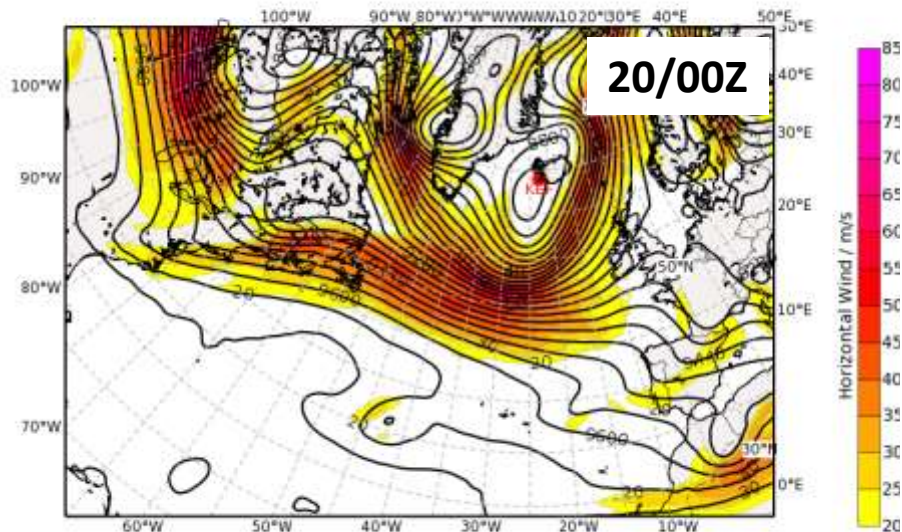
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Sun, 18 Sep 2016, 00 UTC (step 072 h from Thu, 15 Sep 2016, 00 UTC)



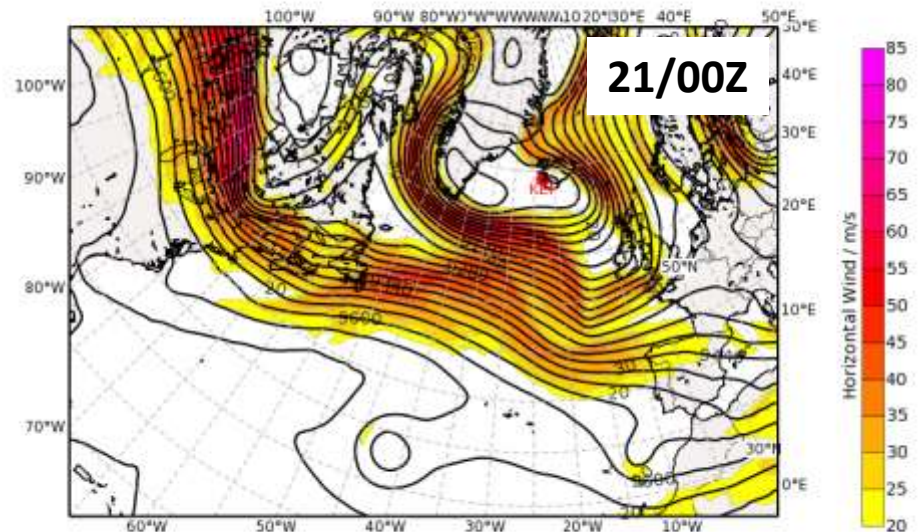
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Mon, 19 Sep 2016, 00 UTC (step 096 h from Thu, 15 Sep 2016, 00 UTC)



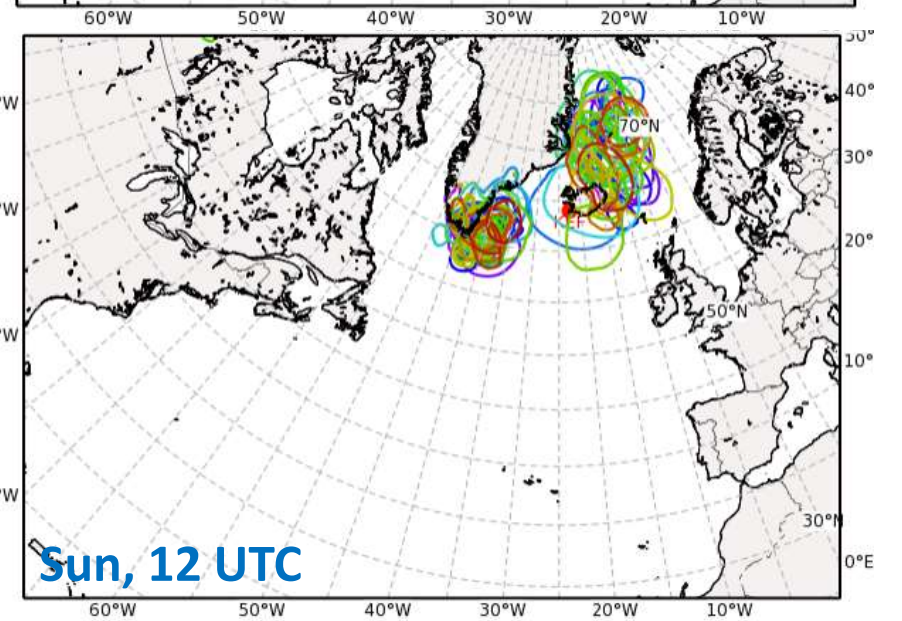
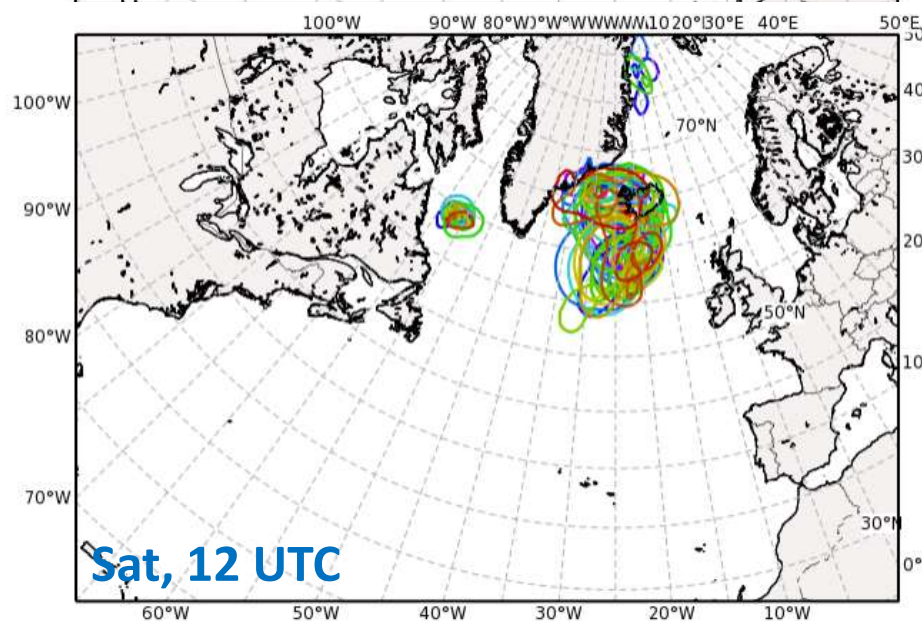
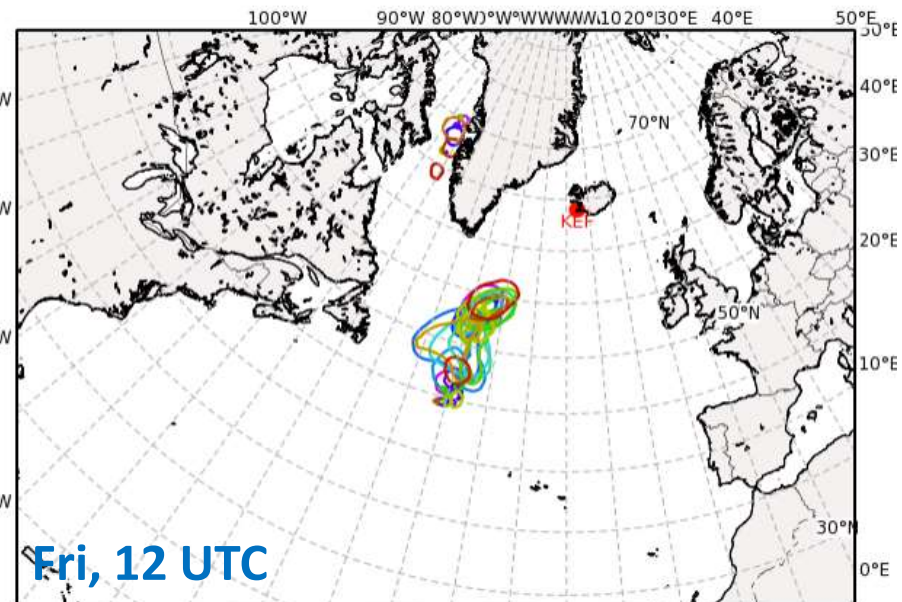
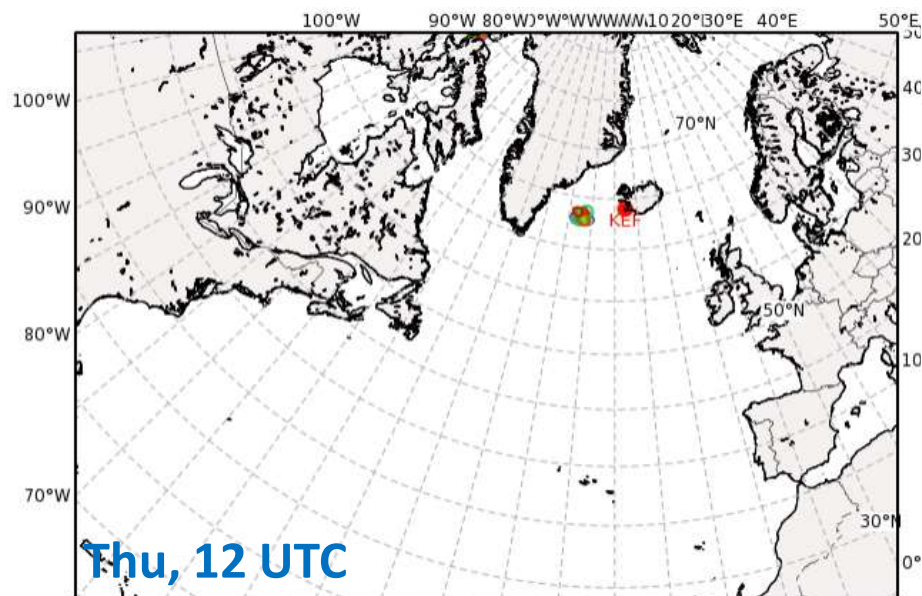
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Tue, 20 Sep 2016, 00 UTC (step 120 h from Thu, 15 Sep 2016, 00 UTC)



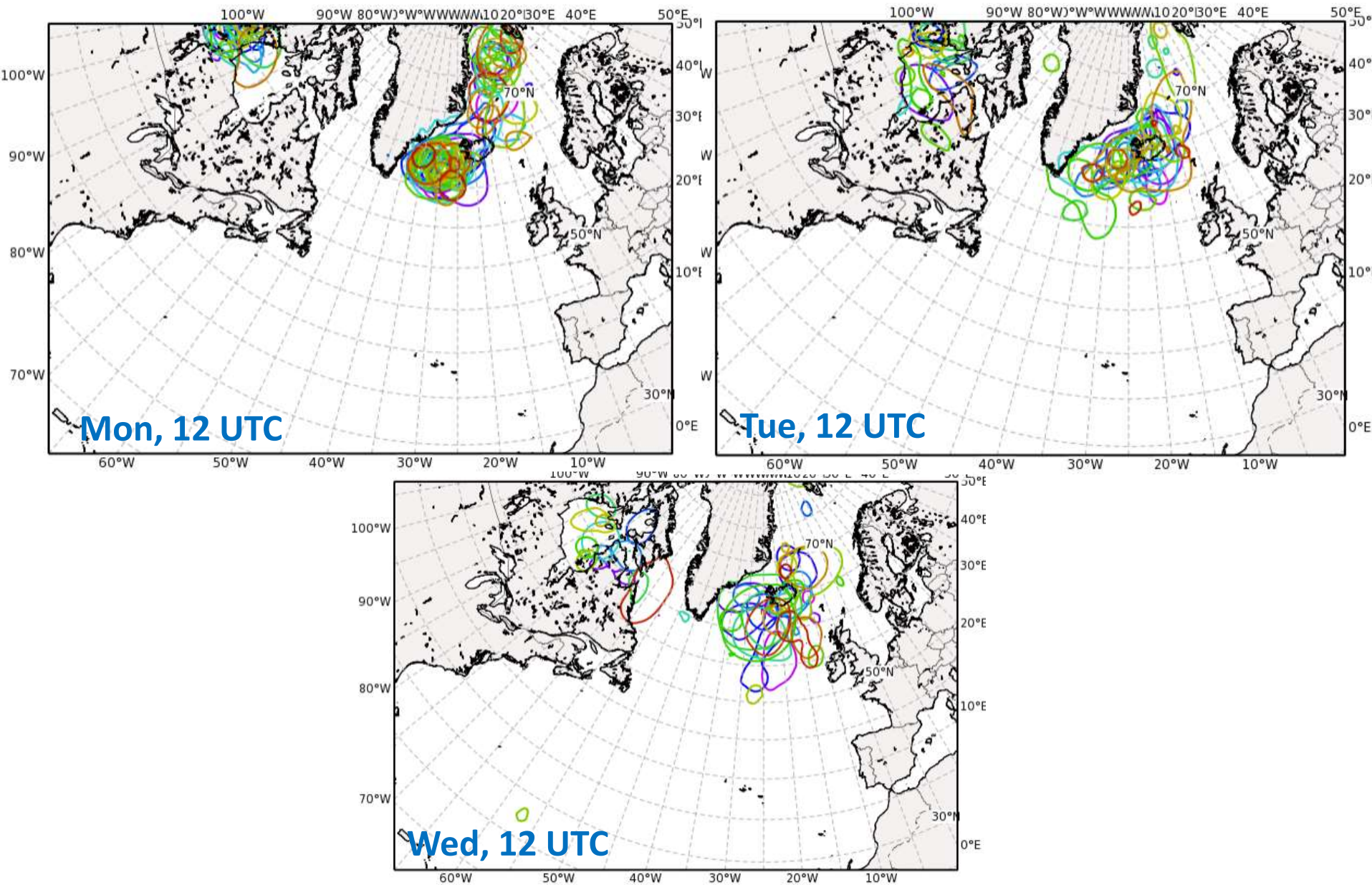
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa
Valid: Wed, 21 Sep 2016, 00 UTC (step 144 h from Thu, 15 Sep 2016, 00 UTC)



Ensemble cyclone locations



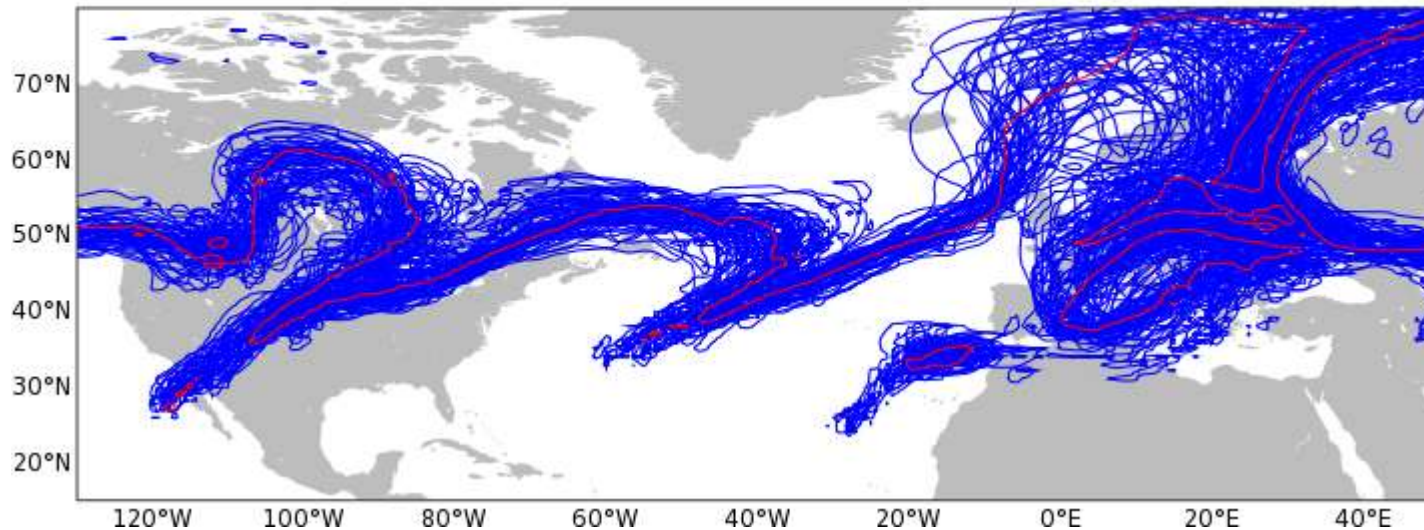
Ensemble cyclone locations



Outlook Sat 17/00Z to Wed 21/00Z : 2PVU@330K(based EC Ens 14/12Z)

Sun 18/12Z

ECMWF ENSEMBLE FC
BT: 20160914 12UTC, VT: 20160918 12UTC
blue: perturbed, red: control



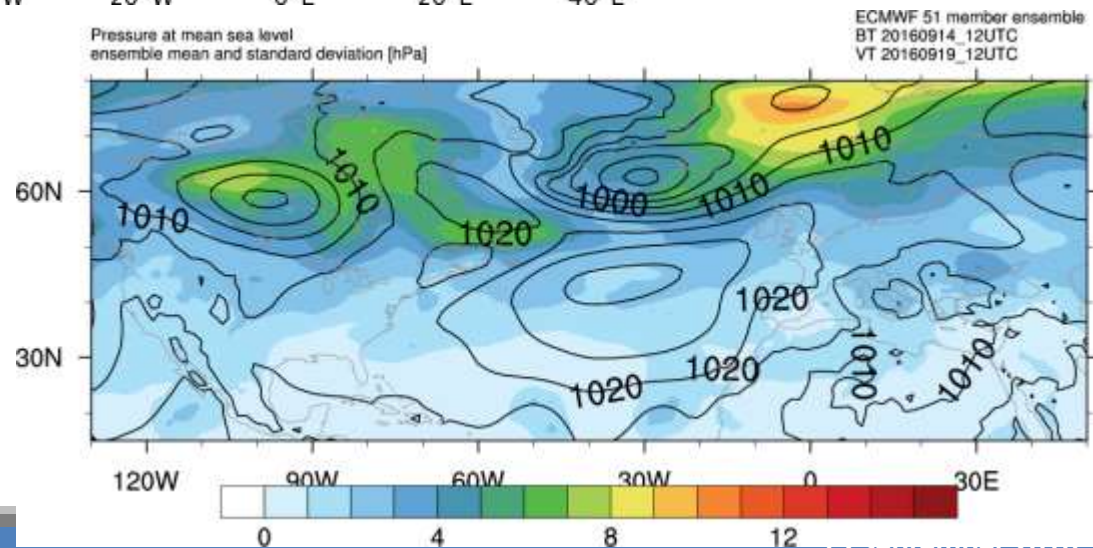
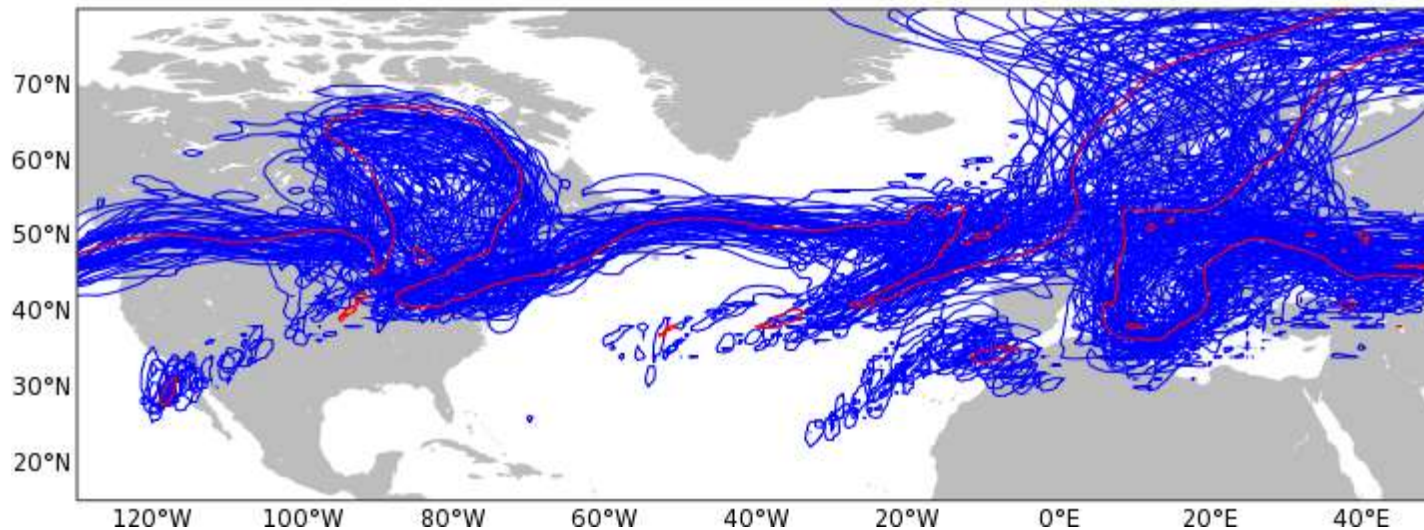
Outlook Sat 17/00Z to Wed 21/00Z : 2PVU@330K(based EC Ens 14/12Z)

Mon 19/12Z

ECMWF ENSEMBLE FC

BT: 20160914 12UTC, VT: 20160919 12UTC

blue: perturbed, red: control



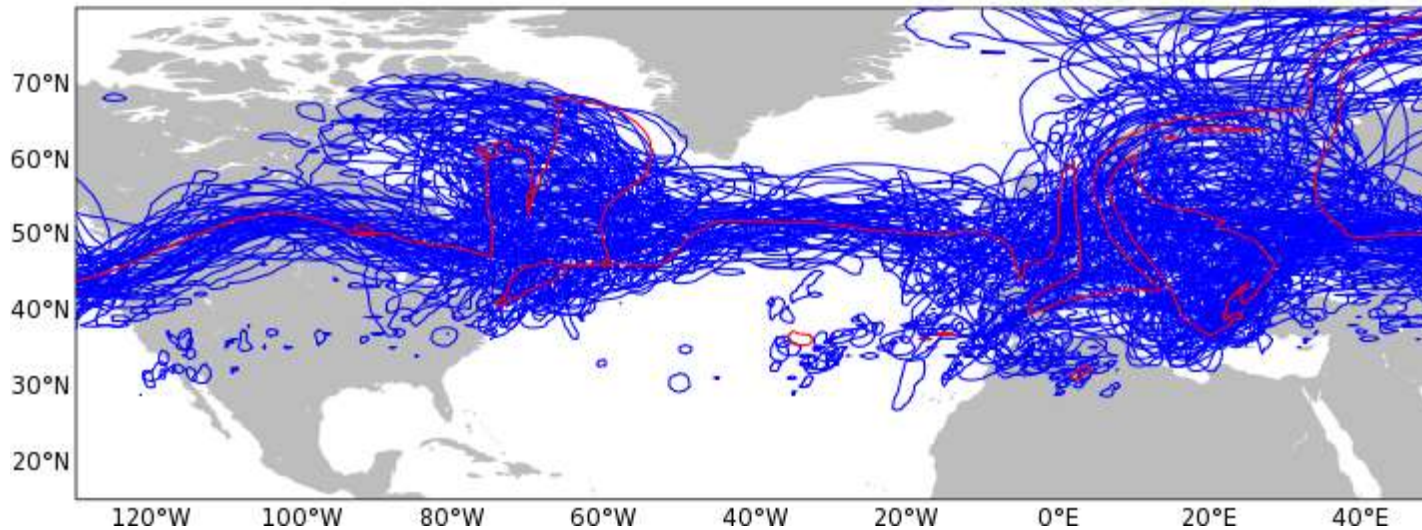
Outlook Sat 17/00Z to Wed 21/00Z : 2PVU@330K(based EC Ens 14/12Z)

Tue 20/12Z

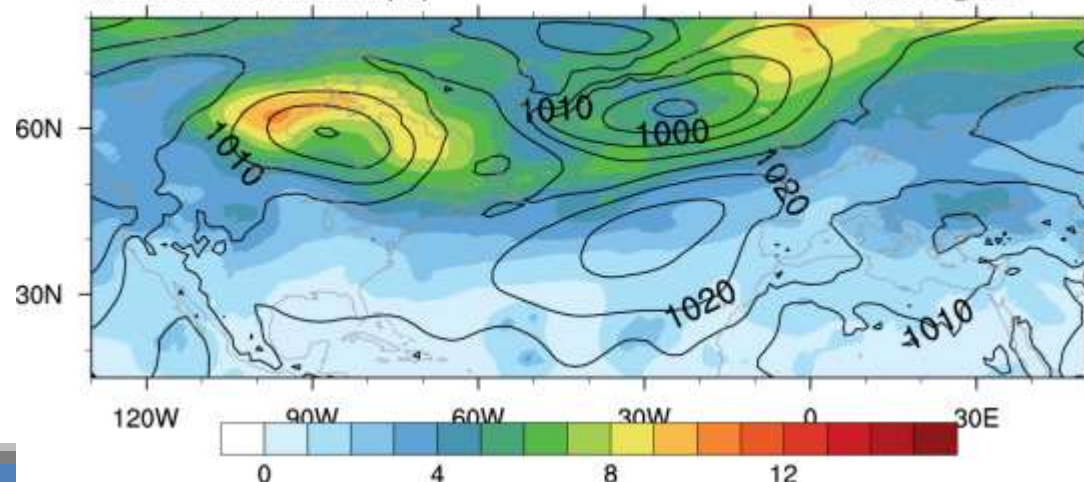
ECMWF ENSEMBLE FC

BT: 20160914 12UTC, VT: 20160920 12UTC

blue: perturbed, red: control



Pressure at mean sea level
ensemble mean and standard deviation [hPa]



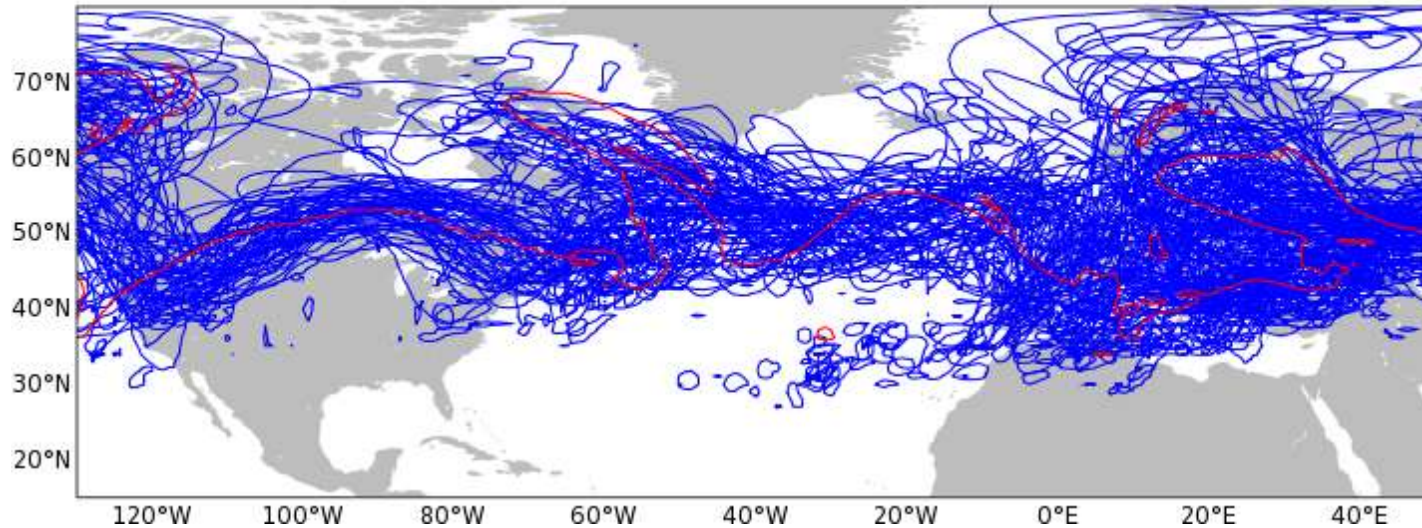
Outlook Sat 17/00Z to Wed 21/00Z : 2PVU@330K(based EC Ens 14/12Z)

Wed 21/12Z

ECMWF ENSEMBLE FC

BT: 20160914 12UTC, VT: 20160921 12UTC

blue: perturbed, red: control



Pressure at mean sea level
ensemble mean and standard deviation (hPa)

