



Forecasting and modelling the high impact effects of Storms for the UK transport and European Energy Sector

Dr Lara Gunn

About us...

- Site specific temperature and condition forecasts for the transportation community supported by our meteorologists 24/7/365
- Provide fast, flexible and reliable data services for energy traders
- Specialist asset specific forecasts updated in real time
- Long range and seasonal forecasts



How we achieve this

- We use a suite of numerical weather models and observations to tailor forecasts to customers
- ECMWF, UK Met Office, GFS, GEM, CMC, HIRLAM
- In-house models
- Radar and satellite tools

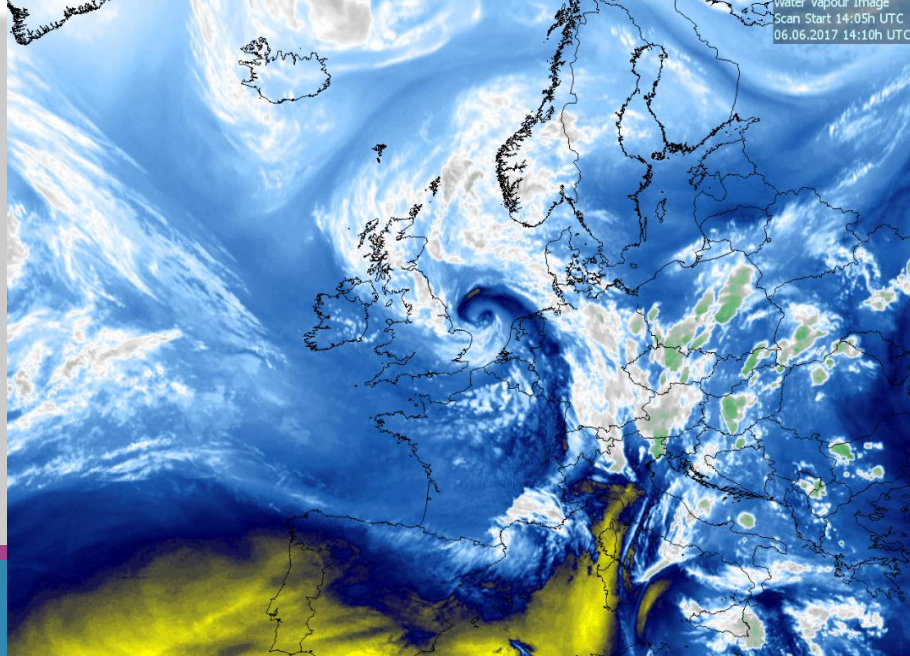
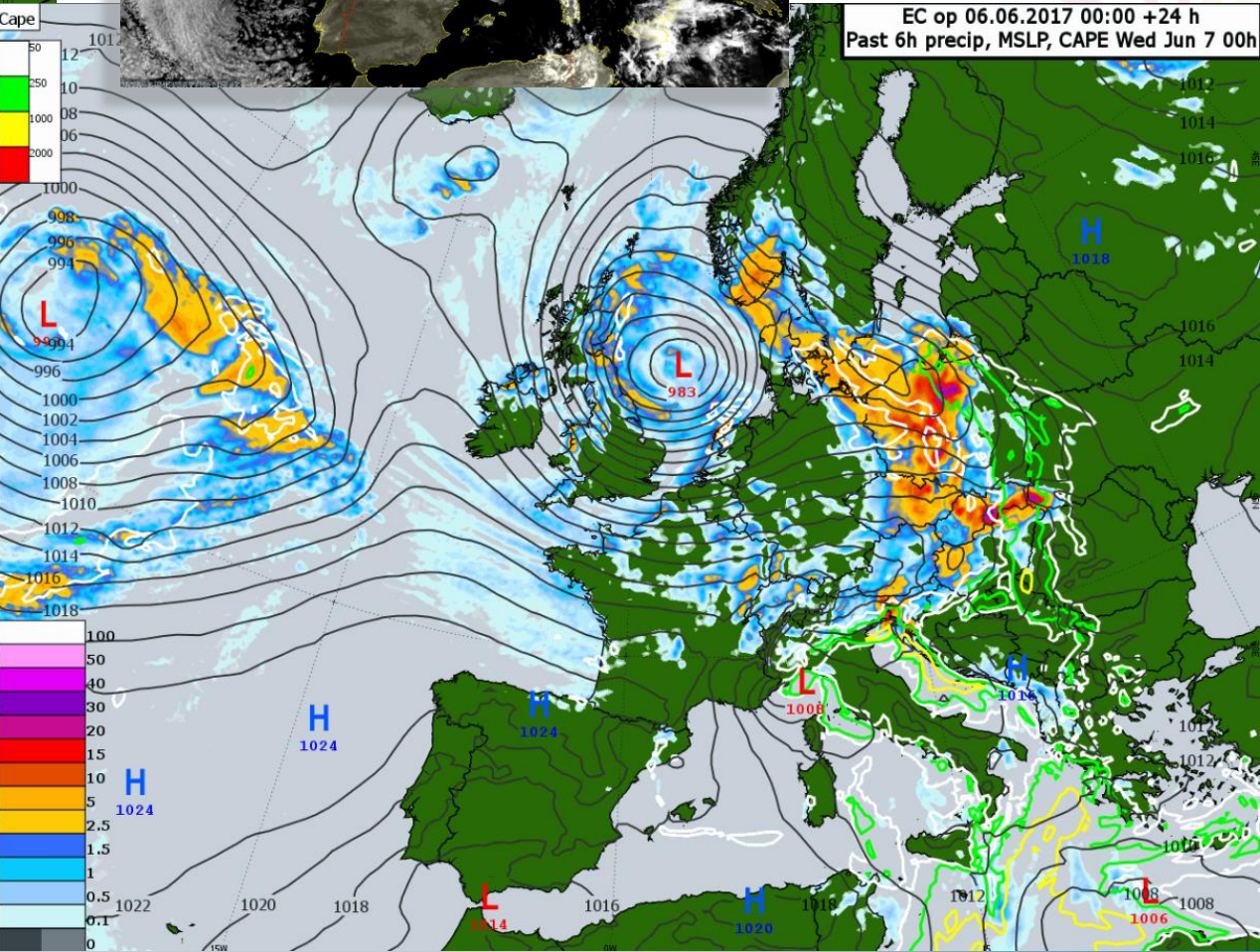
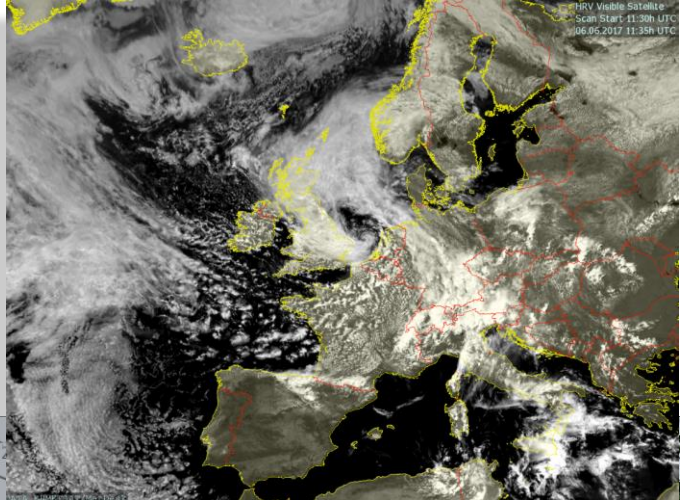
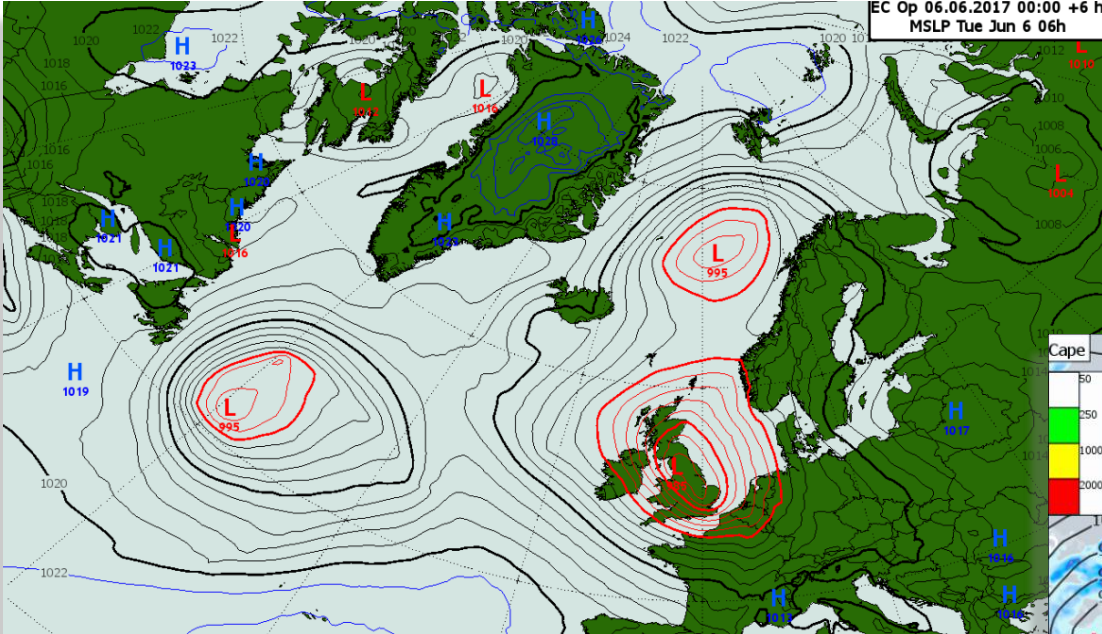


Summary

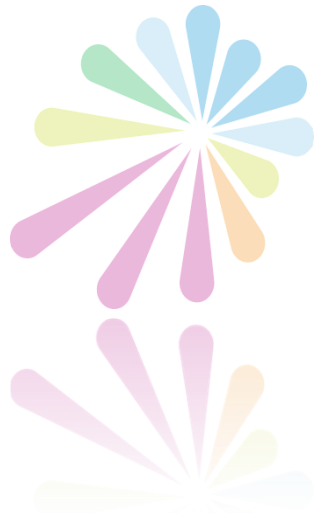
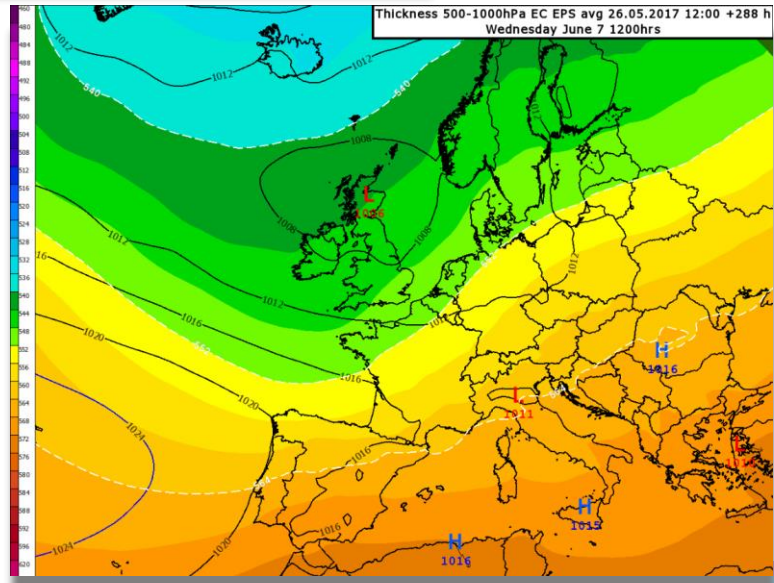
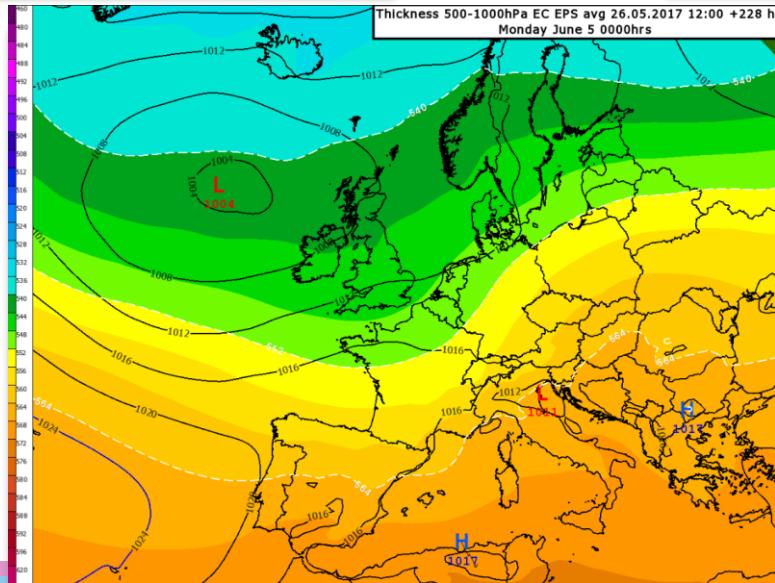
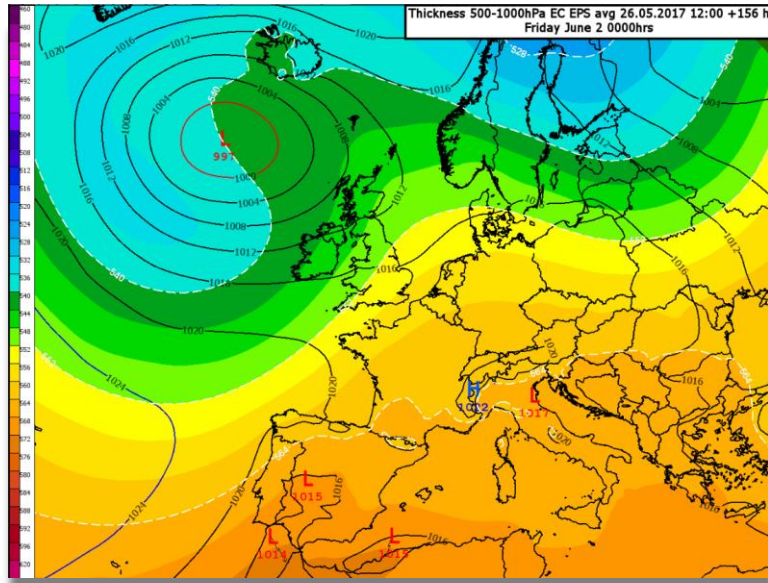
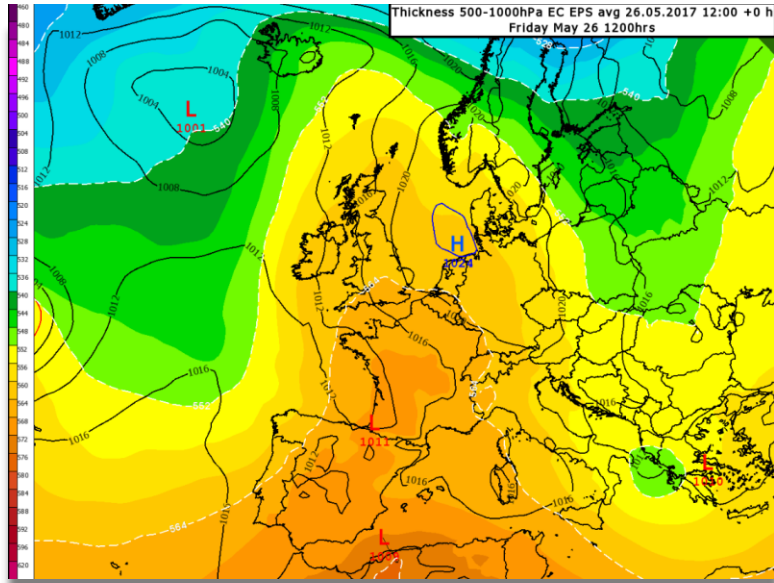
- Last week's weather in the UK and the impacts on UK transport
- In house modelling used for the UK rail and road networks
- Last week's weather in Europe and impact for renewable energy



Last week in Europe



Late May



Rail 10 Day Forecasts



National 10 day forecast issued on **Friday 26th May 2017**

STAYING DRY AND HOT TODAY, BEFORE TURNING MORE THUNDERY INTO THE WEEKEND. **RISK OF TORRENTIAL DOWNPOURS AND LOCALISED FLOODING IN THE SOUTH ON SUNDAY NIGHT.** COOLER INTO NEXT WEEK WITH FINE WEATHER RETURNING FOR A TIME, BUT **MORE CHANGEABLE AGAIN LATER INTO THE WEEK.**

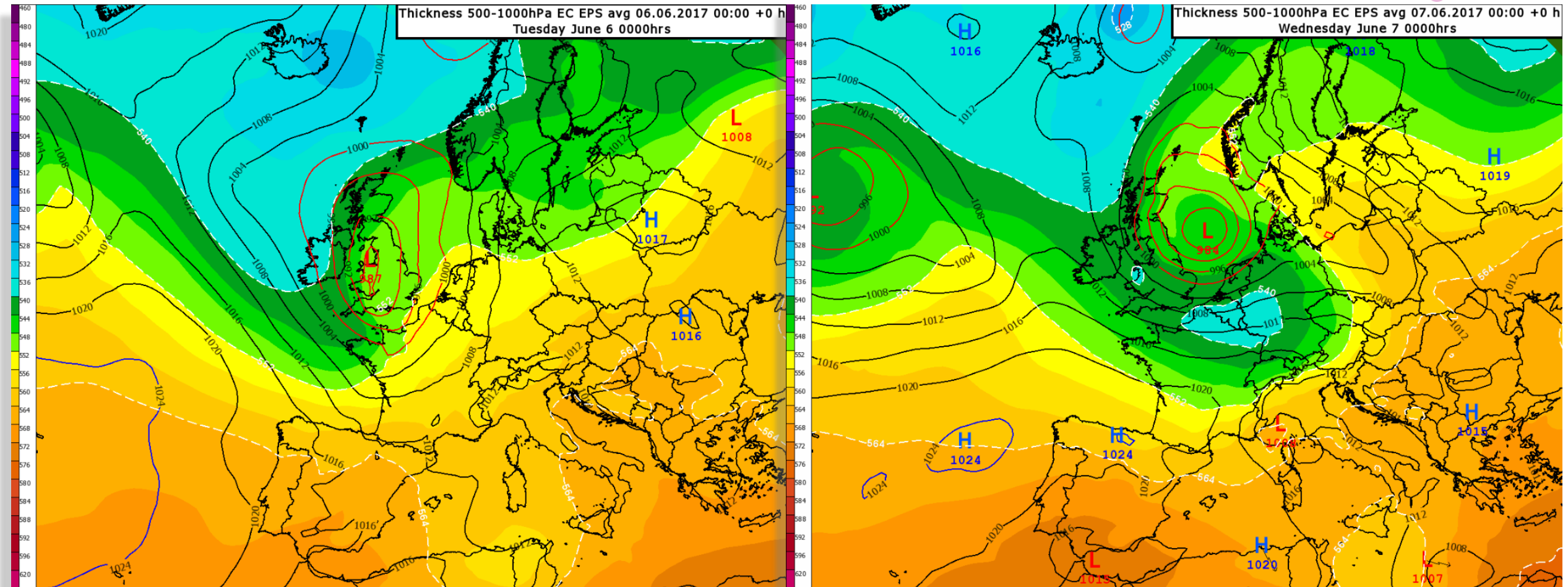
Wednesday 7th June to Saturday 10th June:

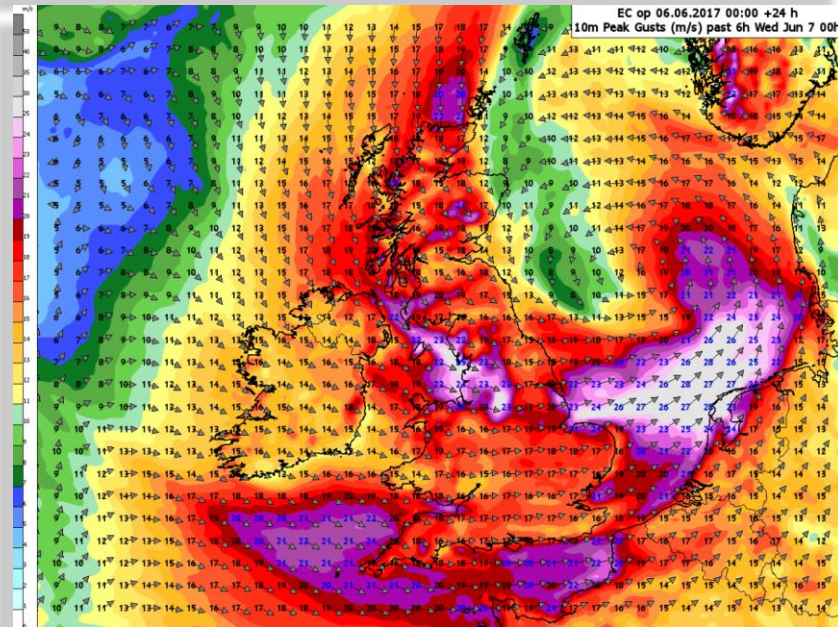
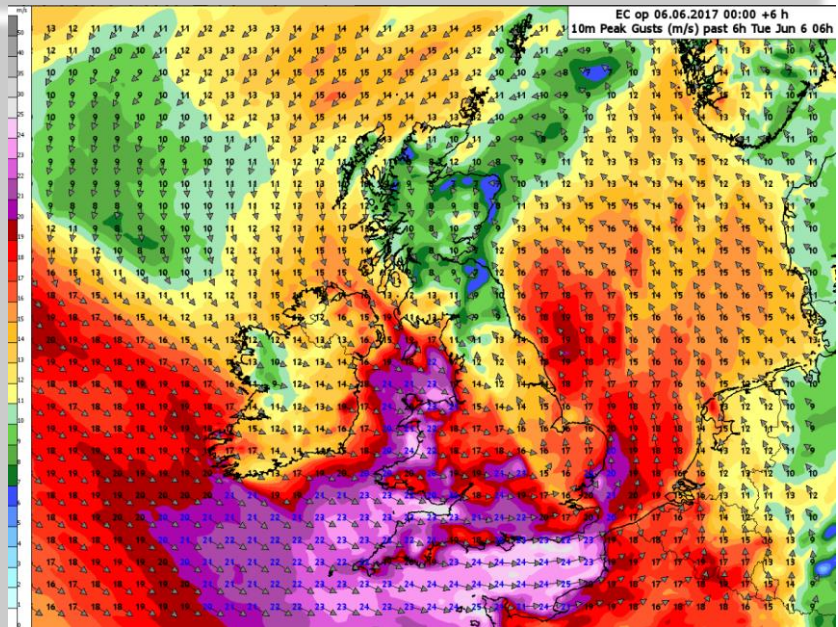
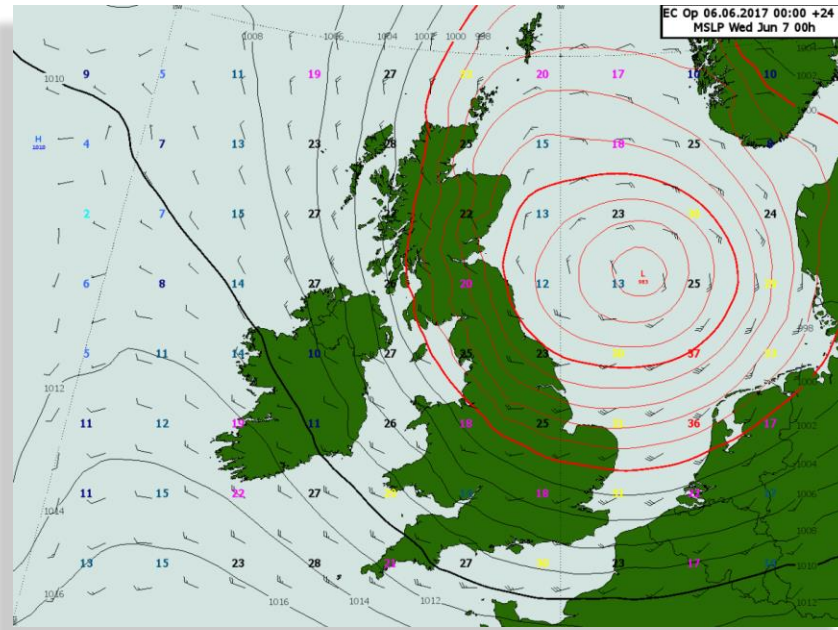
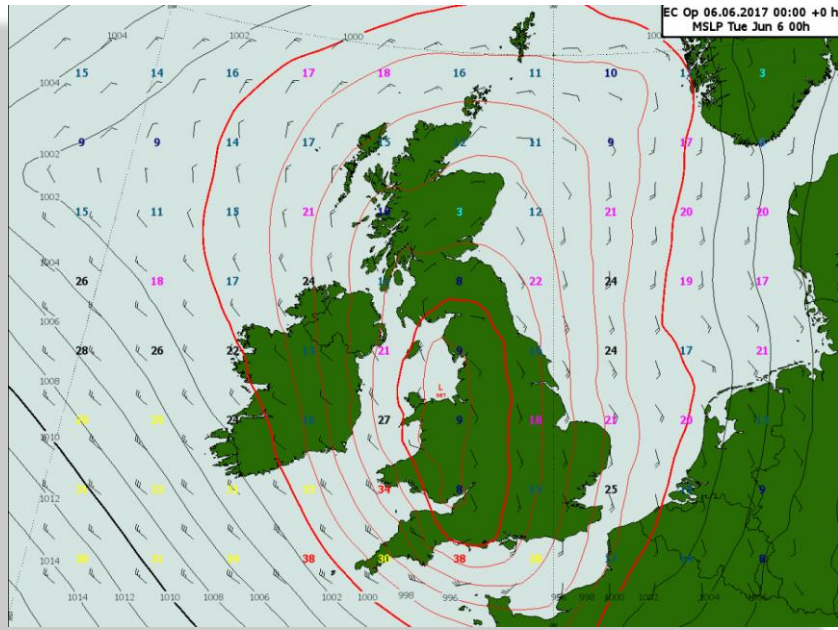
The unsettled theme looks set to continue, **with further outbreaks of rain and brisk winds sweeping in from the west.** Temperatures perhaps returning to above average later in the week, particularly further south.

Energy Briefing

HEADLINE: VERY WARM OR HOT ACROSS WESTERN EU THIS WEEK, WITH A NOTICEABLE BOOST IN AIRCON LOAD, ESPECIALLY TOWARDS THE WEEKEND. COOLER, BREEZIER AND MORE UNSETTLED IN THE EAST. STAYING WARM FOR MANY NEXT WEEK, BUT HIGH PRESSURE DRIFTS S/SE NEXT WEEK ALLOWING **A SOMEWHAT MORE PROGRESSIVE FLOW IN THE N/W.** WARM IN THE SOUTH FOR WEEK 23, BUT A **TOUCH COOLER AND MORE UNSETTLED IN THE NORTH, ESPECIALLY FIRST HALF OF THE WEEK.**

June 6th and 7th 2017





UK Wind

Rail Forecast



Scotland	Wind		Heavy Rain		Snow		Frost		Min Temp Morn (06-11)	Max Temp (06-18)	Min Temp (18-06)	Temp Range		Ice Day		Lightning Risk		Freezing Fog	
	Hazard	Confidence	Hazard	Confidence	Hazard	Confidence	Hazard	Confidence				Hazard	Confidence	Hazard	Confidence	Hazard	Confidence	Hazard	Confidence
Perth	Adverse	High	Extreme	High		High		High	7.5	13.5	4.5		High		High		High		High
Glasgow		Low	Adverse	Medium		High		High	7.0	13.5	4.0		High		High		High		High
Highland	Aware	High	Extreme	High		High		High	6.5	10.5	3.5		High		High		High		High
Motherwell	Aware	High	Adverse	High		High		High	7.5	13.0	4.0		High		High		High		High
Edinburgh	Aware	High	Extreme	High		High		High	9.5	13.5	5.5		High		High		High		High

Day 1 Tue 06-06-2017 06:00 to Wed 07-06-2017 06:00			
A blustery day today with the strongest of winds expected through the afternoon and evening hours across England and Wales. Wind gusts of between 50-55mph are expected in places before easing slightly during the night. Winds picking up across parts of northern England and Scotland overnight with wind gusts between 40-50mph.			
Route/Subroute	Period exceeding 40mph	Max Gust	Time of Max Gust
Scotland - Perth	19-06	51	01:00
Scotland - Glasgow			
Scotland - Highland	21-02	46	23:00
Scotland - Motherwell	07-06	45	01:00
Scotland - Edinburgh	01-06	42	04:00
LNW North - Cumbria	07-06	50	01:00
LNW North - Lancashire	10-06	51	01:00
LNW North - Central West	06-06	52	18:00
LNW North - Central East	10-06	52	03:00



UK Transport Network

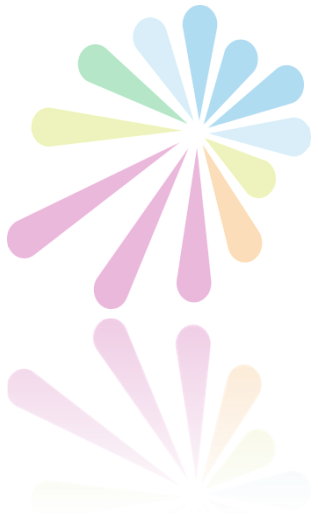


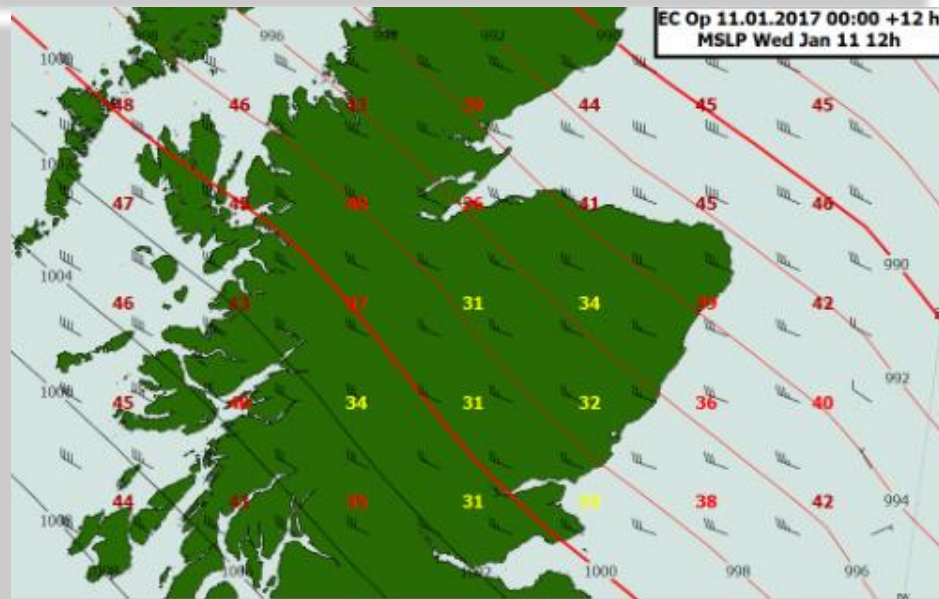
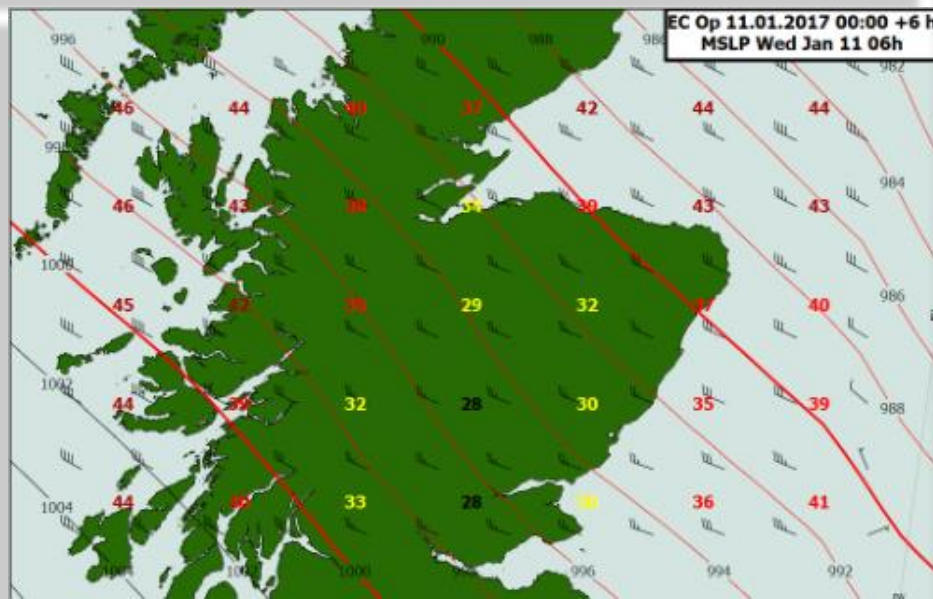
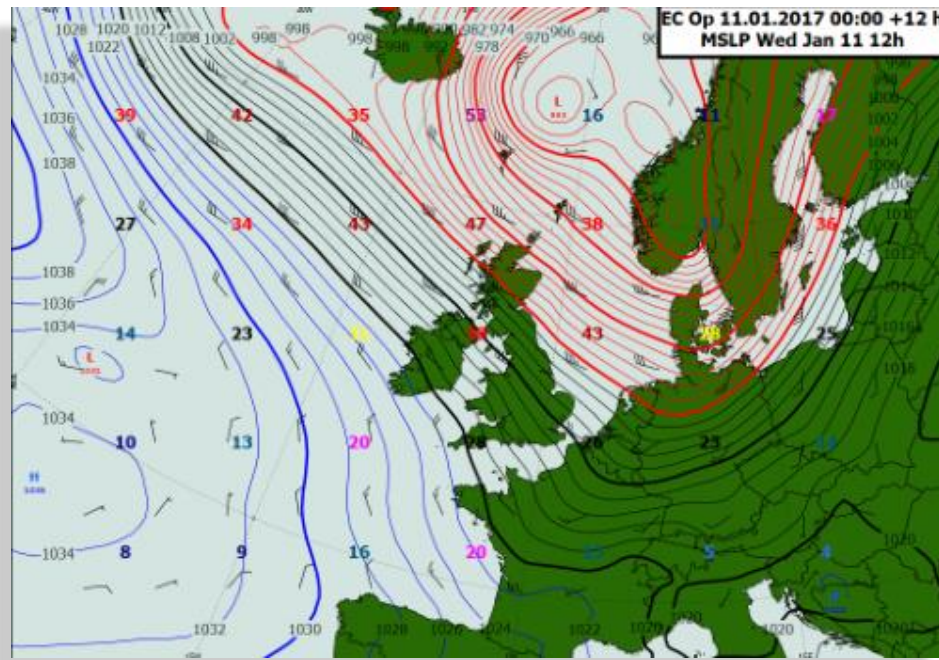
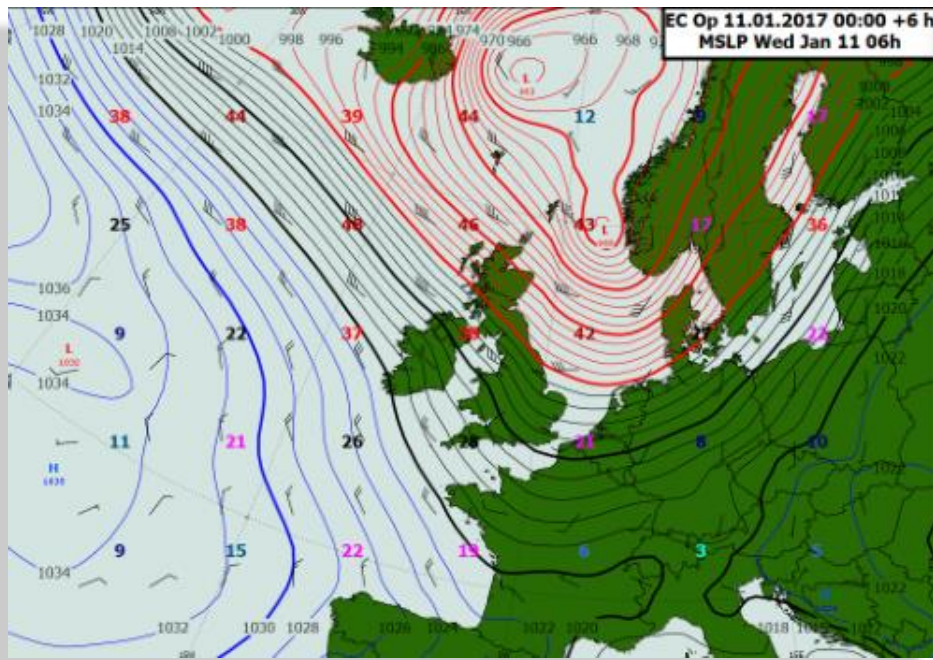
Routes	DTG	Max Temp (C)	Min Temp (C)	Wind Speed (mph)	Wind Gust (mph)	Precip (mm)
Scotland	06/06 07:00	11.8	8.2	26	35	3.2
LNW North	06/06 07:00	13.5	8.3	37	46	3.4
LNW South	06/06 07:00	12.2	8.0	20	30	2.2
LNE and EM	06/06 07:00	14.2	9.1	22	29	4.0
Anglia	06/06 07:00	14.5	11.0	19	30	1.0
Wales	06/06 07:00	11.6	7.9	38	51	2.6
Western	06/06 07:00	12.5	8.2	32	45	2.2
Wessex	06/06 07:00	12.5	8.7	45	60	6.2
South-East	06/06 07:00	11.8	9.0	29	46	3.0

Routes	DTG	Max Temp (C)	Min Temp (C)	Wind Speed (mph)	Wind Gust (mph)	Precip (mm)
Scotland	07/06 07:00	11.1	6.4	40	63	2.4
LNW North	07/06 07:00	12.1	8.0	36	47	0.0
LNW South	07/06 07:00	12.8	10.1	16	30	0.0
LNE and EM	07/06 07:00	12.3	6.8	31	44	3.0
Anglia	07/06 07:00	13.0	10.7	30	48	0.0
Wales	07/06 07:00	12.2	8.4	23	35	0.0
Western	07/06 07:00	13.4	9.3	22	29	0.0
Wessex	07/06 07:00	13.0	9.4	31	39	0.0
South-East	07/06 07:00	13.0	10.6	23	40	0.0

Bridge Model Wind Storm Alerts



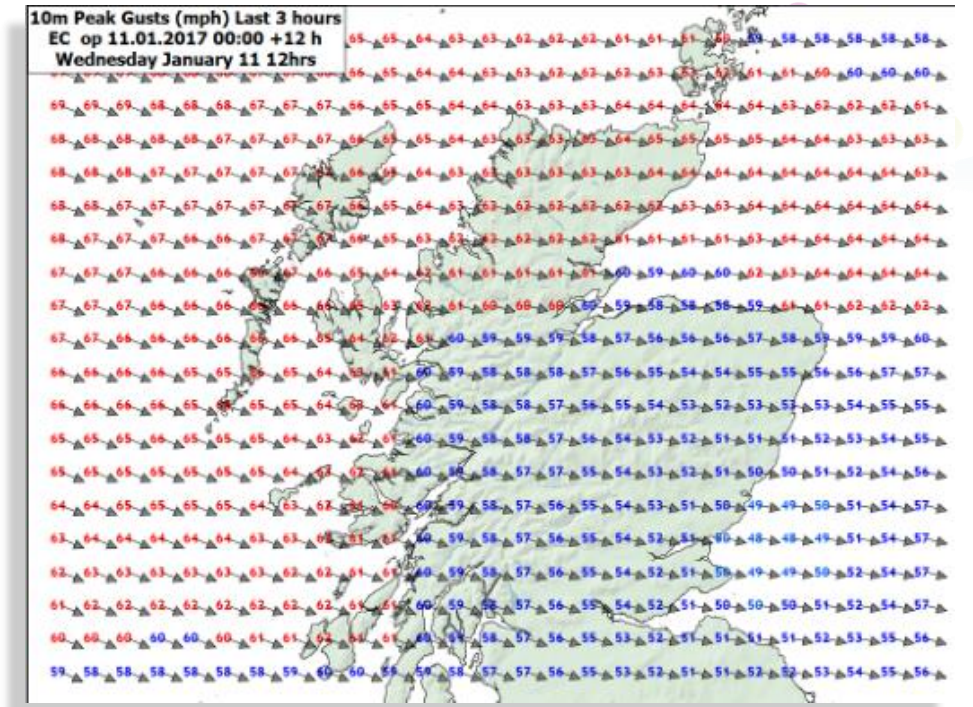
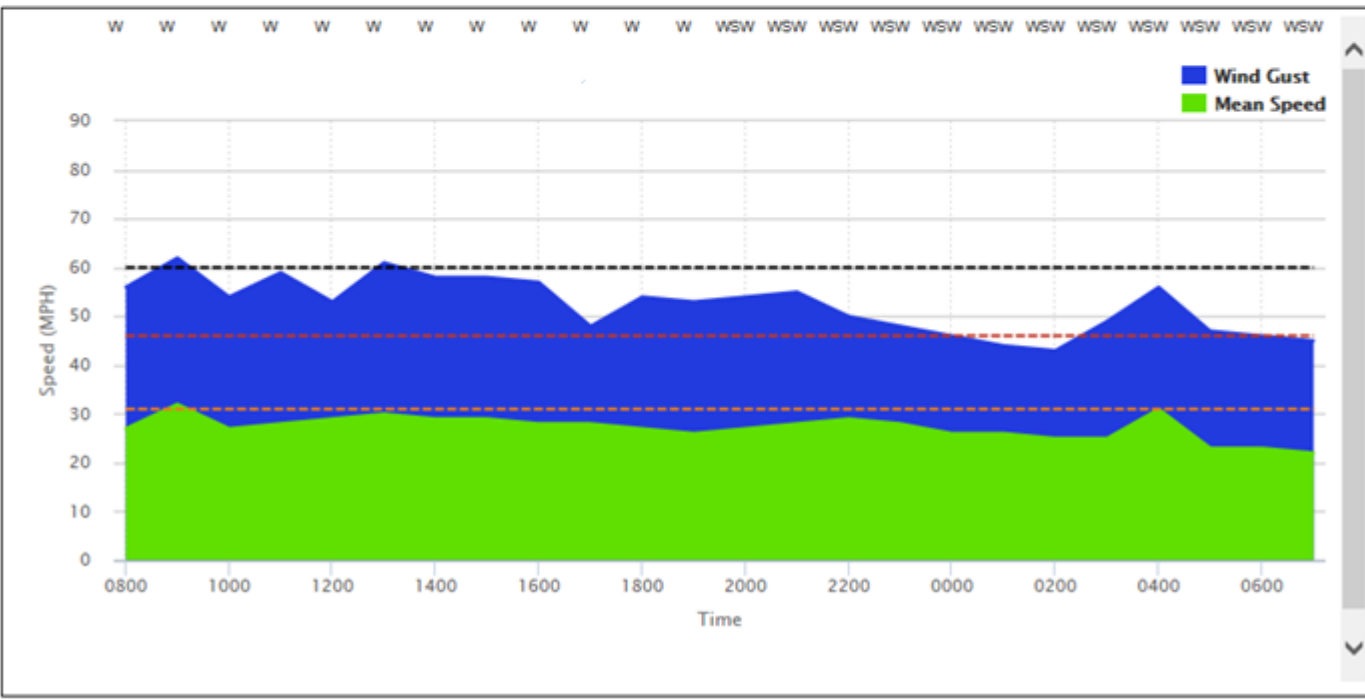






Local Time	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800
Wind Speed (MPH)	27	32	27	28	29	30	29	29	28	28	27	26
Wind Direction	W	W	W	W	W	W	W	W	W	W	W	W
Maximum Gust (MPH)	56	62	54	59	53	61	58	58	57	48	54	53
Wind Alert	Red	Black	Red	Red	Red	Black	Red	Red	Red	Red	Red	Red

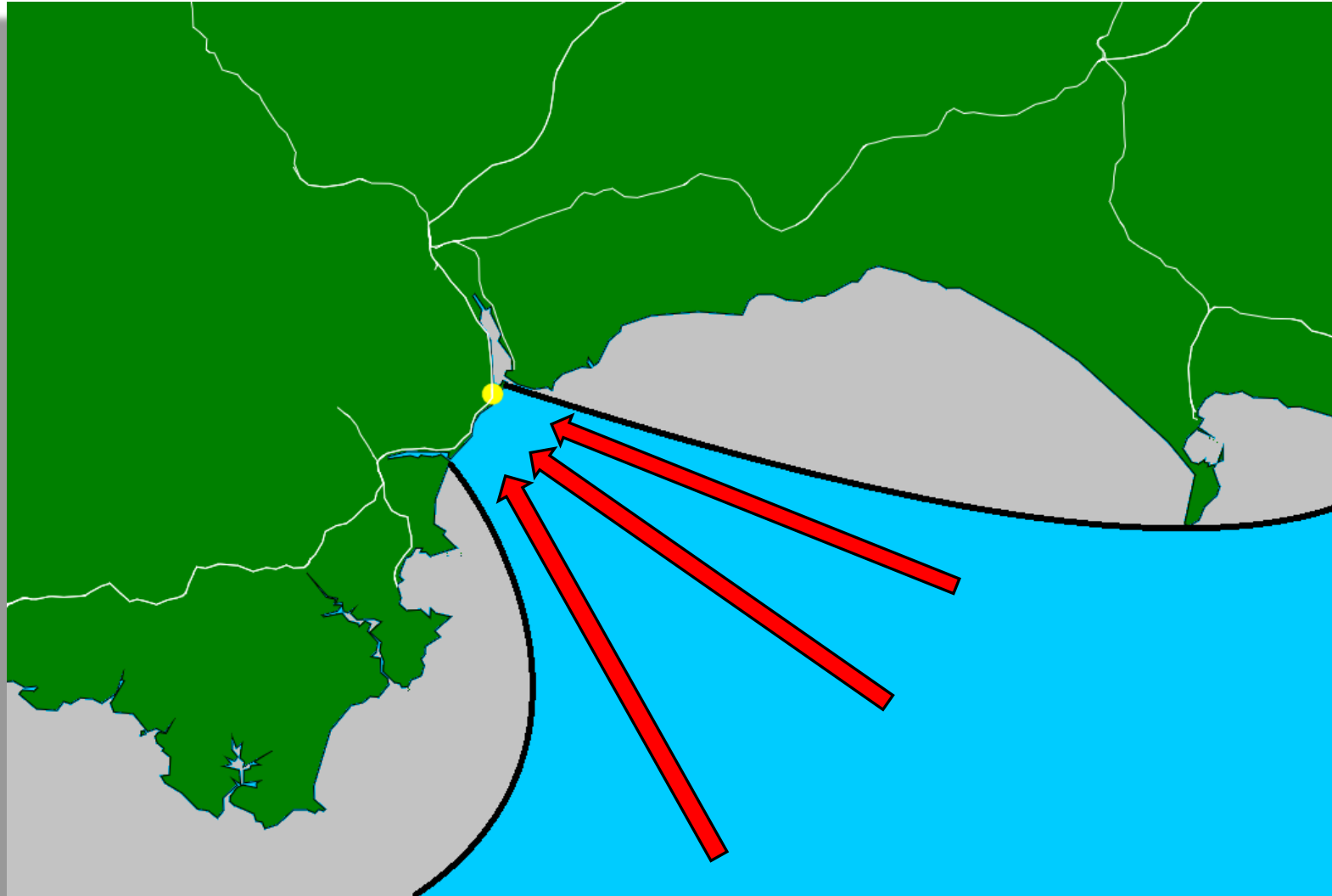
Local Time	1900	2000	2100	2200	2300	0000	0100	0200	0300	0400	0500	0600
Wind Speed (MPH)	27	28	29	28	26	26	25	25	31	23	23	22
Wind Direction	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW
Maximum Gust (MPH)	54	55	50	48	46	44	43	49	56	47	46	45
Wind Alert	Red	Red	Red	Red	Red	Amber	Amber	Red	Red	Red	Red	Amber



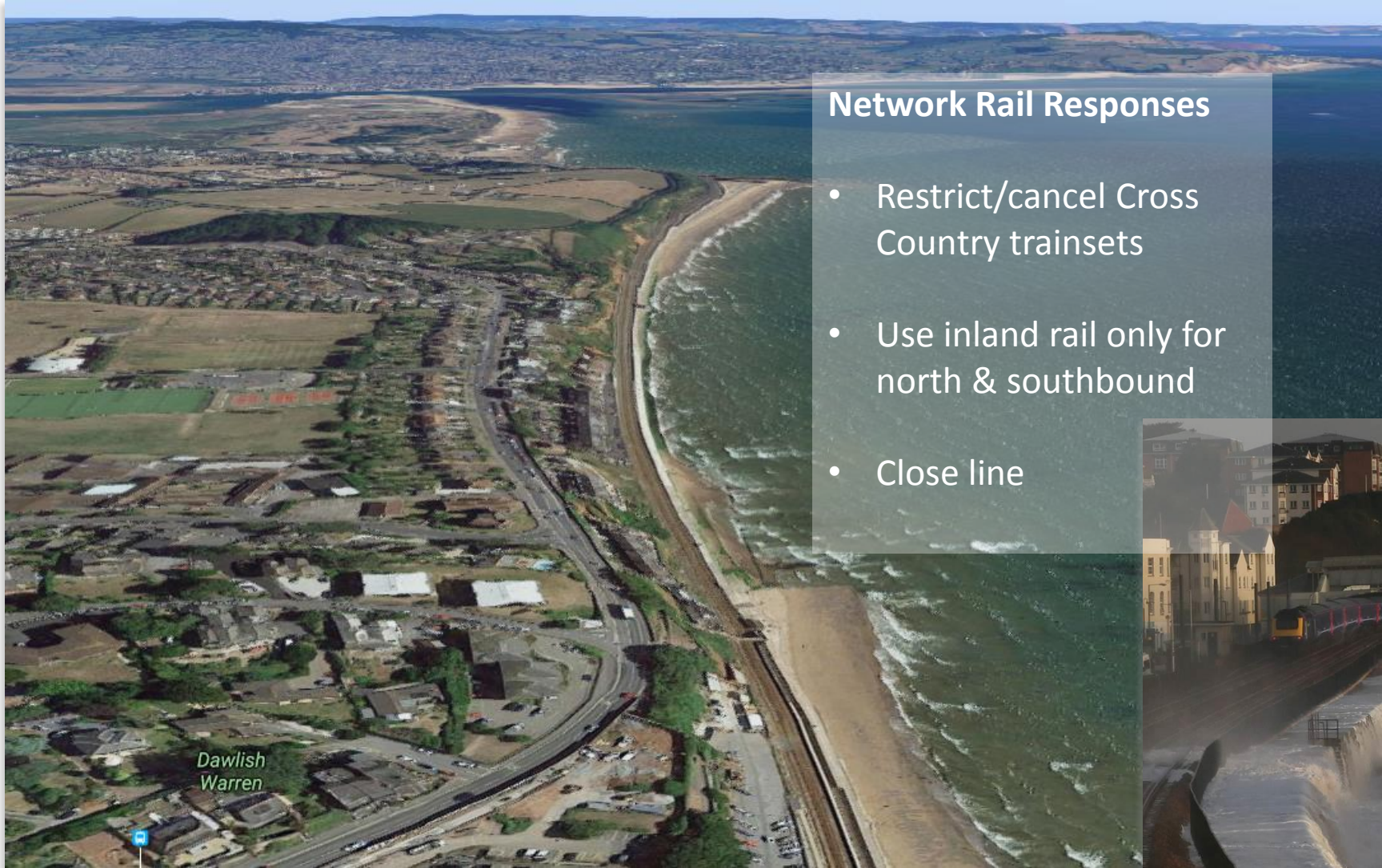
Coastal Model



Dawlish



Dawlish

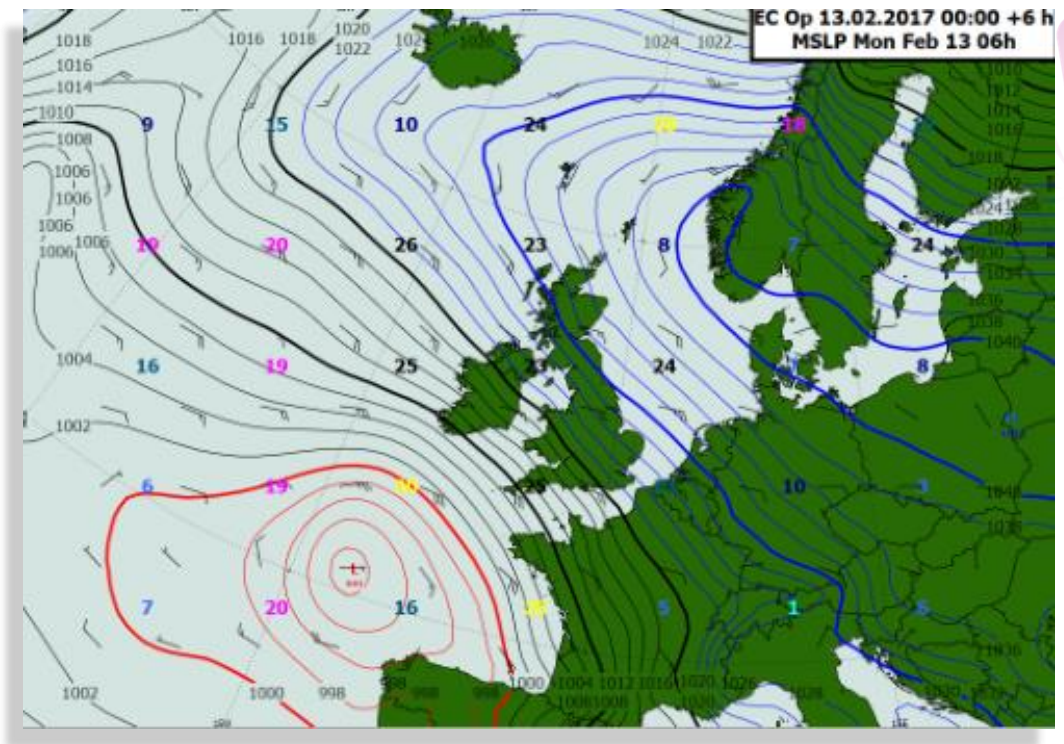
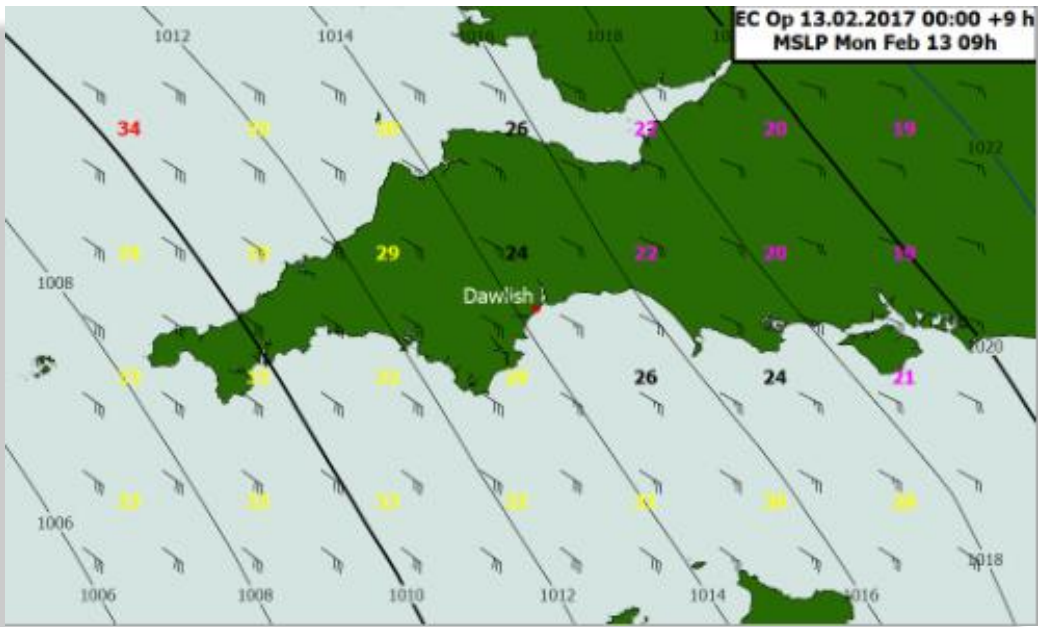
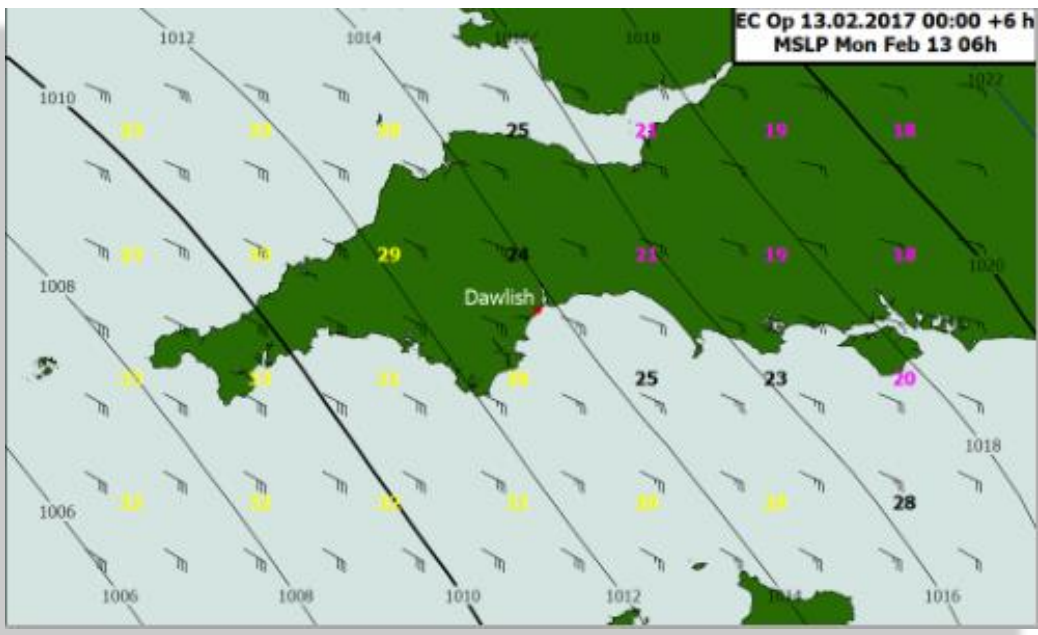


Network Rail Responses

- Restrict/cancel Cross Country trainsets
- Use inland rail only for north & southbound
- Close line

Dawlish
Warren





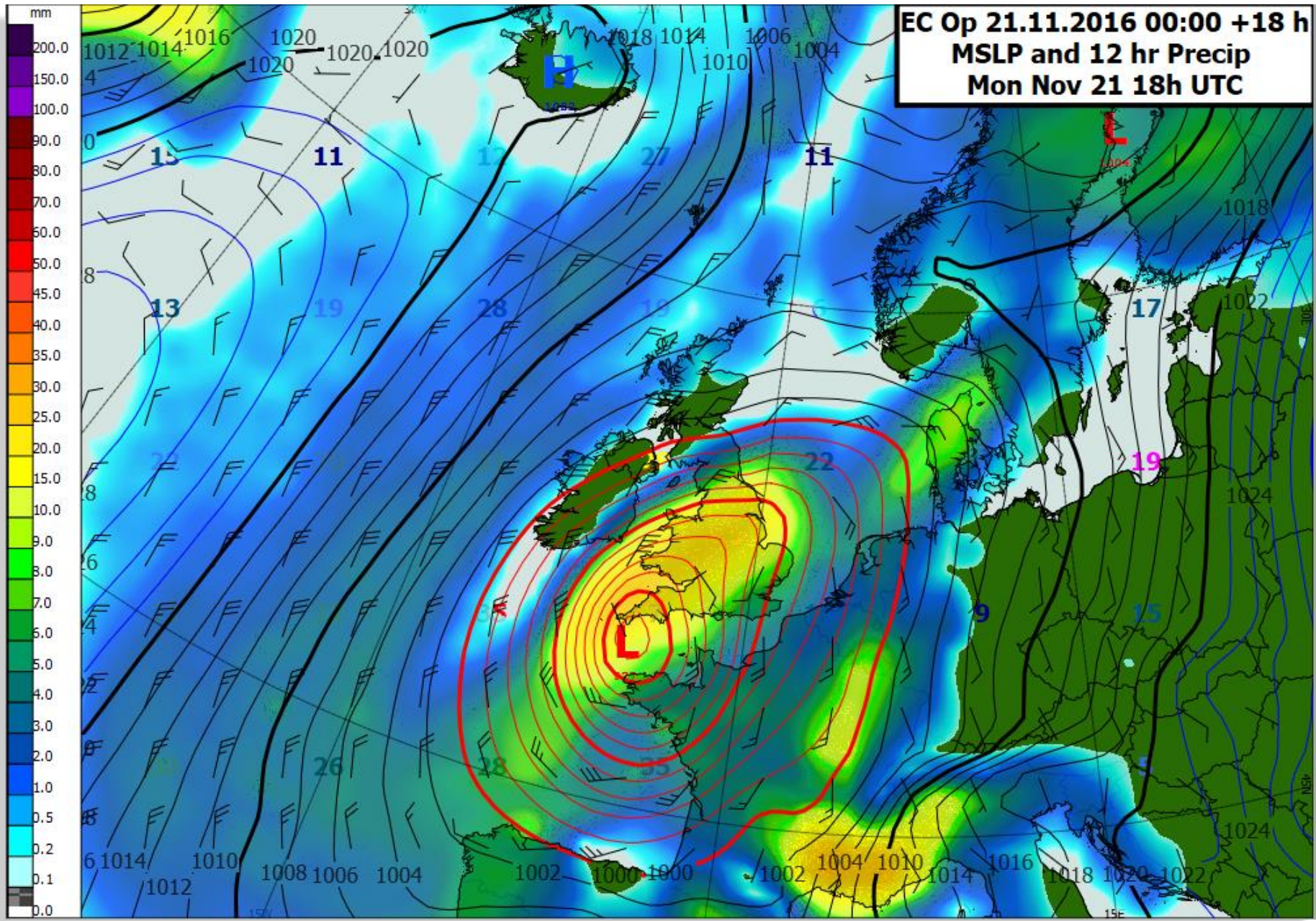
Coastal Model



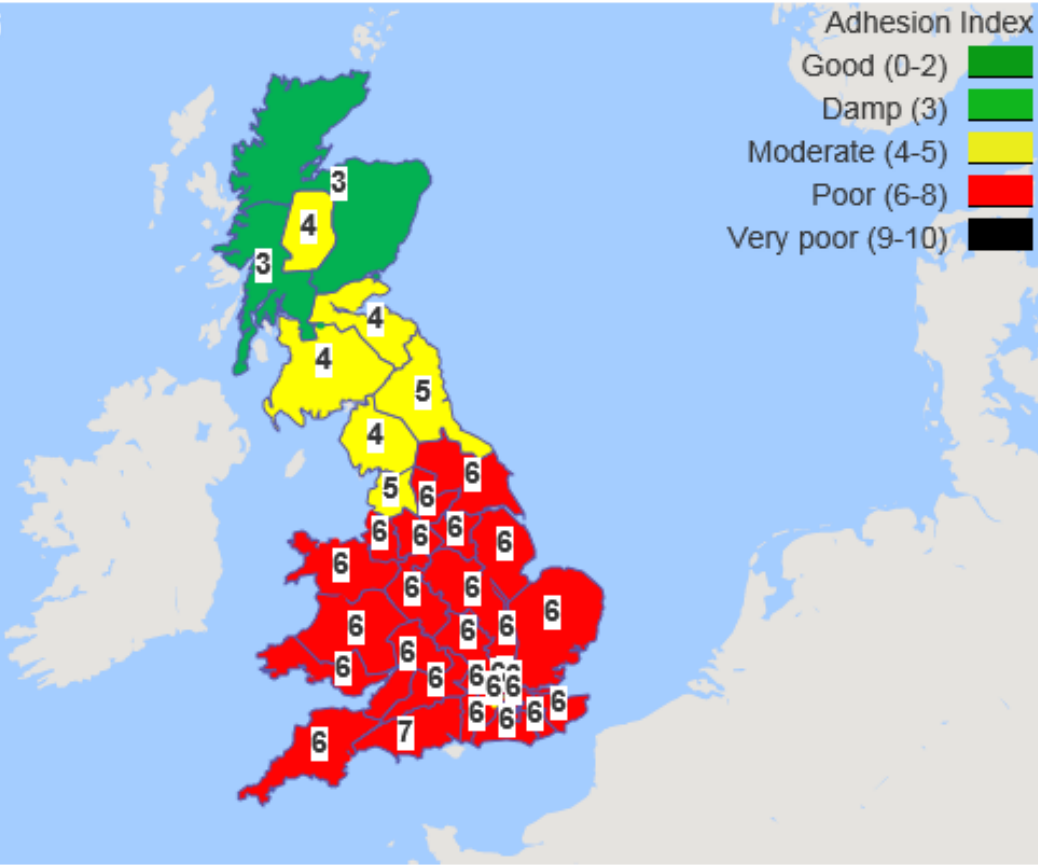
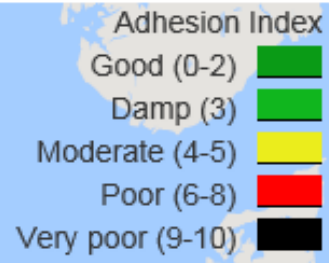
Location	Wind		Significant Wave Height			Swell Waves			Sea Waves			Tidal Level	Warning Level
Dawlish	Mean Wind Speed (m/s)	Wind Direction (deg)	Mean Direction (deg)	Height (m)	Period (s)	Mean Direction (deg)	Height (m)	Period (s)	Mean Direction (deg)	Height (m)	Period (s)	Height (m)	Index / Status
13/02 06:00	12.4	83 (E)	106 (ESE)	2.01	5.1	171 (S)	0.29	5.1	105 (ESE)	1.99	7.1	4.0	2
13/02 07:00	12.6	85 (E)	106 (ESE)	2.01	5.1	171 (S)	0.31	5.1	105 (ESE)	1.98	7.1	4.8	3
13/02 08:00	12.8	86 (E)	106 (ESE)	2.04	5.1	172 (S)	0.32	5.1	105 (ESE)	2.01	7.1	4.9	4
13/02 09:00	13.2	87 (E)	106 (ESE)	2.09	5.1	173 (S)	0.32	5.1	105 (ESE)	2.06	7.1	4.8	4
13/02 10:00	13.2	88 (E)	106 (ESE)	2.15	5.2	173 (S)	0.35	5.2	105 (ESE)	2.12	7.1	4.1	3
13/02 11:00	13.3	89 (E)	107 (ESE)	2.22	5.3	173 (S)	0.36	5.3	105 (ESE)	2.18	7.3	3.3	2
13/02 12:00	13.4	89 (E)	107 (ESE)	2.26	5.3	172 (S)	0.41	5.3	105 (ESE)	2.22	7.4	1.9	1
13/02 13:00	13.1	89 (E)	107 (ESE)	2.30	5.4	173 (S)	0.38	5.4	105 (ESE)	2.25	7.5	0.7	0
13/02 14:00	12.6	89 (E)	107 (ESE)	2.31	5.5	173 (S)	0.39	5.5	105 (ESE)	2.28	7.6	0.5	0
13/02 15:00	12.2	89 (E)	107 (ESE)	2.28	5.5	172 (S)	0.40	5.5	105 (ESE)	2.23	7.6	1.0	0
13/02 16:00	12.2	89 (E)	106 (ESE)	2.25	5.4	171 (S)	0.40	5.4	104 (ESE)	2.21	7.6	1.6	1
13/02 17:00	12.4	90 (E)	106 (ESE)	2.26	5.4	172 (S)	0.38	5.4	104 (ESE)	2.22	7.6	2.5	1
13/02 18:00	12.4	91 (E)	105 (ESE)	2.28	5.4	171 (S)	0.38	5.4	104 (ESE)	2.24	7.6	3.6	2
13/02 19:00	12.2	91 (E)	105 (ESE)	2.26	5.4	171 (S)	0.36	5.4	104 (ESE)	2.23	7.6	4.5	3
13/02 20:00	12.2	92 (E)	105 (ESE)	2.18	5.4	172 (S)	0.34	5.4	104 (ESE)	2.16	7.6	4.8	4
13/02 21:00	12.1	93 (E)	106 (ESE)	2.08	5.3	171 (S)	0.34	5.3	104 (ESE)	2.06	7.5	4.6	3
13/02 22:00	11.5	93 (E)	106 (ESE)	2.00	5.2	172 (S)	0.33	5.2	104 (ESE)	1.97	7.5	3.9	2
13/02 23:00	11.1	94 (E)	105 (ESE)	1.95	5.1	173 (S)	0.30	5.1	104 (ESE)	1.92	7.3	3.2	1
14/02 00:00	10.5	95 (E)	105 (ESE)	1.89	5.0	172 (S)	0.32	5.0	104 (ESE)	1.86	7.2	2.3	0

Leaf Fall/Adhesion Model





Mon 21-Nov-16



Parameter	Adhesion Index Max					Adhesion Index Avg					Leaves On The Trees					Leaves On The Ground				
	21/11	22/11	23/11	24/11	25/11	21/11	22/11	23/11	24/11	25/11	21/11	22/11	23/11	24/11	25/11	21/11	22/11	23/11	24/11	25/11
Scotland																				
Route average	5	5	5	5	5	4	5	5	5	5	16.9	15.4	14.6	14.0	13.4	1.6	2.5	2.7	2.5	2.4
Perth	4	5	5	5	5	3	5	4	5	5	12.4	11.2	10.5	10.0	9.4	1.3	2.1	2.2	2.2	2.2
Glasgow	4	5	5	5	5	3	4	4	4	4	20.2	19.0	18.3	17.8	17.3	1.2	2.1	2.2	2.1	2.1
Highland	5	5	5	5	5	4	5	5	5	5	15.0	13.2	12.1	11.3	10.5	1.5	2.9	3.1	3.0	2.9
Motherwell	5	6	5	5	5	4	5	5	5	5	19.6	17.8	17.0	16.4	15.9	1.9	2.9	3.0	2.7	2.4
Edinburgh	5	6	6	5	5	4	5	5	5	5	17.5	15.9	15.0	14.5	14.0	1.9	2.7	2.8	2.5	2.3

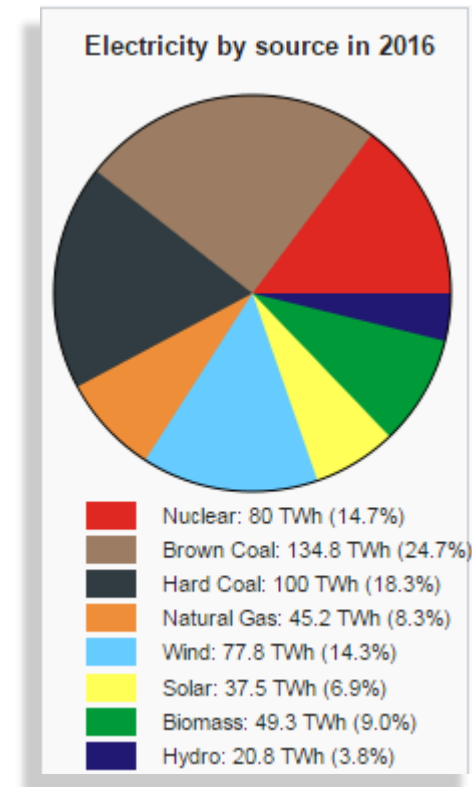
Energy Trading



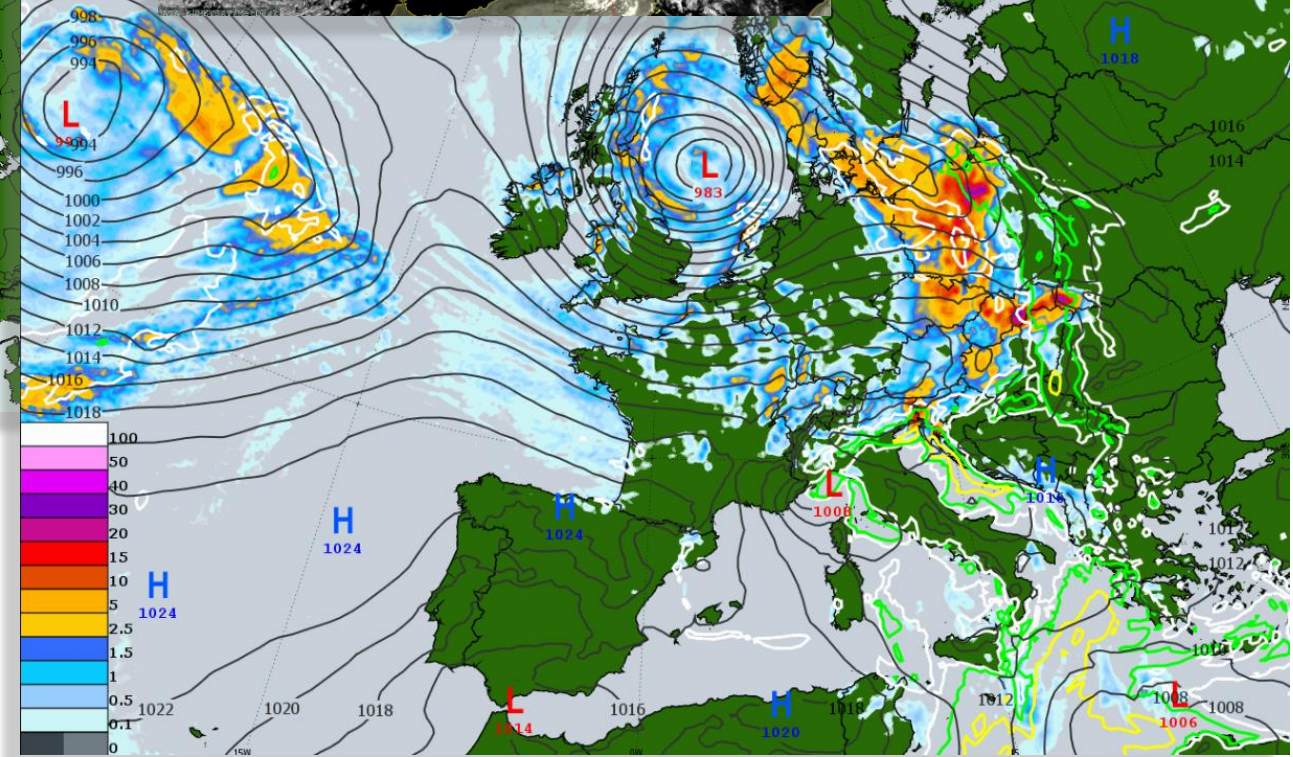
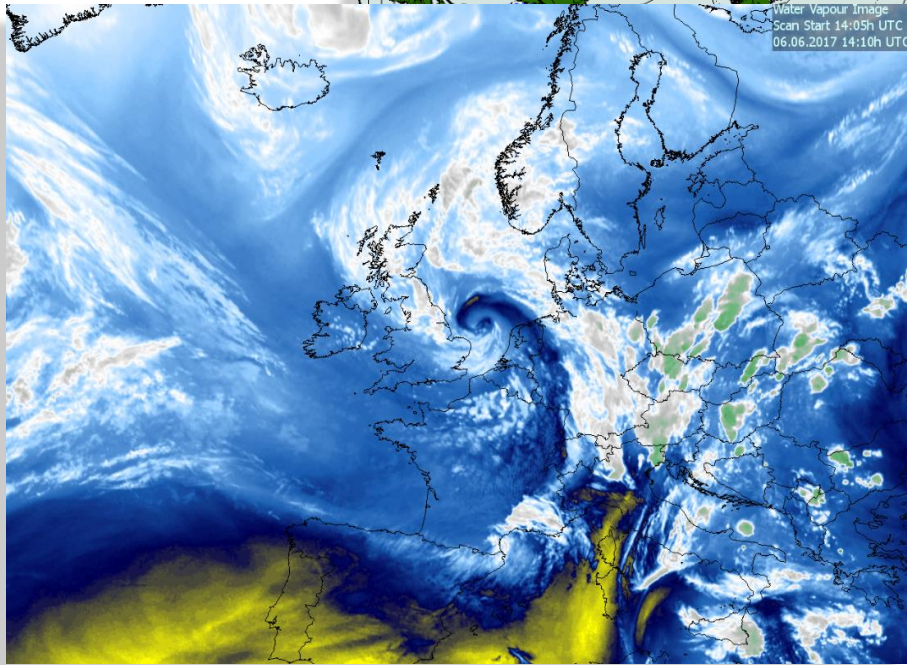
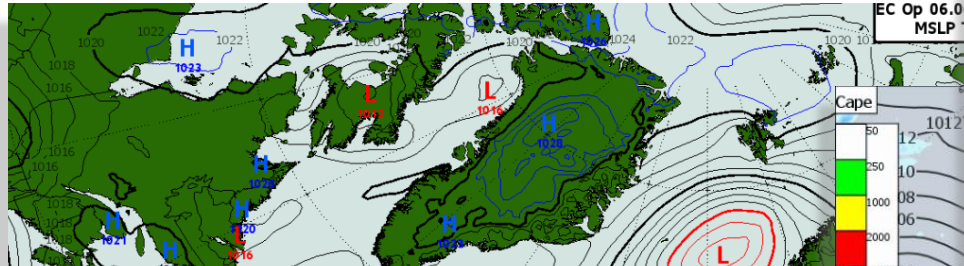
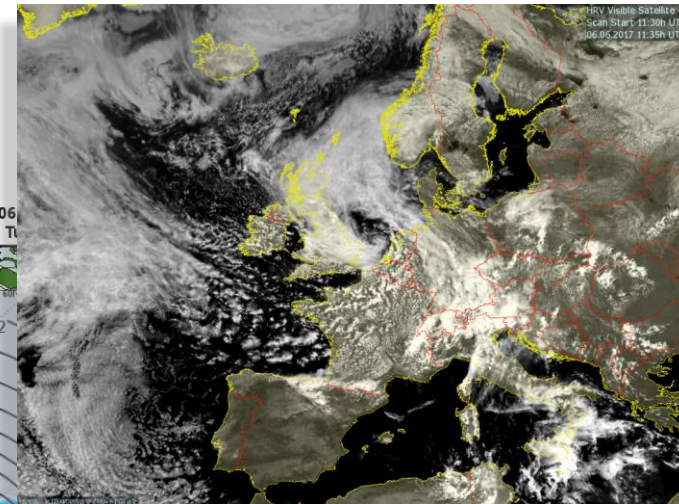
Energy Trading



- Renewable energy is growing throughout the world
- Germany last year saw around 25% of their energy consumption derived from renewable sources
- Wind, solar and hydro power forecasts are vital for traders and energy companies
- Energy Meteorologists and Analysts need all possible data to inform their trading decision especially in extreme weather



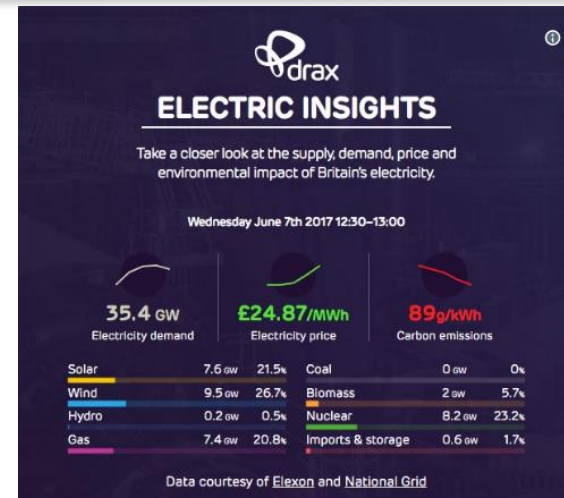
Last week in Europe



UK sets new renewable energy record as wind and solar surge



1 Comment



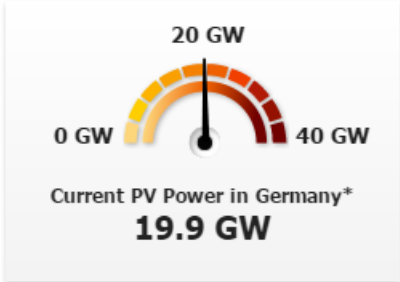
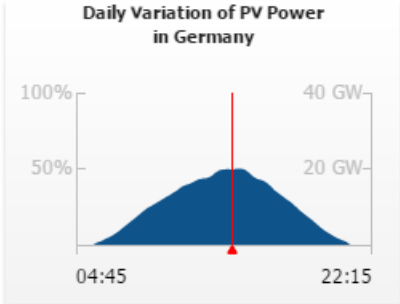
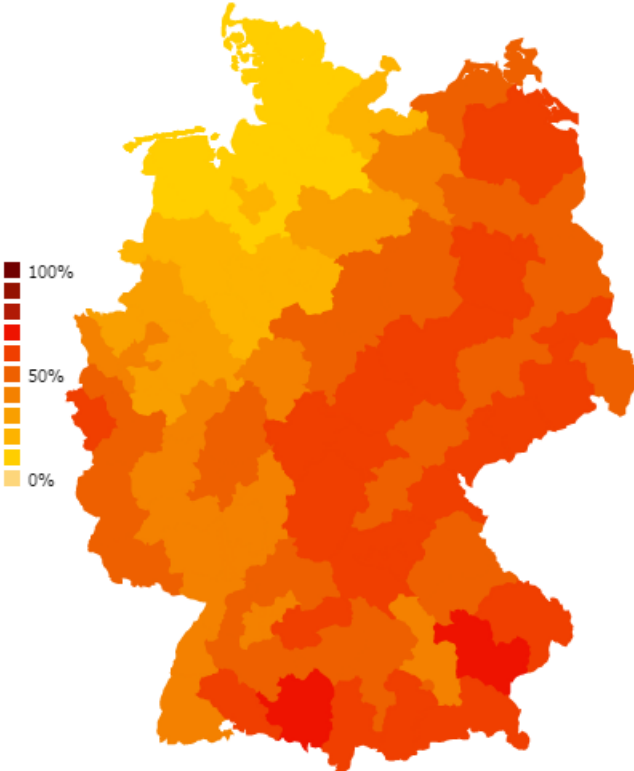
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Britain has a new #renewables peak power record of 19.3 GW!
☀️ 7.6 GW
🌲 2 GW
💧 9.5 GW
🌊 0.2 GW electricinsights.co.uk
1:12 PM - 7 Jun 2017 · Drax, England
🔄 42 ❤️ 33

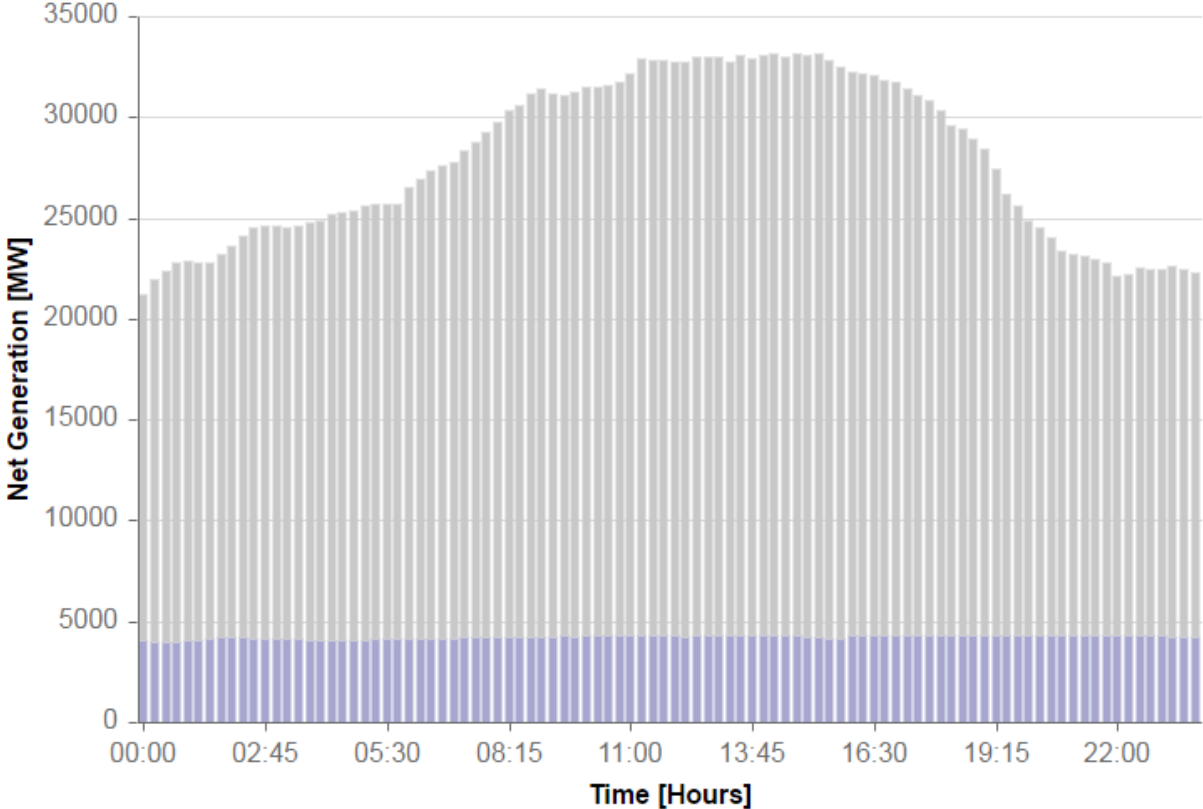
Germany wind June record



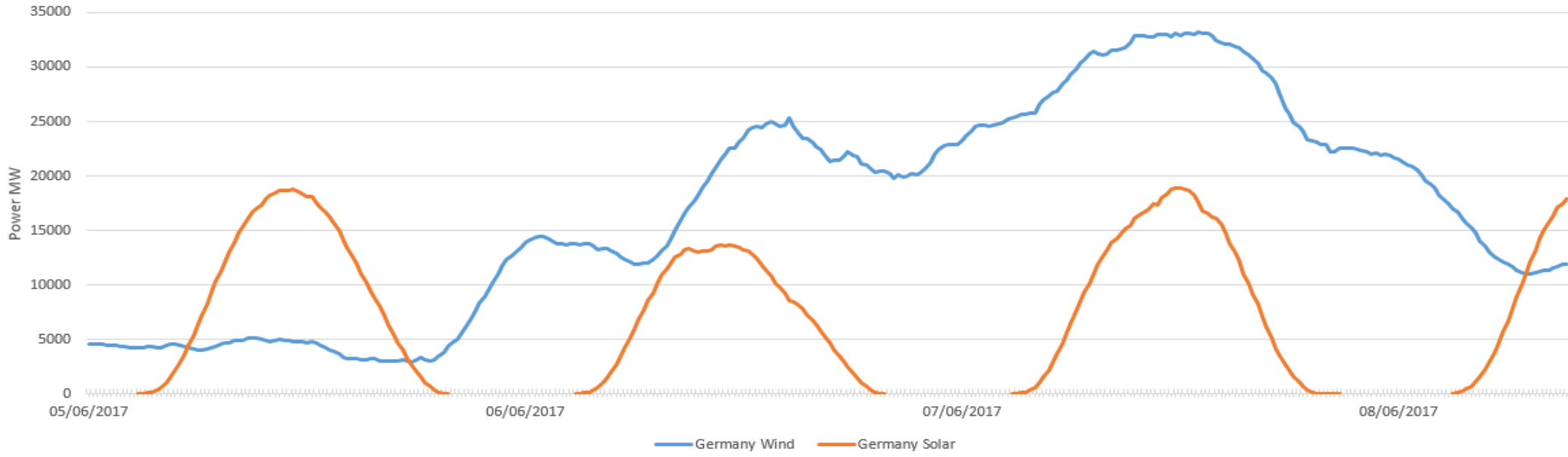
Relative output from 07.06.2017 - 14:00



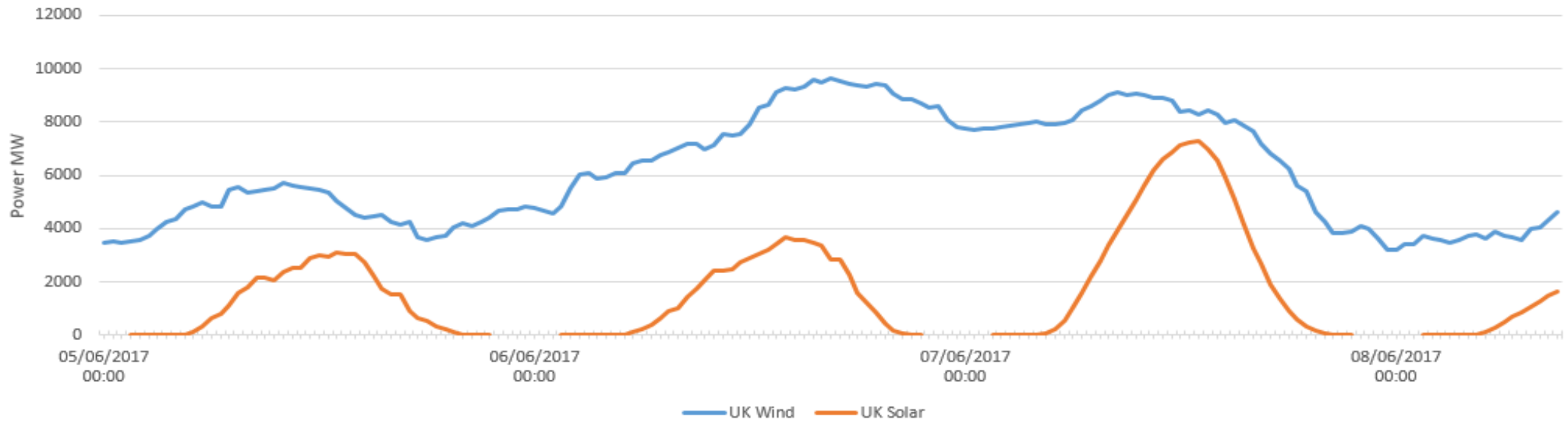
*projected current output of all PV plants installed before 28.02.2017 with a total 40.21 GW nominal power according to the German Federal Network Agency.



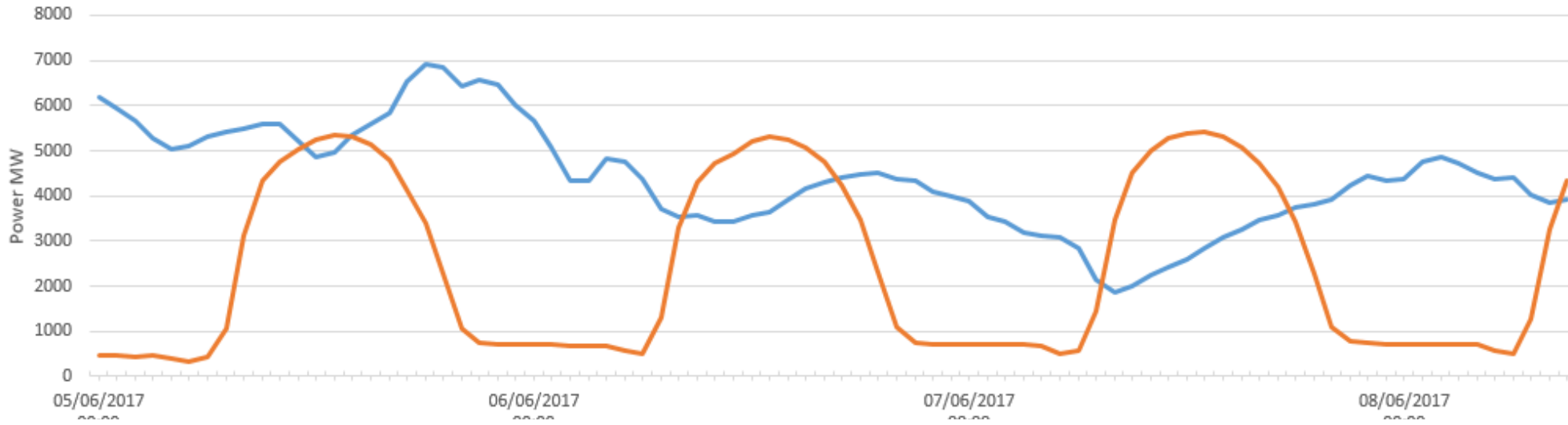
Germany wind and Solar Observed Values



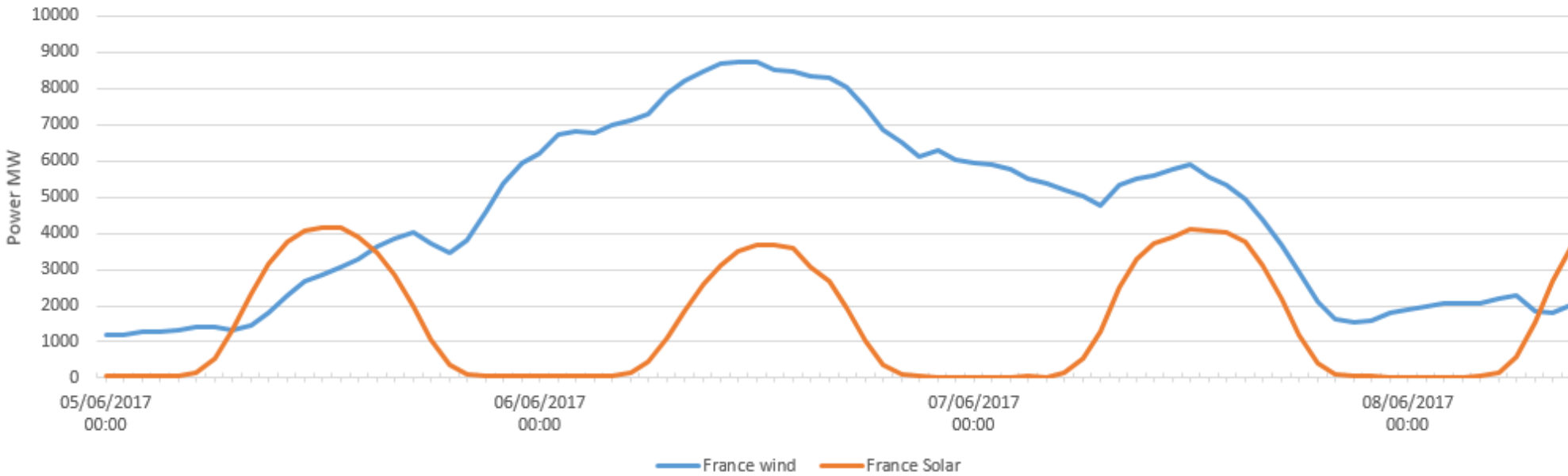
UK wind and Solar Observed Values



Spain Wind and Solar Observed Values

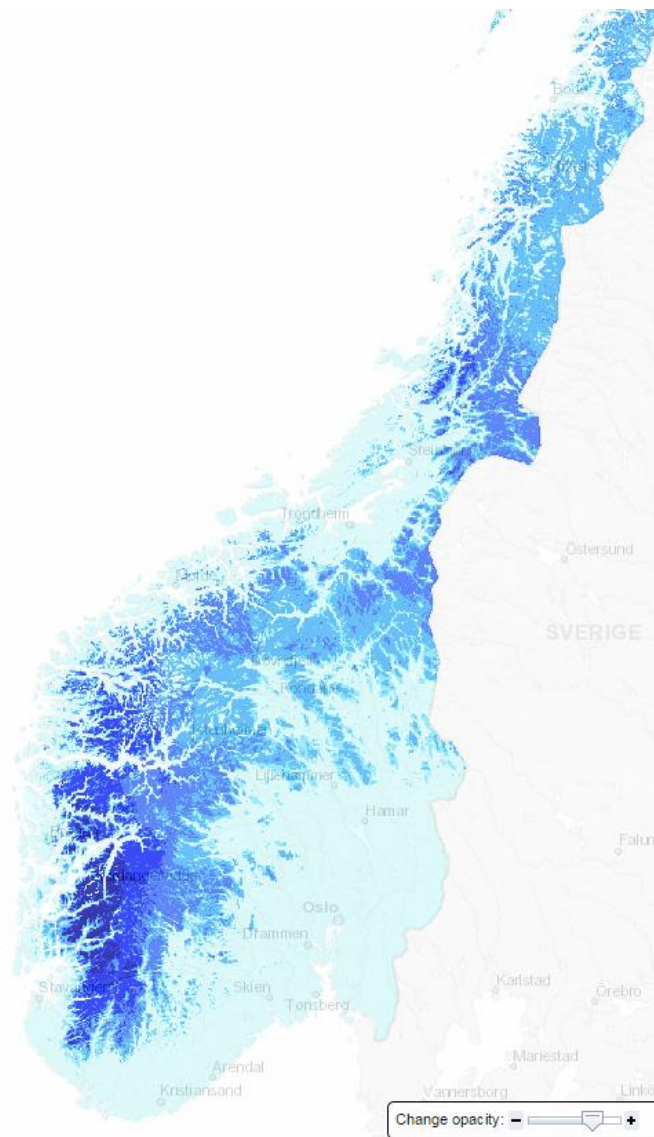


France Wind and Solar Observed Values



— France wind — France Solar

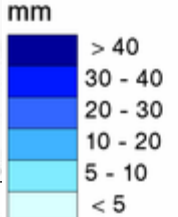




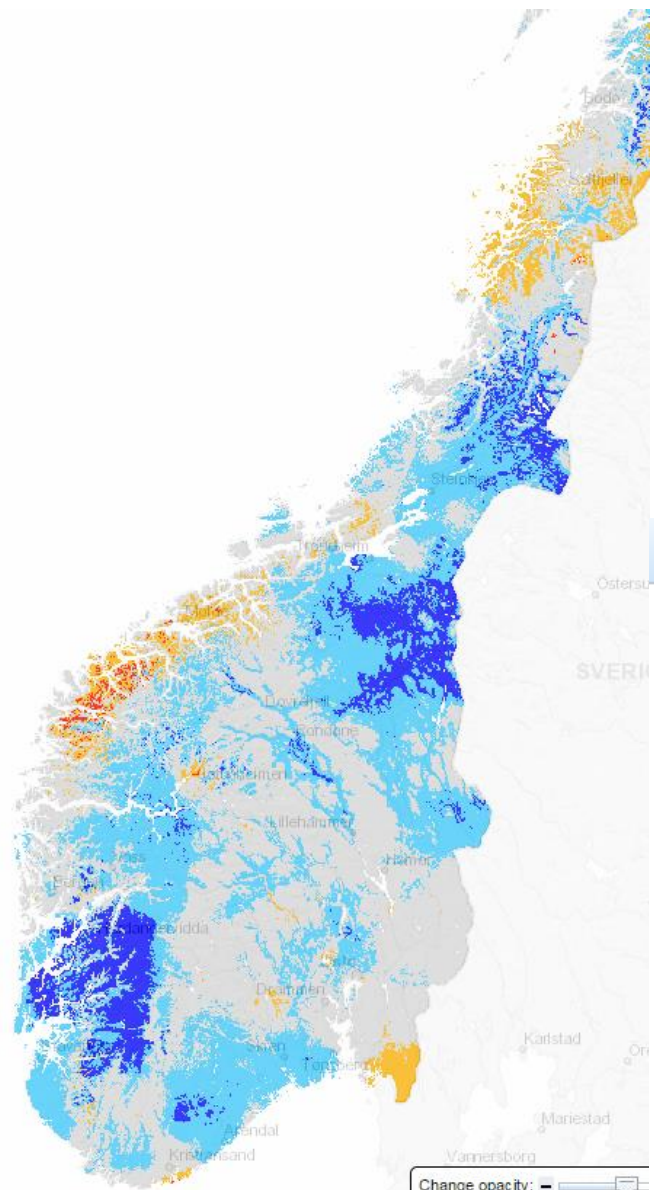
▼ Runoff

The maps shows total runoff previous 24 hours simulated by spatially distributed version of the HBV-model. Runoff = precipitation - evapotranspiration - difference in water storage in soil or snow. The map is updated at 07:30, 09:00, 11:30 and 20:00 Norwegian standard time. Data from 01.01.1970 until tomorrow

Data owner: Norwegian Water Resources and Energy Directorate



Change opacity: - [slider] +



▼ Ground water level compared to normal

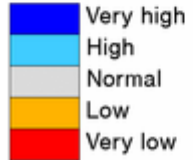
The map shows the groundwater level compared to average for the same day for the reference period 1981-2010 (percentiles). The groundwater level is simulated using the HBV-model.

Updated at 07.30, 09, 11.30 and 20 Norwegian standard time.

Data from 01.01.1970 until tomorrow

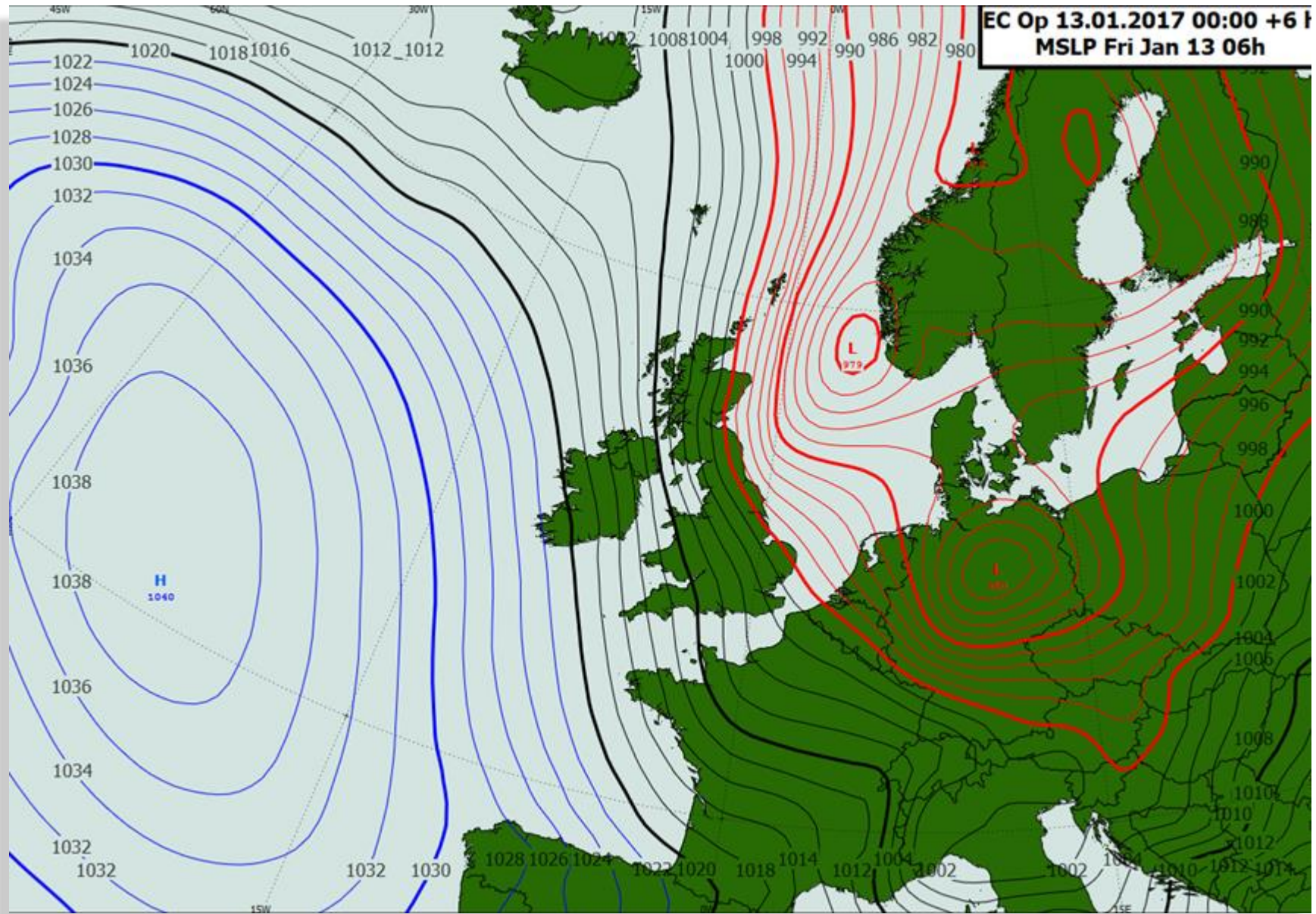
Data owner: Norwegian Water Resources and Energy Directorate

Compared to normal



Change opacity: - [slider] +







Thank you for listening

Any Questions?

