



Meteorologisk
institutt

The October flood in western Norway: Large scale setup and model performance

Eivind Støylen, Richard Moore; MET Norway

09.09.2015

Måtte berge biler i Lørenskog

- ** Se liste: Flere veier stengt
- ** Hus evakueres i Røyken
- ** Jordskredfare for store deler av Sør-Norge



Av **CAMILLA SVENNÆS BERGLAND**, **TOR-HARTVIG BONDØ**, **LINE ORFJELL**, **JENNY-LINN LOHNE** og **ØYSTEIN DAVID JOHANSEN**

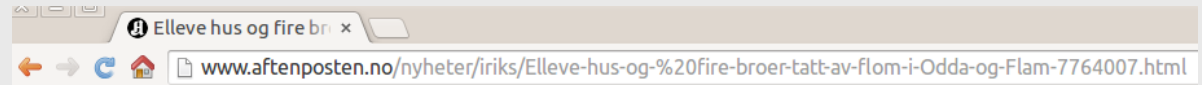
(VG) 02.09.2015 07:23 - oppdatert 02.09.2015 14:45

Siste saker fra Nyheter

Frp-nestleder vil la flyktninger søke 46 minutter siden

October 2014 flood

«The flom in flåm»



Elleve hus og fire broer tatt av flom i Odda og Flåm

HANS O. TORGERSEN, ANDREAS SLETTTHOLM

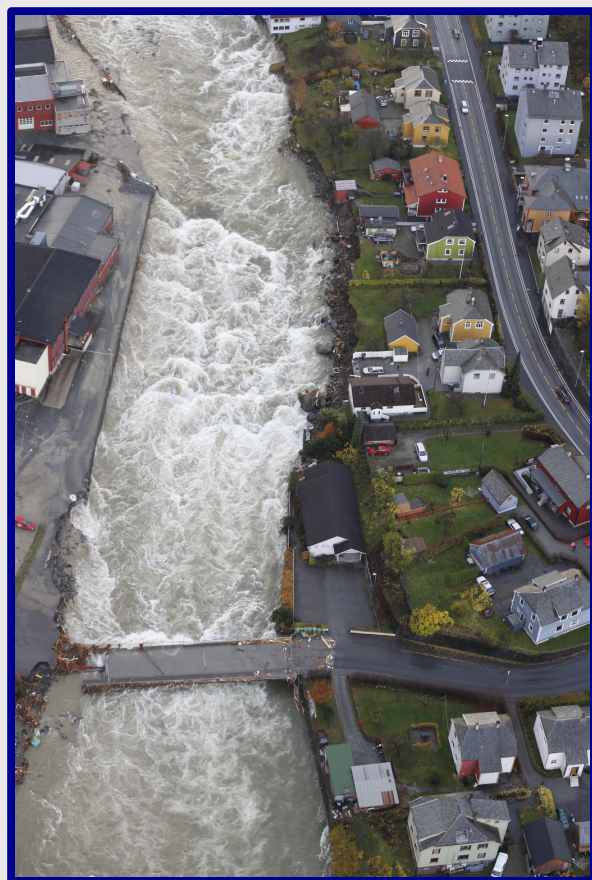
OPPDATERT: 29.OKT. 2014 17:42



Se de enorme skadene i Odda



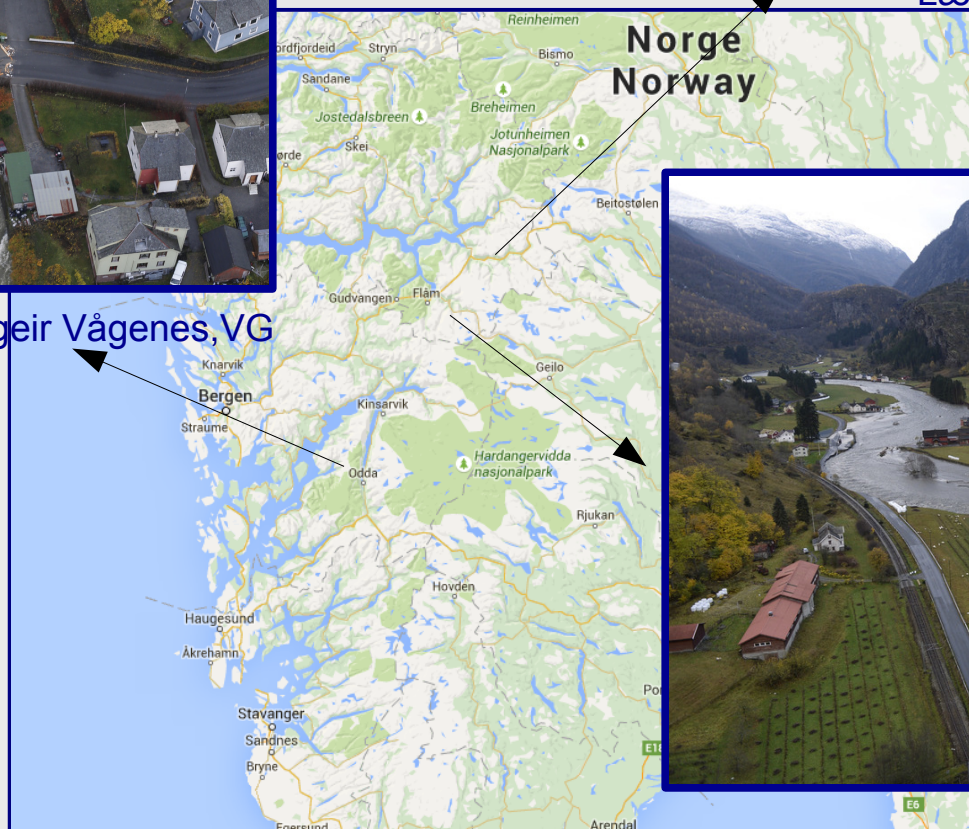
Totalt er flere hundre evakuert, elleve hus er gått tapt, fire broer har kollapset og hovedveier på Vestlandet er stengt etter flommens herjinger



Odda. FOTO: Hallgeir Vågnes, VG

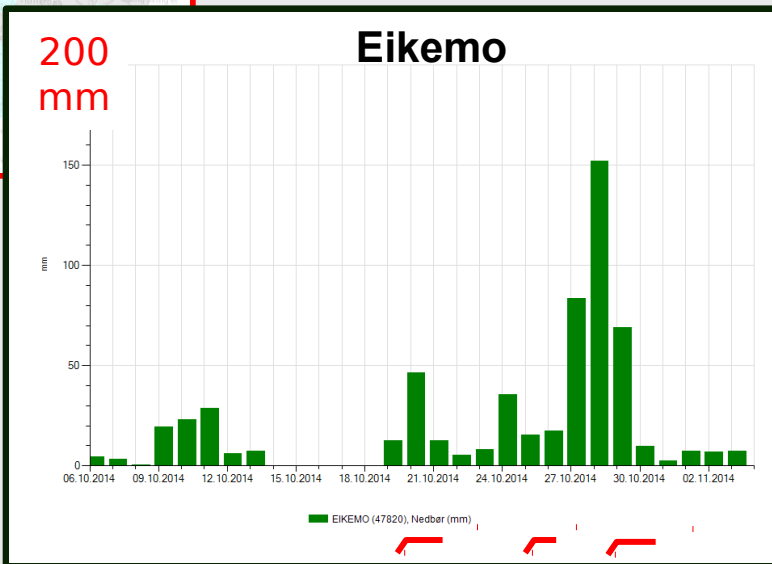
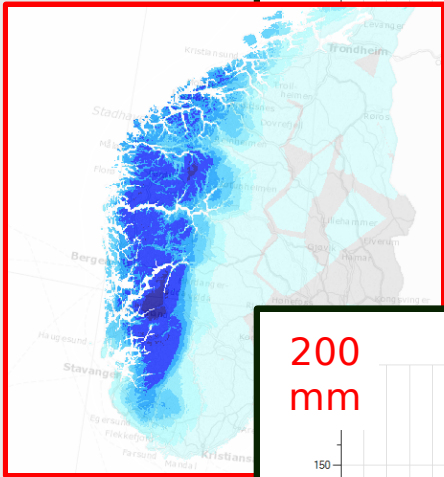
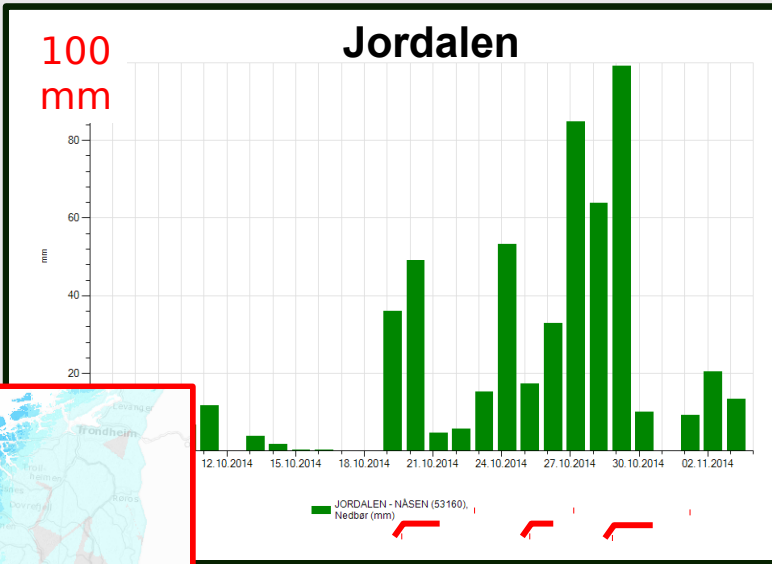


Lærdal. FOTO: Oddleif Løset, NRK

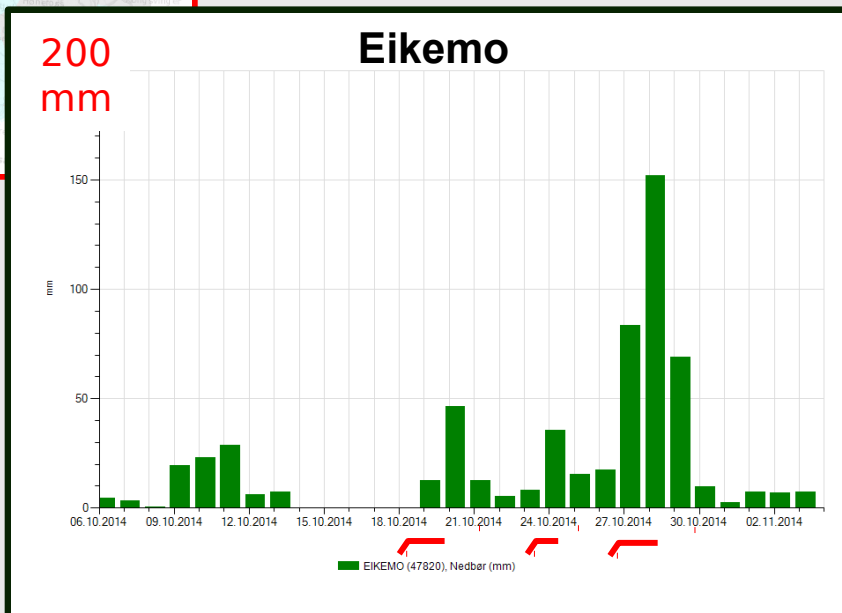
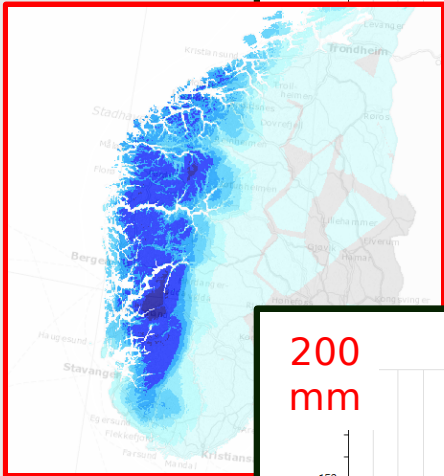
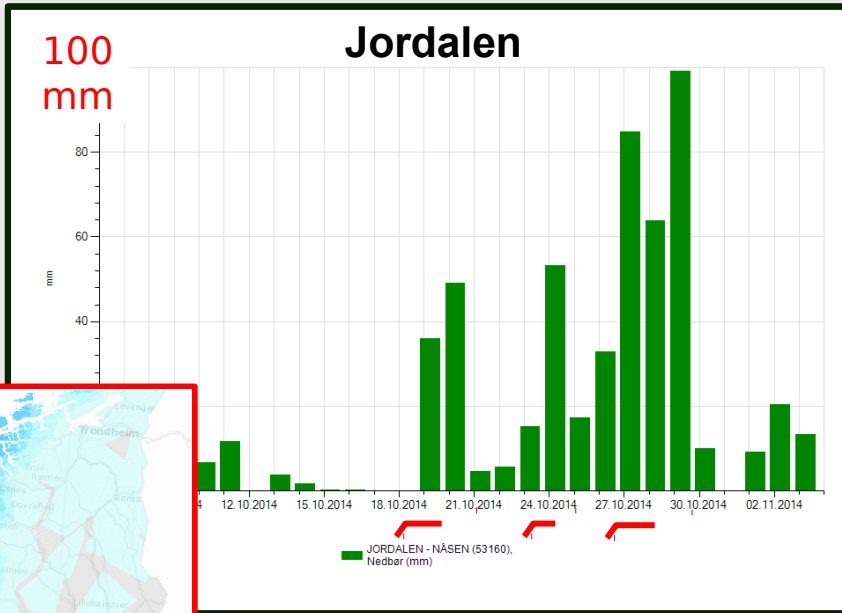


Flåm. FOTO: Helge Mikalsen, VG

Observations – 25 yrs service



Observations



Facts:

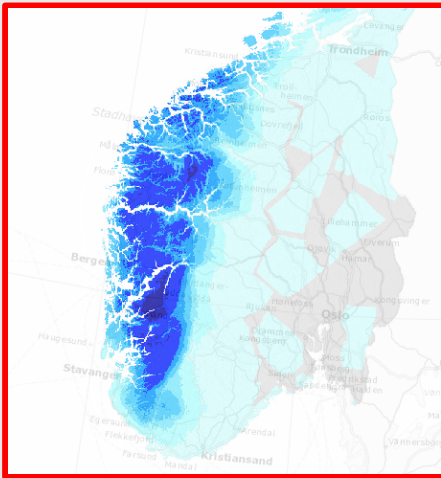
- 3-day rainfall amounts exceeding 300 mm
- Return period between 100-500 years¹
- 100-150 million NOK¹

Setup:

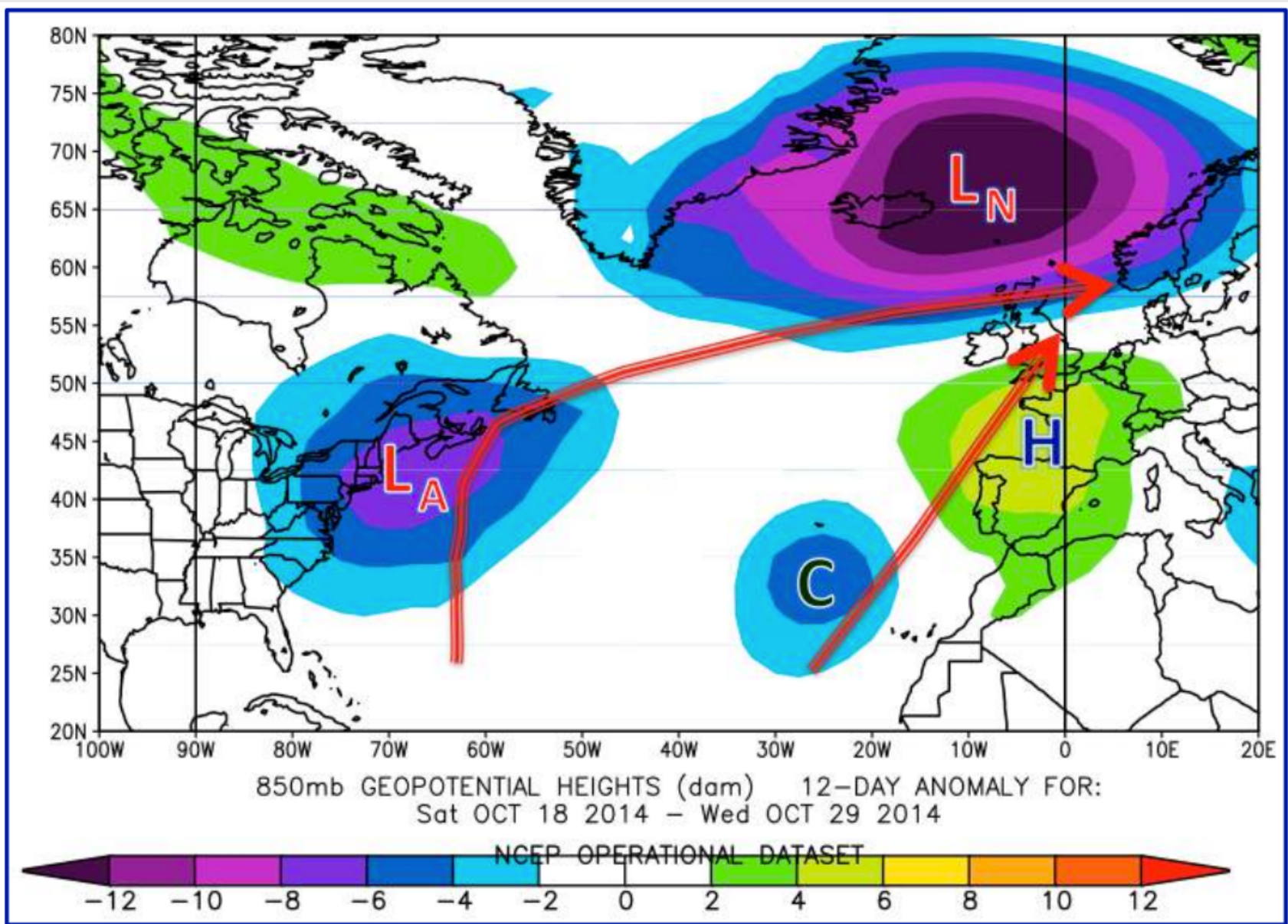
- 'Consistent' flow pattern
- Significant moisture advection
- Orographic lifting

¹Meteorologisk Institute Report
ISSN 1503-8017

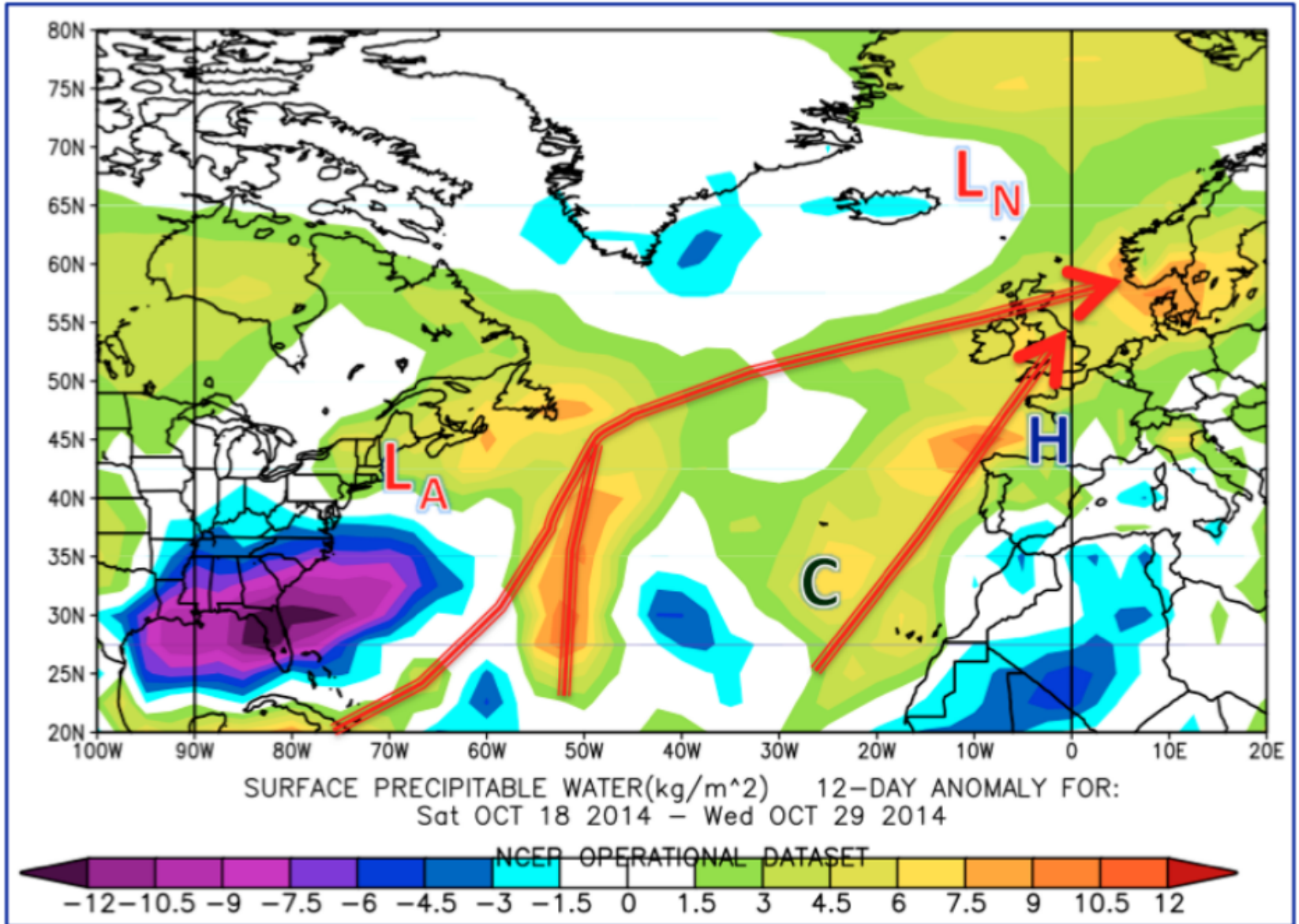
Topics for today

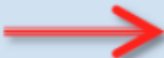


- How predictable was this system?
 - Large scale setup
- How did our forecast models handle the situation?
 - Challenges/benefits from high resolution model
- From forecast to decision making
 - Flood warning
 - Model uncertainties
- The way forward



L_N Norwegian Sea Low
 L_A West Atlantic low
 H high pressure center
C cutoff low
 → warm moist advection



L_N Norwegian Sea Low
 L_A West Atlantic low
 H high pressure center
C cutoff low
  warm moist advection

12 UTC 18 October

- L** low pressure center
- H** high pressure center
- surface wind trajectory
- total precipitable water

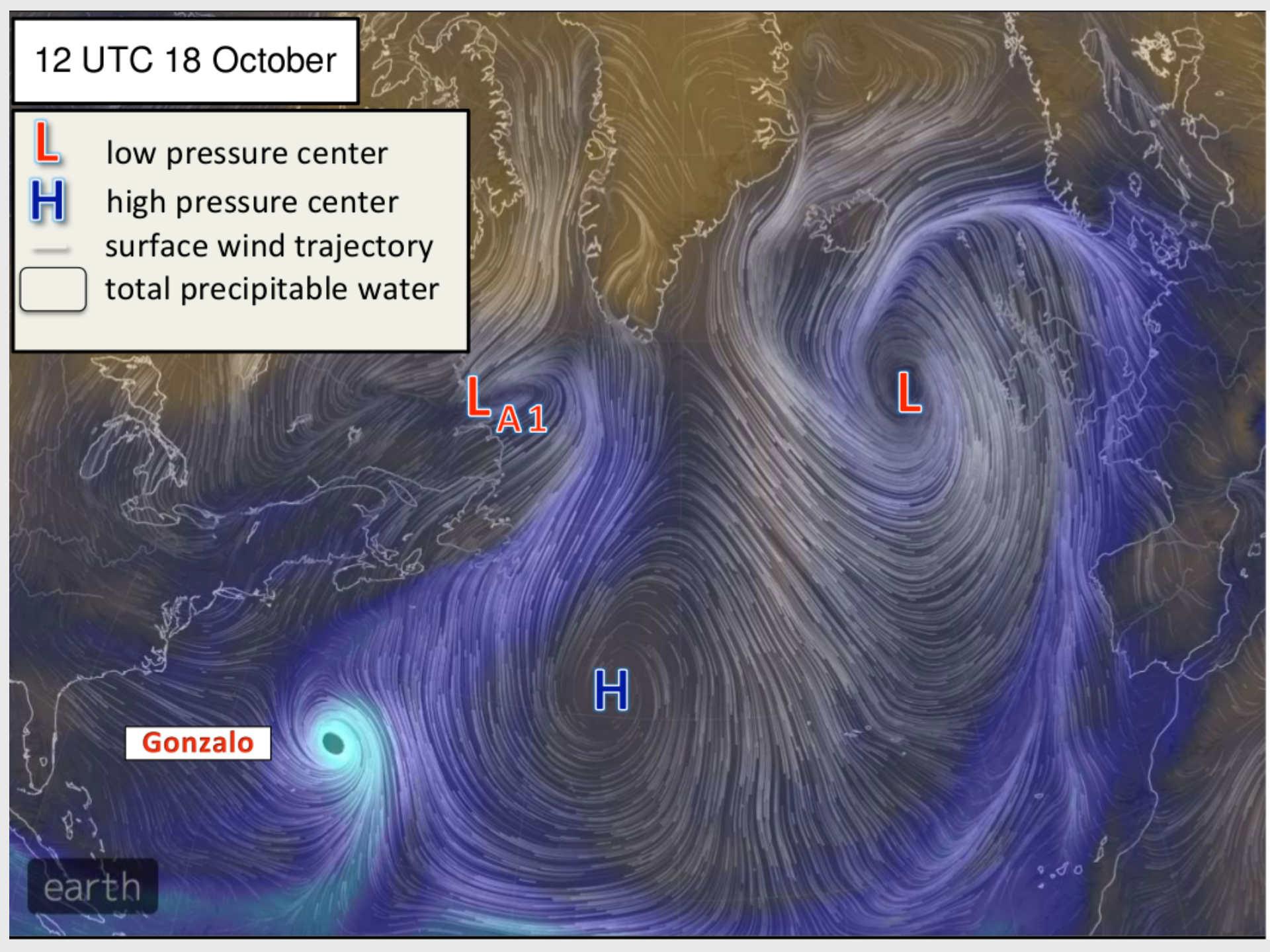
L
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L

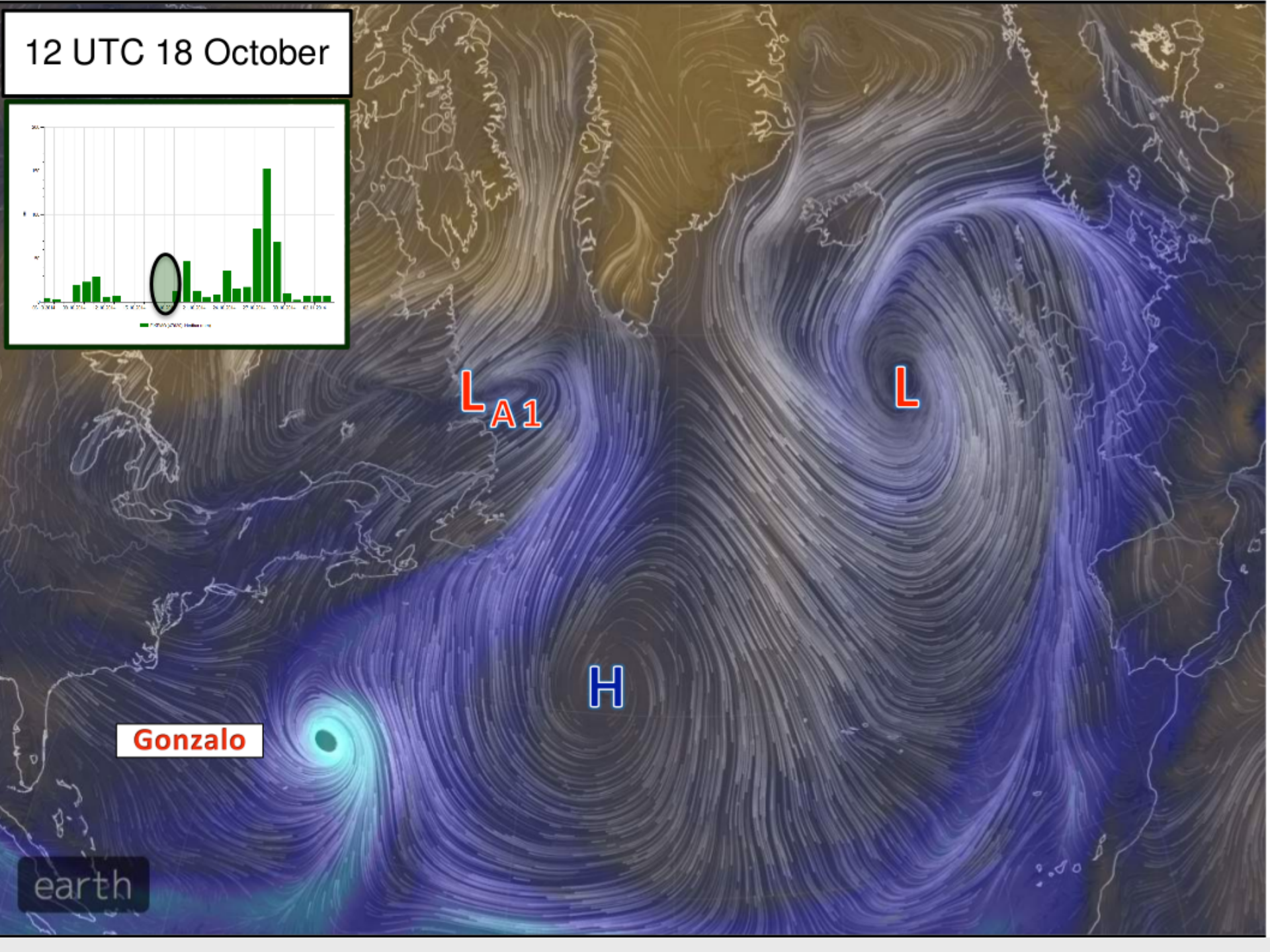
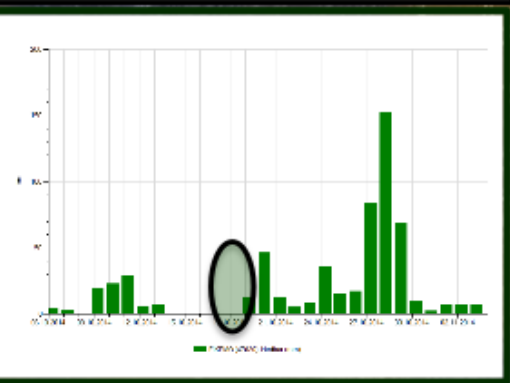
H

Gonzalo

earth

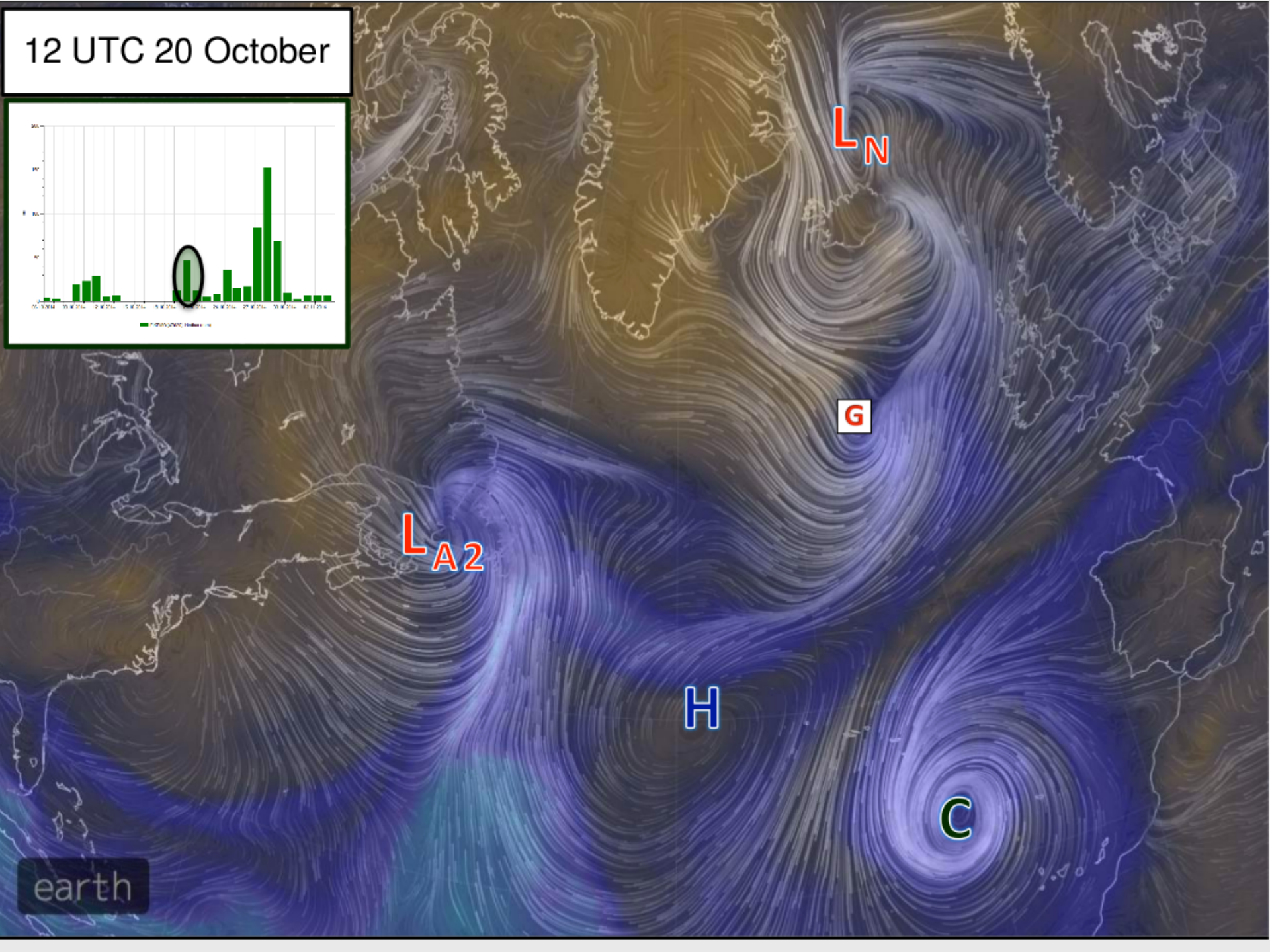
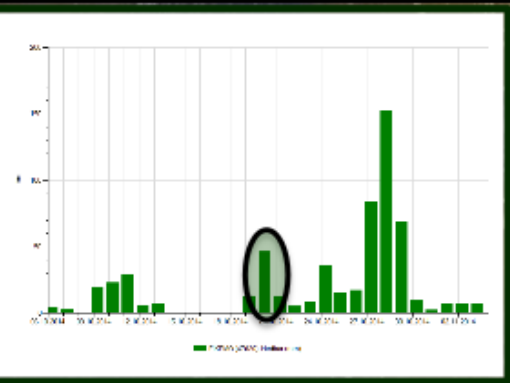


12 UTC 18 October



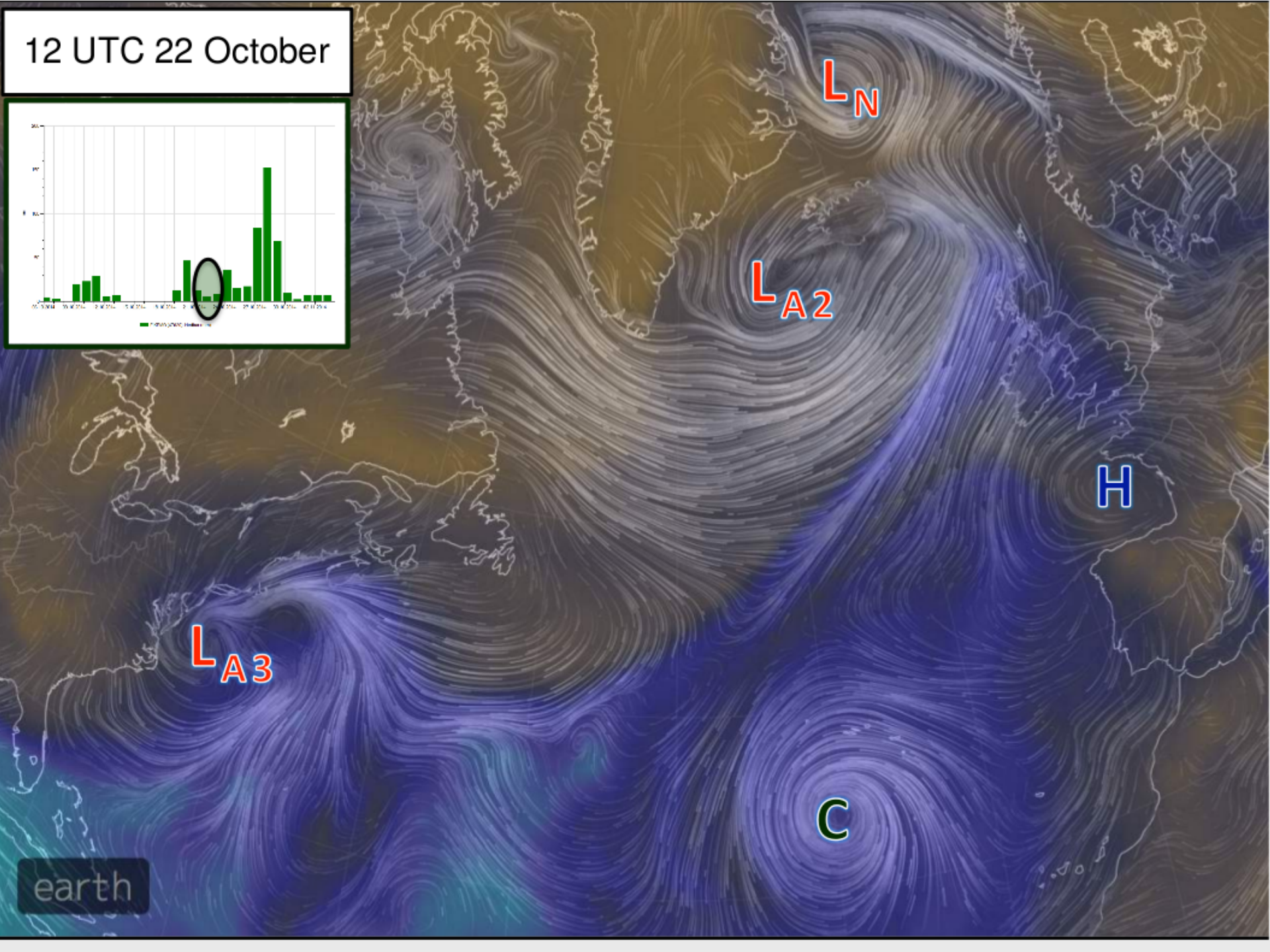
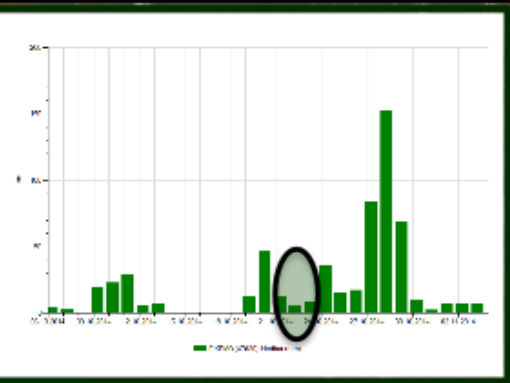
Gonzalo

12 UTC 20 October



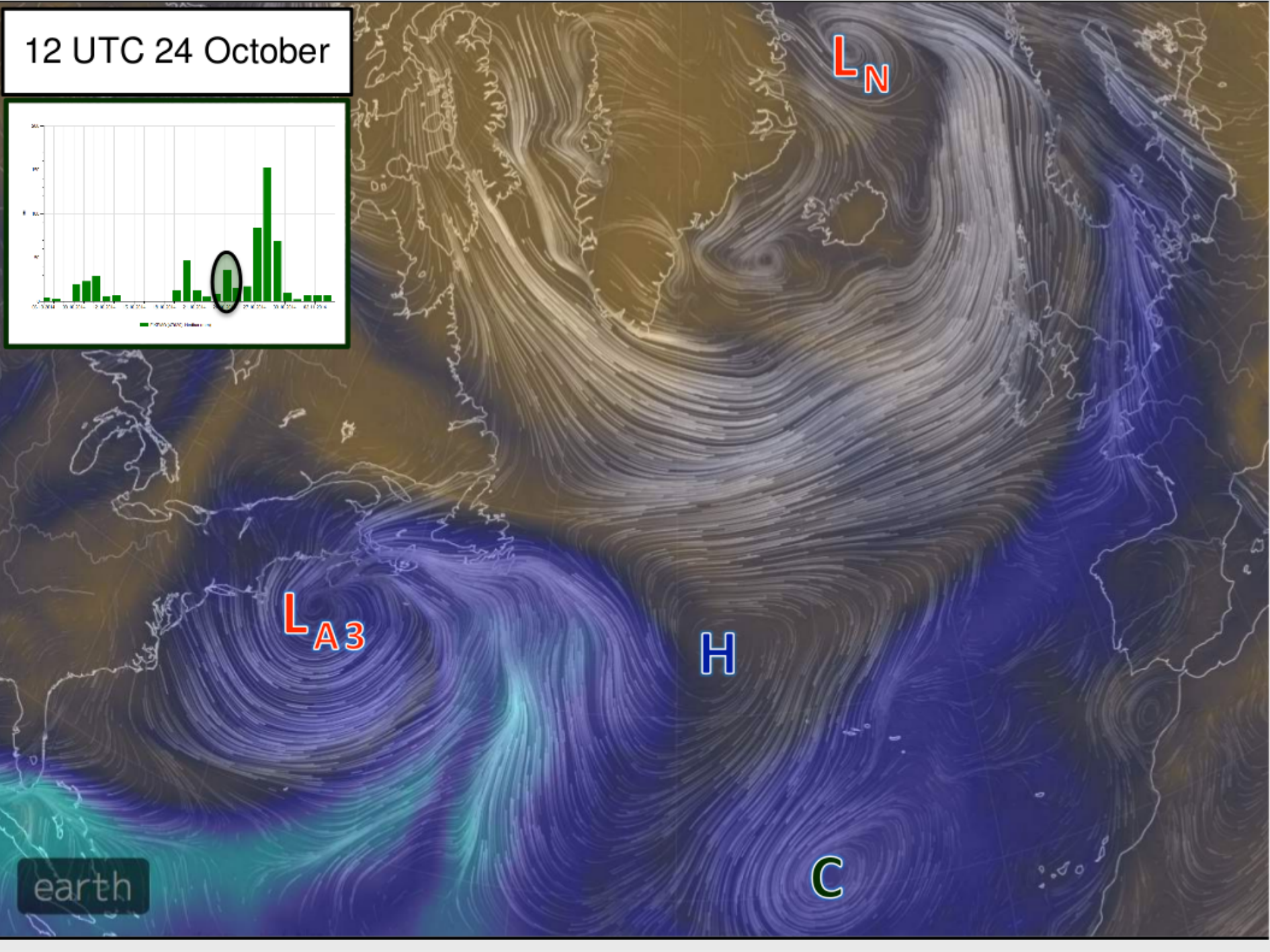
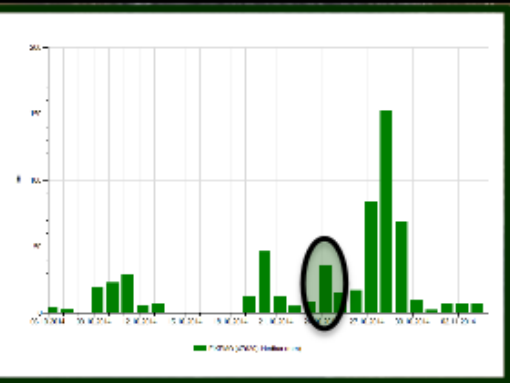
earth

12 UTC 22 October

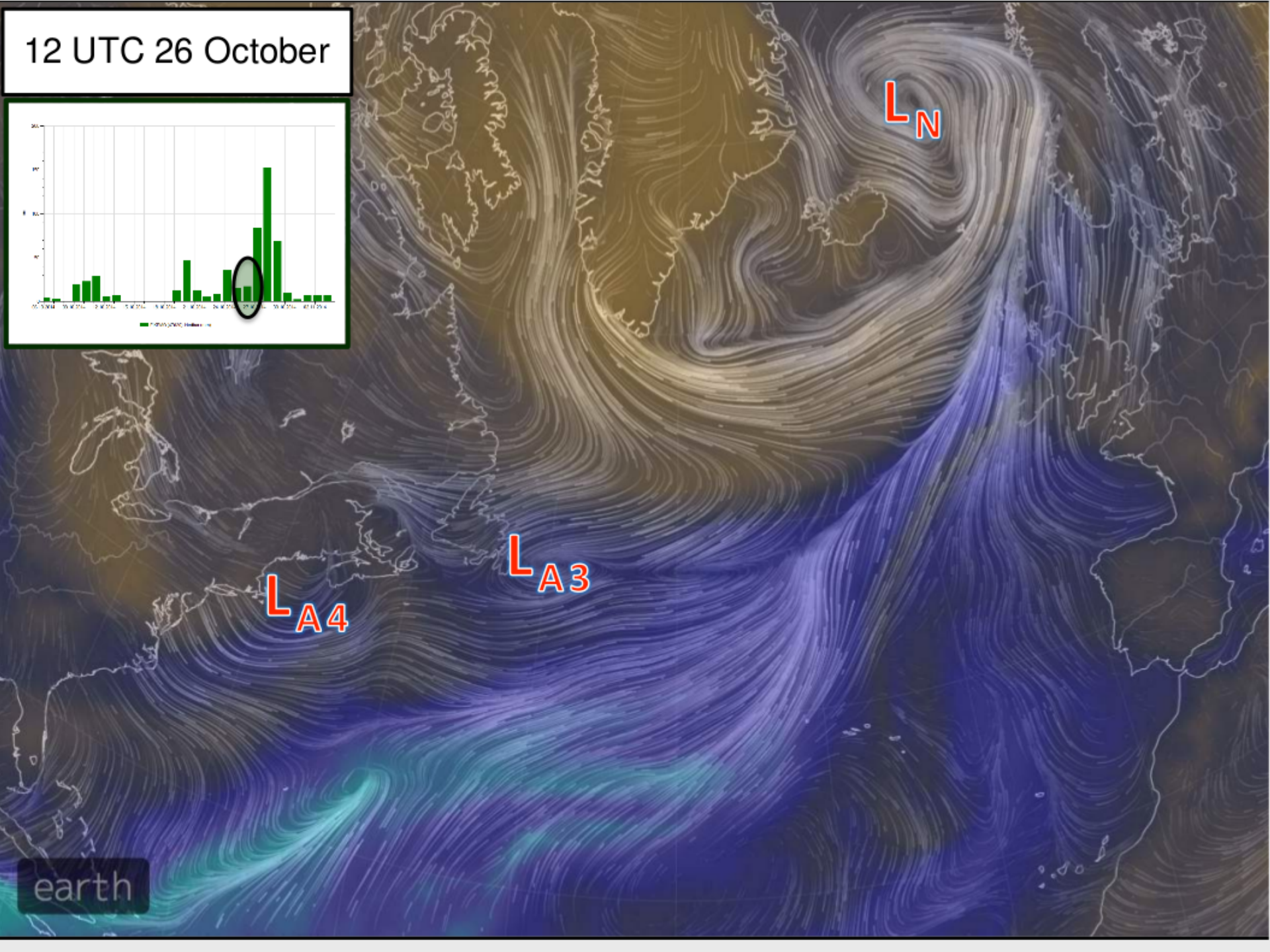
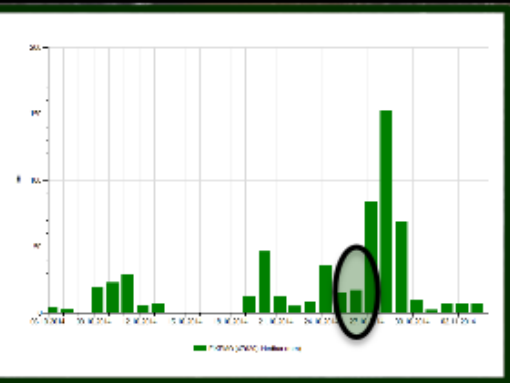


earth

12 UTC 24 October

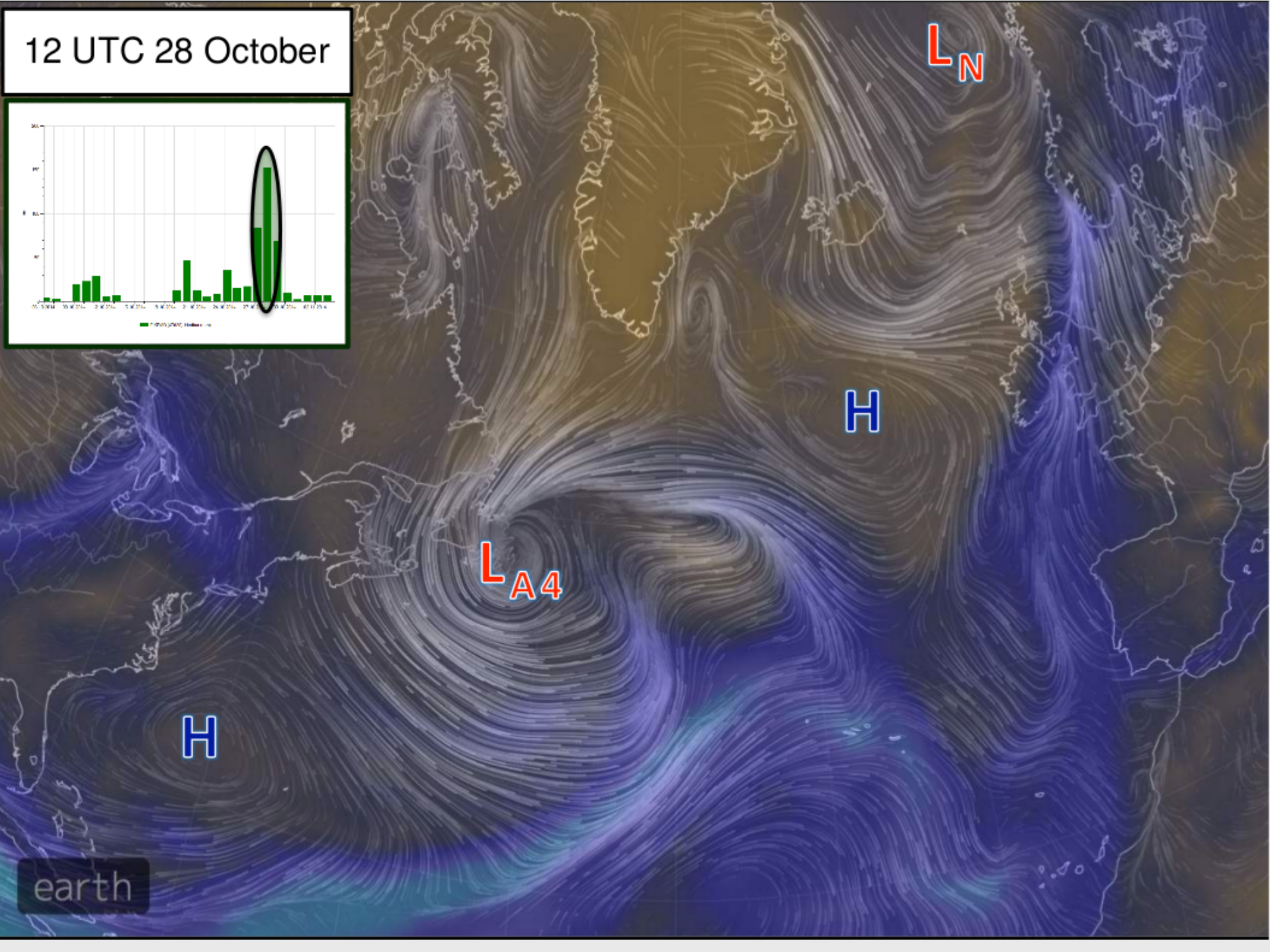
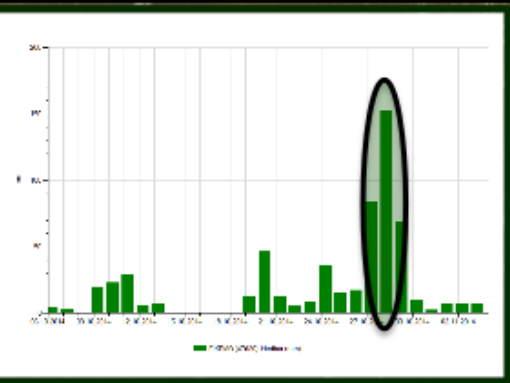


12 UTC 26 October



earth

12 UTC 28 October



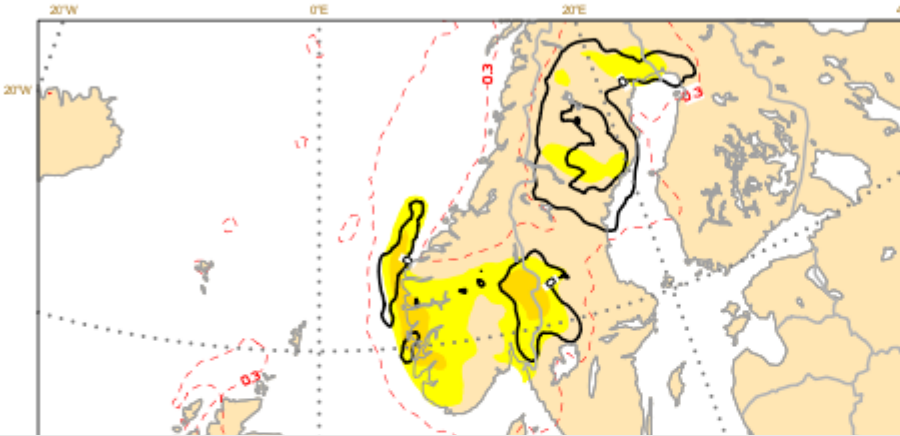
earth

Early warning - predictability

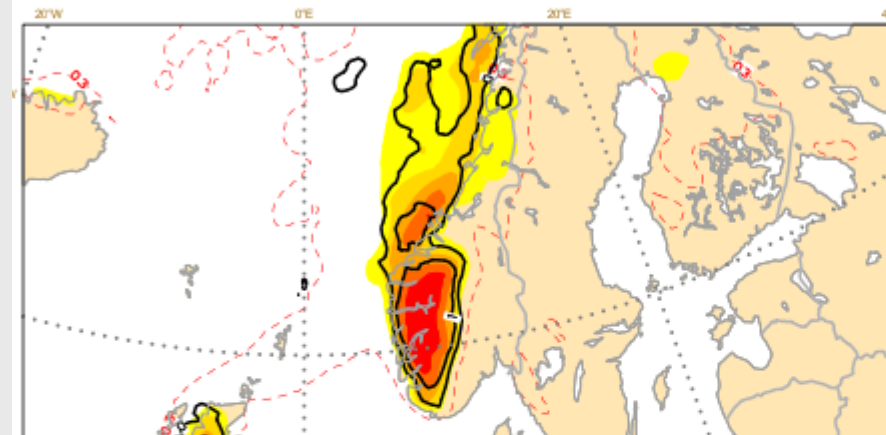
Early warning - predictability

ECMWF EFI (Extreme Forecast Index)
Signal already at October 20th

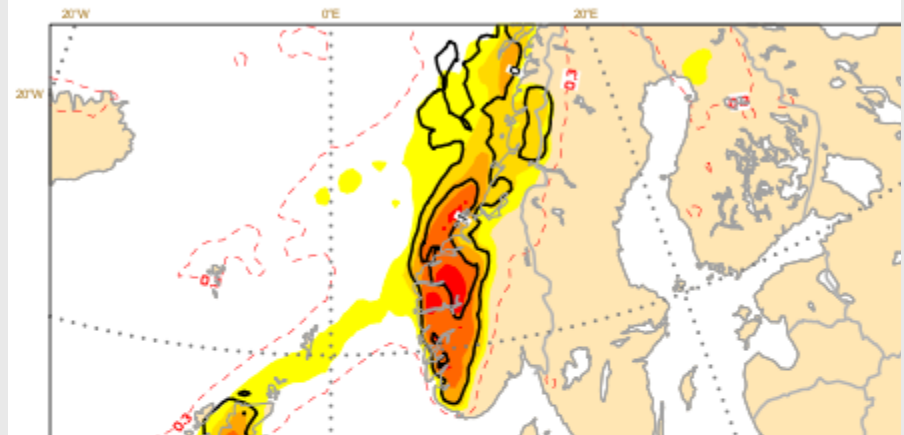
20 Oct 2014 00UTC @ECMWF VT: Fri 24 Oct 2014 00UTC - Wed 29 Oct 2014 00UTC 96-216h
recast index and Shift of Tails (black contours 0,1,5,10,15) for: total precipitation



23 Oct 4 00UTC @ECMWF VT: Sun 26 Oct 2014 00UTC - Wed 29 Oct 2014 00UTC 72-144h
recast index and Shift of Tails (black contours 0,1,5,10,15) for: total precipitation

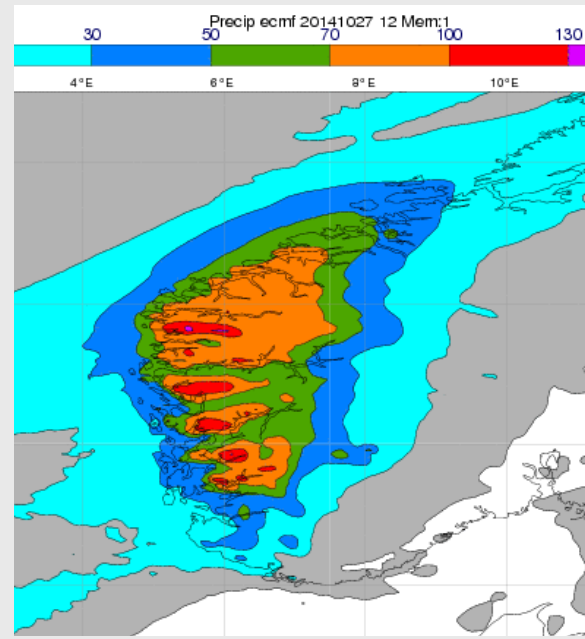
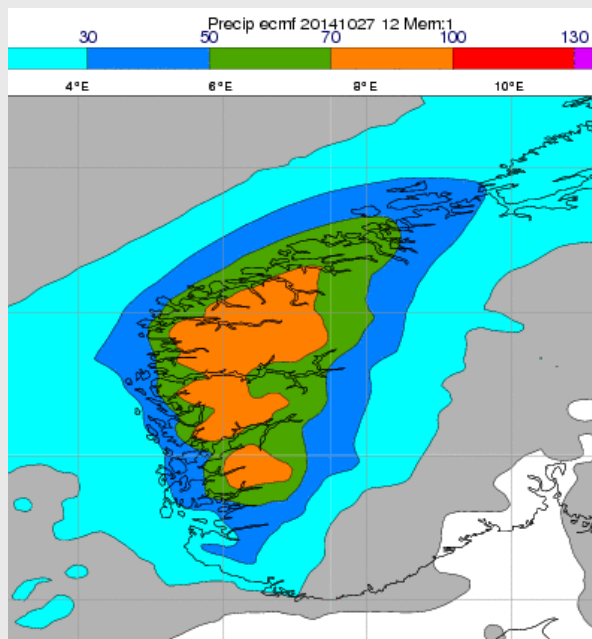
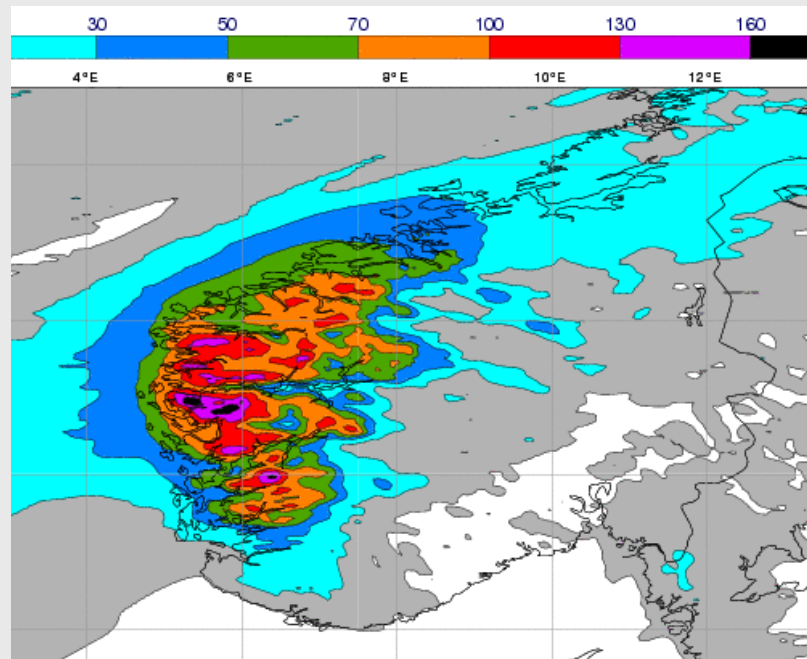


25 Oct 2014 00UTC @ECMWF VT: Sun 26 Oct 2014 00UTC - Wed 29 Oct 2014 00UTC 24-96h
recast index and Shift of Tails (black contours 0,1,5,10,15) for: total precipitation



Long range model skill

- Right: Operational 2.5 km AROME-MetCoOp
- Down: Operational EC 16km "HRES"
- Downright: EC 8km HRES "next generation"

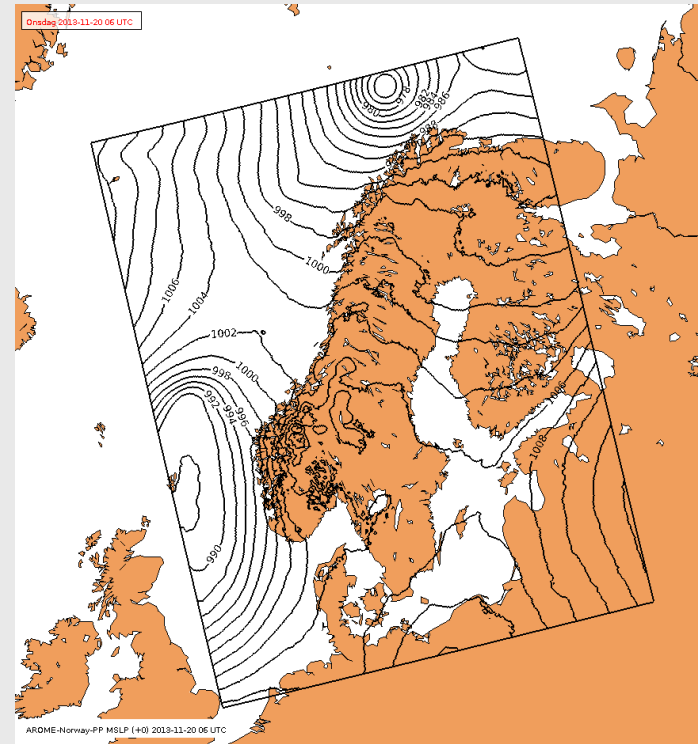


From long to short range

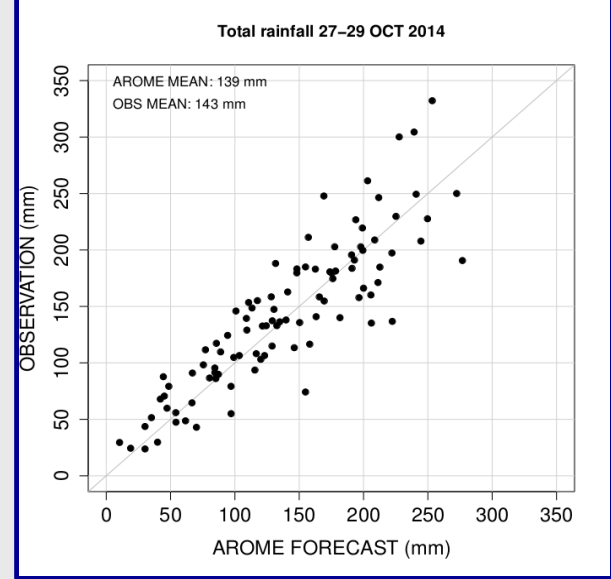
- Course model: High predictability, but underestimation
- What about our operational high-resolution model?

Some quick model details...

- "AROME-MetCoOp"
 - cooperation with SMHI, Sweden
- 2.5 km horizontal resolution, 65 vert. levels
- Data assimilation every 3 hours
- Non-hydrostatic physics
- Boundary data from EC HRES

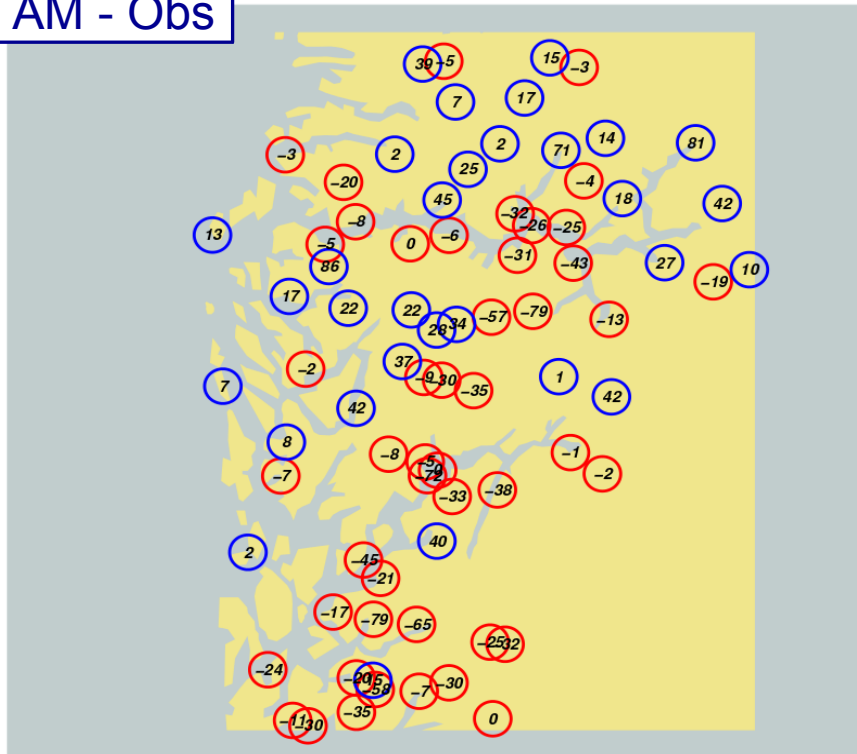


Precipitation Accumulation October 27-29

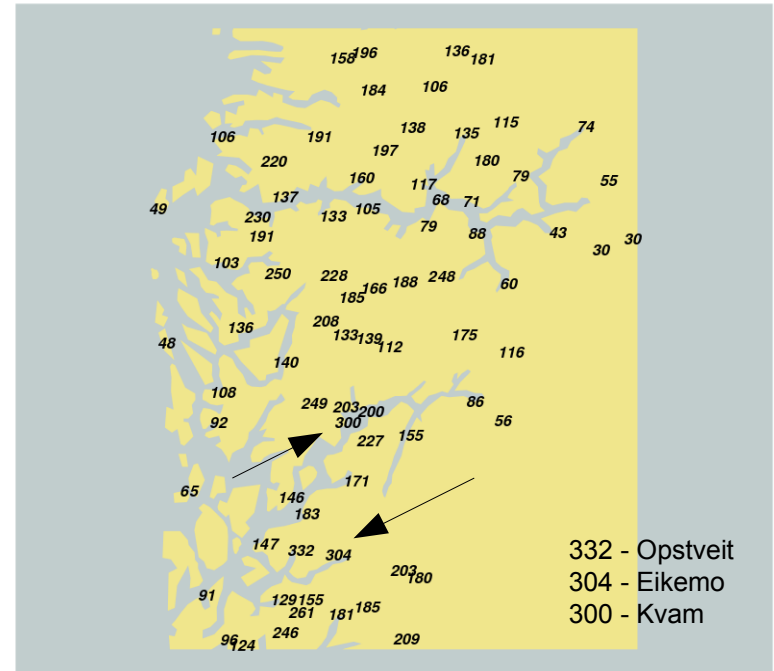


AROME-OBS total rainfall 06 UTC 27-29 OCT 2014

AM - Obs



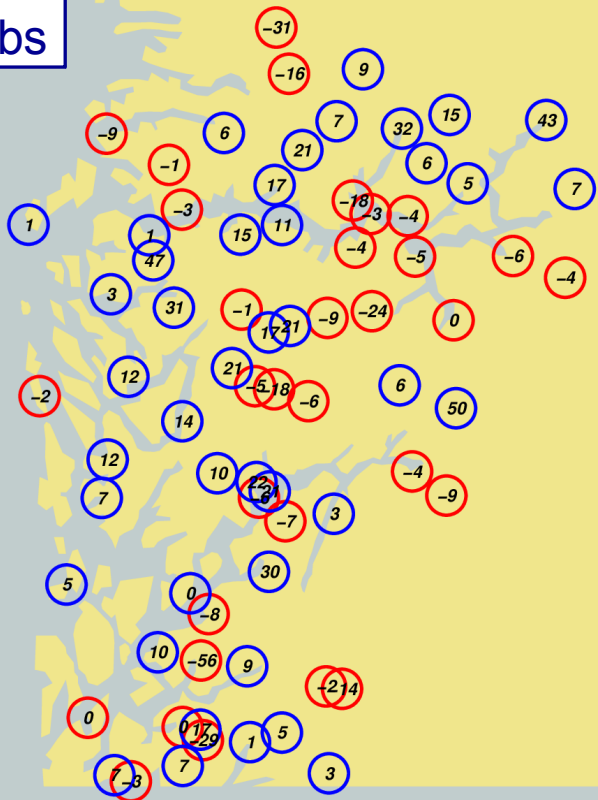
Observed 3 day total rainfall 06 UTC 27-29 OCT 2014



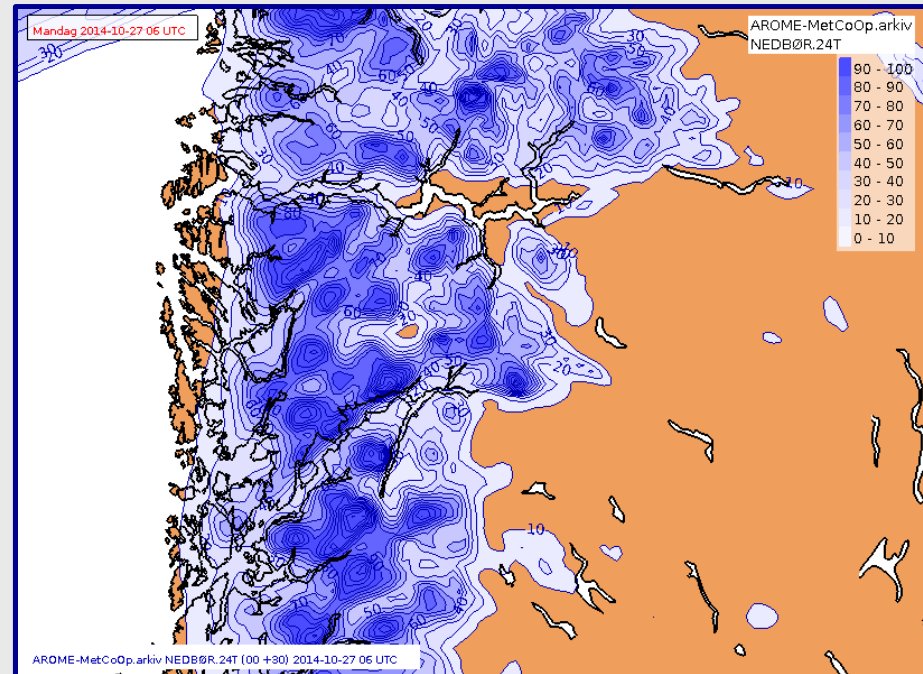
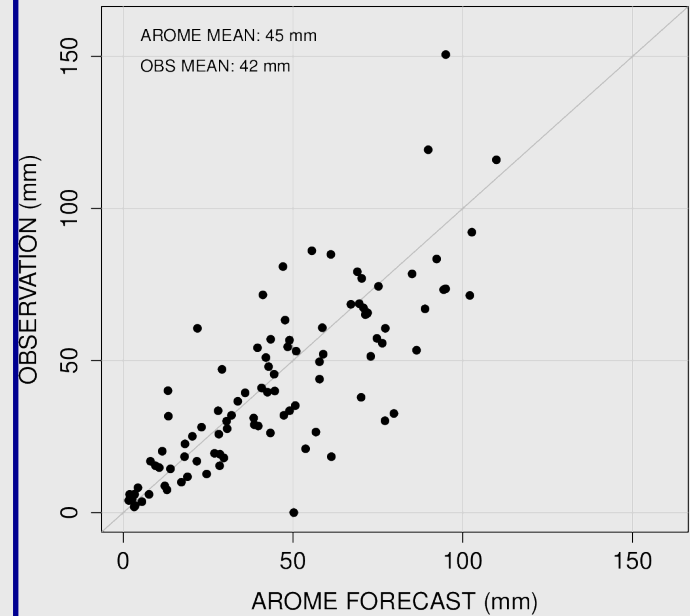
Precipitation Accumulation October 27

AROME-OBS total rainfall 06 UTC 27 OCT 2014

AM - Obs



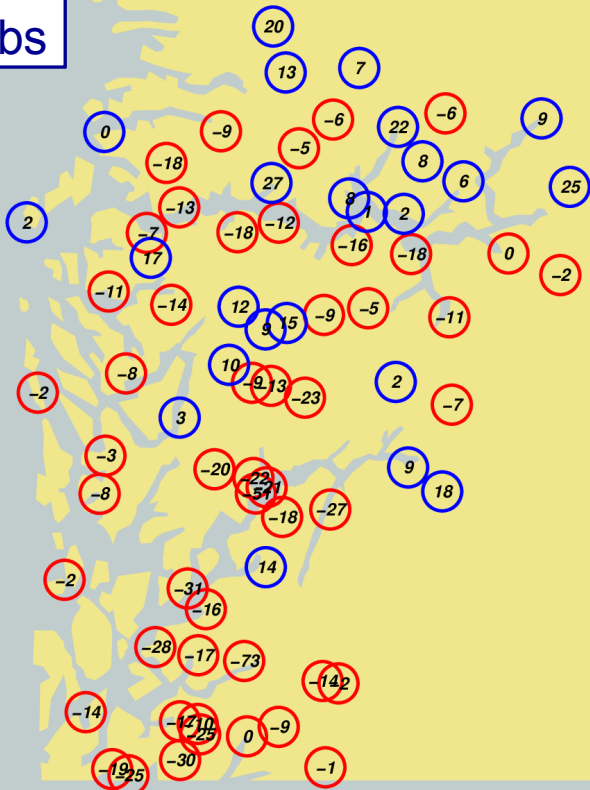
24h rainfall 06 UTC 27 OCT 2014



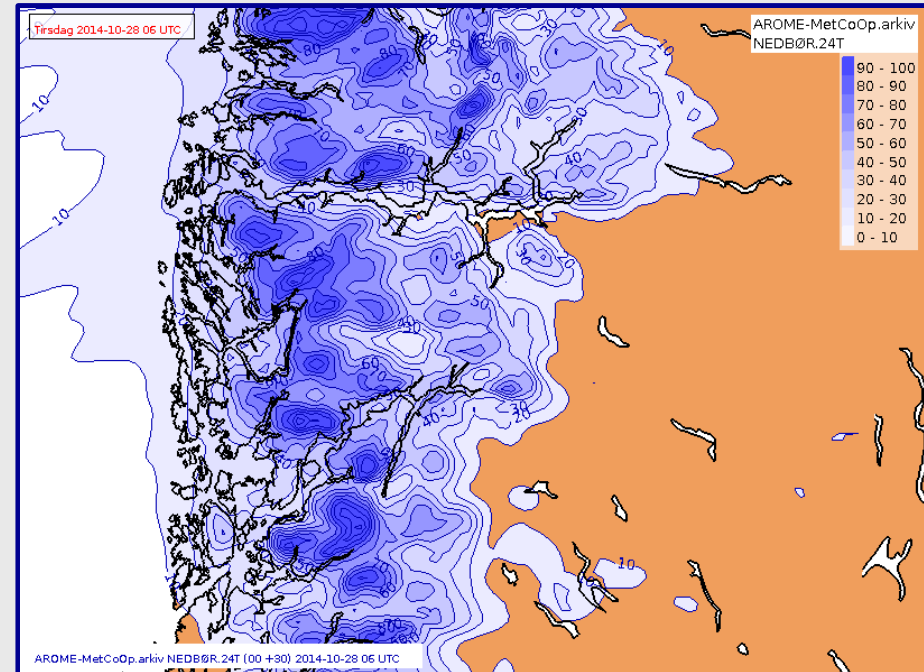
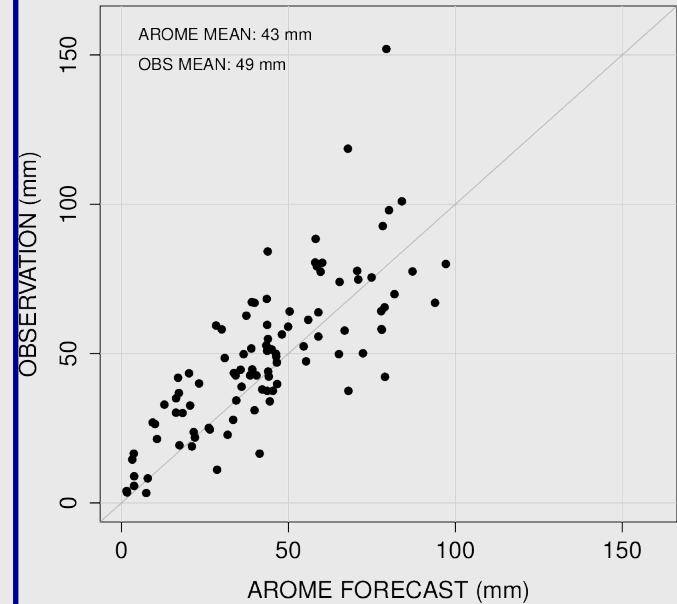
Precipitation Accumulation October 28

AROME-OBS total rainfall 06 UTC 28 OCT 2014

AM - Obs



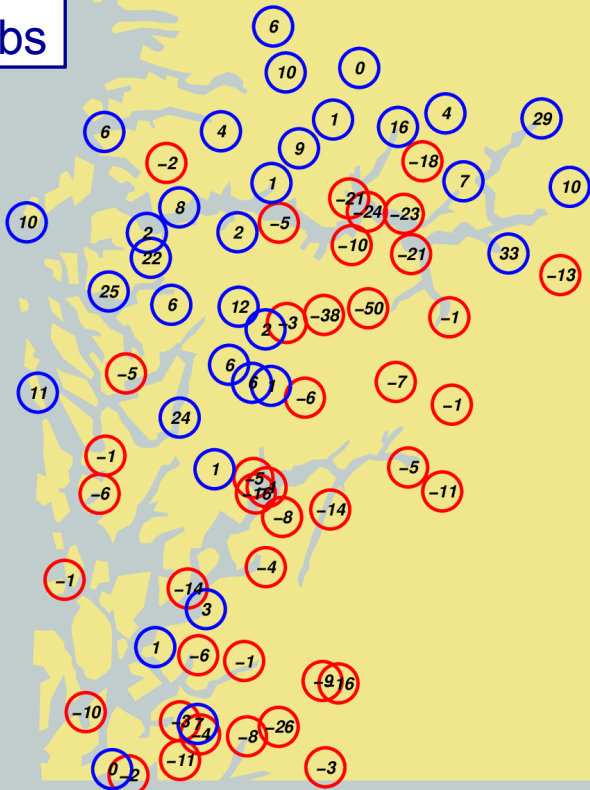
24h rainfall 06 UTC 28 OCT 2014



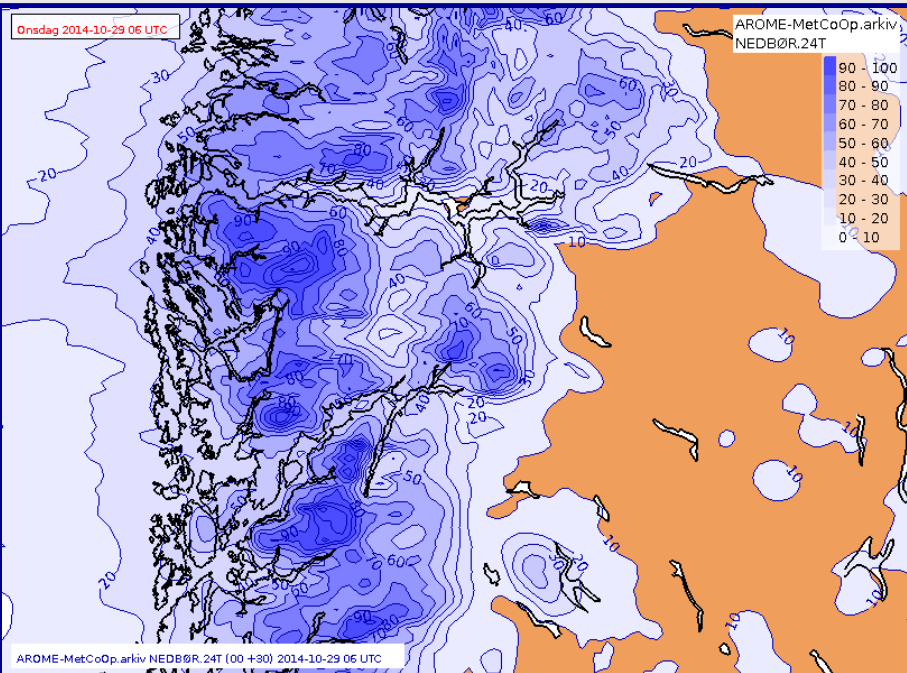
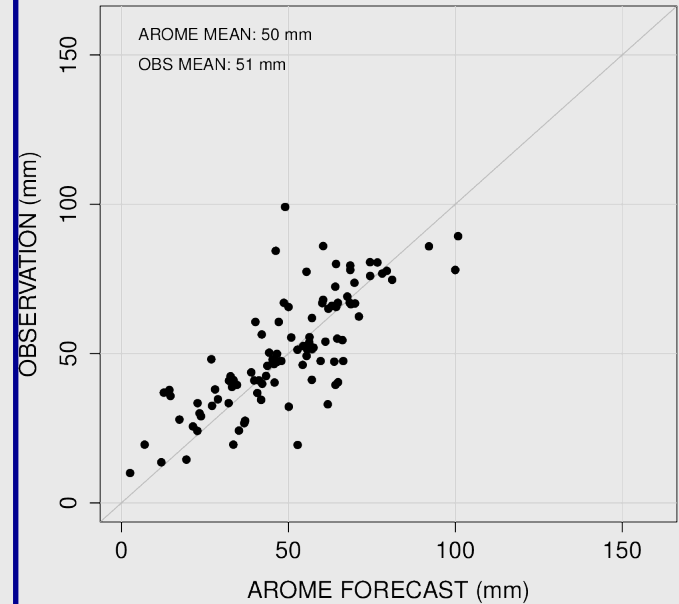
Precipitation Accumulation October 29

AROME-OBS total rainfall 06 UTC 29 OCT 2014

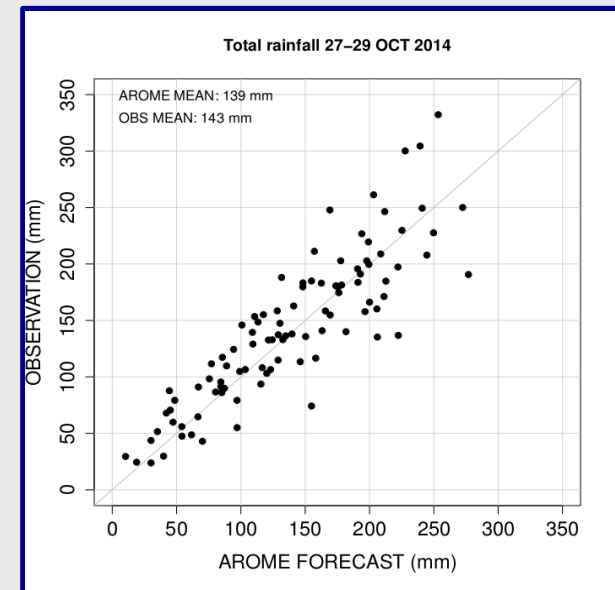
AM - Obs



24h rainfall 06 UTC 29 OCT 2014

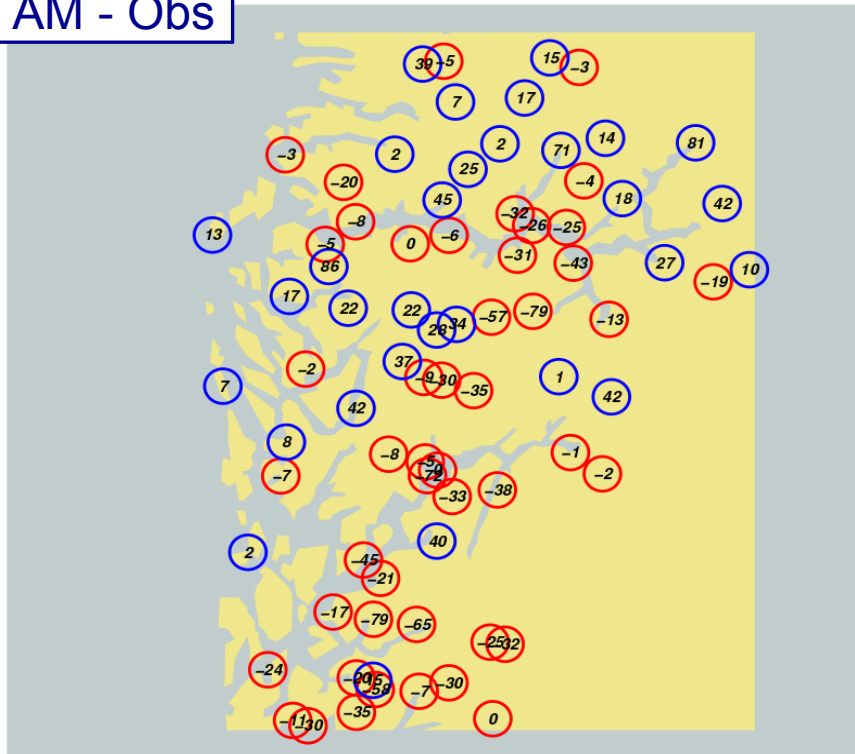


Precipitation Accumulation October 27-29

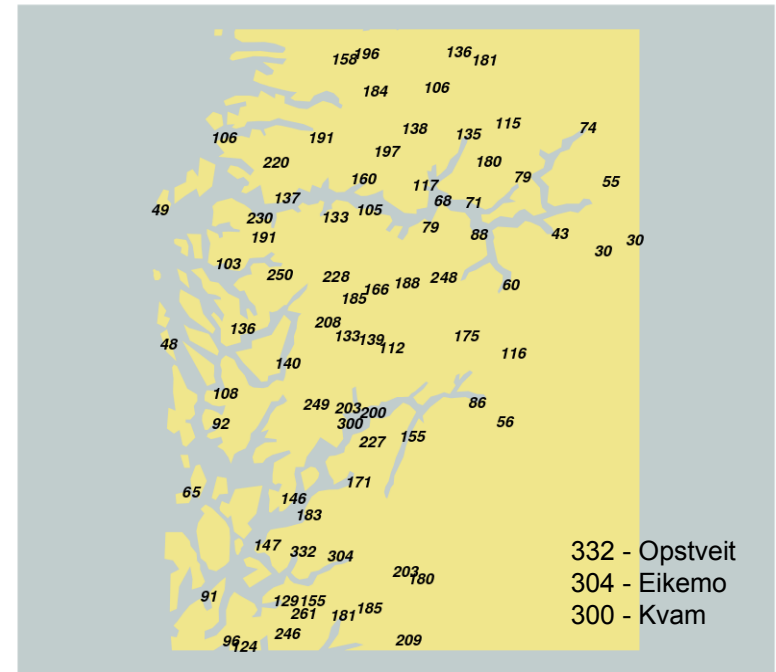


AROME-OBS total rainfall 06 UTC 27-29 OCT 2014

AM - Obs



Observed 3 day total rainfall 06 UTC 27-29 OCT 2014



High-resolution challenges

- (a bunch, but let's focus on)
- Near-miss issues
- Workaround – neighbourhood method

	O					
			X			
				O		

(..insert ad here..)

- 20/80 % on yr

Time for time

Detaljert

Langtidsvarsel

Værradar

Været som var

Værkart

AKTUELLE STEDER

[Oslo \(Blindern\) målestasjon](#)

[Folgefonna skisenter målestasjon](#)

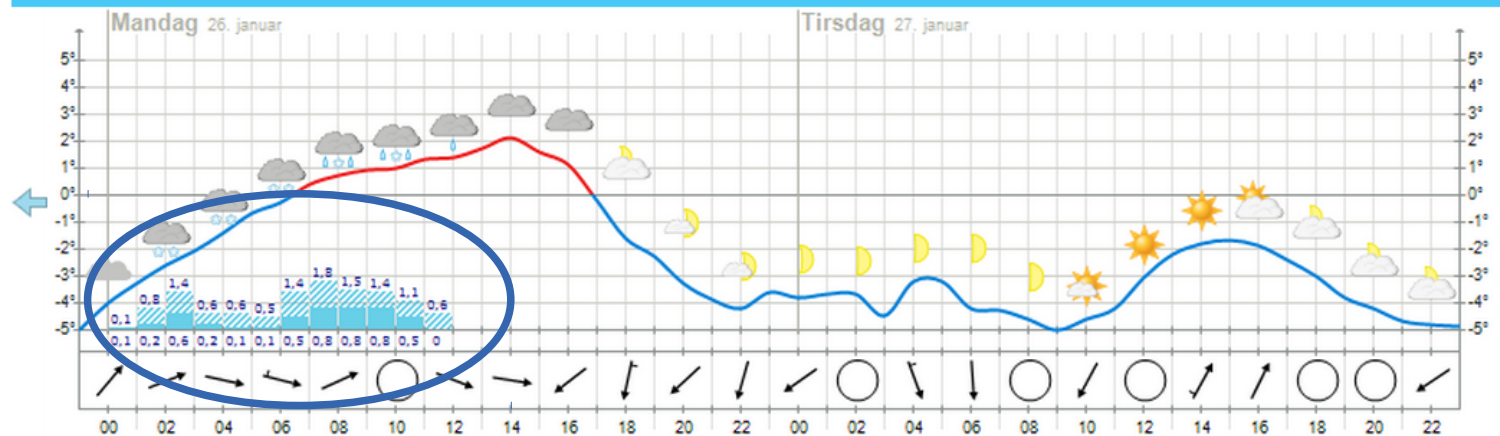
[Oslo](#)

Til hovedmeny i bunnen av sida



OBS-varsel for Oslo: Natt til mandag tære for regn som tryser på bakken.

Meteogram, neste 48 timer



I dag og i natt, 25. januar 2015

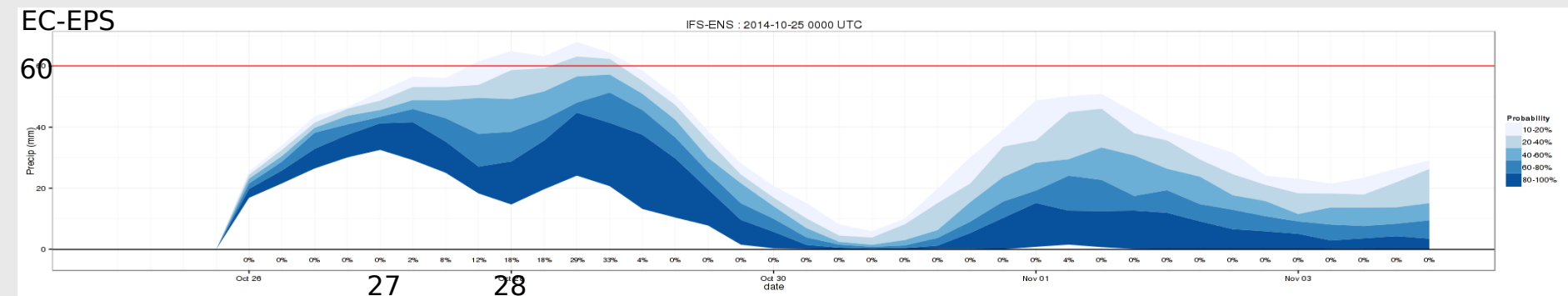
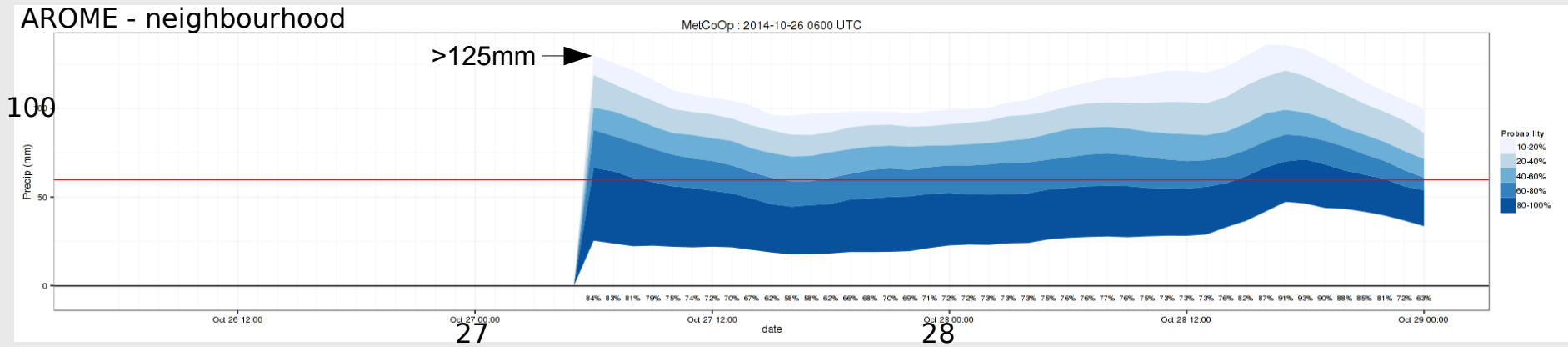
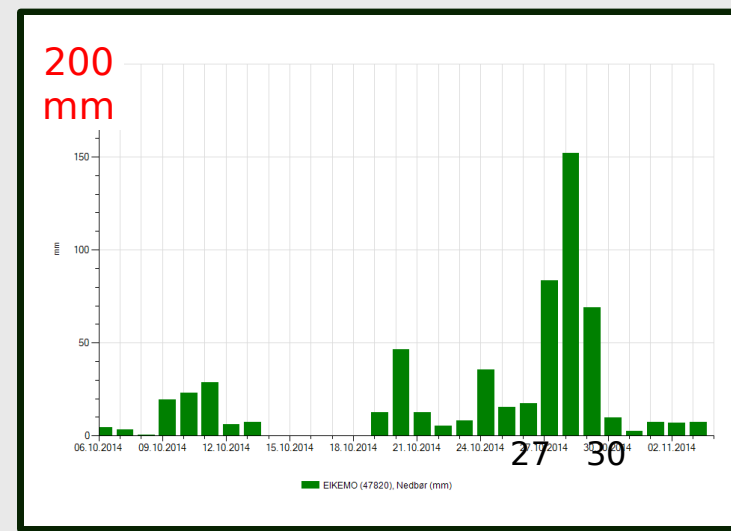
Tid	Varsel	Temp.	Nedbør	Vind
søndag kl 23		-5°	0 mm	↘ Flau vind, 1 m/s fra sørvest
mandag kl 0		-4°	0,1 mm	○ Stille, 0 m/s

27. januar 2015

Tid	Varsel	Temp.	Nedbør	Vind
tirsdag kl 0		-4°	0 mm	○ Stille, 0 m/s
tirsdag kl 1		-4°	0 mm	○ Stille, 0 m/s

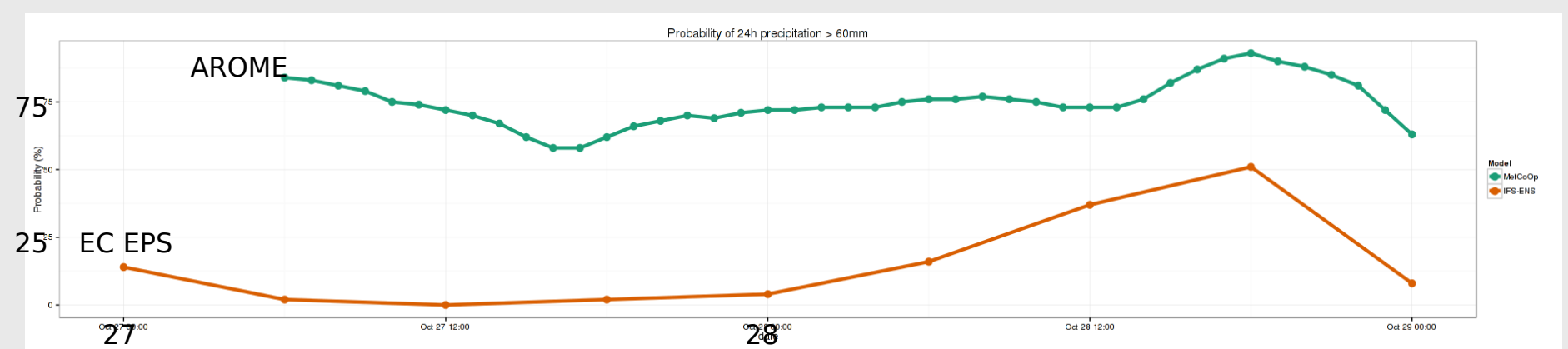
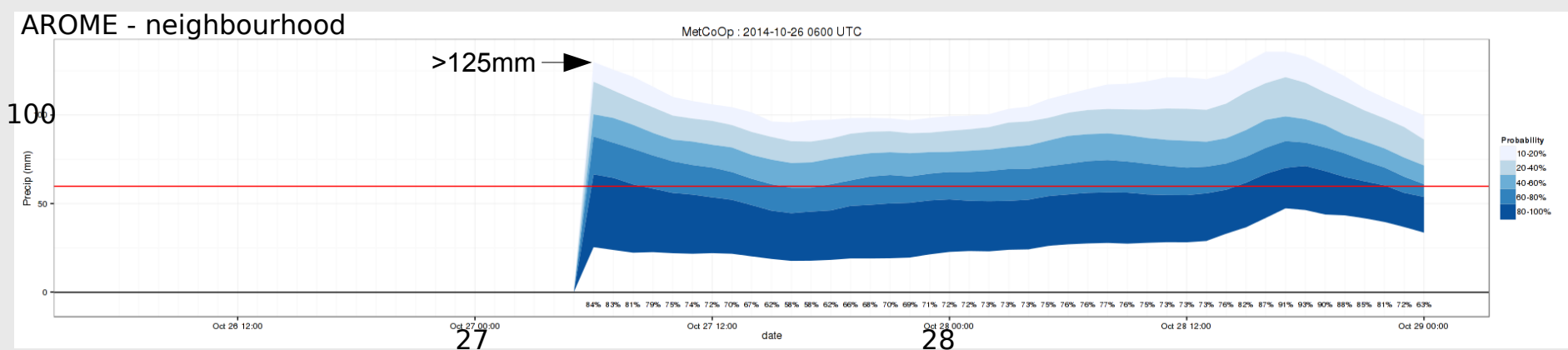
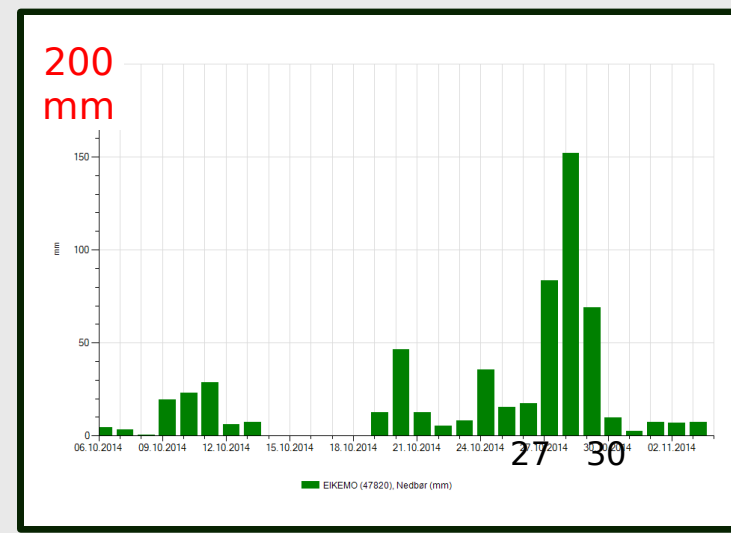
Two kinds of probability

- Eikemo

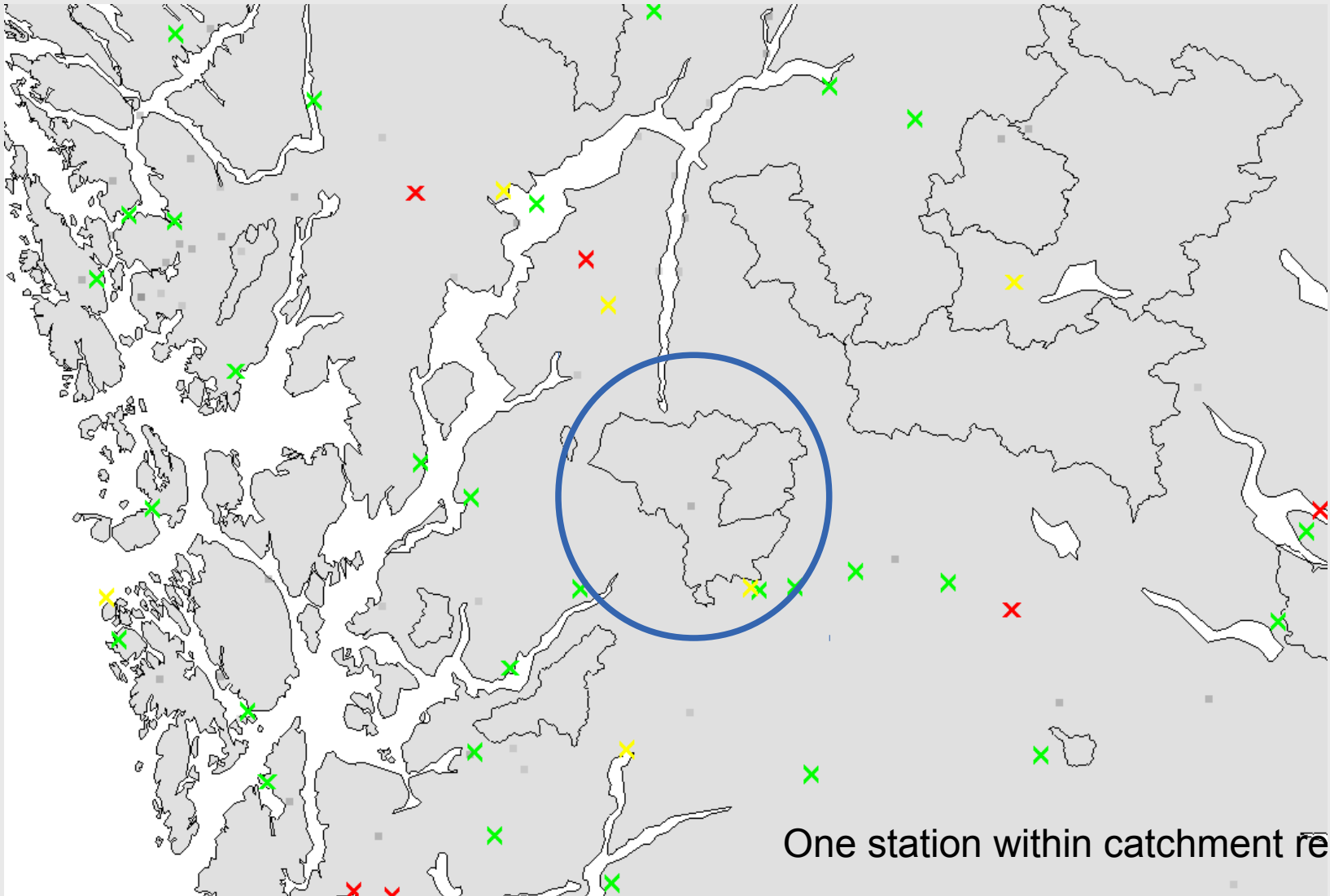


Two kinds of probability

- Eikemo

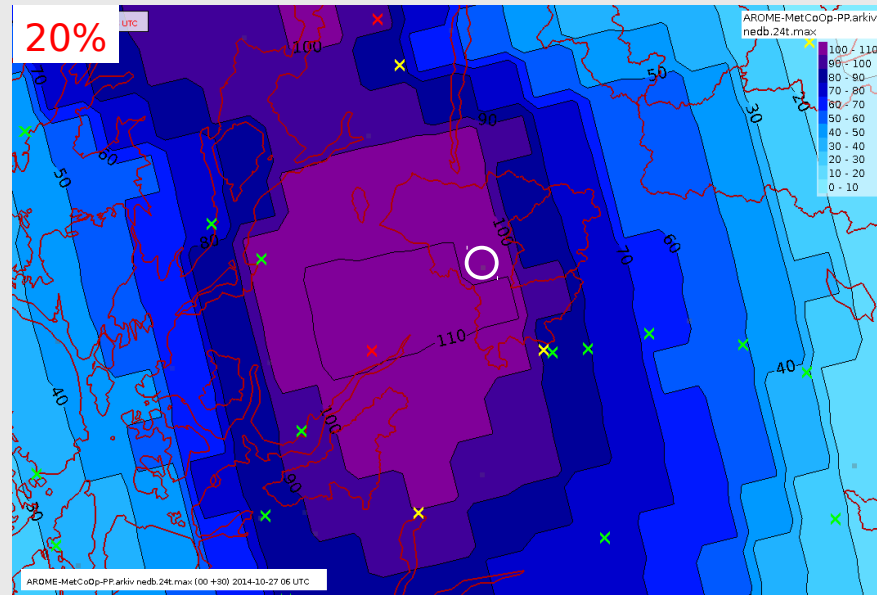
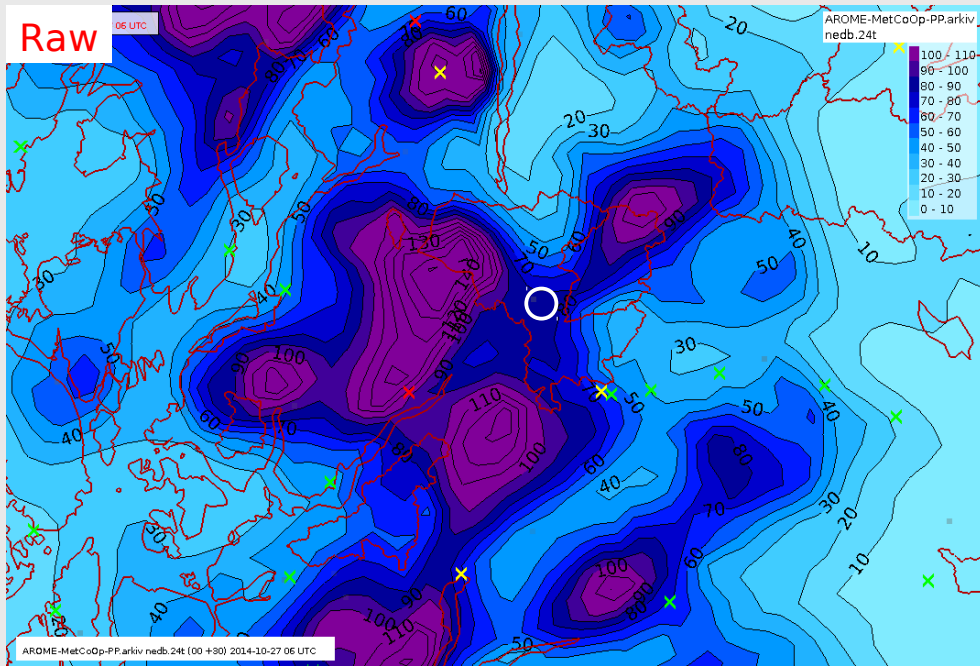
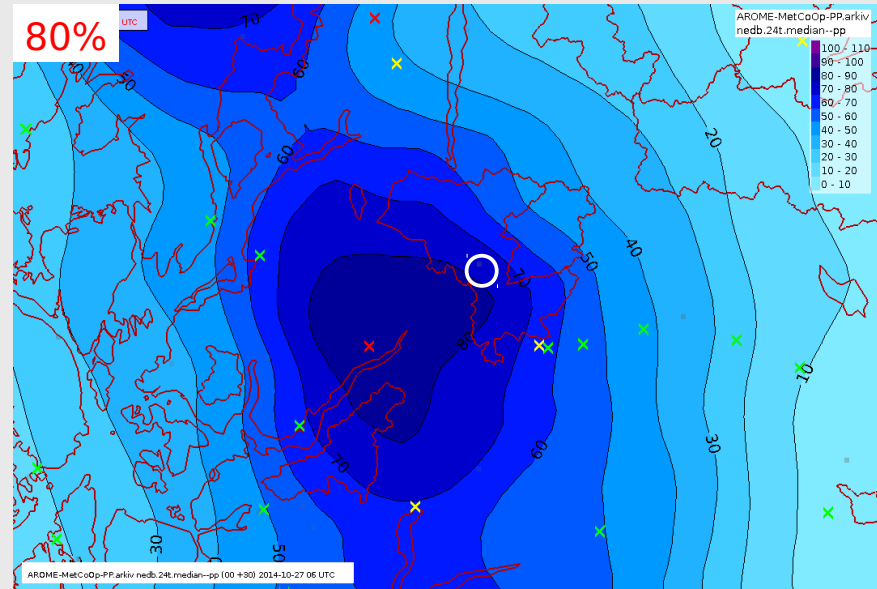


Odda



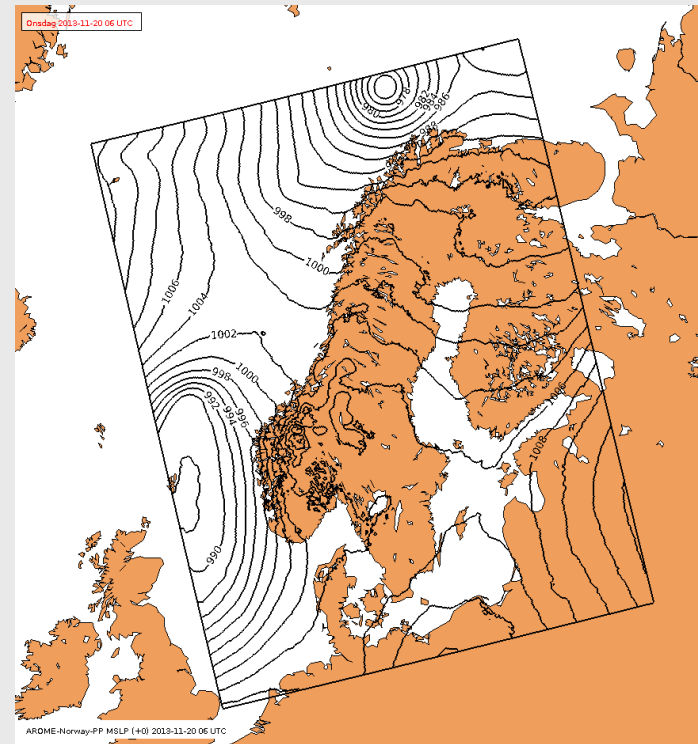
One station within catchment region

Odda – 27. Oct

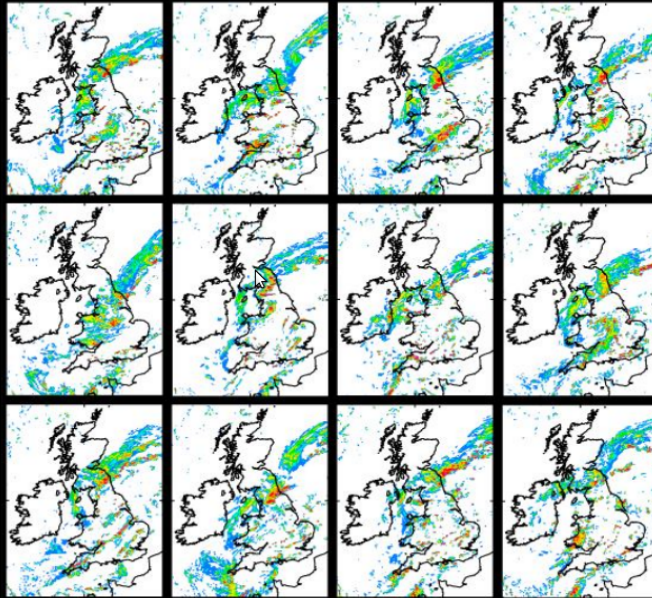


Next steps

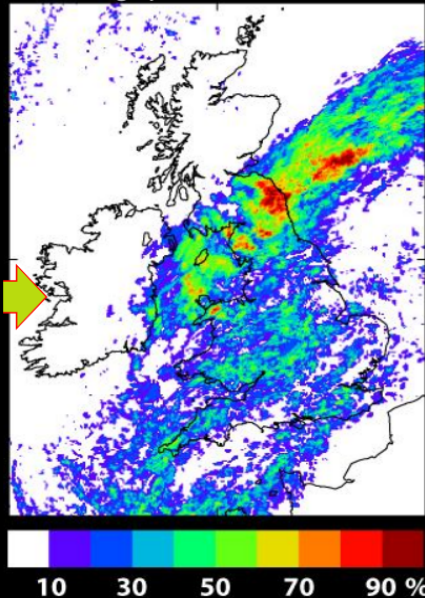
- AROME-EPS – time is ripe!
 - In test now, operational 2016
 - 8 AROME members, 2.5 km (+1 ALARO control)
- Ensemble flood calculations; NVE v/ Trine Egdahl
- Post processing of EPS



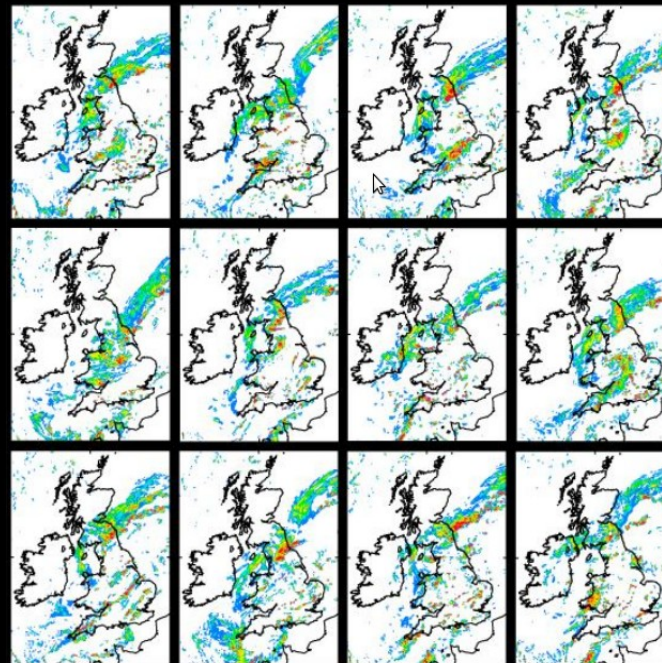
Met Office



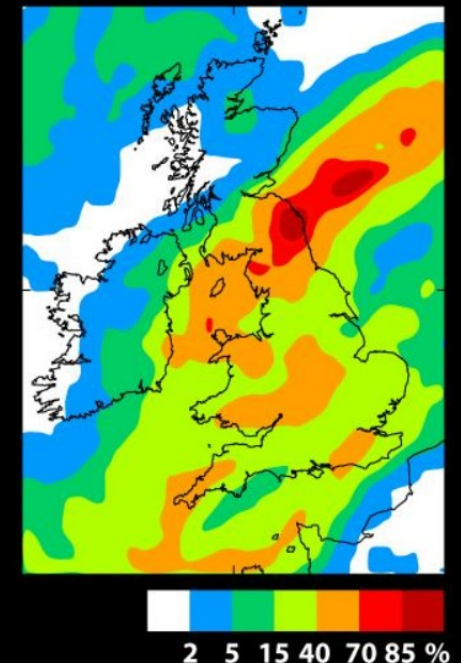
Insufficient ensemble size leaves gaps



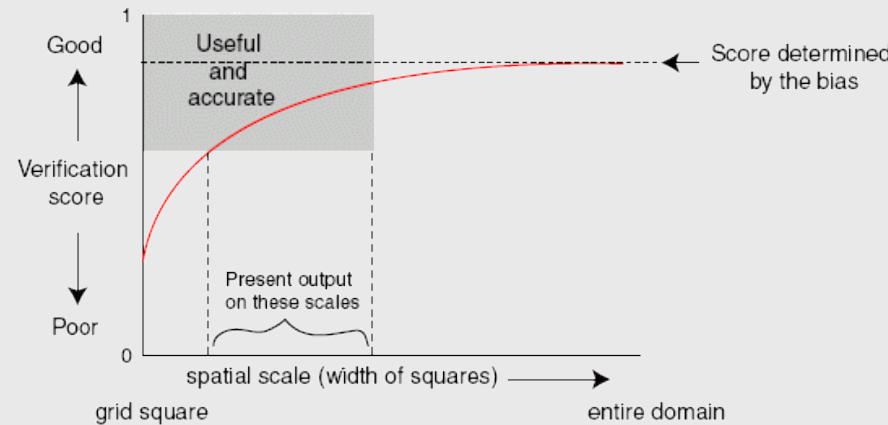
Met Office



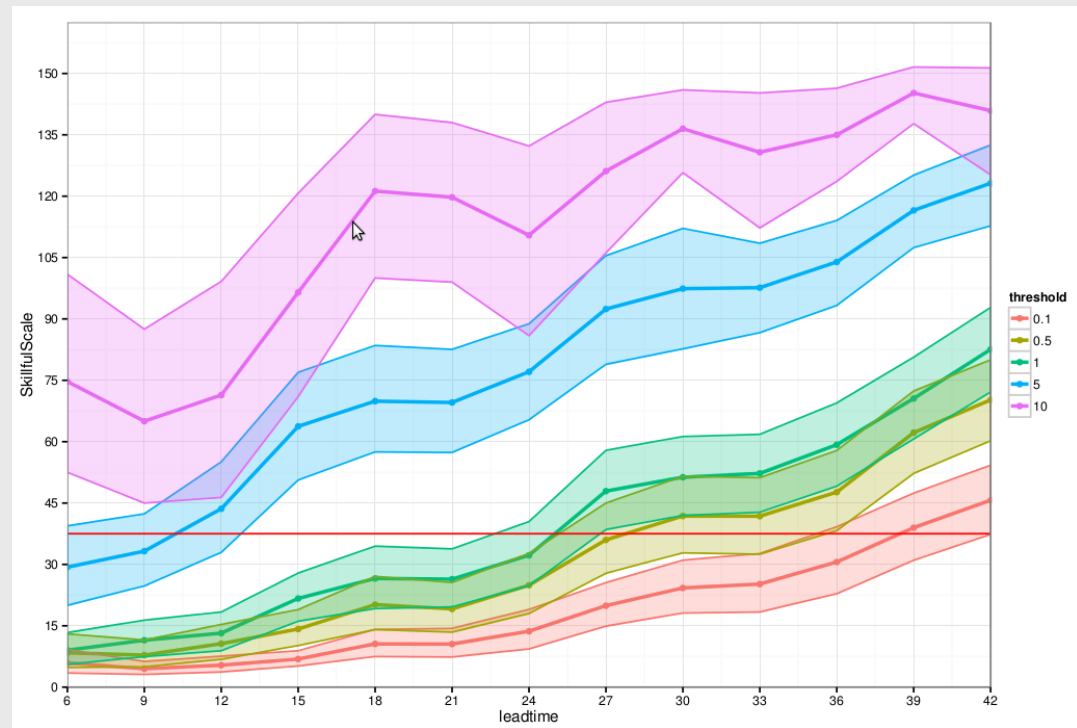
Probability of rain in period around the time of interest



Adaptive neighbourhood



- Based on FSS between members
- Region increases with threshold and lead time
 - Data from HarmonEPS summer 2013



From model to decisions

- Predictable cold season wet event
- NOT Extreme Event (© MET Norway)
 - what is an extreme event?
- How is our data used?
 - Raw data, pp products, general public
- Verification – unfavourable station locations, radar challenges
 - Use of river discharge for precip validation?

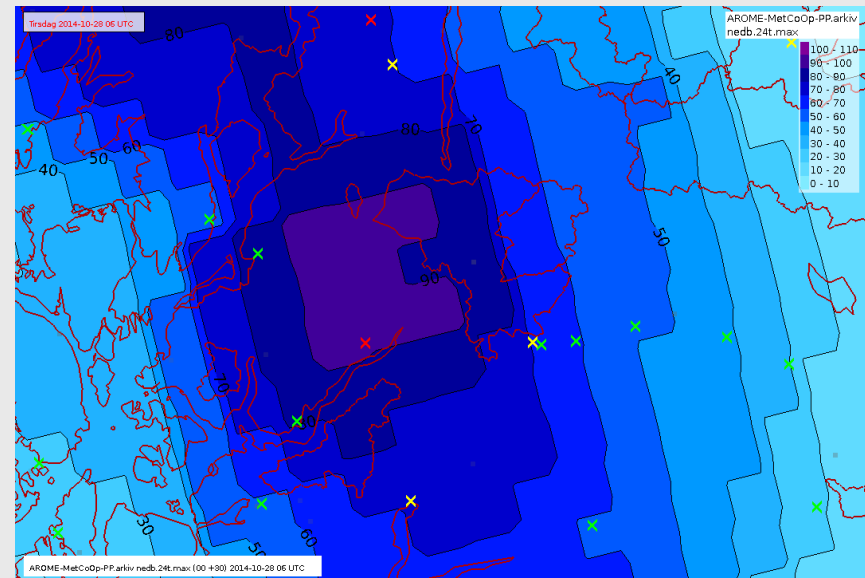
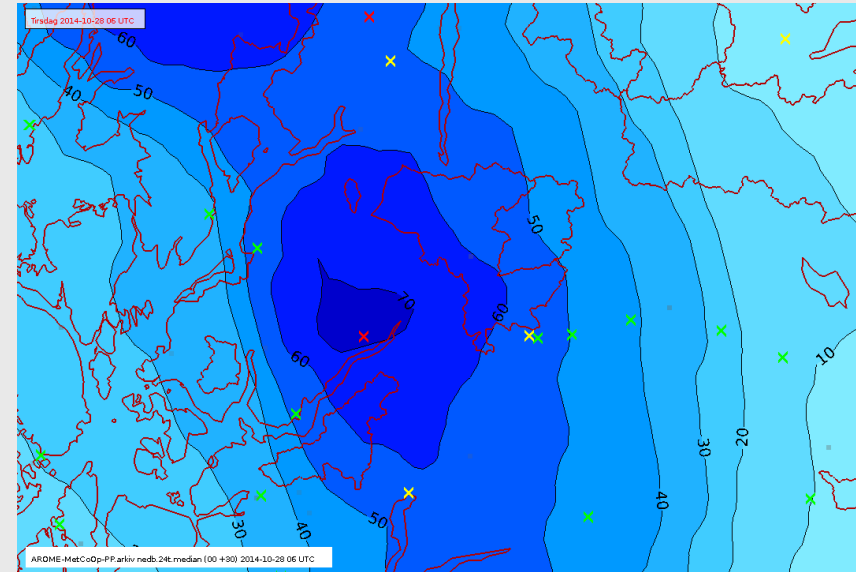
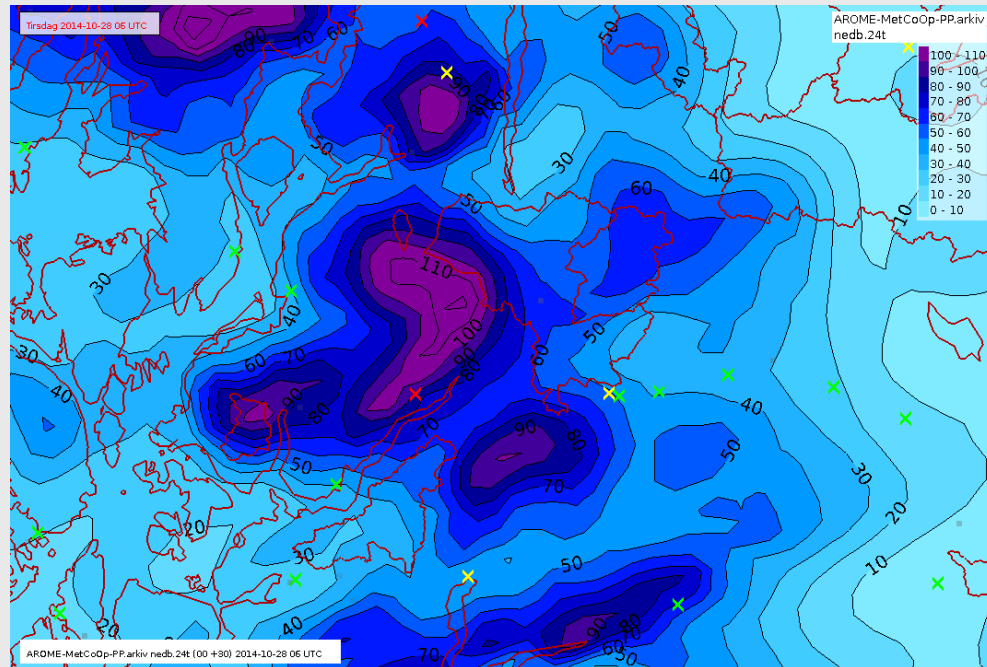


Meteorologisk
institutt

Takk

Extras

Odda – 28. Oct



Odda – 29. Oct

