

# NAWDEX – WEATHER discussion

19 September 2016, Keflavik 16 UTC

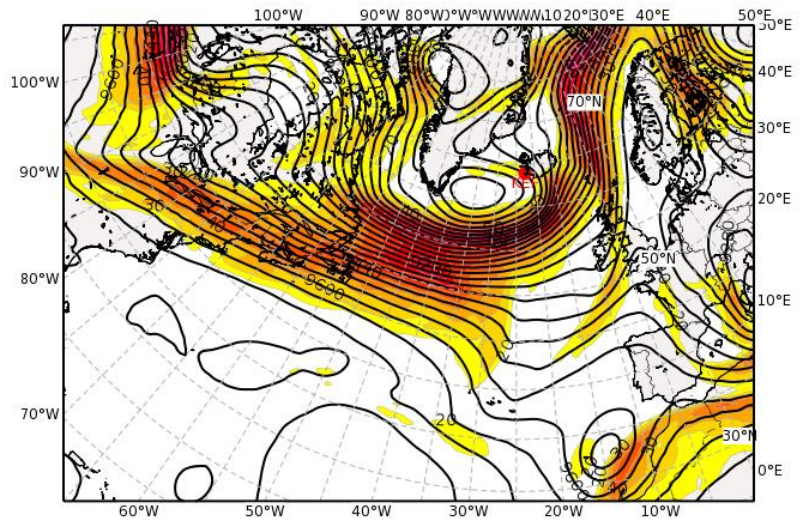
- Current situation & evolution until Sunday 24 September
- **Next mission Wednesday 21 September**
- Model consistency
- **Potential 2nd mission Friday/Saturday 23/24 September**
- Outlook **Sunday - Wednesday**

# Summary ToDos

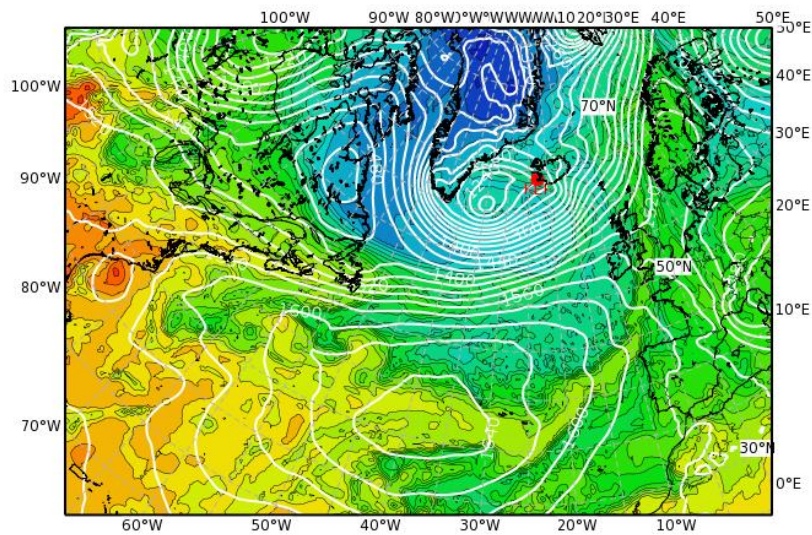
- **Next mission Wednesday 21 September**
  - Decision about final flight pattern: Falcon box size & location, HALO legs, Sat overpass, flight times
- **Potential 2nd mission Friday/Saturday 23/24 September**
  - Activation of NOTAM box (Wednesday), flight times, coordination inflow UK BAE 146, ascent Halo, outflow Halo and Falcon, extra sounding
- **Outlook Sunday – Wednesday:**
  - Scheduling/day off times for promising 3<sup>rd</sup> and 4<sup>th</sup> mission in downstream cyclone of Karl and Karl itself, coordination with SHOUT

# Analysis – 19 Sep 2016, 00 UTC

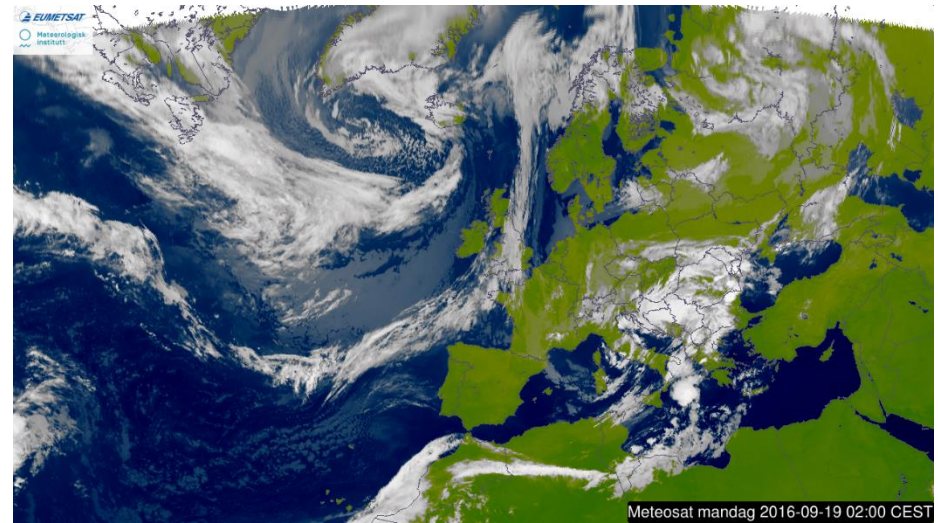
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Mon, 19 Sep 2016, 00 UTC (step 000 h from Mon, 19 Sep 2016, 00 UTC)



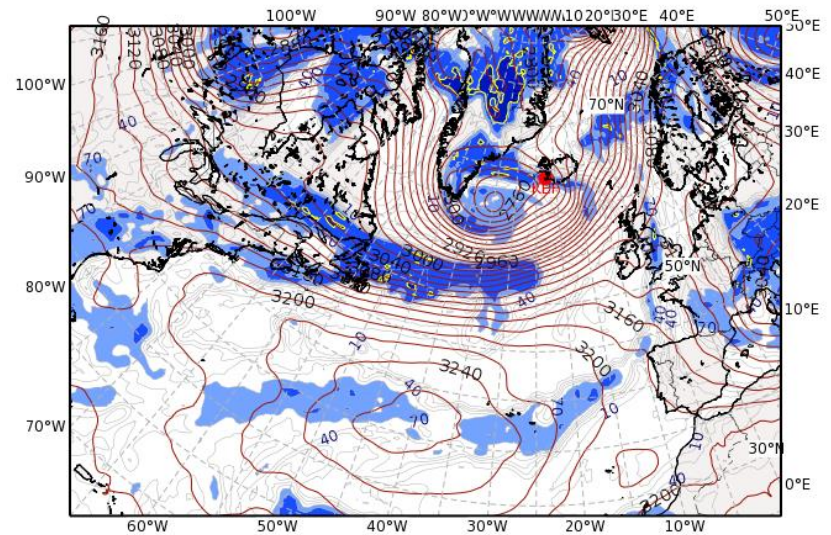
Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Mon, 19 Sep 2016, 00 UTC (step 000 h from Mon, 19 Sep 2016, 00 UTC)



Z300, SAT  
THE850, RH700

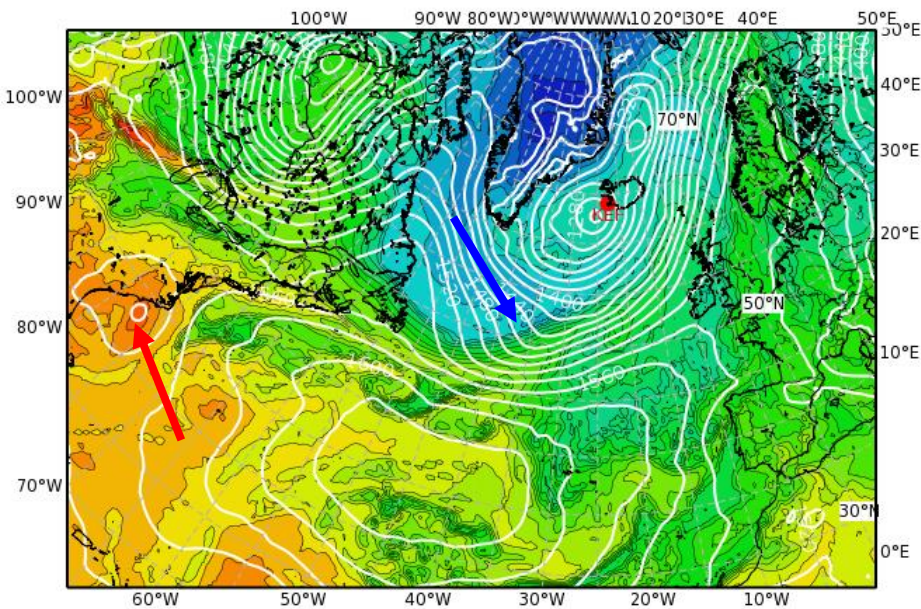


Relative Humidity (%) and Z (m) at 700 hPa  
Valid: Mon, 19 Sep 2016, 00 UTC (step 000 h from Mon, 19 Sep 2016, 00 UTC)

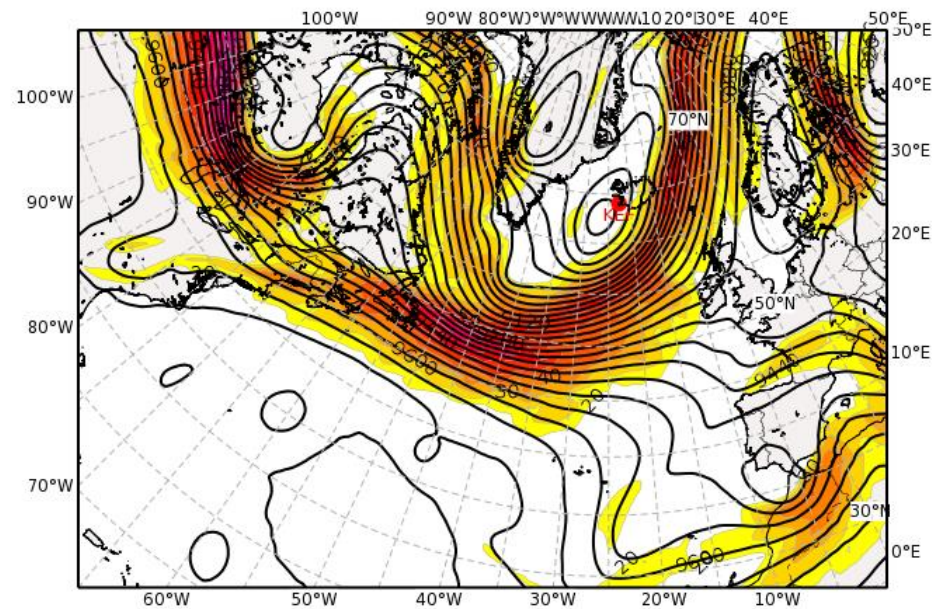




Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Tue, 20 Sep 2016, 00 UTC (step 024 h from Mon, 19 Sep 2016, 00 UTC)



Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Tue, 20 Sep 2016, 00 UTC (step 024 h from Mon, 19 Sep 2016, 00 UTC)

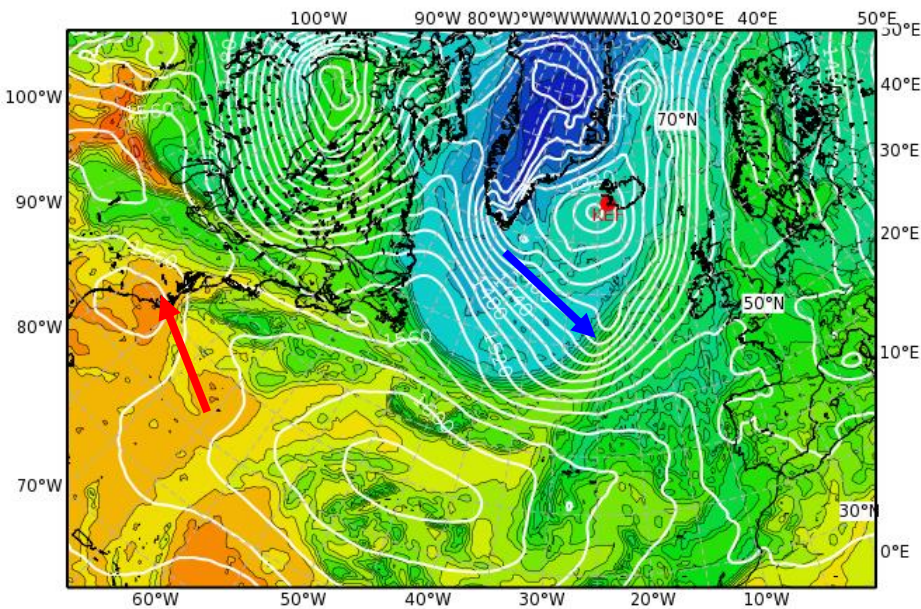




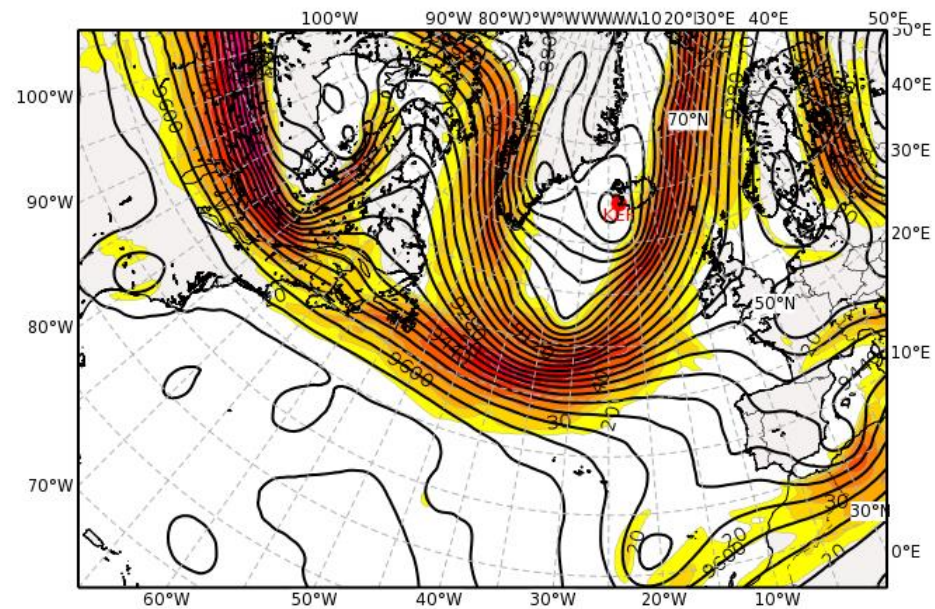
# Forecast for Tue, 20 Sep 2016 12 UTC

THE850, Z300 BT19/00Z

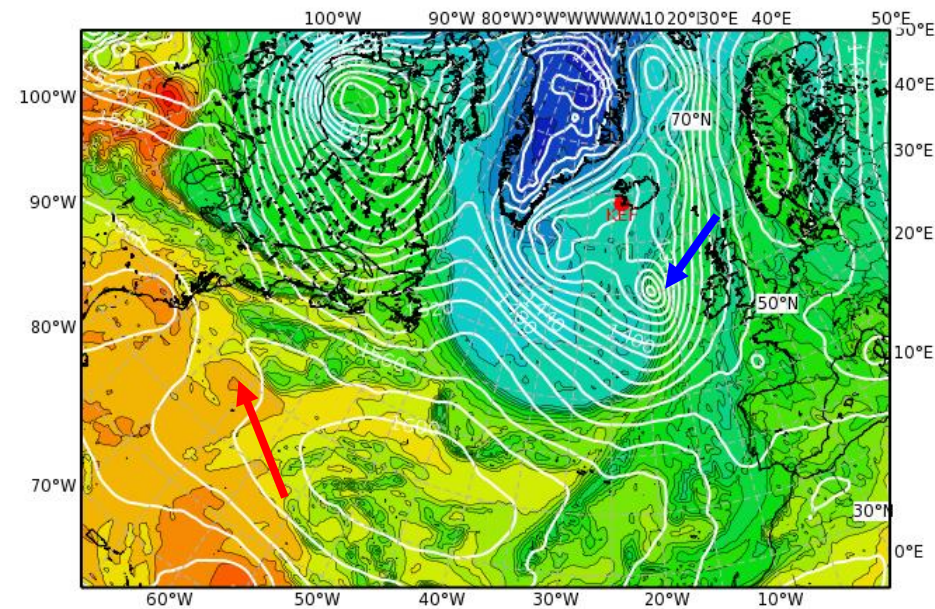
Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Tue, 20 Sep 2016, 12 UTC (step 036 h from Mon, 19 Sep 2016, 00 UTC)



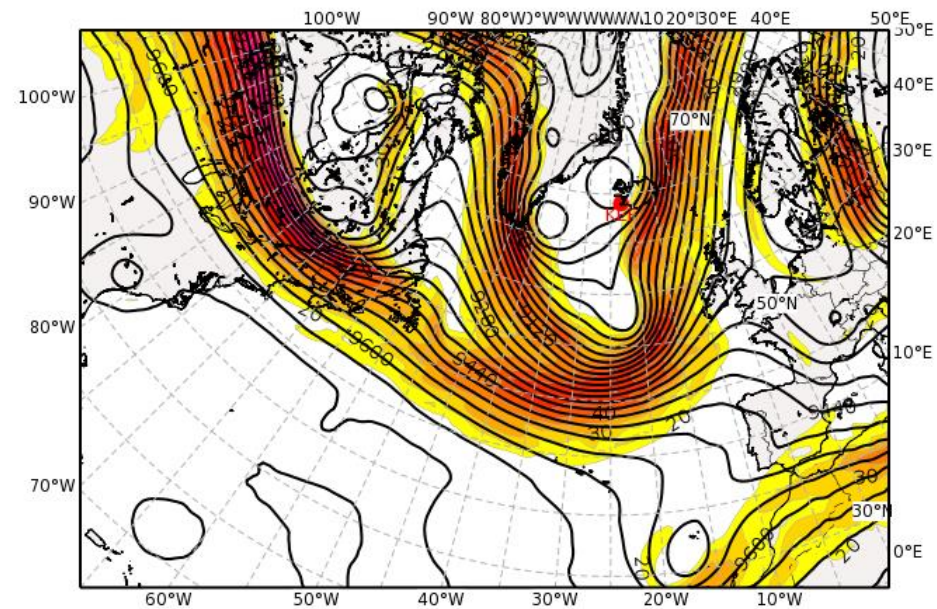
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Tue, 20 Sep 2016, 12 UTC (step 036 h from Mon, 19 Sep 2016, 00 UTC)



Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Wed, 21 Sep 2016, 00 UTC (step 048 h from Mon, 19 Sep 2016, 00 UTC)



Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Wed, 21 Sep 2016, 00 UTC (step 048 h from Mon, 19 Sep 2016, 00 UTC)

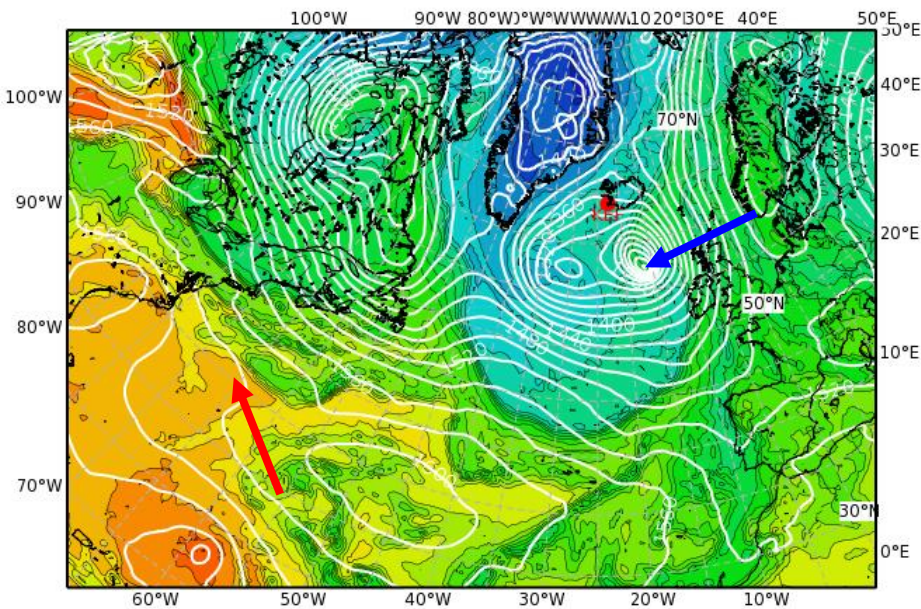




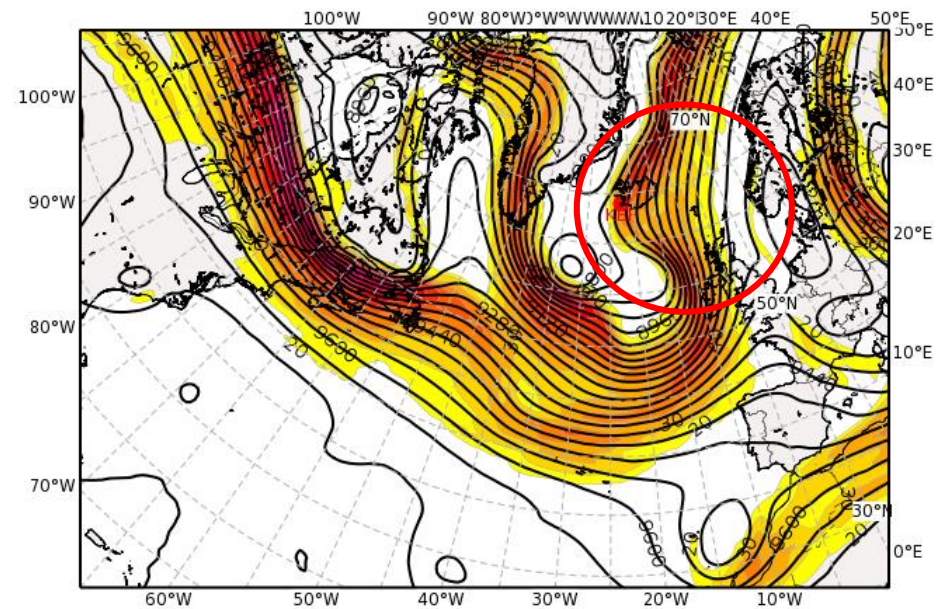
# Forecast for Wed, 21 Sep 2016 12 UTC

THE850, Z300 BT19/00Z

Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Wed, 21 Sep 2016, 12 UTC (step 060 h from Mon, 19 Sep 2016, 00 UTC)



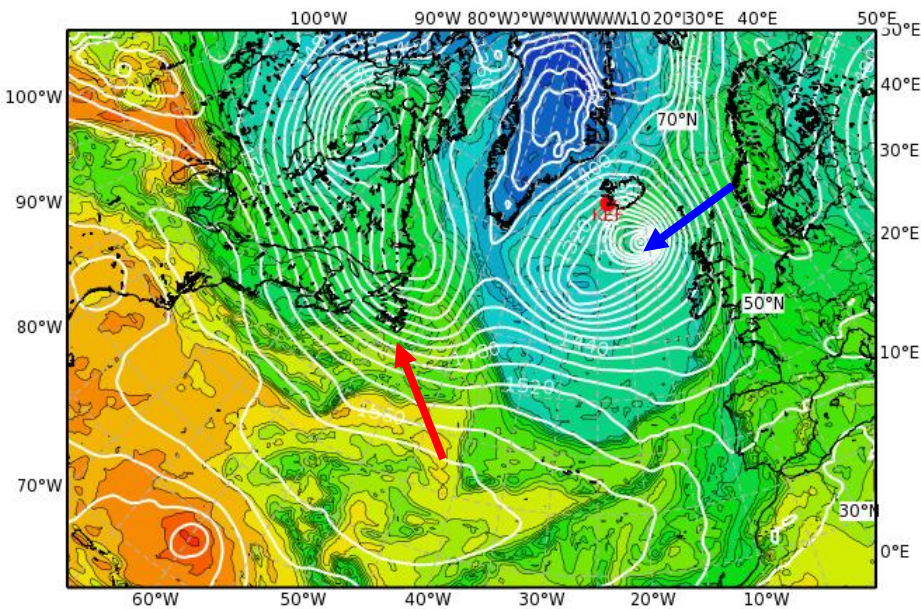
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Wed, 21 Sep 2016, 12 UTC (step 060 h from Mon, 19 Sep 2016, 00 UTC)



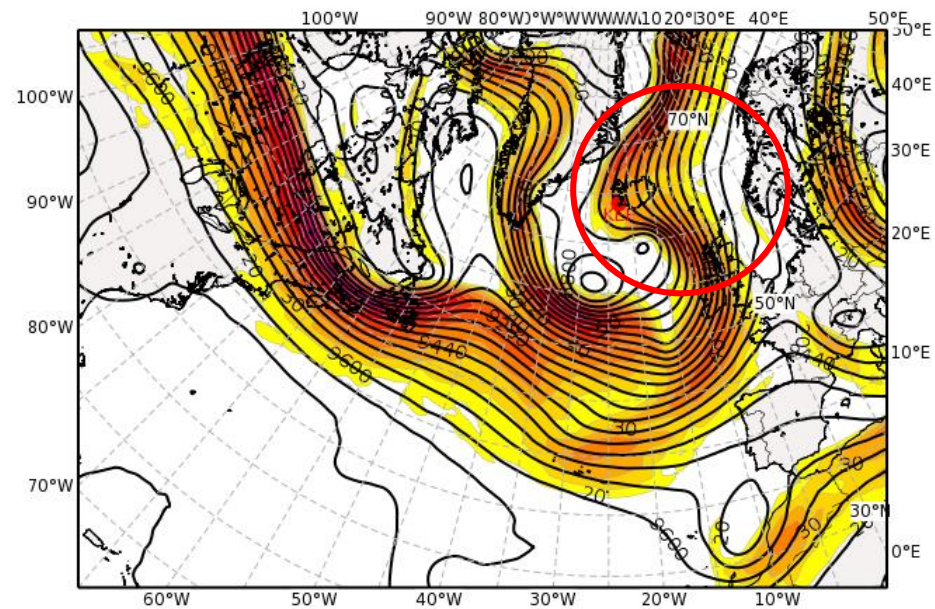
# Forecast for Wed, 21 Sep 2016 18 UTC

THE850, Z300 BT19/00Z

Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Wed, 21 Sep 2016, 18 UTC (step 066 h from Mon, 19 Sep 2016, 00 UTC)

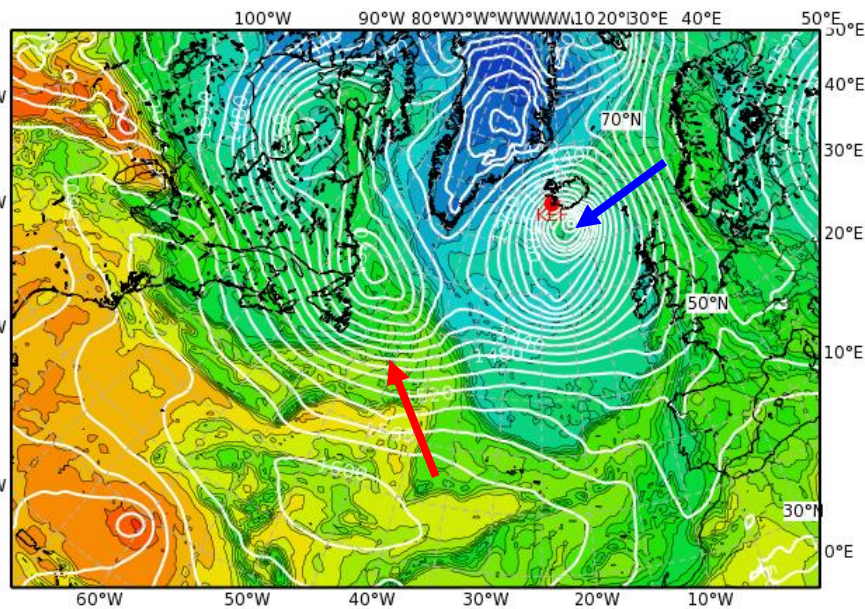


Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Wed, 21 Sep 2016, 18 UTC (step 066 h from Mon, 19 Sep 2016, 00 UTC)

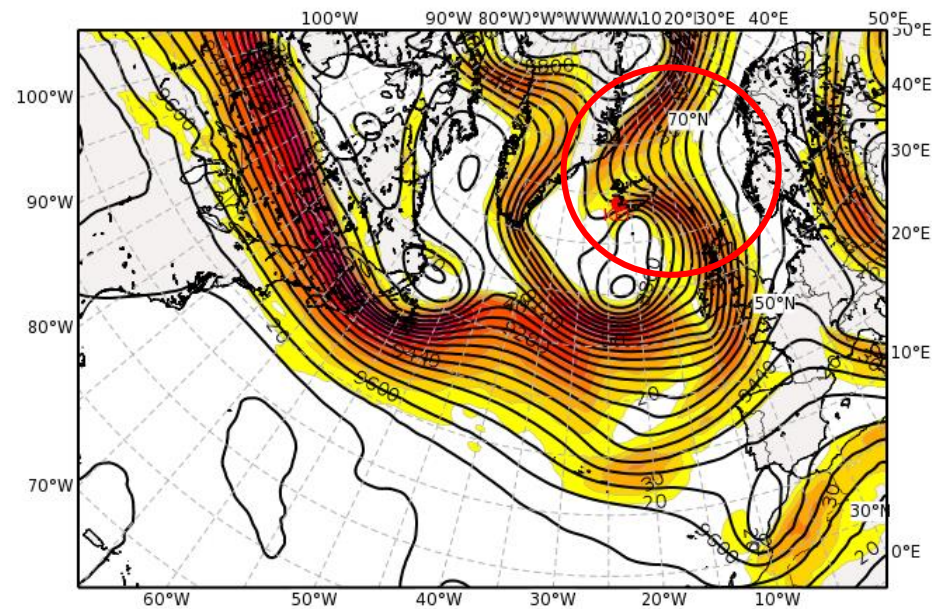




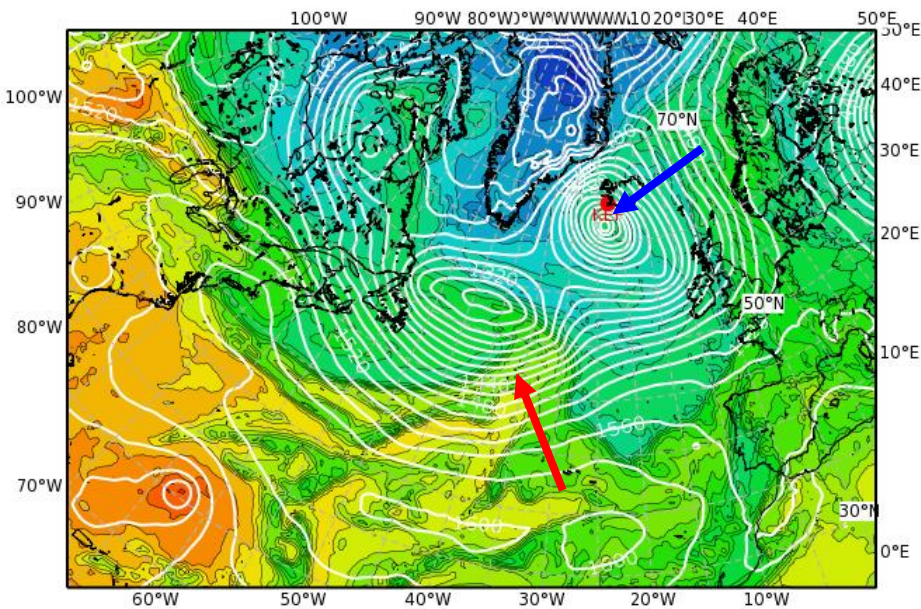
Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Thu, 22 Sep 2016, 00 UTC (step 072 h from Mon, 19 Sep 2016, 00 UTC)



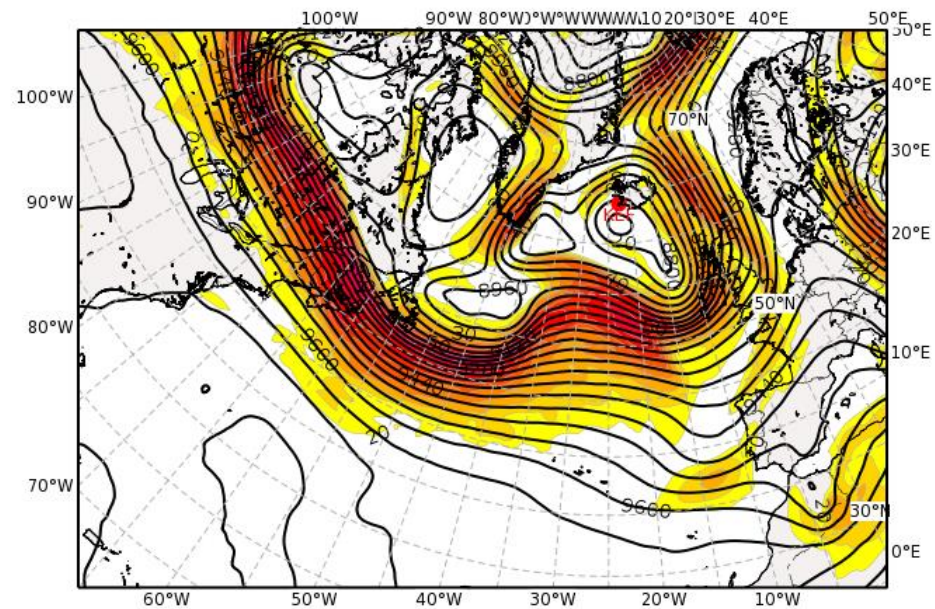
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Thu, 22 Sep 2016, 00 UTC (step 072 h from Mon, 19 Sep 2016, 00 UTC)



Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Thu, 22 Sep 2016, 12 UTC (step 084 h from Mon, 19 Sep 2016, 00 UTC)

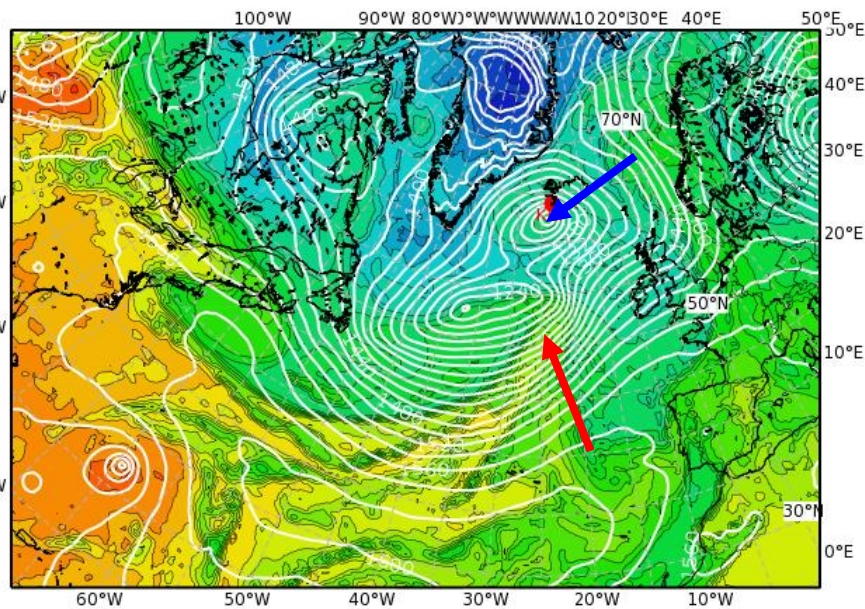


Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Thu, 22 Sep 2016, 12 UTC (step 084 h from Mon, 19 Sep 2016, 00 UTC)



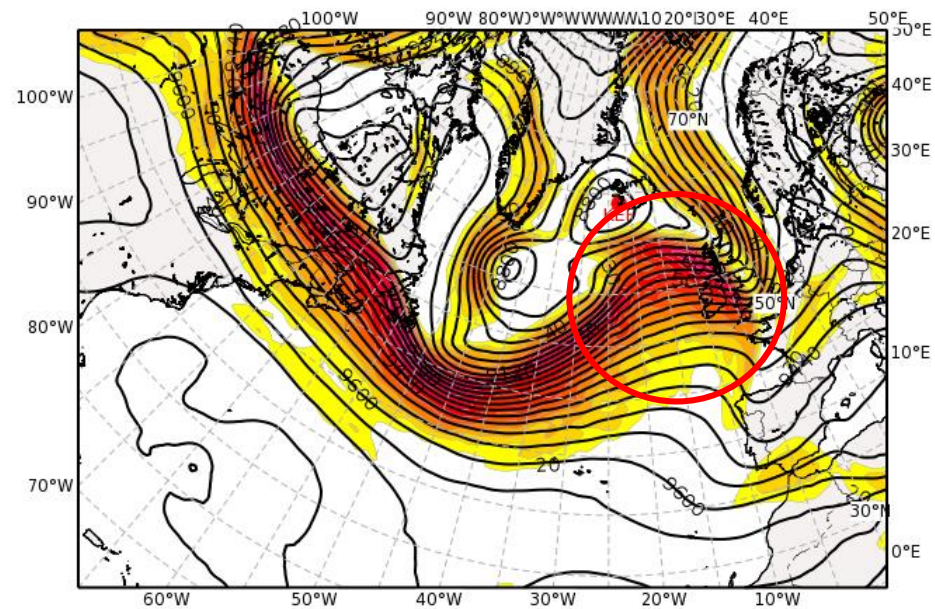


Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Fri, 23 Sep 2016, 00 UTC (step 096 h from Mon, 19 Sep 2016, 00 UTC)

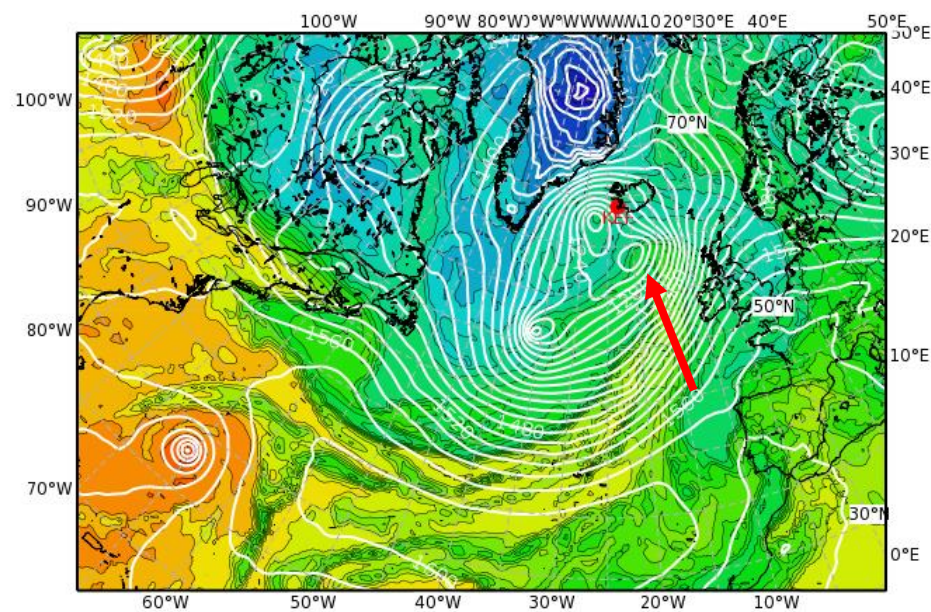


**TC Karl**

Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Fri, 23 Sep 2016, 00 UTC (step 096 h from Mon, 19 Sep 2016, 00 UTC)

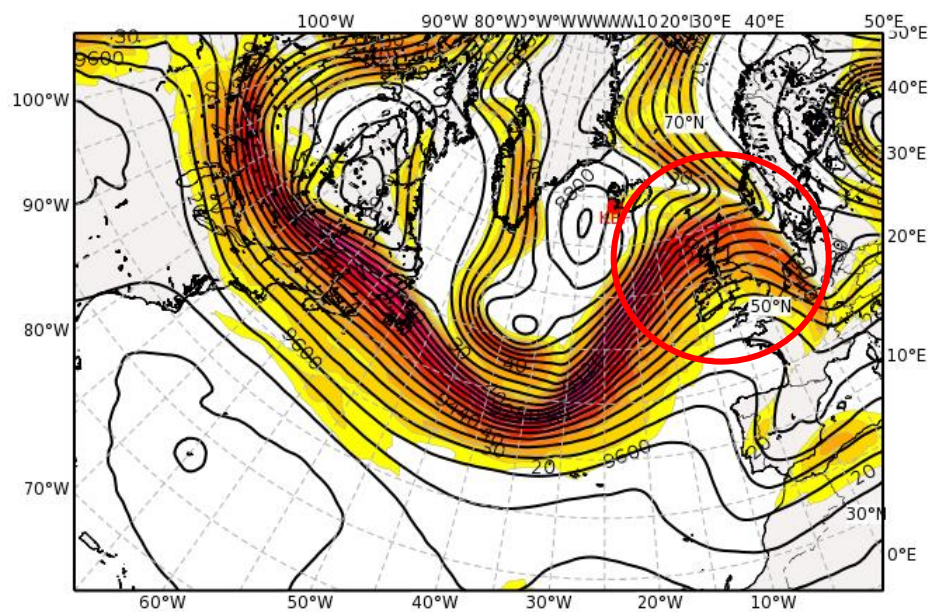


Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Fri, 23 Sep 2016, 12 UTC (step 108 h from Mon, 19 Sep 2016, 00 UTC)



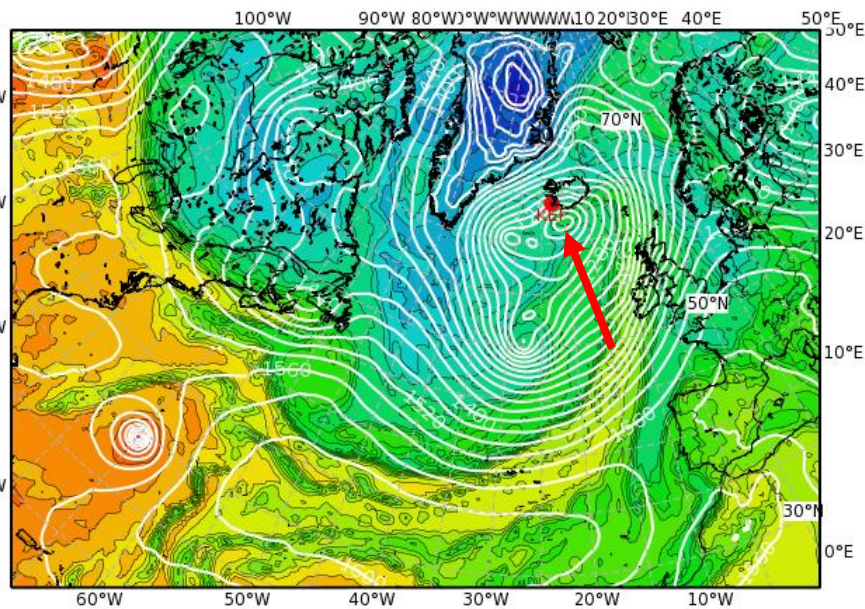
**TC Karl**

Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Fri, 23 Sep 2016, 12 UTC (step 108 h from Mon, 19 Sep 2016, 00 UTC)



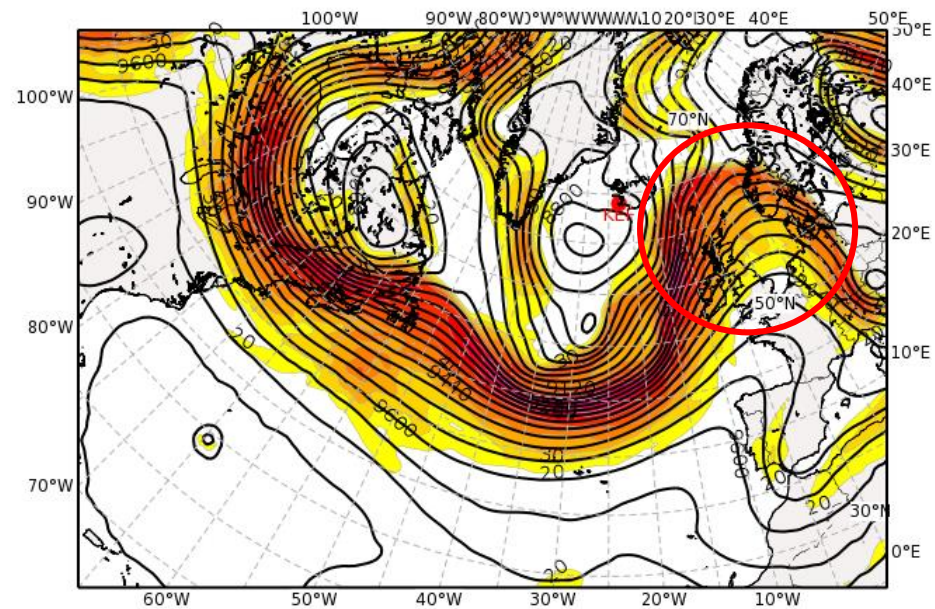


Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Sat, 24 Sep 2016, 00 UTC (step 120 h from Mon, 19 Sep 2016, 00 UTC)



**TC Karl**

Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Sat, 24 Sep 2016, 00 UTC (step 120 h from Mon, 19 Sep 2016, 00 UTC)

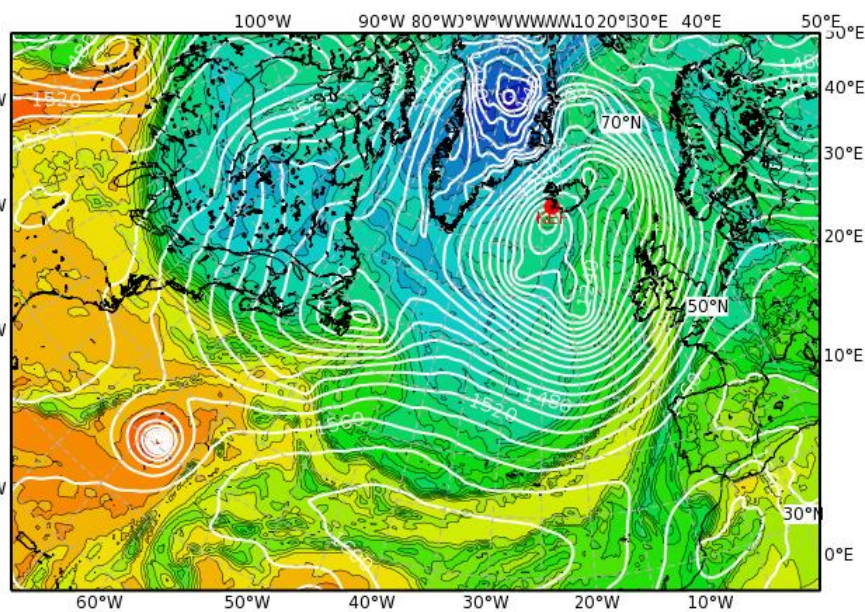




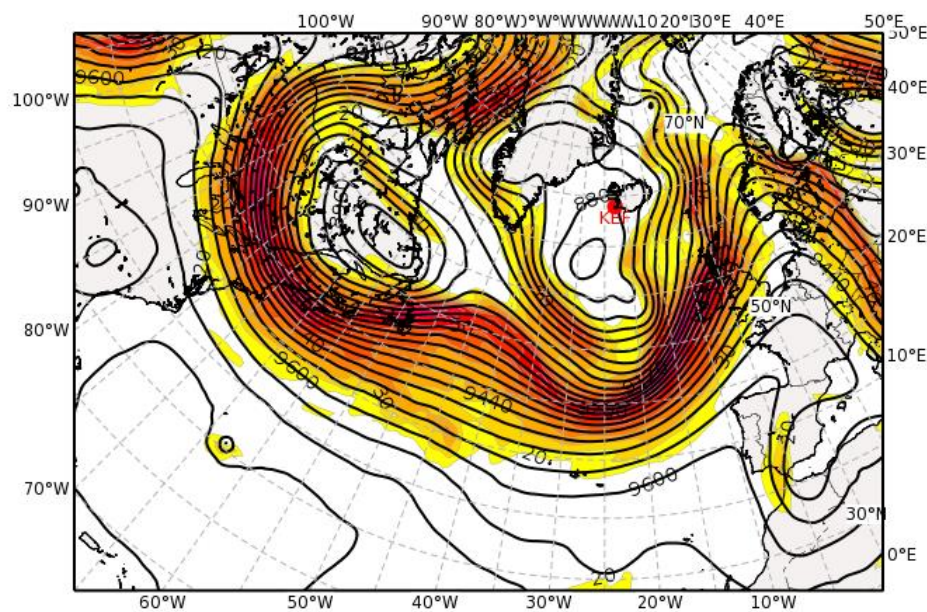
# Forecast for Sat, 24 Sep 2016 12UTC

THE850, Z300 BT19/00Z

Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Sat, 24 Sep 2016, 12 UTC (step 132 h from Mon, 19 Sep 2016, 00 UTC)



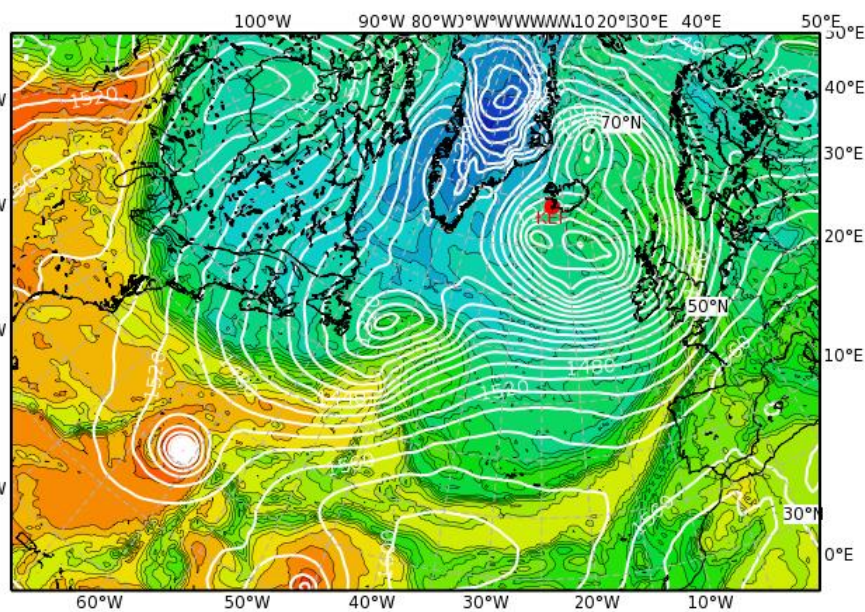
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Sat, 24 Sep 2016, 12 UTC (step 132 h from Mon, 19 Sep 2016, 00 UTC)



**TC Karl**

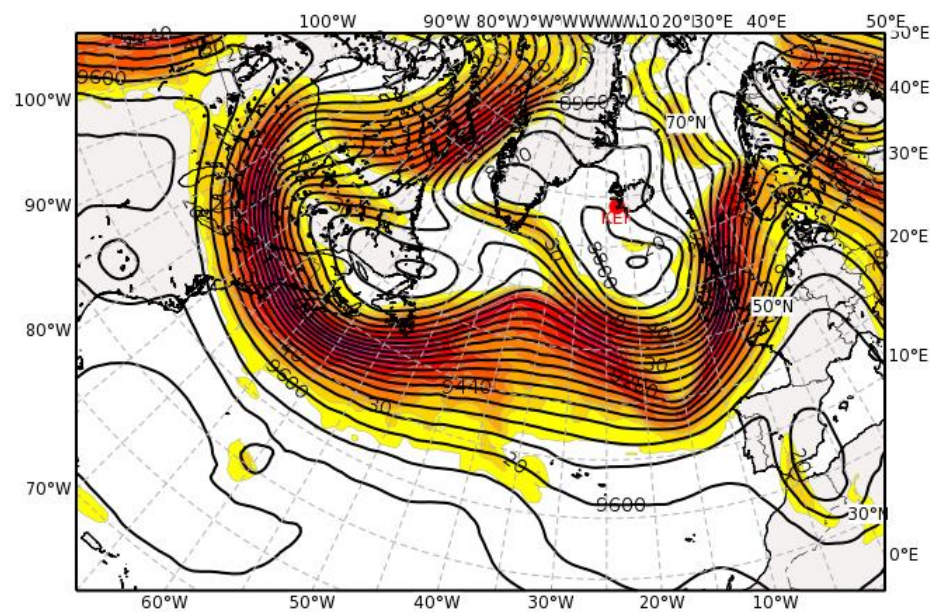


Equivalent Potential Temperature (degC) & Streamlines at 850 hPa  
Valid: Sun, 25 Sep 2016, 00 UTC (step 144 h from Mon, 19 Sep 2016, 00 UTC)



**TC Karl**

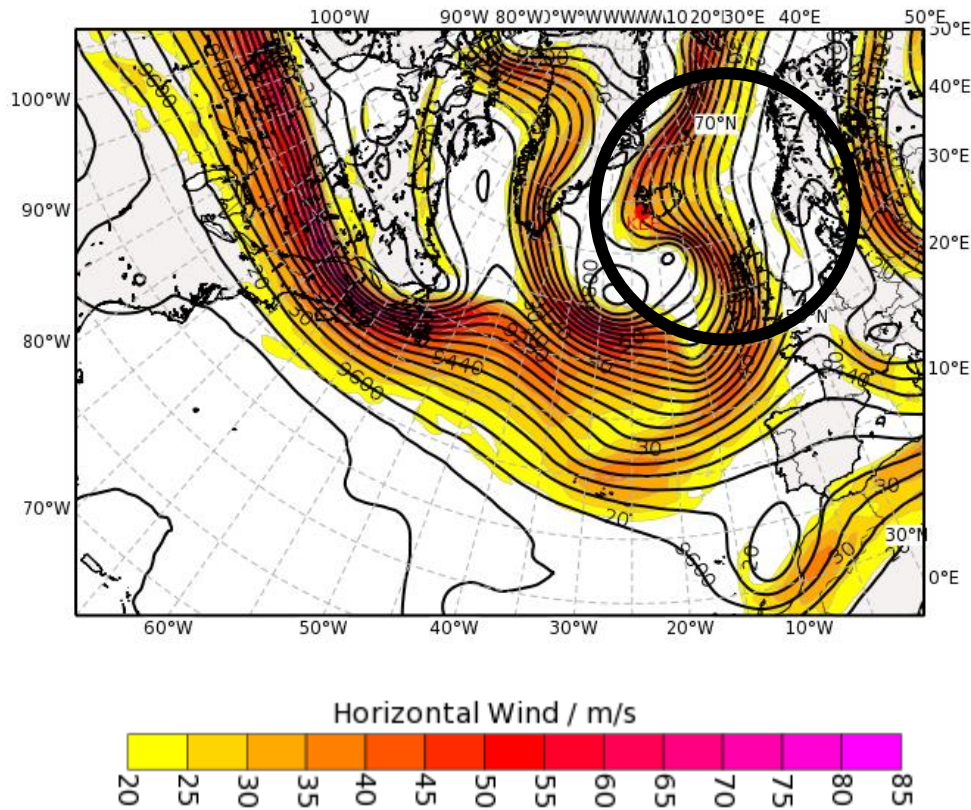
Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Sun, 25 Sep 2016, 00 UTC (step 144 h from Mon, 19 Sep 2016, 00 UTC)



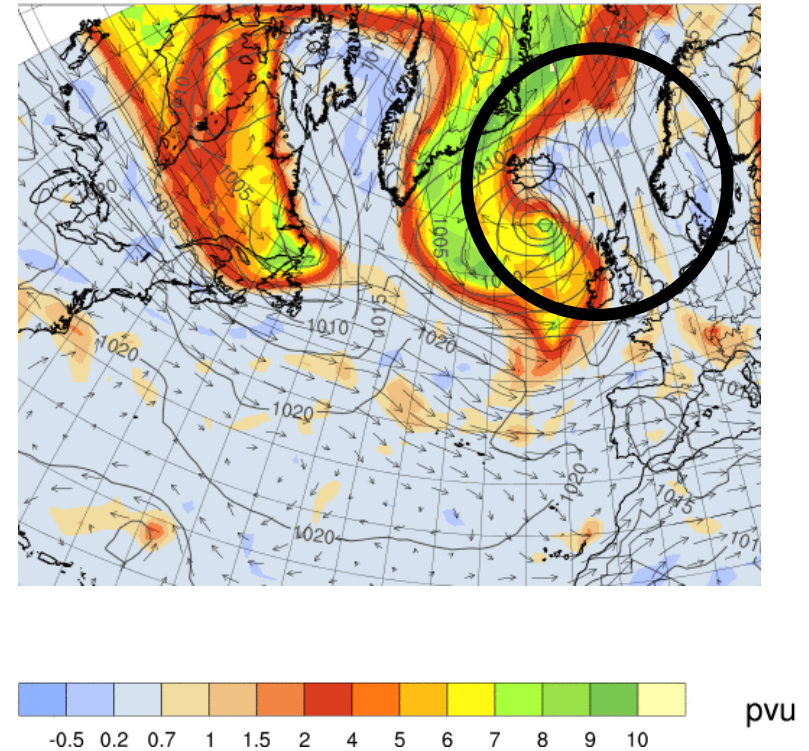
## Geopotential height 300hPa and wind speed

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

Valid: Wed, 21 Sep 2016, 18 UTC (step 066 h from Mon, 19 Sep 2016, 00 UTC)



## PV@320K at 20160921\_18



Comes potentially earlier!

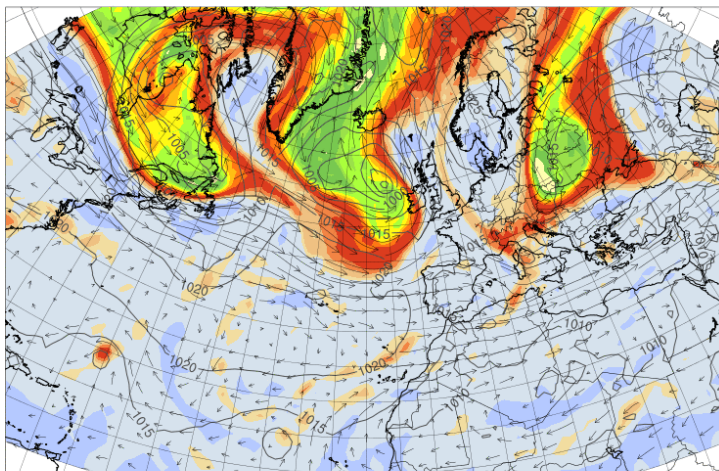


# Forecast for Wed, 21 Sep 2016 15/18 UTC MODEL CONSISTENCY

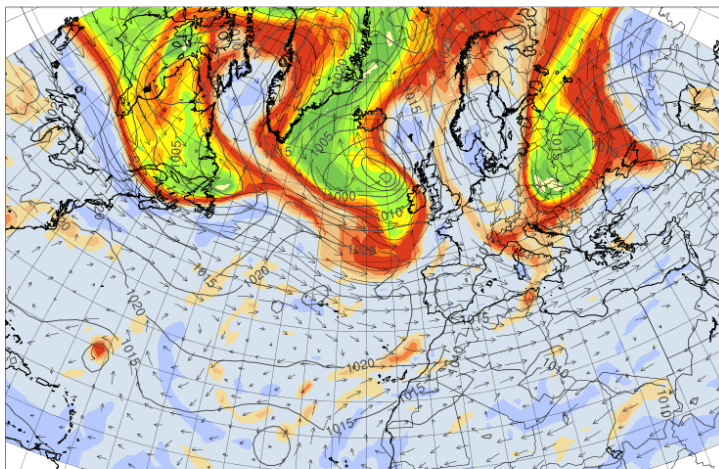
BT 18/00

15 UTC

PV@325K at 20160921\_15

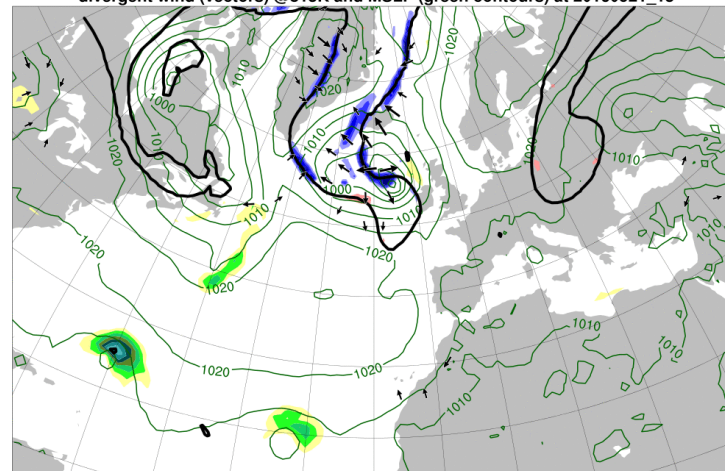


PV@325K at 20160921\_18

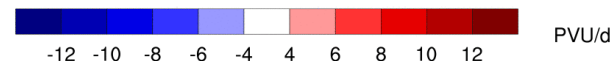
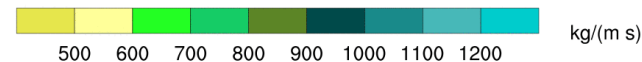
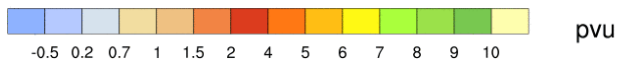
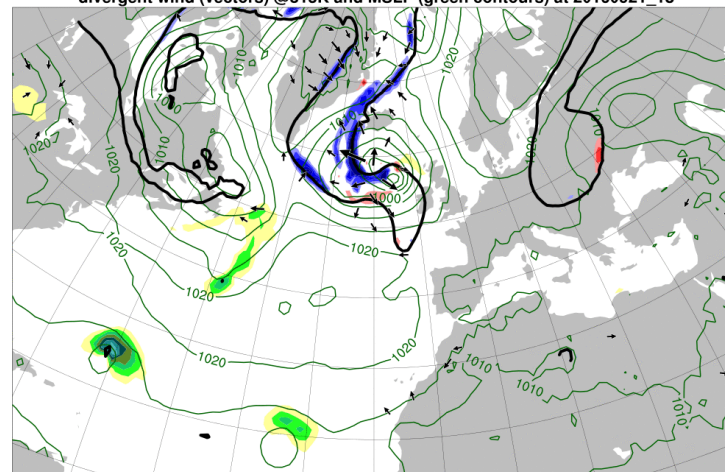


18 UTC

2 PVU (black contour), PV advection through divergent wind (shading), divergent wind (vectors) @315K and MSLP (green contours) at 20160921\_15



2 PVU (black contour), PV advection through divergent wind (shading), divergent wind (vectors) @315K and MSLP (green contours) at 20160921\_18

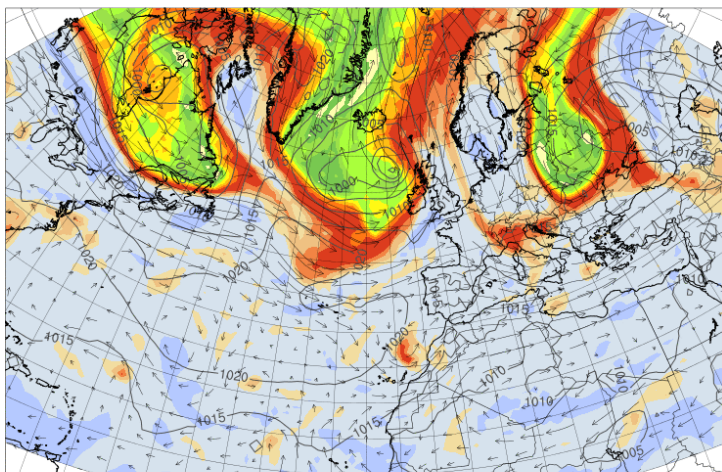


# Forecast for Wed, 21 Sep 2016 15/18 UTC MODEL CONSISTENCY

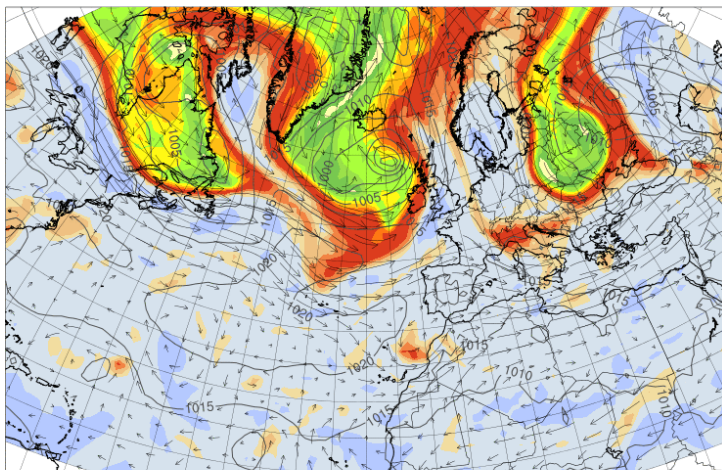
BT 18/12

15 UTC

PV@325K at 20160921\_15

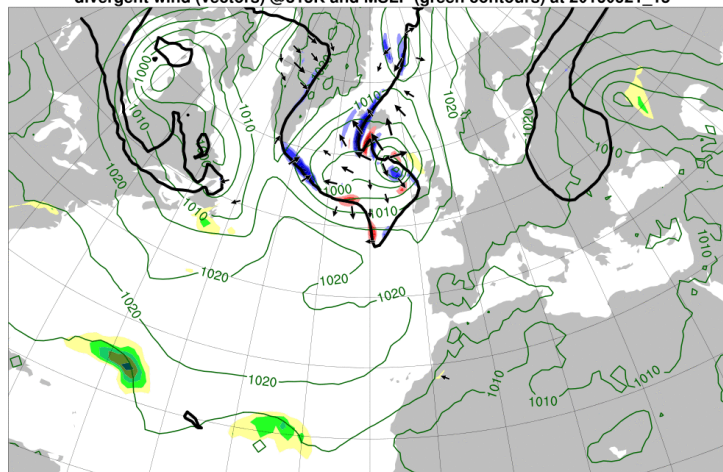


PV@325K at 20160921\_18

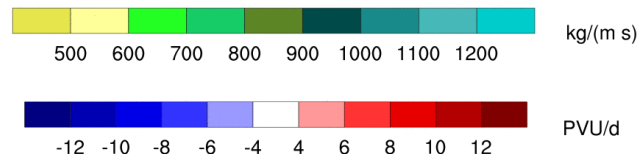
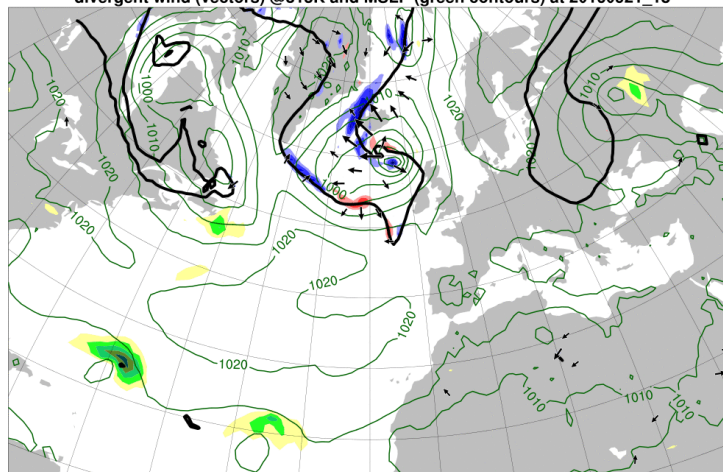


18 UTC

2 PVU (black contour), PV advection through divergent wind (shading), divergent wind (vectors) @315K and MSLP (green contours) at 20160921\_15



2 PVU (black contour), PV advection through divergent wind (shading), divergent wind (vectors) @315K and MSLP (green contours) at 20160921\_18



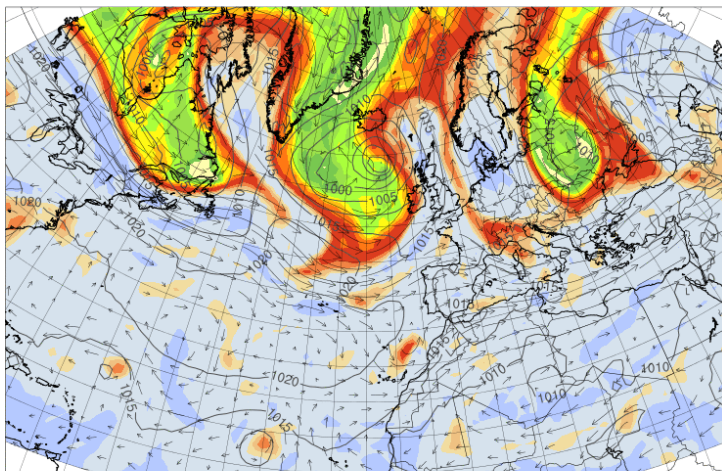


# Forecast for Wed, 21 Sep 2016 15/18 UTC MODEL CONSISTENCY

BT 19/00

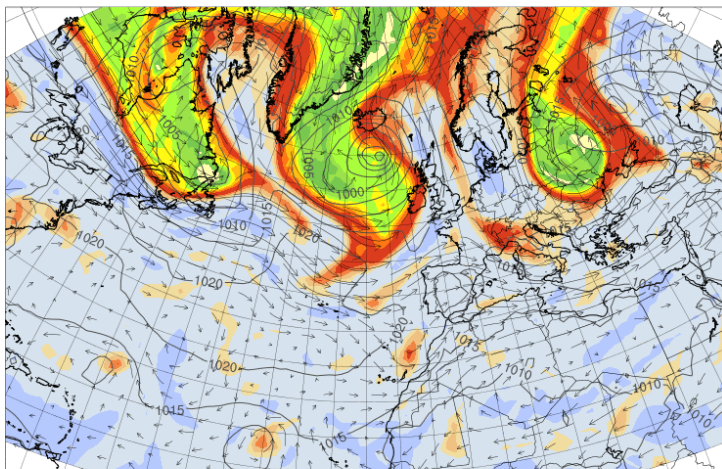
15 UTC

PV@325K at 20160921\_15

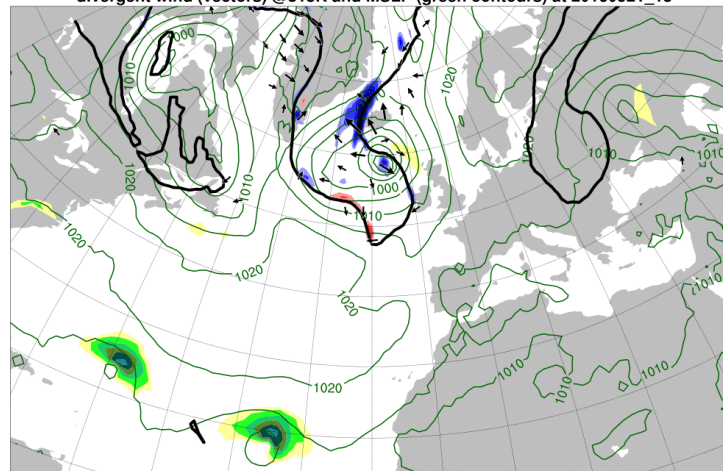


18 UTC

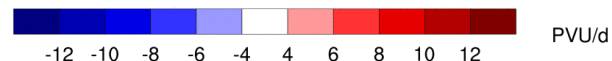
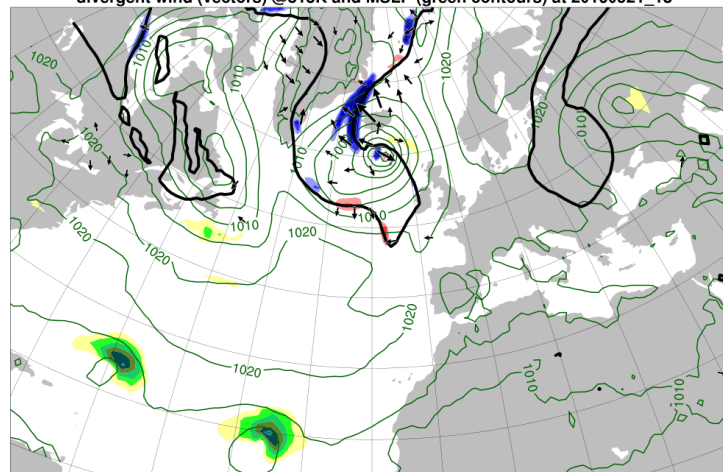
PV@325K at 20160921\_18



2 PVU (black contour), PV advection through divergent wind (shading),  
divergent wind (vectors) @315K and MSLP (green contours) at 20160921\_15



2 PVU (black contour), PV advection through divergent wind (shading),  
divergent wind (vectors) @315K and MSLP (green contours) at 20160921\_18



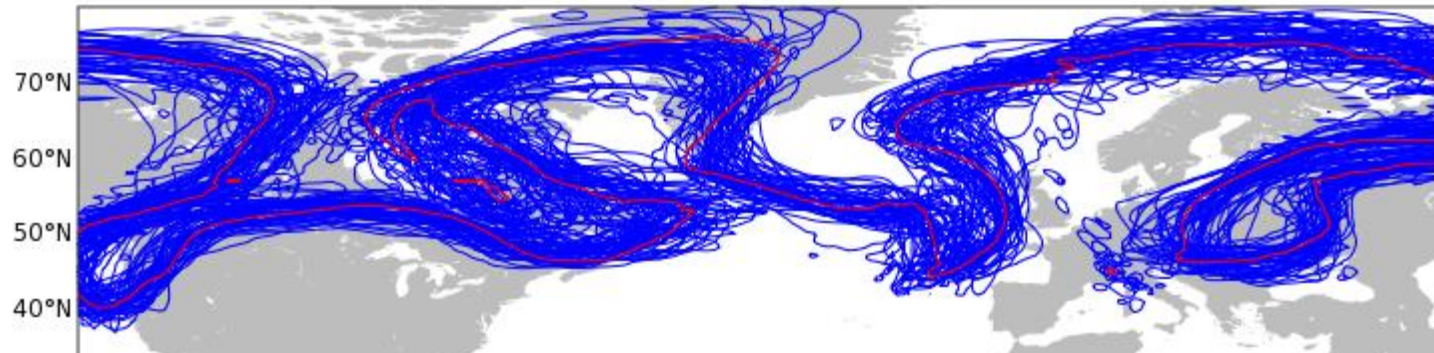
# Forecast for Wed, 21 Sep 2016 18 UTC – Model consistency

BT18/00Z

ECMWF ENSEMBLE FC

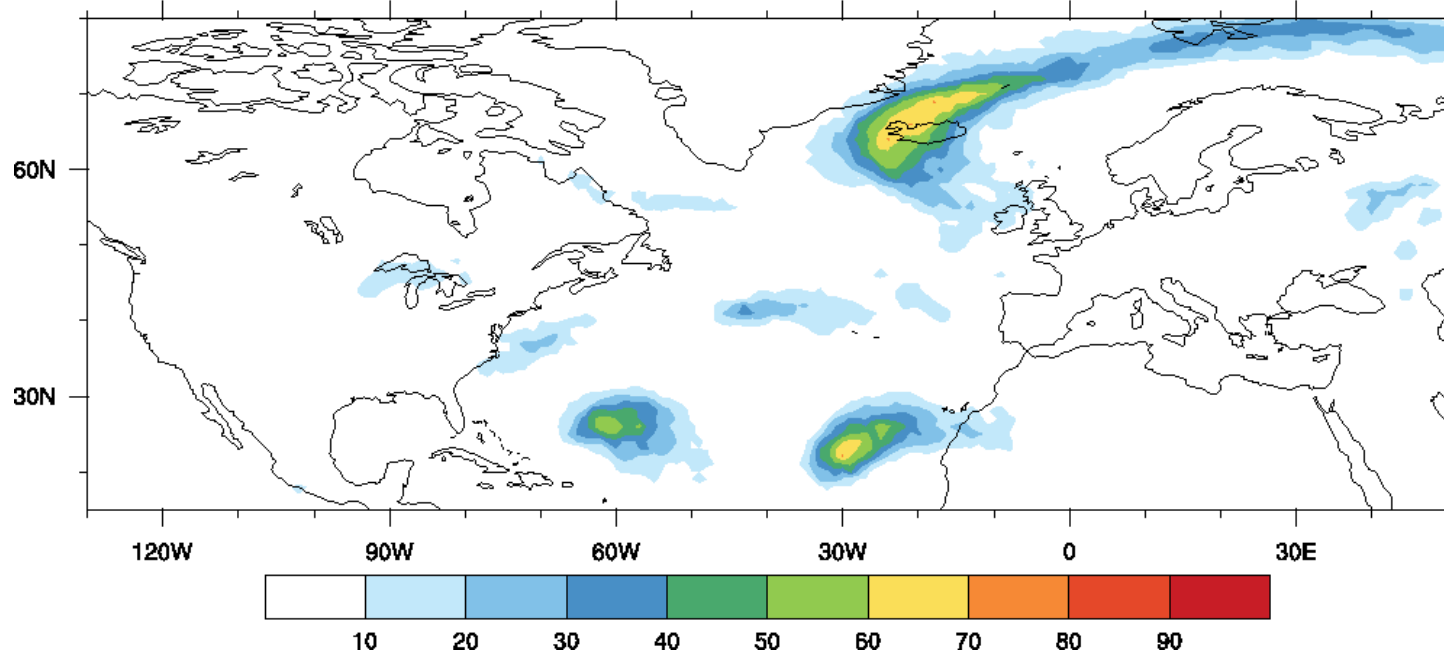
BT: 20160918 00UTC, VT: 20160921 18UTC

blue: perturbed, red: control



ECMWF ensemble forecast  
BT 20160918\_00UTC  
VT 20160921\_18UTC

lt400hPa: Probability [%] of traj. occurrence in ENS





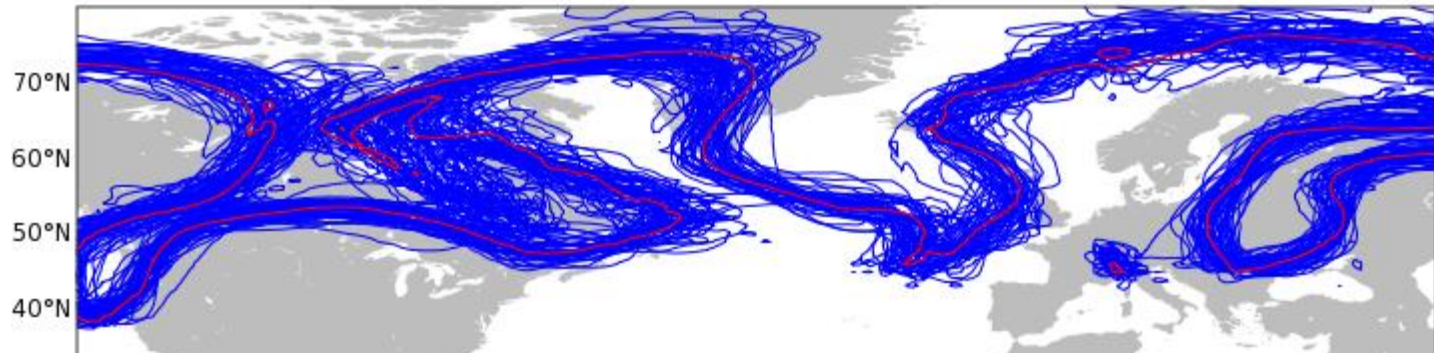
# Forecast for Wed, 21 Sep 2016 18 UTC – Model consistency

BT18/12Z

ECMWF ENSEMBLE FC

BT: 20160918 12UTC, VT: 20160921 18UTC

blue: perturbed, red: control

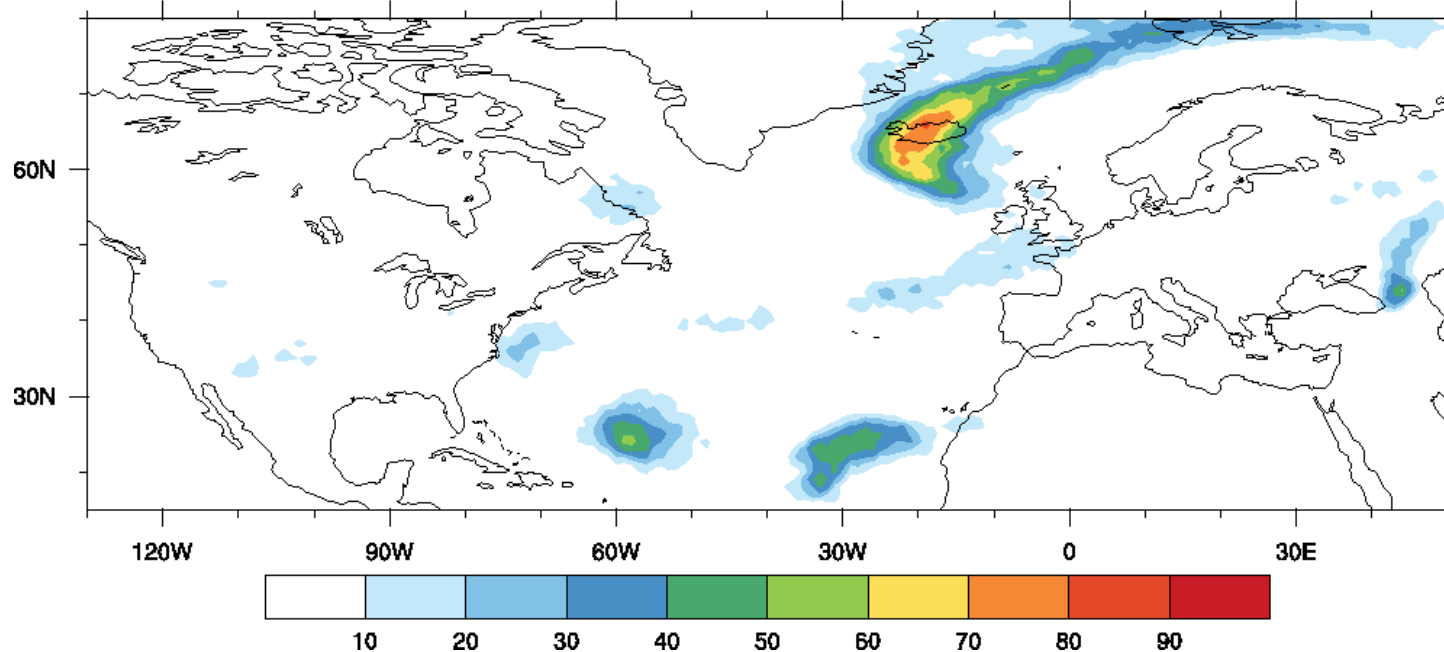


ECMWF ensemble forecast

BT 20160918\_12UTC

VT 20160921\_18UTC

lt400hPa: Probability [%] of traj. occurrence in ENS



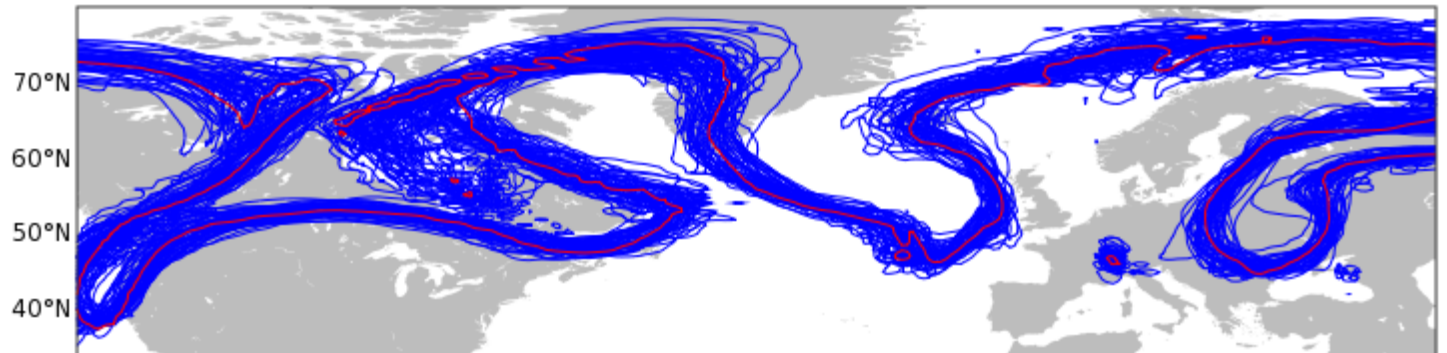
# Forecast for Wed, 21 Sep 2016 18 UTC – Model consistency

BT19/00Z

ECMWF ENSEMBLE FC

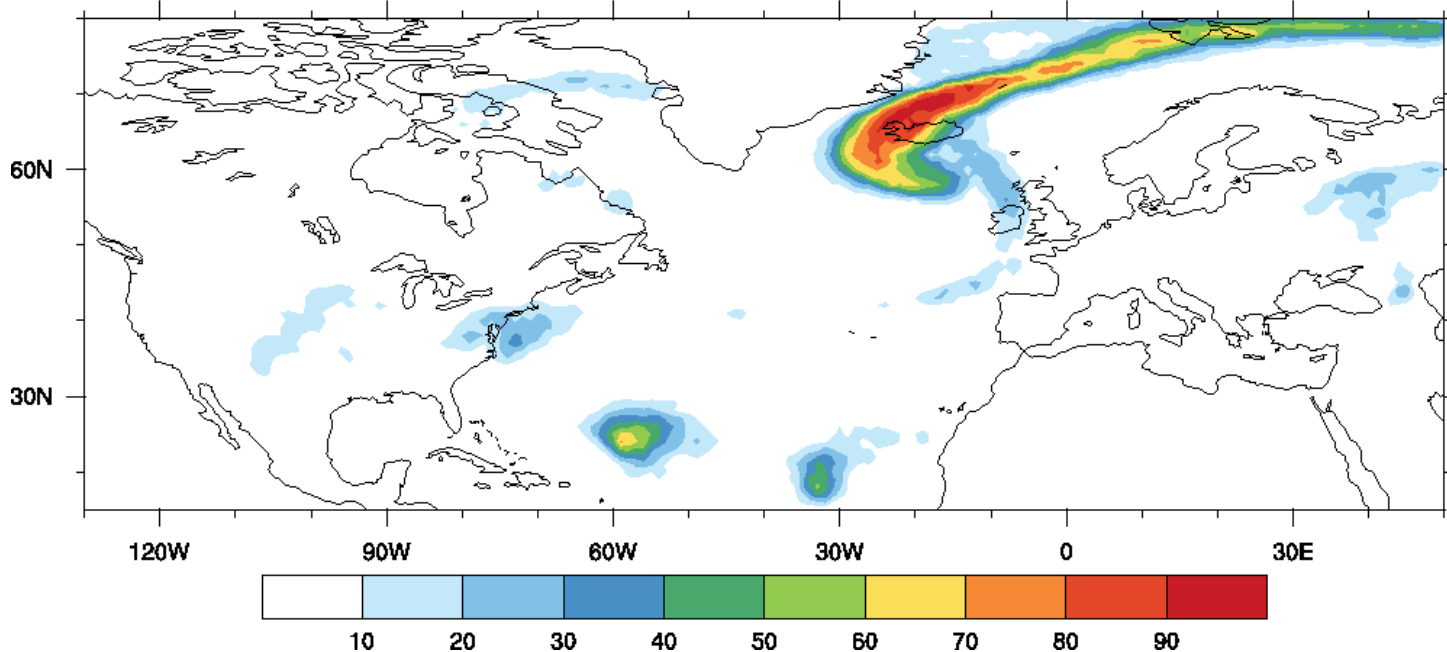
BT: 20160919 00UTC, VT: 20160921 18UTC

blue: perturbed, red: control



ECMWF ensemble forecast  
BT 20160919\_00UTC  
VT 20160921\_18UTC

lt400hPa: Probability [%] of traj. occurrence in ENS

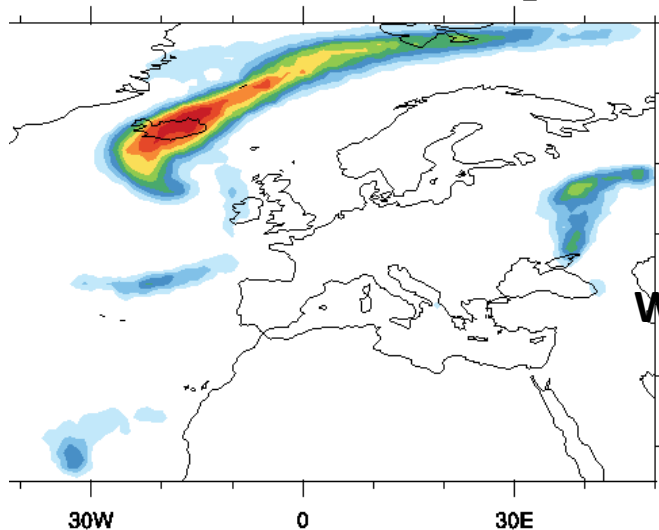




# Forecast for Wed, 21 Sep 2016 18 UTC – Model consistency

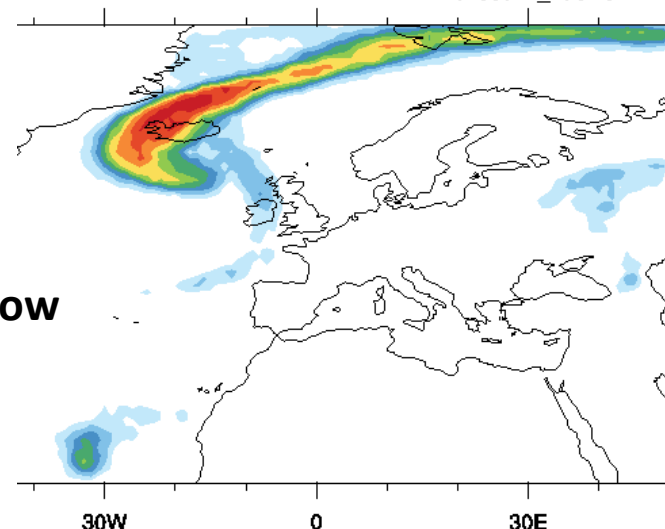
BT19/00Z

VT21/12Z  
ECMWF ensemble forecast  
BT 20160919\_00UTC  
VT 20160921\_12UTC

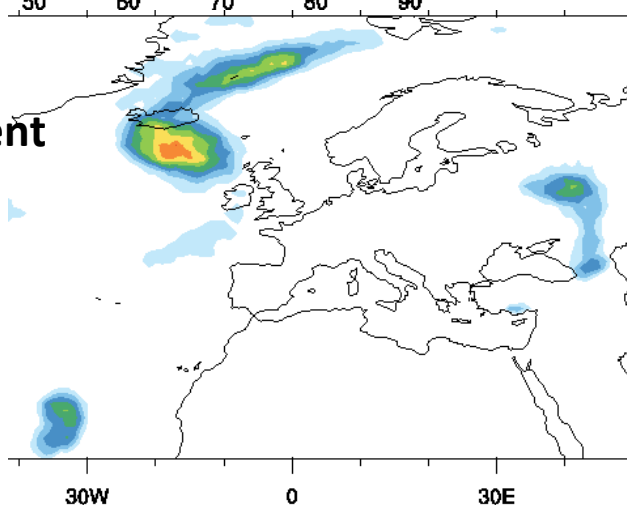
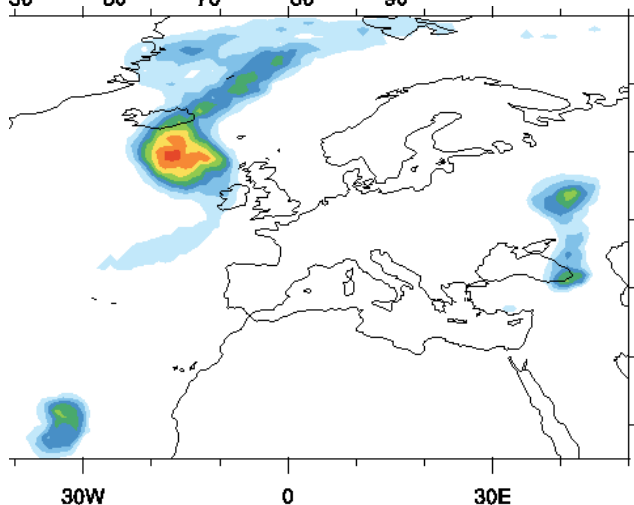


WCB outflow

VT21/18Z  
ECMWF ensemble forecast  
BT 20160919\_00UTC  
VT 20160921\_18UTC



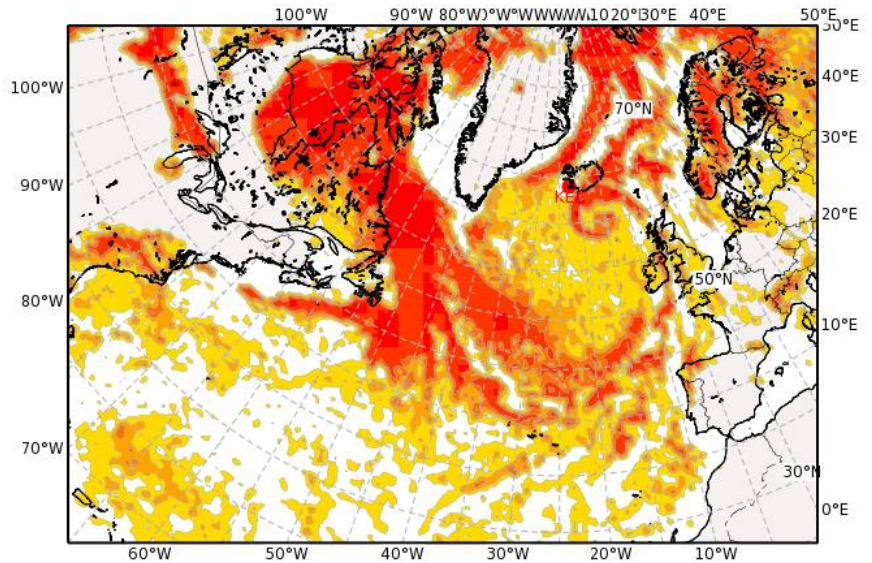
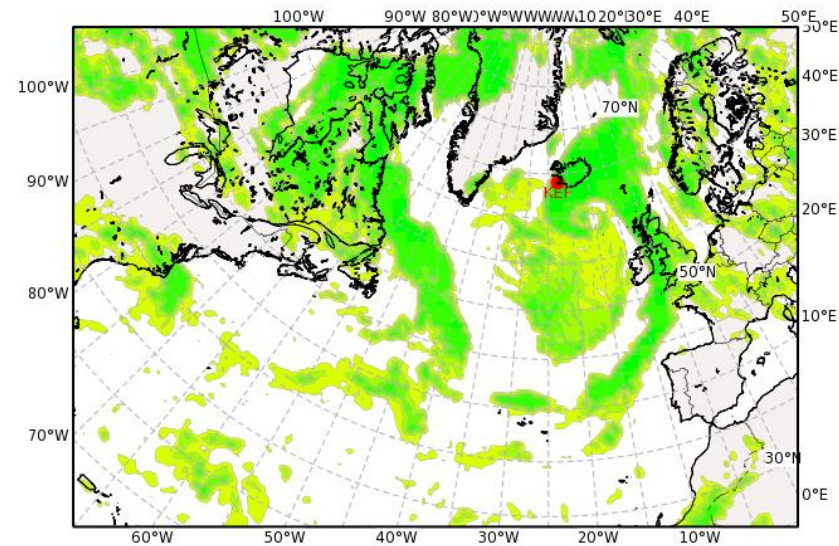
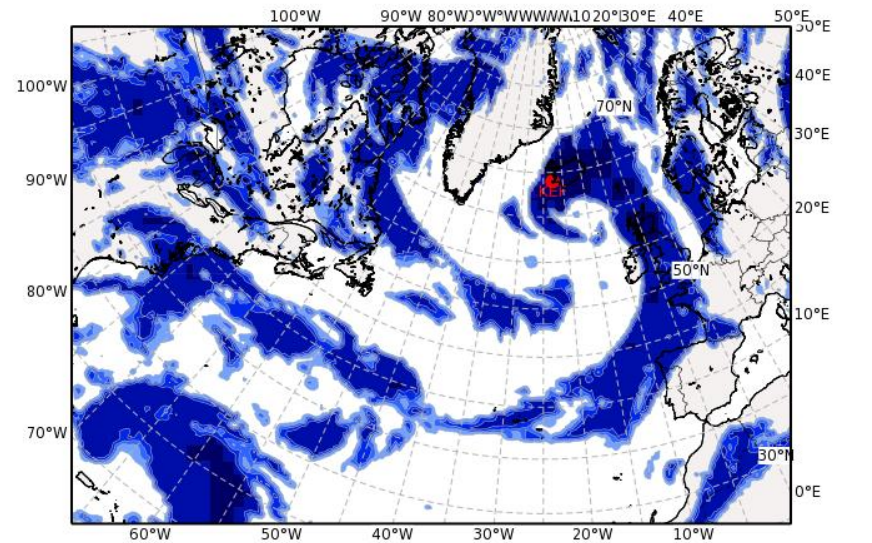
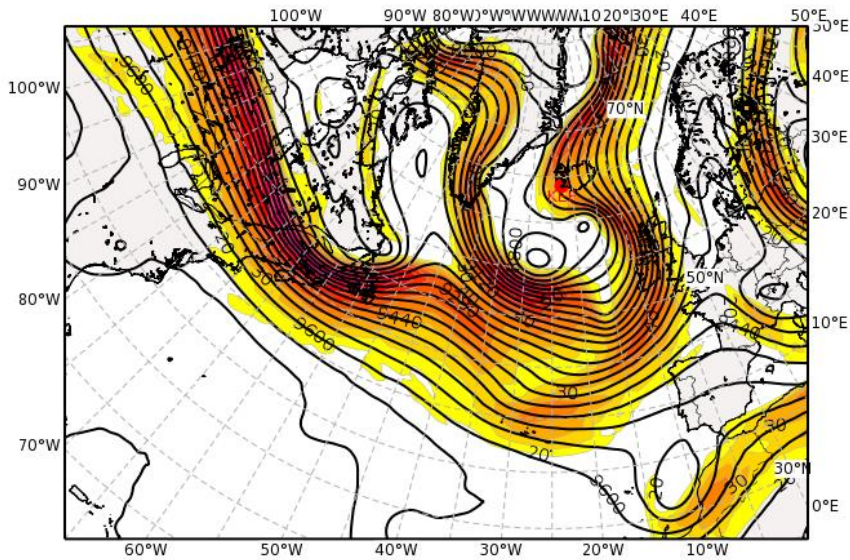
WCB ascent



# Forecast for Wed, 21 Sep 2016 18 UTC

Z300, high  
mid, low clouds

**BT19/00Z**

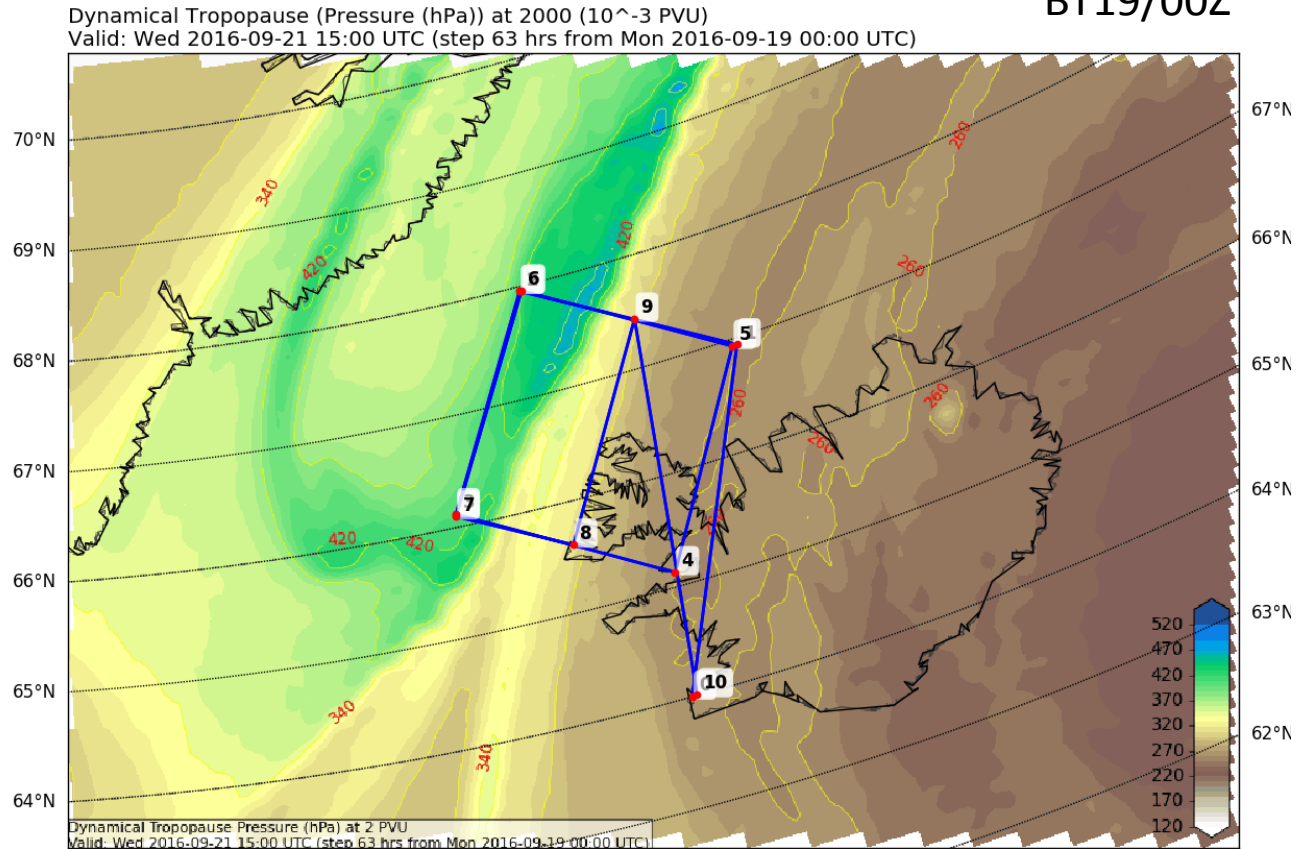




# Potential flight pattern for Wednesday 21 September, 15UTC

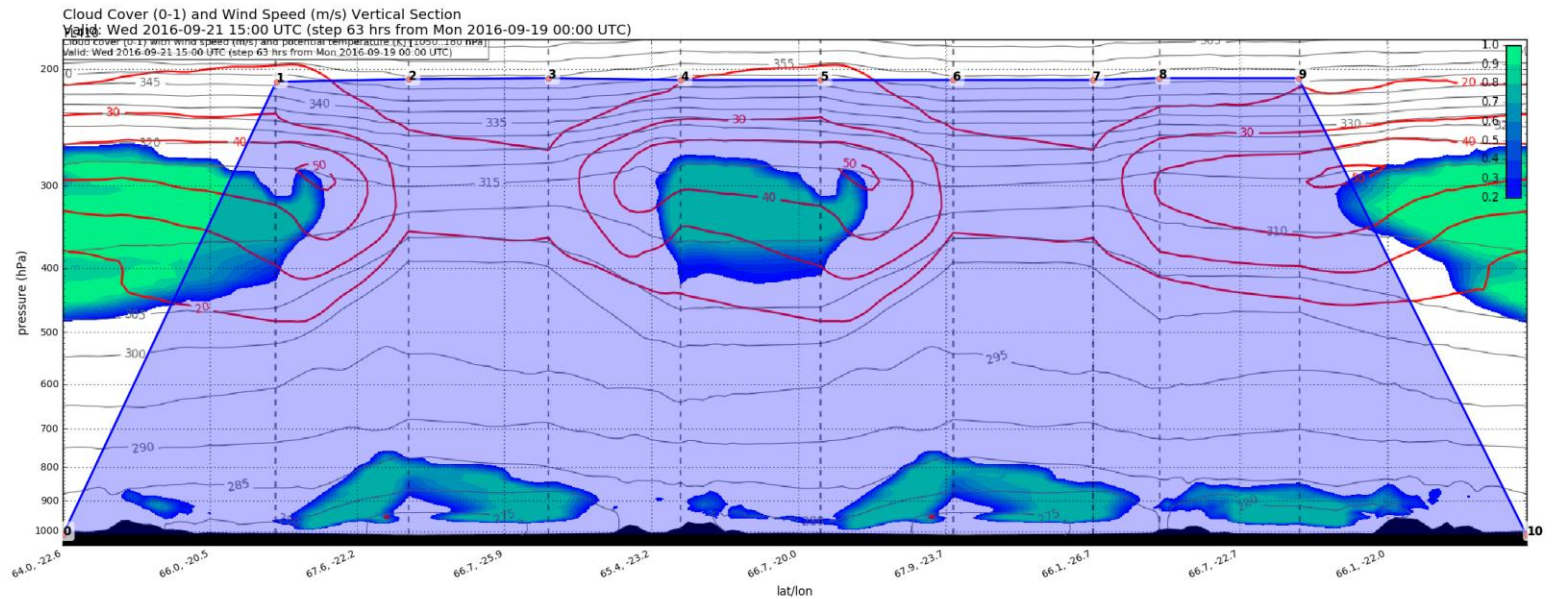
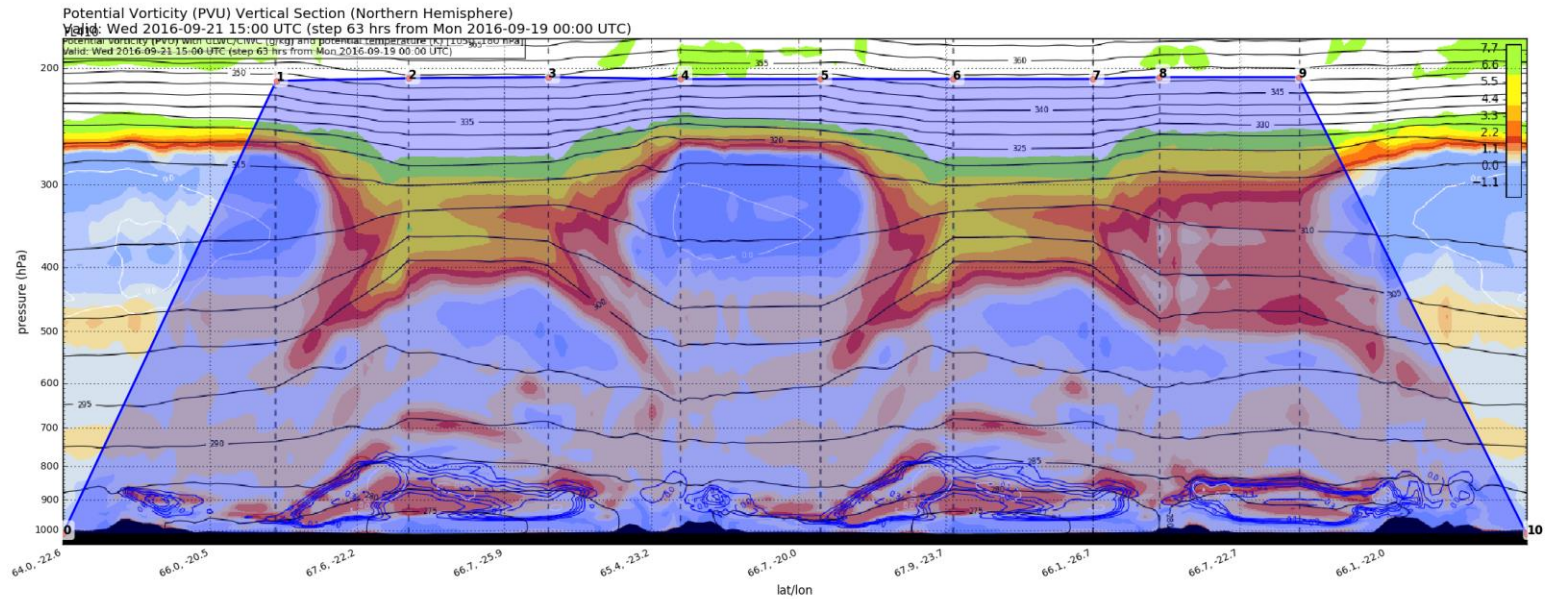
BT19/00Z

# FALCON



- Have to shrink the box!
- Coordinate with Halo

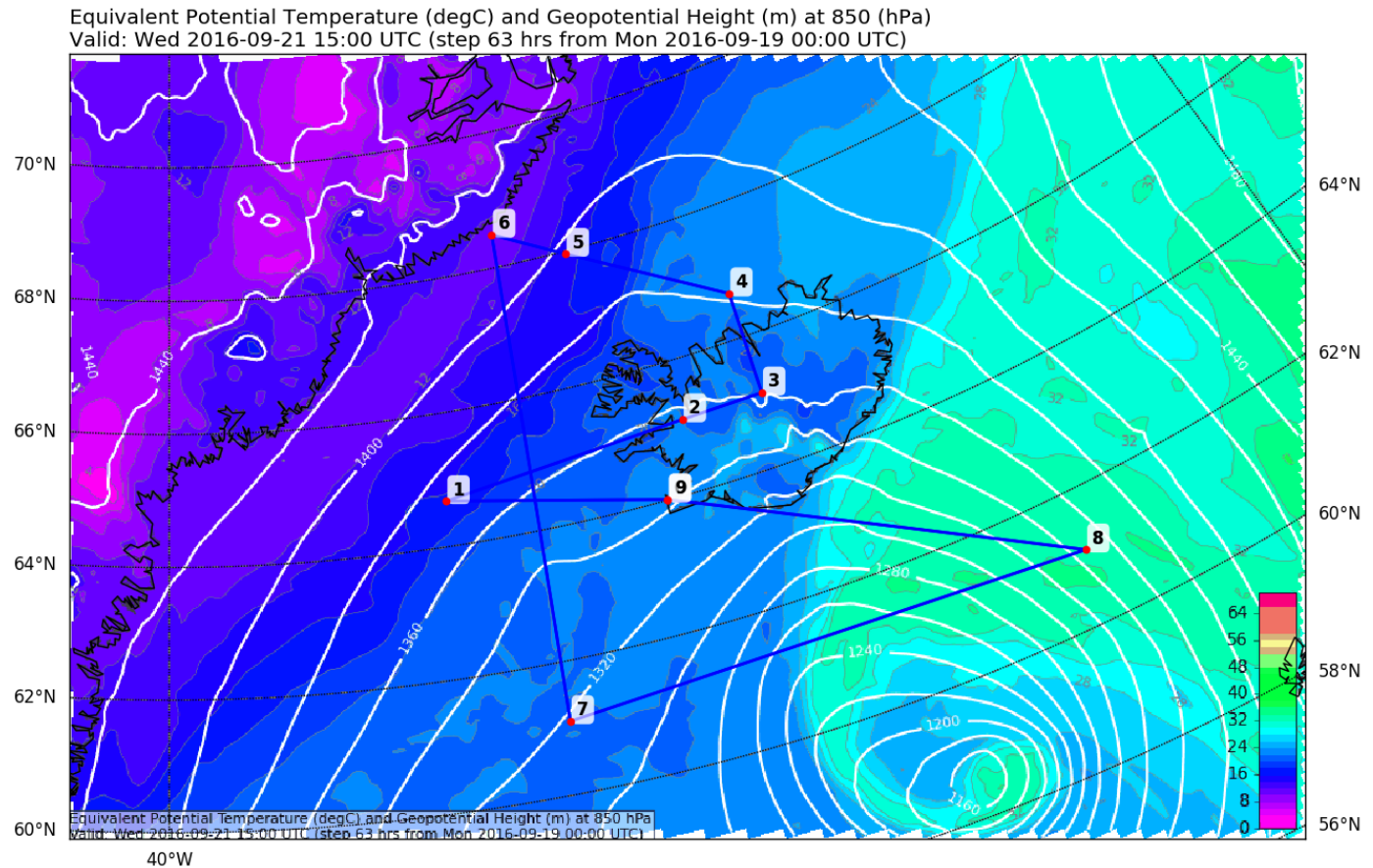
shift of box very likely





# Potential flight pattern for Wednesday 21 September, 15UTC

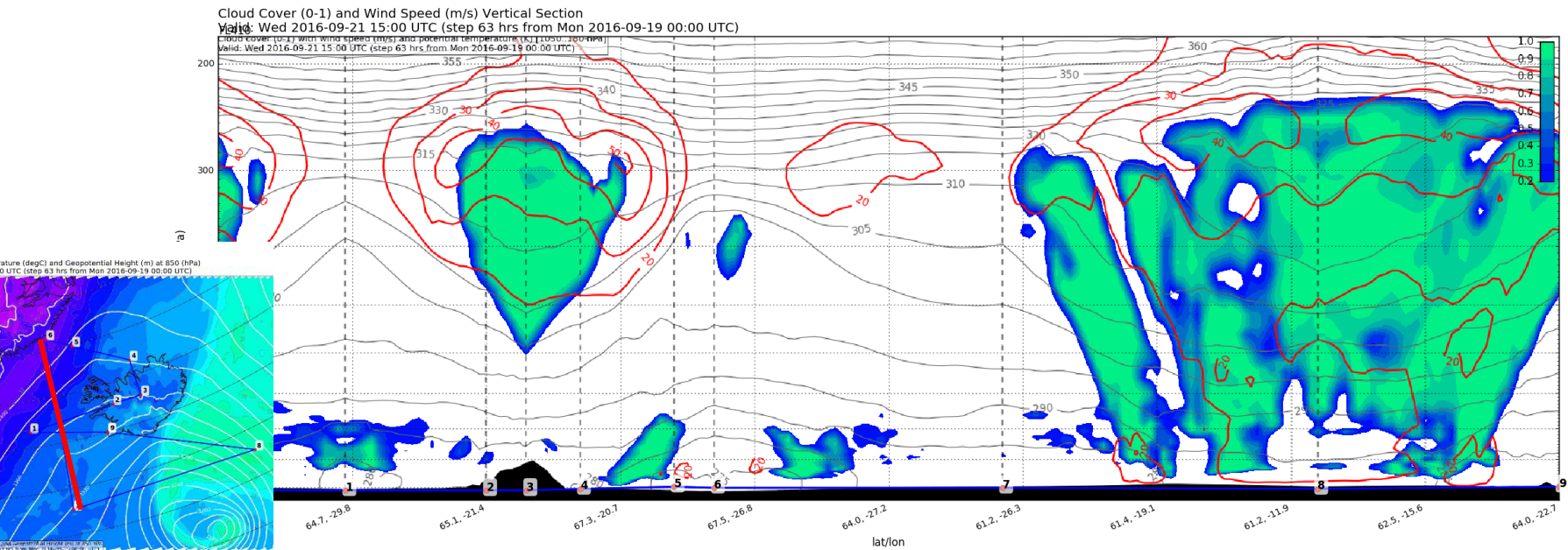
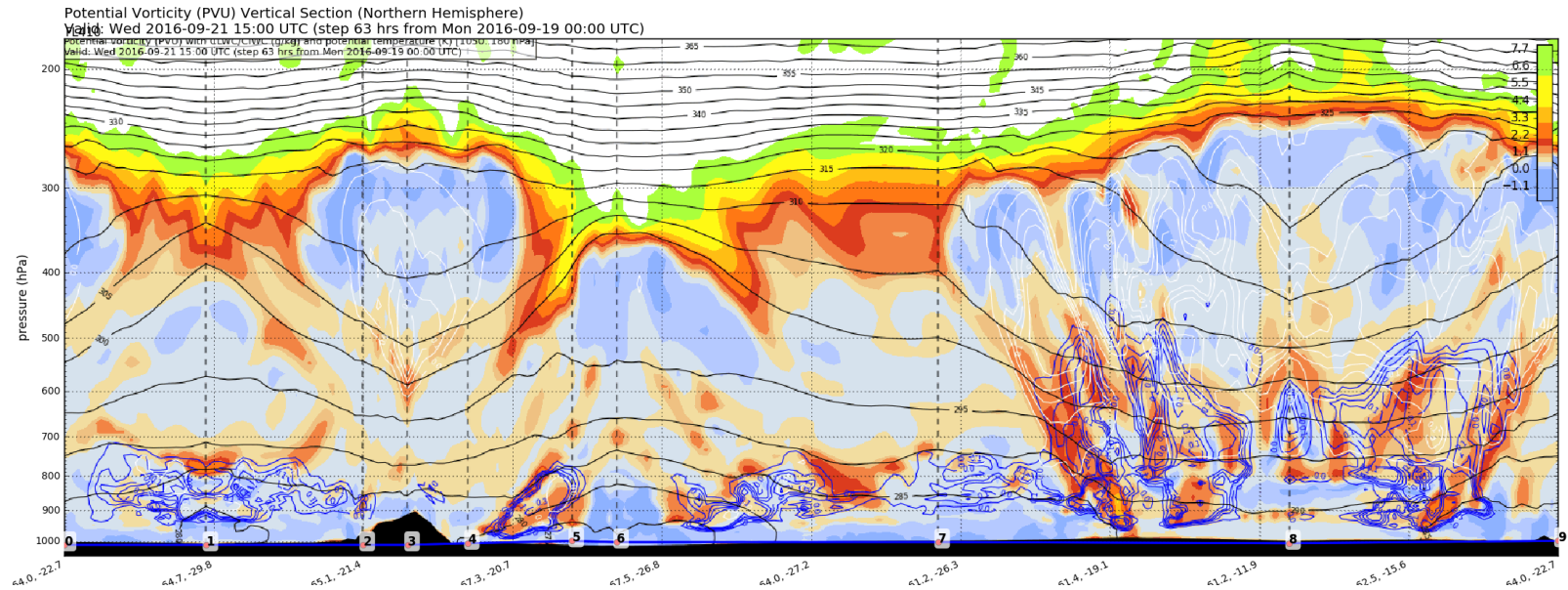
# HALO



- Let 6 to 7 or 6 to 8?
- Where how many dropsondes?
- Coordinate with Falcon

# Potential flight pattern for Wednesday 21 September, 15UTC

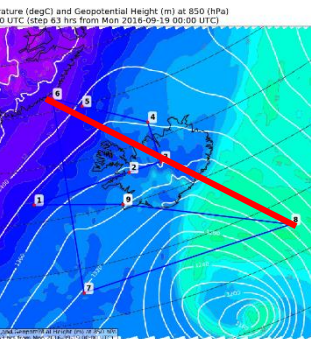
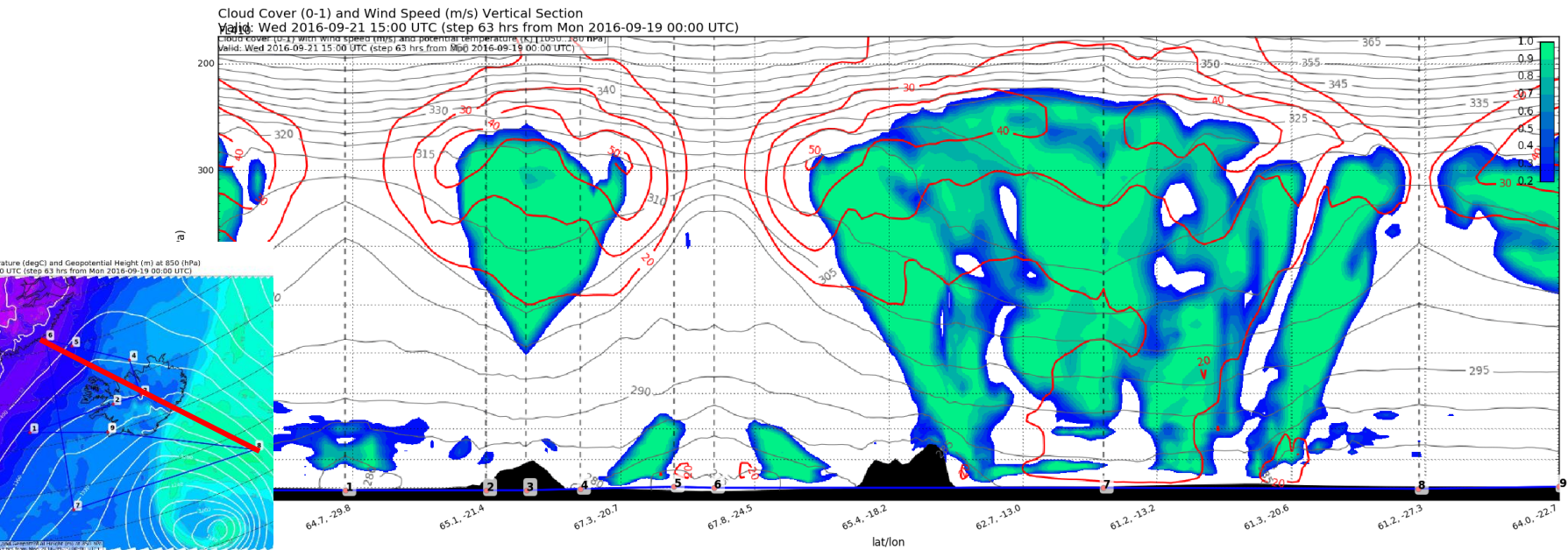
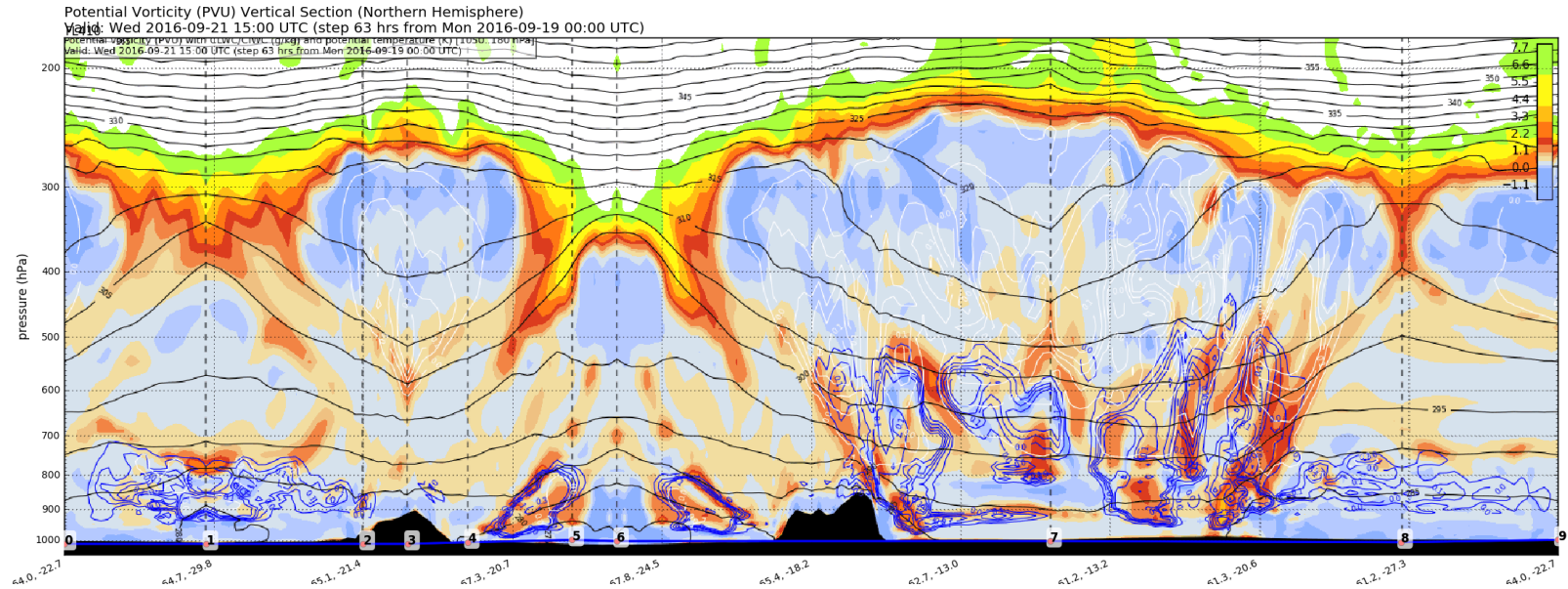
# HALO





# Potential flight pattern for Wednesday 21 September, 15UTC

# HALO



Discussion of Mission Scientist latest Flight tracks

Sat overpass 20min leg requested

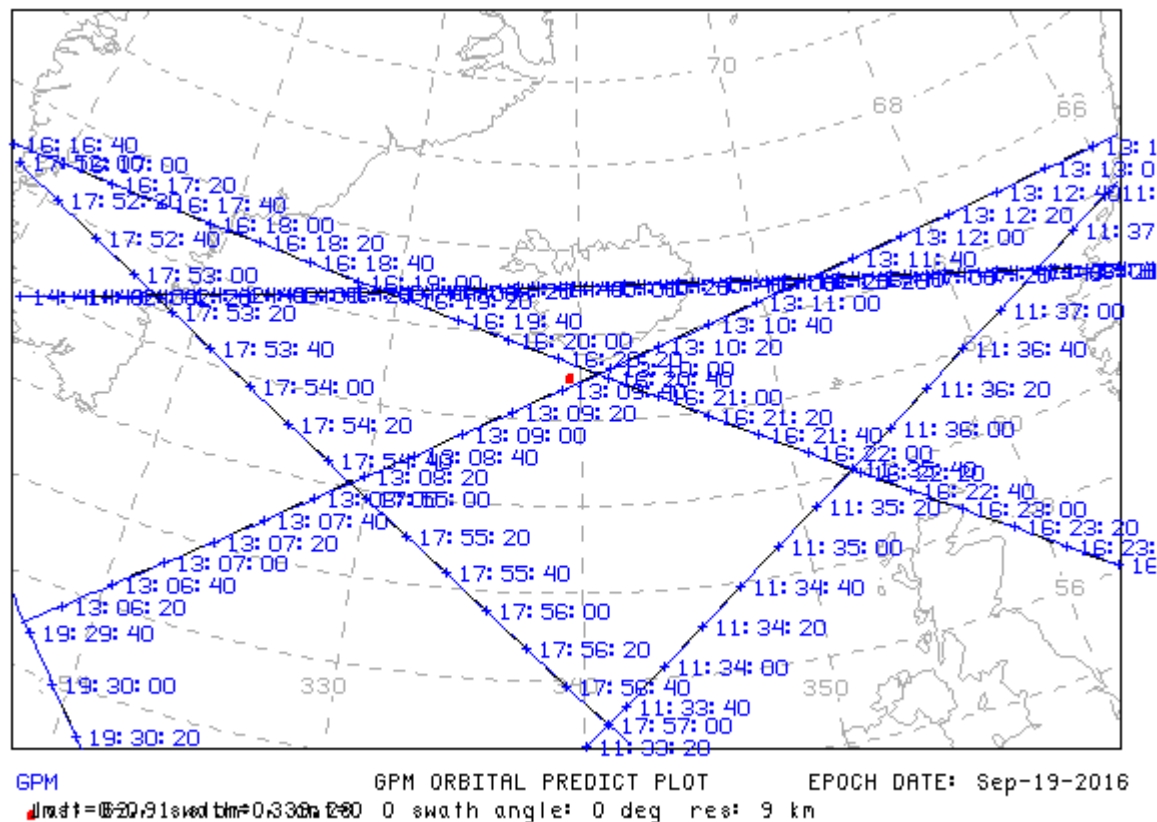
Cross sections

Timing

Ground Based observations manager report.



# GPM overpass: planned to coordinate with HALO on Wed 21 Sep 14:44

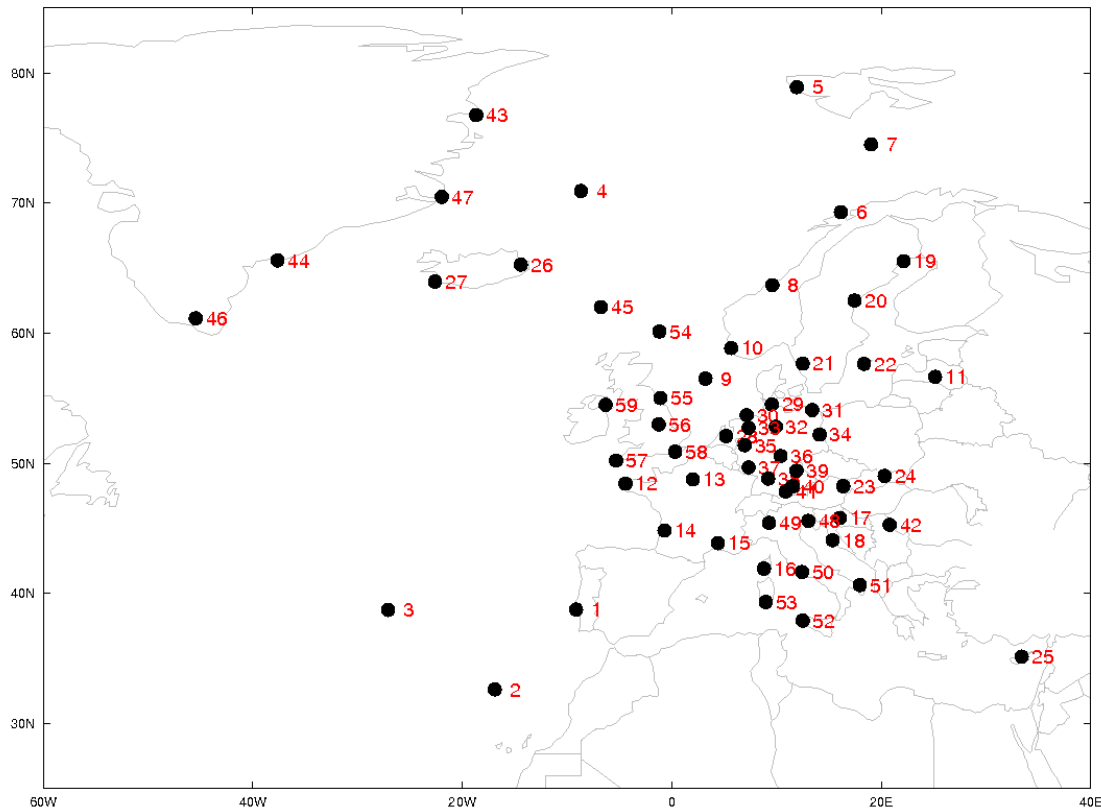


# Additional Radiosondes

- EUMETNET: 200-250
- Iceland Met Office: 60 (2 stations)
- DLR: 62 (all from Keflavik)
- UK Met Office: 30
- NCAS: 50 (Aberystwyth)
- France: 30 (Brest)
- Norway: 60 (location?)
- Canada: 4xdaily at 6 stations



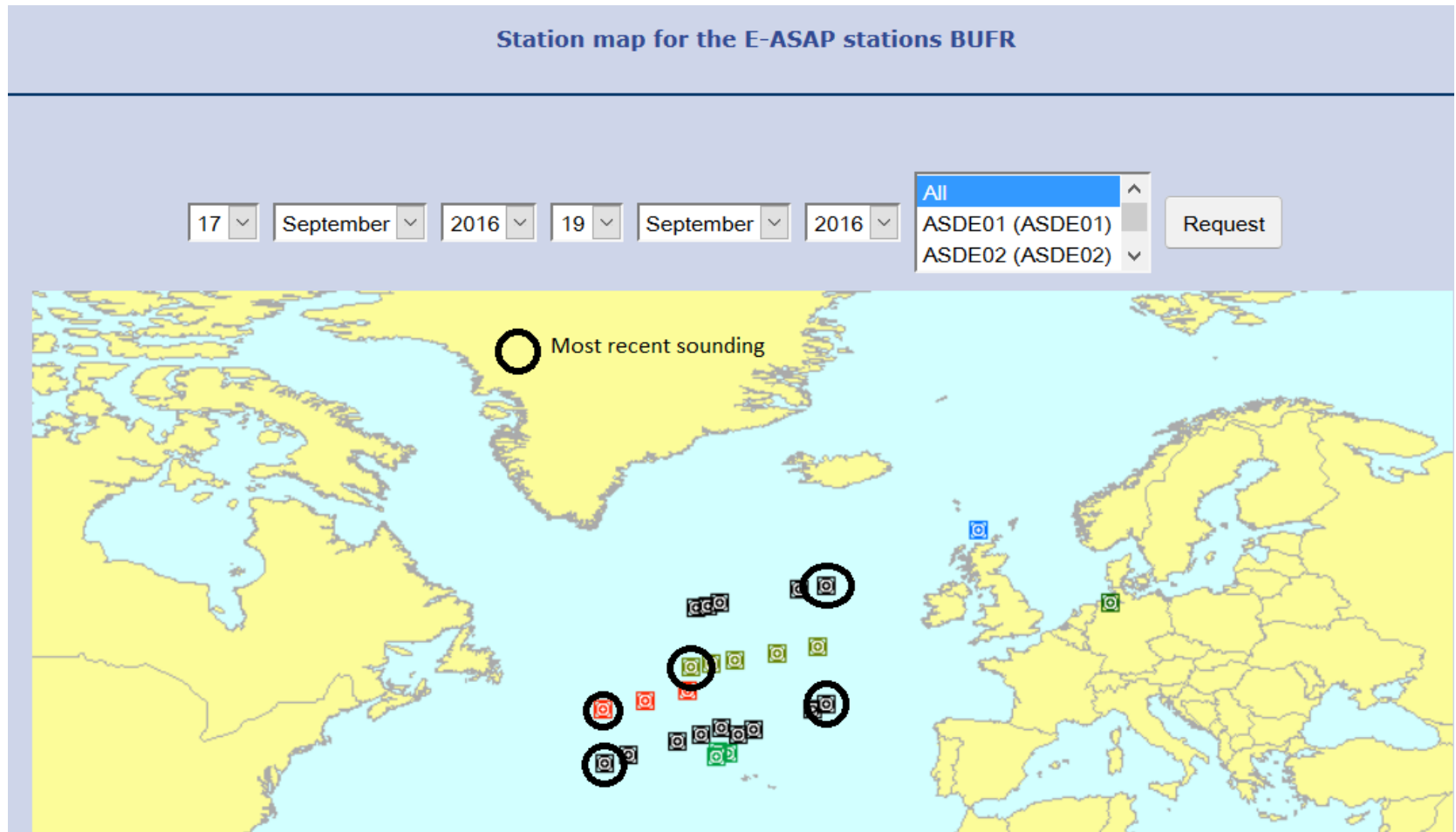
# EUMETNET stations



1 08579 Lisbon  
 2 08522 Madeira  
 3 08508 Azores  
 4 01001 JAN MAYEN  
 5 01004 NY-ALESUND  
 6 01010 ANDOYA  
 7 01028 BJORNOYA  
 8 01241 ORLAND  
 9 01400 EKOFISK  
 10 01415 STAVANGER/SOLA  
 11 26435 Sriveri each second day  
 12 07110 BREST  
 13 07145 TRAPPE  
 14 07510 BORDEAUX  
 15 07645 Nimes  
 16 07761 AJACCIO  
 17 14240 Zagreb  
 18 14430 Zadar  
 19 02185 Lulea  
 20 02365 Sundsvall  
 21 02527 Goteborg  
 22 02591 Visby  
 23 11035 Wien  
 24 11952 POPRAD-GANOVCE  
 25 17607 ATHALASSA  
 26 04089 Egilsstadir  
 27 04018 KEFLAVIK  
 28 06260 DE BILT AWS  
 29 10035 SCHLESWIG  
 30 10113 Norderney

31 10184 Greifswald  
 32 10238 Bergen  
 33 10304 Meppen  
 34 10393 Lindenberg  
 35 10410 Essen  
 36 10548 Meiningen  
 37 10618 Idar-Oberstein  
 38 10739 Stuttgart  
 39 10771 K mmersbruck  
 40 10868 Muenchen  
 41 10954 Altenstadt  
 42 13275 BEOGRAD /KOSUTIN  
 43 04320 DANMARKSHAVN  
 44 04360 TASILAQ (AMMASS  
 45 06011 TORSHAVN  
 46 04270 Narsarsuaq  
 47 04339 Itoqqortoormiit (Score  
 48 16045 Udine/Rivolto  
 49 16080 Milano/Linate  
 50 16245 Pratica di Mare  
 51 16320 Brindisi  
 52 16429 Trapani/Birgi  
 53 16546 Decimomannu  
 54 03005 Lerwick  
 55 03238 Albenmarle  
 56 03354 Nottingham/Watnall  
 57 03838 Cambourne  
 58 03882 Herstmonceaux  
 59 03918 Castor Bay

# EASAP (N Atl shipping)

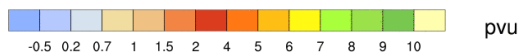
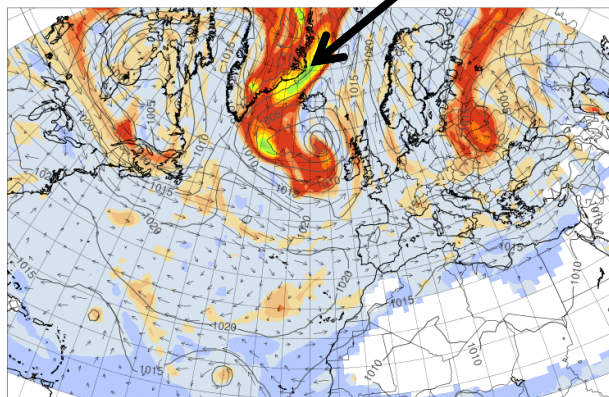




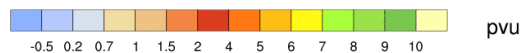
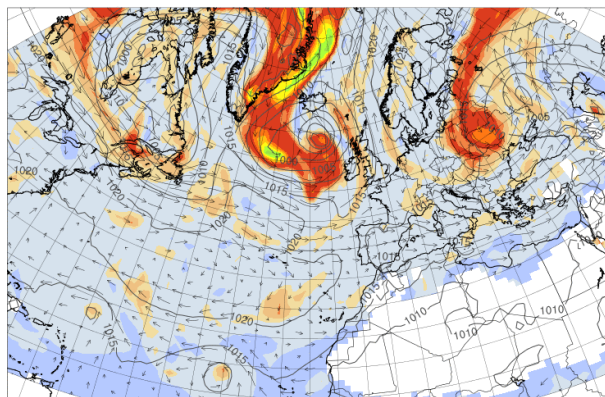
# Plans for Wed 21 Sep

- Most stations require 24hr notice
  - Time for discussion
  - Suggest (need 24hr notice):
    - Keflavik (26): 00,12,**15,18,21**,00/22
    - Egilsstadir (27): 00,**12**
- Already requested (need 48 hr notice):
  - Ittoqqortoormiit (47): 12,**15,18,21**,00/22,**03/22**

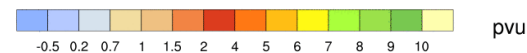
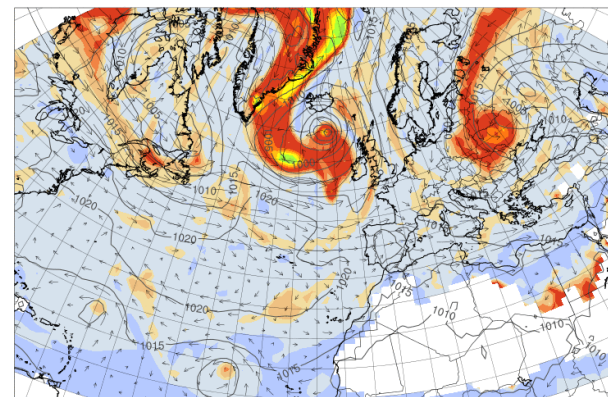
PV@310K at 20160921\_12



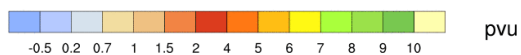
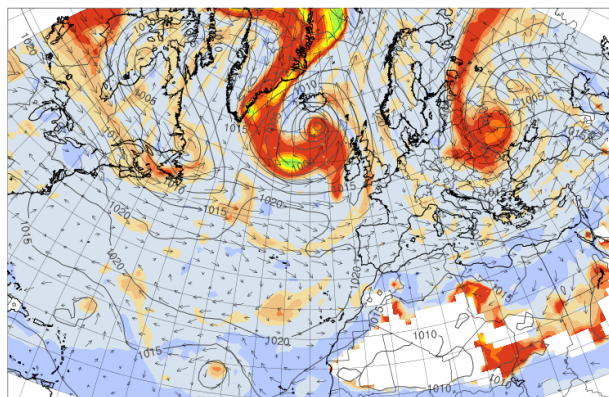
PV@310K at 20160921\_15



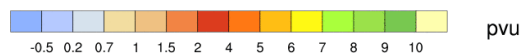
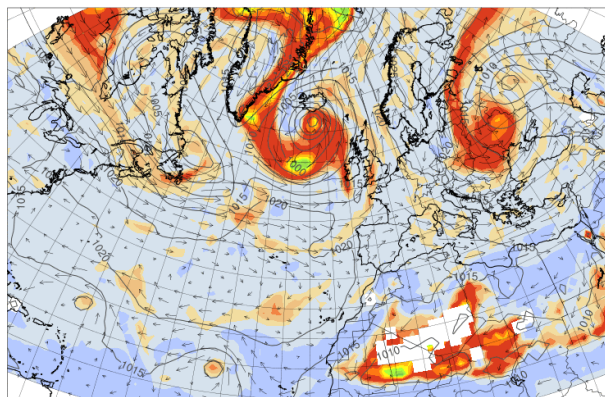
PV@310K at 20160921\_18



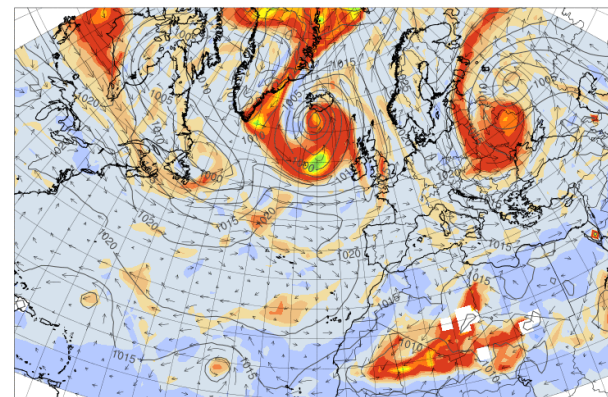
PV@310K at 20160921\_21



PV@310K at 20160922\_00



PV@310K at 20160922\_03

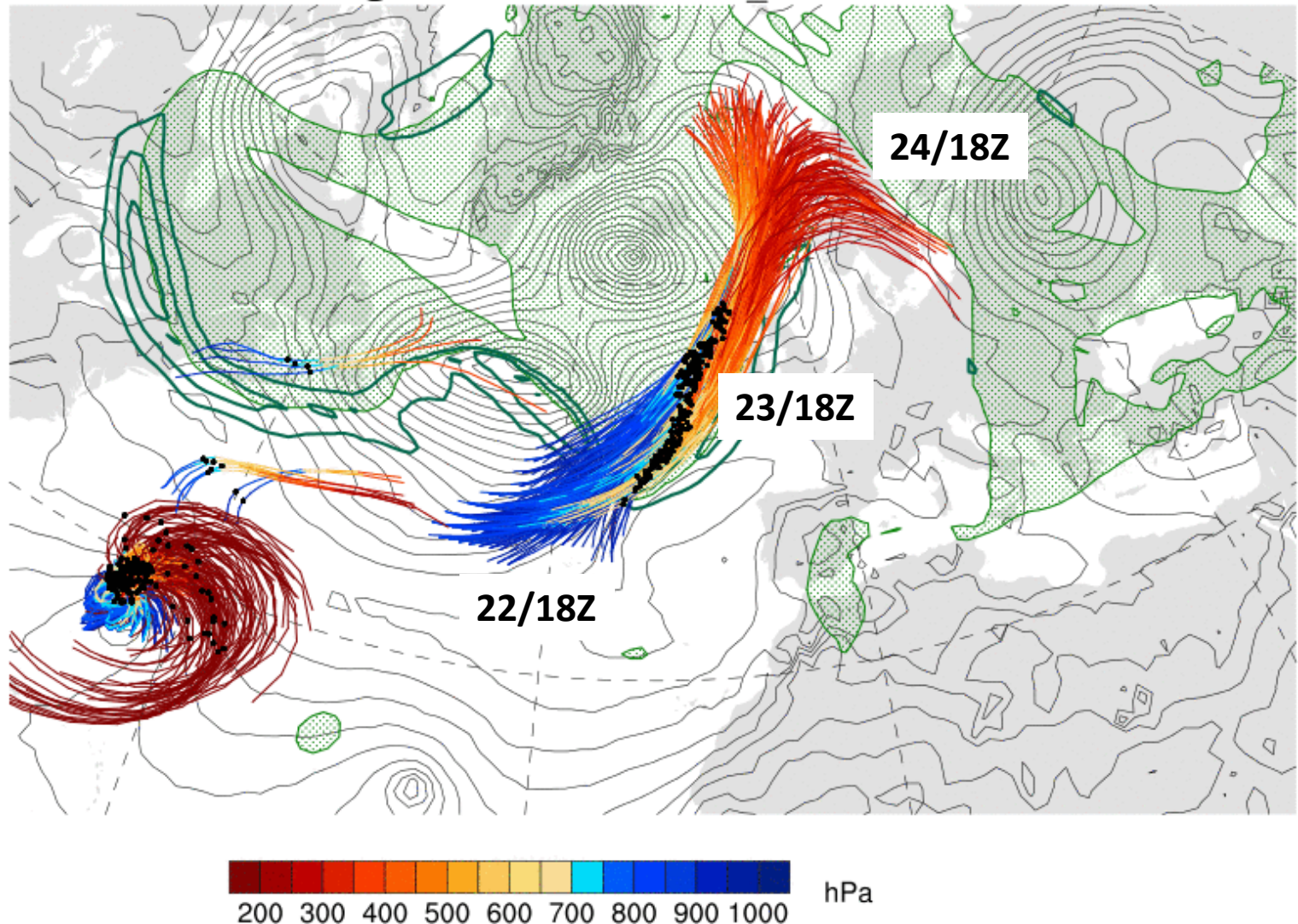




# Potential Friday/Saturday mission, full Lagrangian measurements

Trajectory start and SLP VT: 20160922\_18

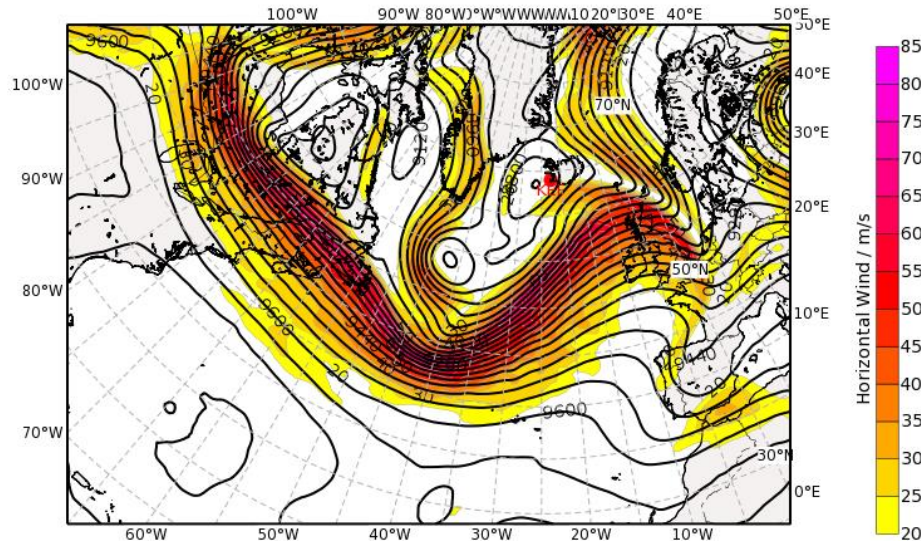
WCB outflow and PV@250hPa VT: 20160924\_18



## 2nd Mission for Friday/Saturday 23/24 September

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

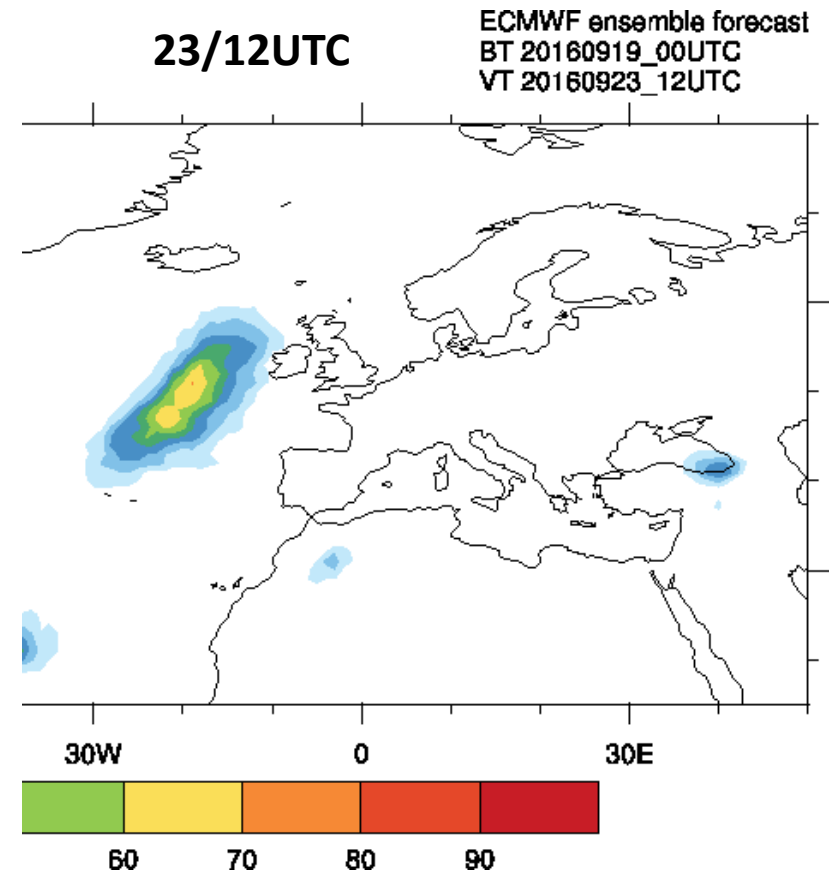
Valid: Fri, 23 Sep 2016, 06 UTC (step 102 h from Mon, 19 Sep 2016, 00 UTC)



- Flight in WCB inflow?
- Which time?

# UK Bae 146

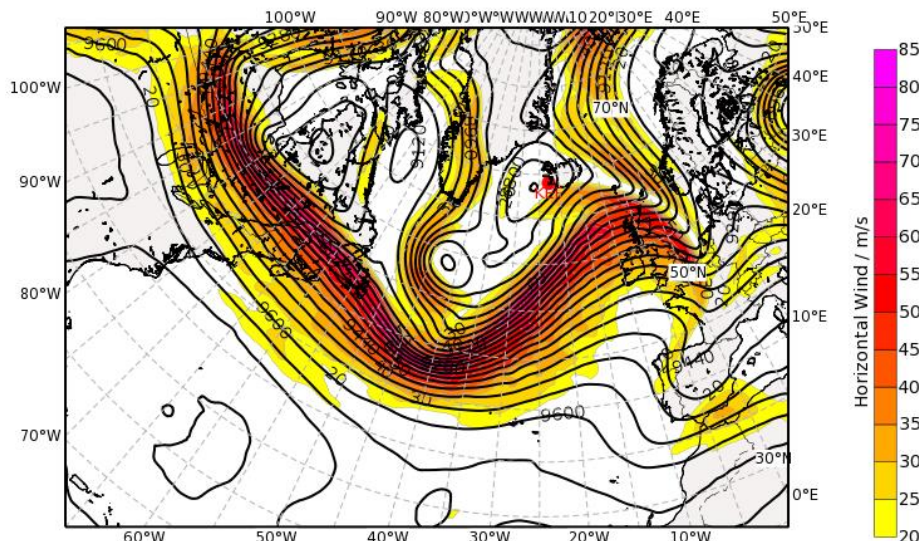
~Friday 00-18UTC





# 2nd Mission for Friday/Saturday 23/24 September

Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Fri, 23 Sep 2016, 06 UTC (step 102 h from Mon, 19 Sep 2016, 00 UTC)

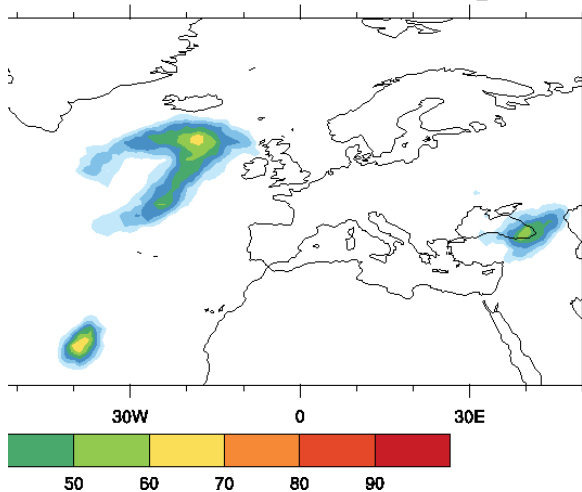


- Flight in WCB inflow and ascent south of 61°N (in NAT region)
- FL280 with dropsondes HALO
- activation of a NOTAM region ?
- Which time?

**HALO**  
~Friday 06-18UTC

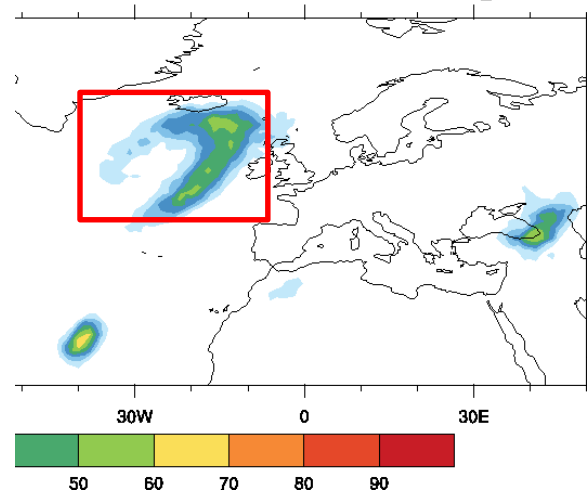
23/06UTC

ECMWF ensemble forecast  
BT 20160919\_00UTC  
VT 20160923\_06UTC



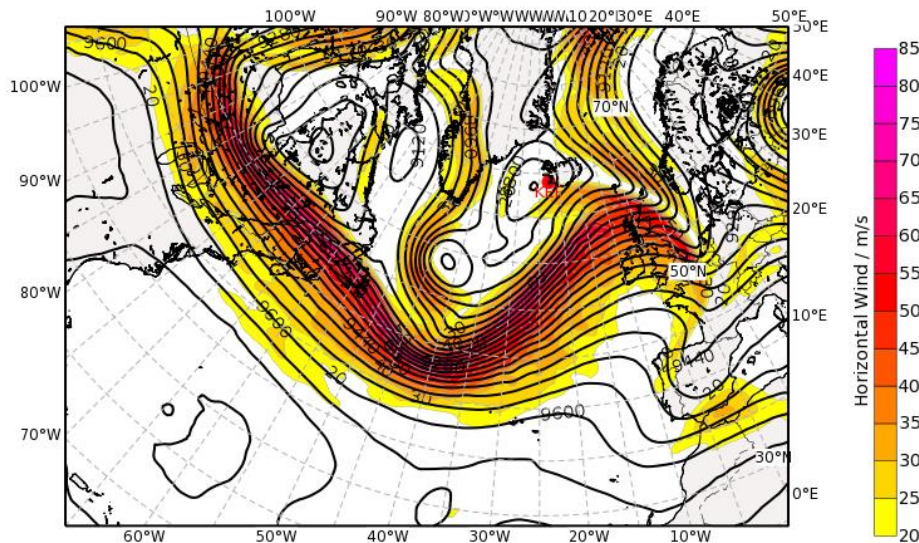
23/12UTC

ECMWF ensemble forecast  
BT 20160919\_00UTC  
VT 20160923\_12UTC



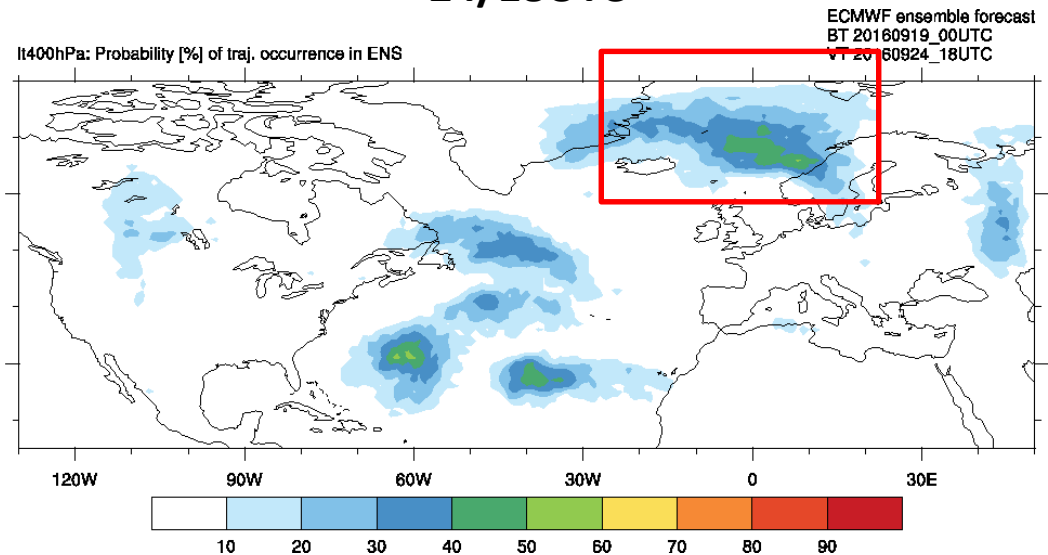
## 2nd Mission for Friday/Saturday 23/24 September

Geopotential Height (m) & Horizontal Wind (m/s) at 300 hPa  
Valid: Fri, 23 Sep 2016, 06 UTC (step 102 h from Mon, 19 Sep 2016, 00 UTC)



- Sampling of WCB outflow North and East of Iceland with both aircraft
- Which time? -> later higher prob
- Upcoming 3<sup>rd</sup> cyclone and Karl!

24/18UTC



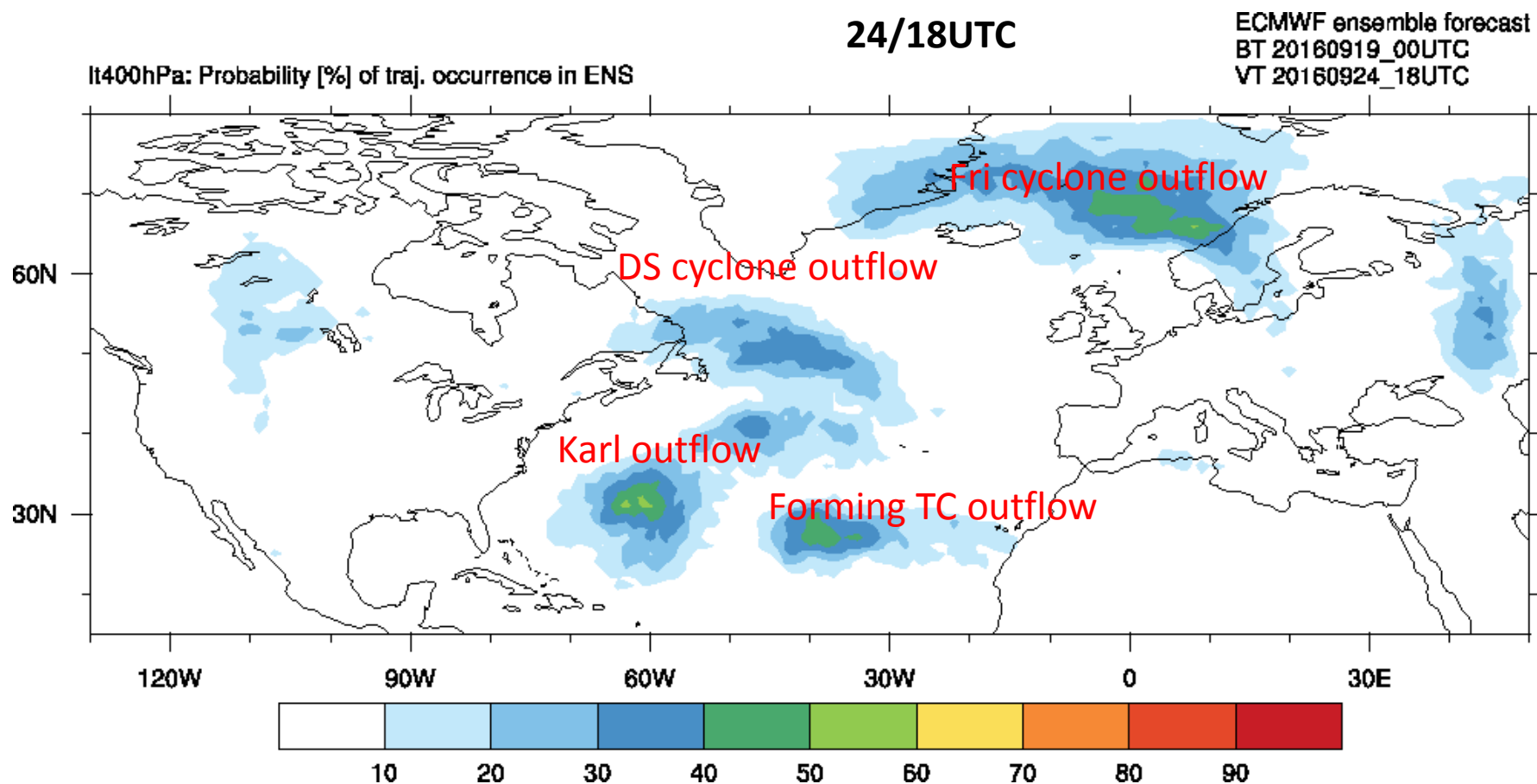
# HALO & Falcon

~Saturday 18-00UTC



## 2nd Mission for Friday/Saturday 23/24 September

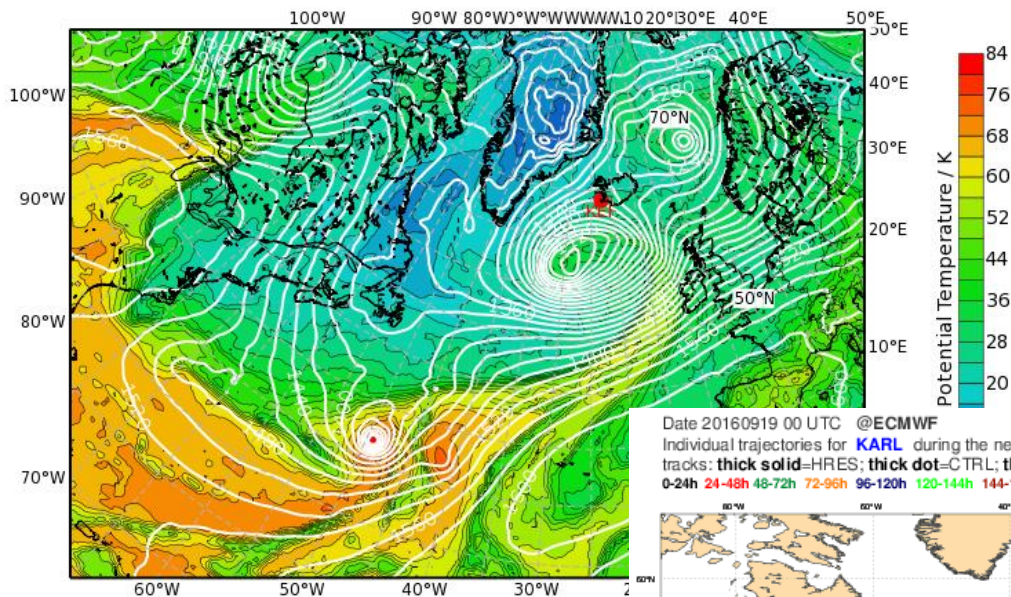
- Upcoming 3<sup>rd</sup> cyclone and Karl!
- missions on Sun-Wed ....



# Outlook Sunday – Tuesday: extratropical transition of TC Karl

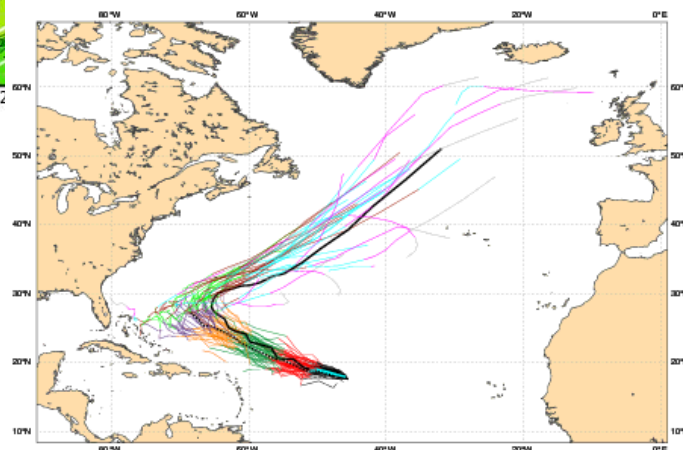
Equivalent Potential Temperature (degC) & Streamlines at 850 hPa

Valid: Mon, 26 Sep 2016, 12 UTC (step 180 h from Mon, 19 Sep 2016, 00 UTC)



Sunday – Tuesday 25-27.9.2016  
Coordination with **SHOUT**?

Date 20160919 00 UTC @ECMWF  
Individual trajectories for **KARL** 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]

+0004 h	hr	02	03	04	05	07	08	11	12	13	14	15	17	18	19	20	21	22	23	24	26	27	28	29	30	31	32	33	34	35	36	38	40	41	42	44	45	46	47	48	49
+0004 h	hr	02	03	04	05	07	08	11	12	13	14	15	17	18	19	20	21	22	23	24	26	27	28	29	30	31	32	33	34	35	36	38	40	41	42	44	45	46	47	48	49
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+0004 h	hr	02	03	04	05	07	08	11	12	13	14	15	17	18	19	20	21	22	23	24	26	27	28	29	30	31	32	33	34	35	36	38	40	41	42	44	45	46	47	48	49
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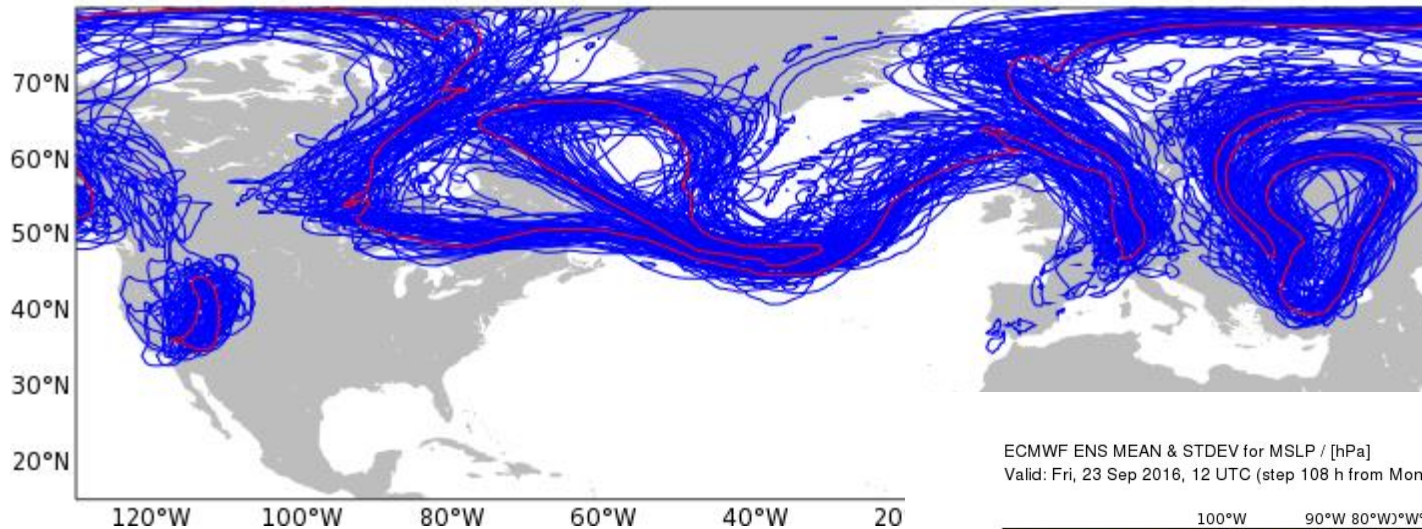
# Outlook Fri 23/12Z to Wed 28/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 19/00Z)

Fri 23/12Z

ECMWF ENSEMBLE FC

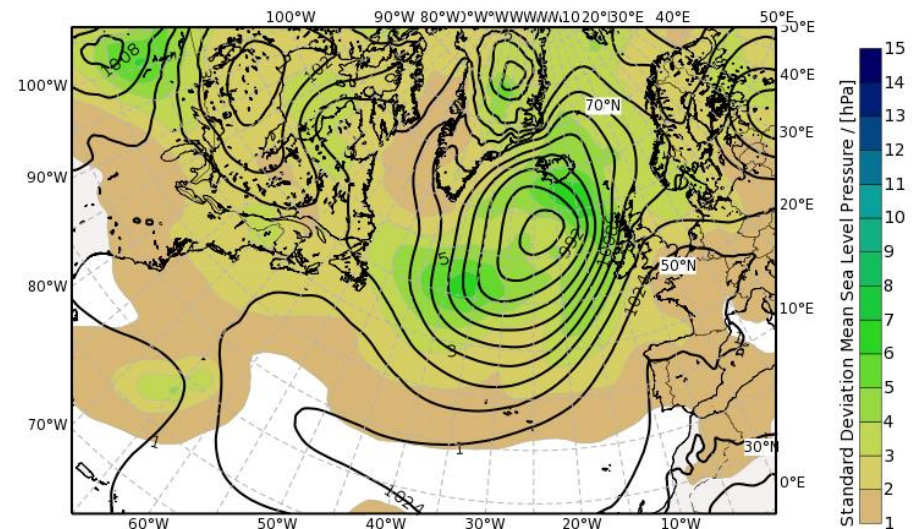
BT: 20160919 00UTC, VT: 20160923 12UTC

blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

Valid: Fri, 23 Sep 2016, 12 UTC (step 108 h from Mon, 19 Sep 2016, 00 UTC)



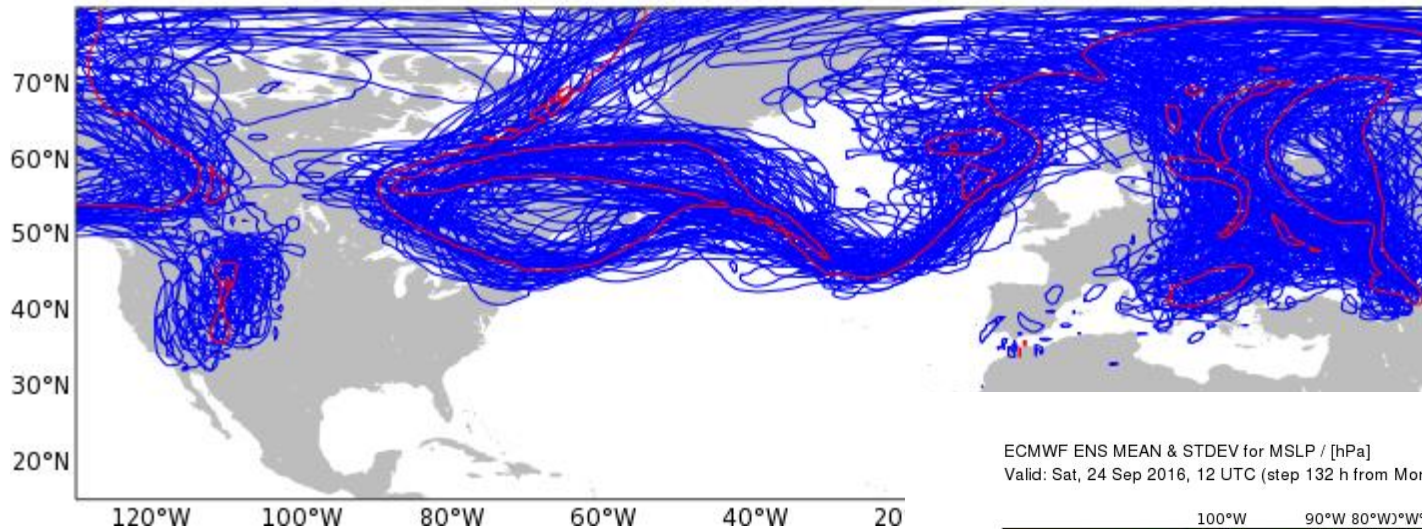
# Outlook Fri 23/12Z to Wed 28/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 19/00Z)

Sat 24/12Z

ECMWF ENSEMBLE FC

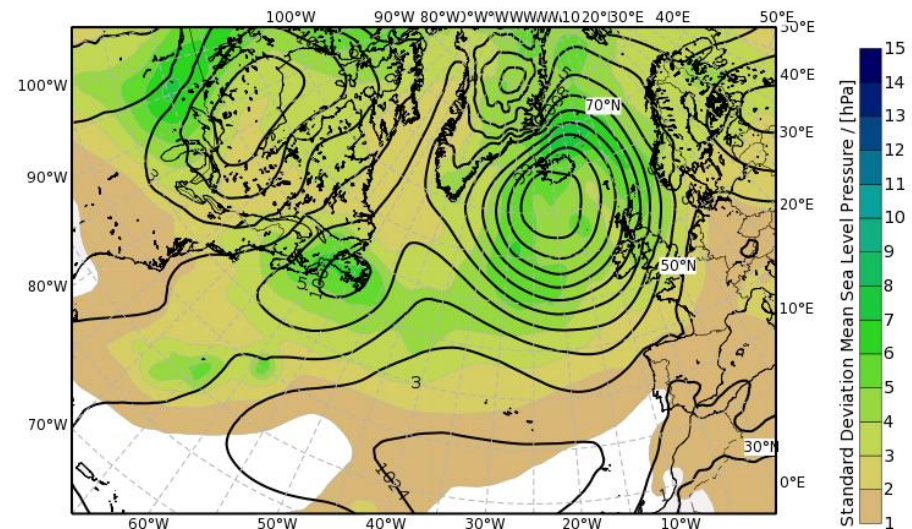
BT: 20160919 00UTC, VT: 20160924 12UTC

blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

Valid: Sat, 24 Sep 2016, 12 UTC (step 132 h from Mon, 19 Sep 2016, 00 UTC)





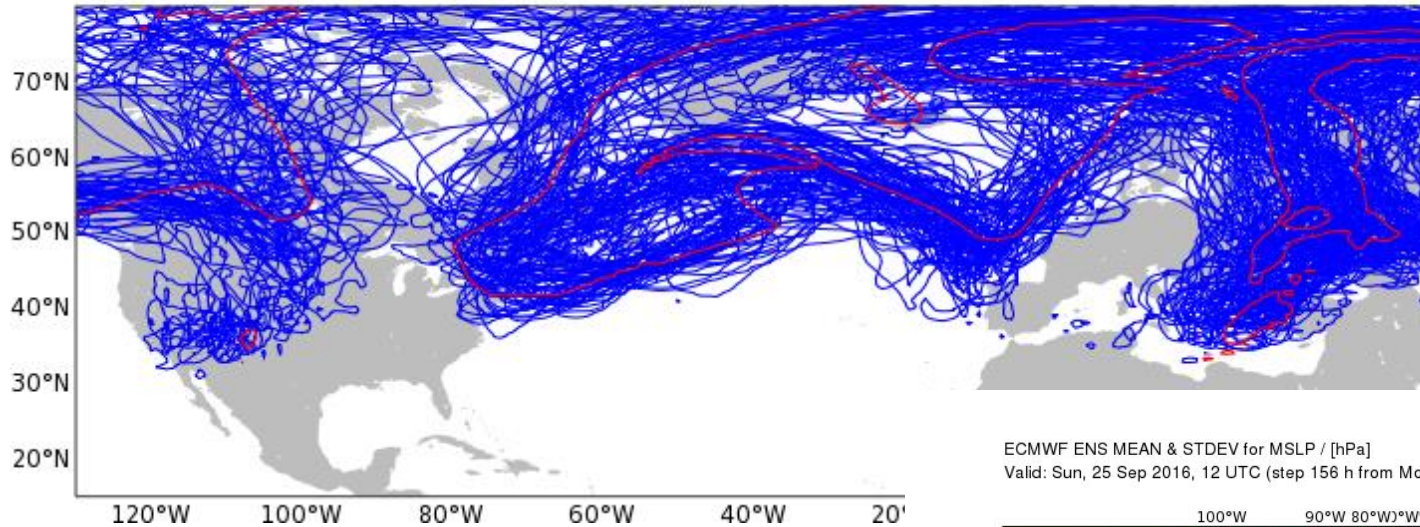
# Outlook Fri 23/12Z to Wed 28/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 19/00Z)

Sun 25/12Z

ECMWF ENSEMBLE FC

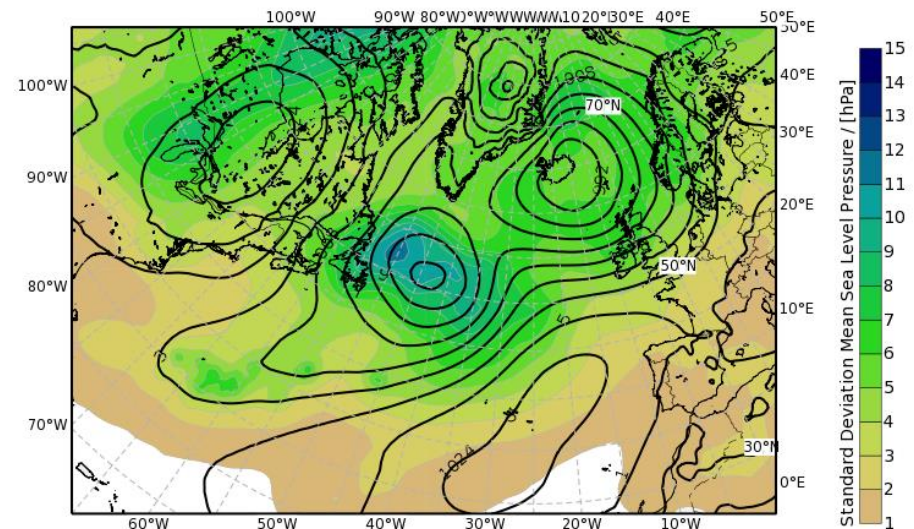
BT: 20160919 00UTC, VT: 20160925 12UTC

blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

Valid: Sun, 25 Sep 2016, 12 UTC (step 156 h from Mon, 19 Sep 2016, 00 UTC)



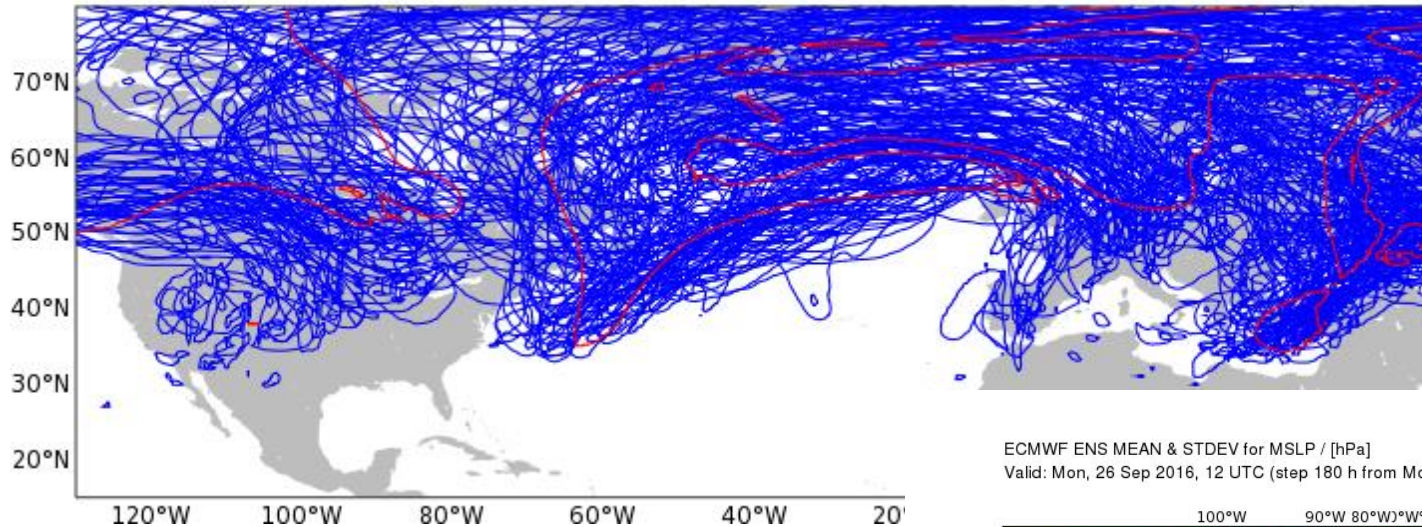
# Outlook Fri 23/12Z to Wed 28/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 19/00Z)

Mon 26/12Z

ECMWF ENSEMBLE FC

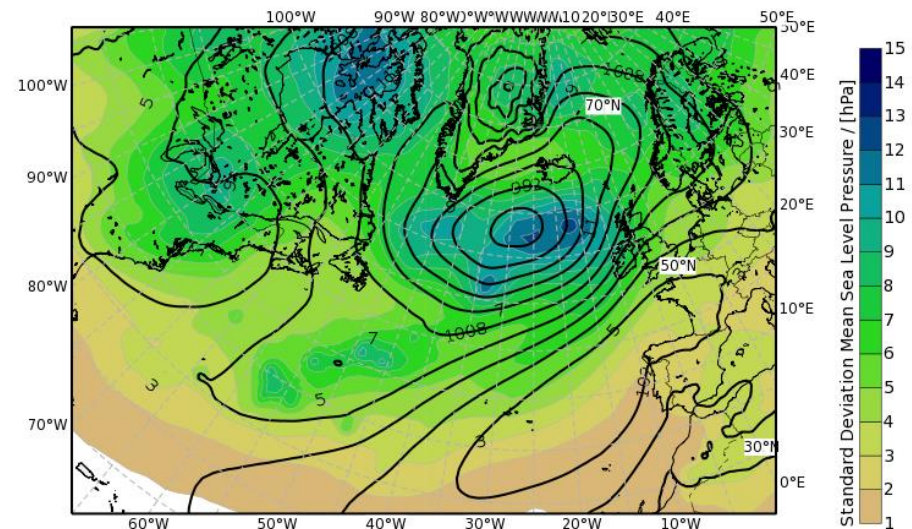
BT: 20160919 00UTC, VT: 20160926 12UTC

blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

Valid: Mon, 26 Sep 2016, 12 UTC (step 180 h from Mon, 19 Sep 2016, 00 UTC)





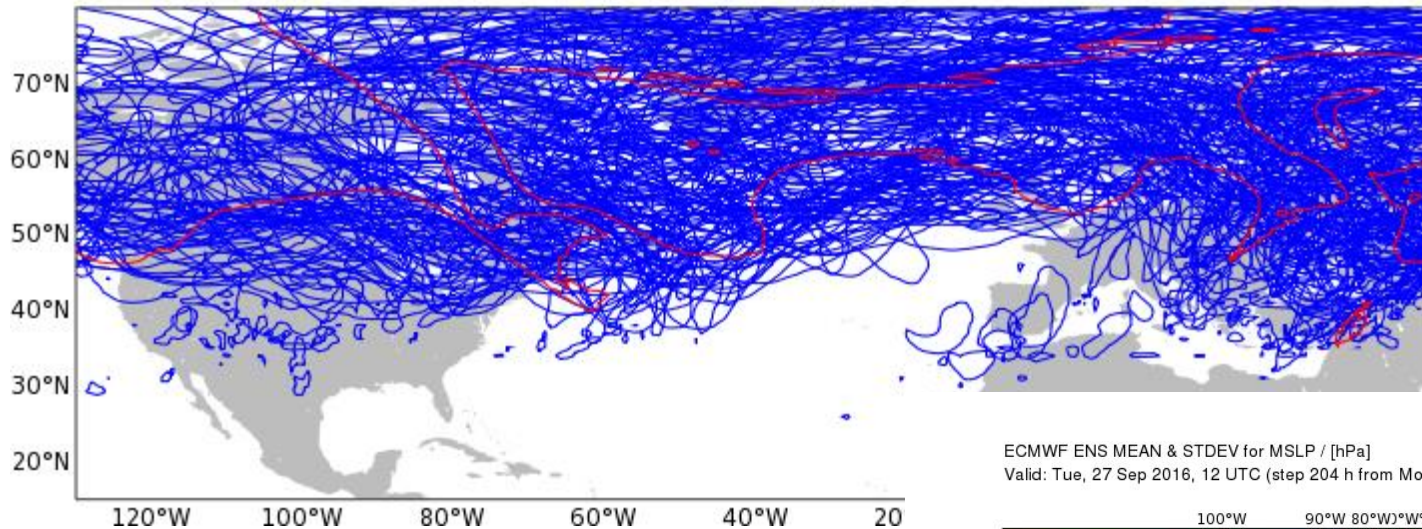
# Outlook Fri 23/12Z to Wed 28/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 19/00Z)

Tue 27/12Z

ECMWF ENSEMBLE FC

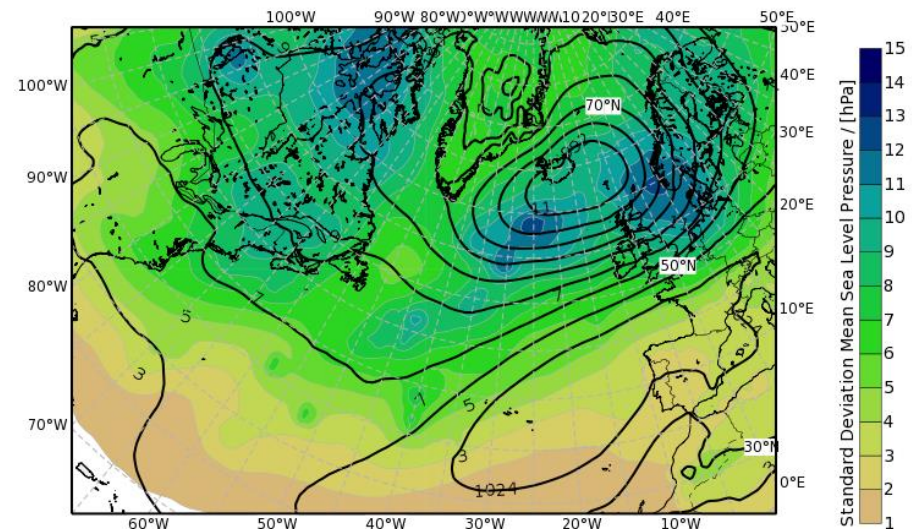
BT: 20160919 00UTC, VT: 20160927 12UTC

blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

Valid: Tue, 27 Sep 2016, 12 UTC (step 204 h from Mon, 19 Sep 2016, 00 UTC)



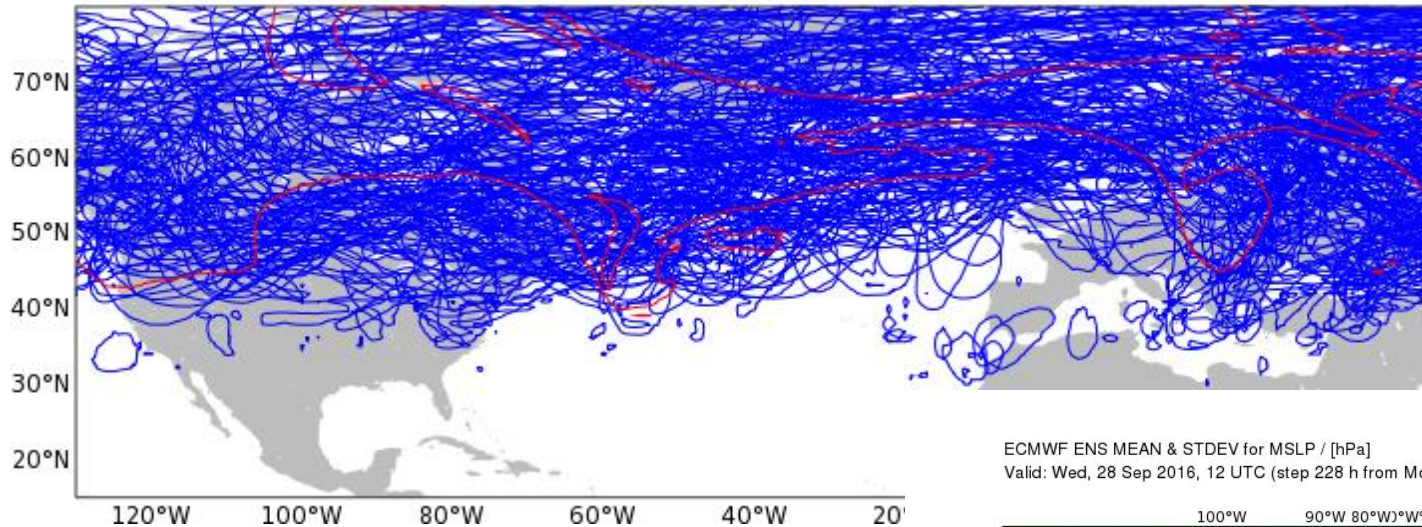
# Outlook Fri 23/12Z to Wed 28/12Z : 2PVU@320K, MEAN & STDEV MLSP (based EC Ens 19/00Z)

Wed 28/12Z

ECMWF ENSEMBLE FC

BT: 20160919 00UTC, VT: 20160928 12UTC

blue: perturbed, red: control



ECMWF ENS MEAN & STDEV for MSLP / [hPa]

Valid: Wed, 28 Sep 2016, 12 UTC (step 228 h from Mon, 19 Sep 2016, 00 UTC)

