



Hazard Impact Modelling for Storms Workshop

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ECMWF UEF 2017, 15th June 2017



Context

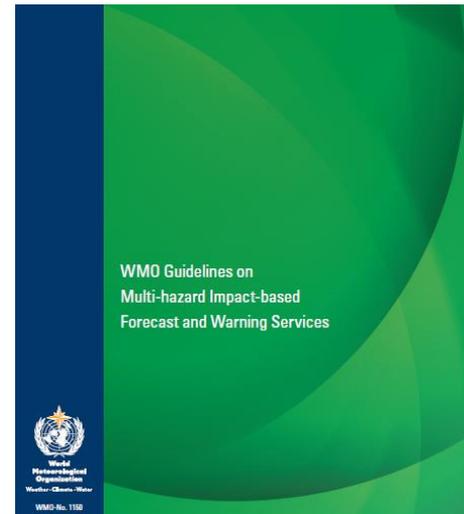
Effective decision-making on severe weather forecasts comes from understanding of Impact and Risk
– major topic of WWOSC in Montreal, 2014.

WMO strategy for Seamless GDPFS (Global Data Processing and Forecasting System)

WWOSC defined seamless as spanning:

- time – hours to months
- hazards
- from hazard to *Impact*

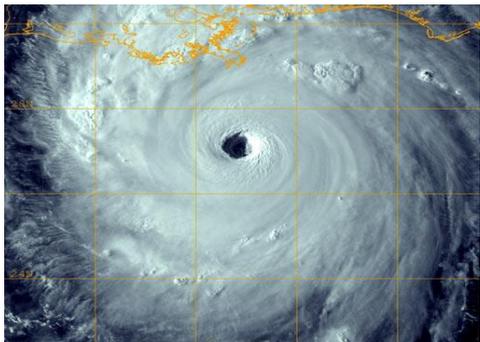
**Probability –
use ENS**



Coping with Hurricanes/Typhoons

Weather and climate extremes

Weather analyses & forecast data



Hurricane track, size, & intensity

Weather Translation to hazards

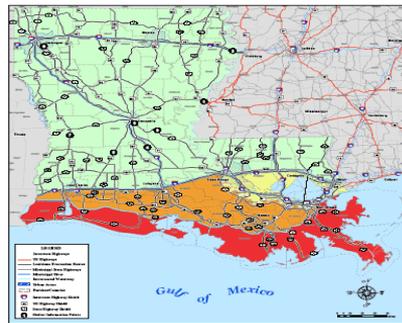
Extraction of relevant information to predict hazards



Storm surge, flooding, inundated areas

Impact Estimation

Placing into situational context



Affected population & infrastructure, disruption of services, damages due to wind & water, etc.

Reducing risk & response scenarios

Mitigation strategies



Implementation of evacuation & recovery plans





Programme

Introduction - Ken Mylne

Refresher on UK Experience - Becky Hemingway

ECMWF Experience - Ervin Zsoter

Breakout Discussions

Plenary Conclusions

Key Question: Can you identify one key opportunity for impact model development exploiting the ENS?

NHP

Hazard Impact Models: Risk Algorithm



Hazard

x

Vulnerability

x

Exposure

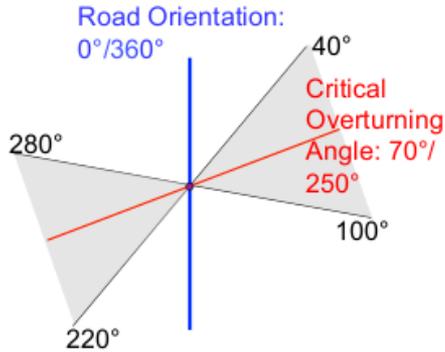
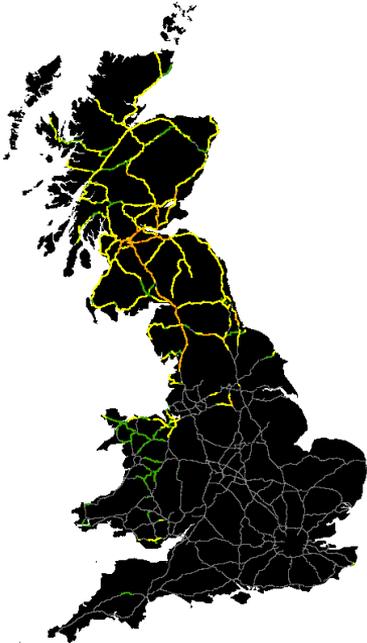


Currently use high detail and resolution

Vehicle OverTurning Model

Road sections < 2km

MOGREPS-UK 2.2km resolution

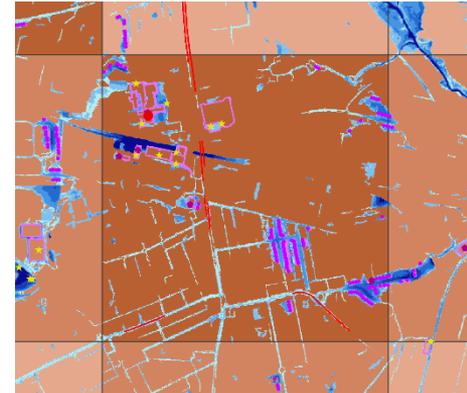


Surface Water Flooding HIM

Flood Map 2m resolution

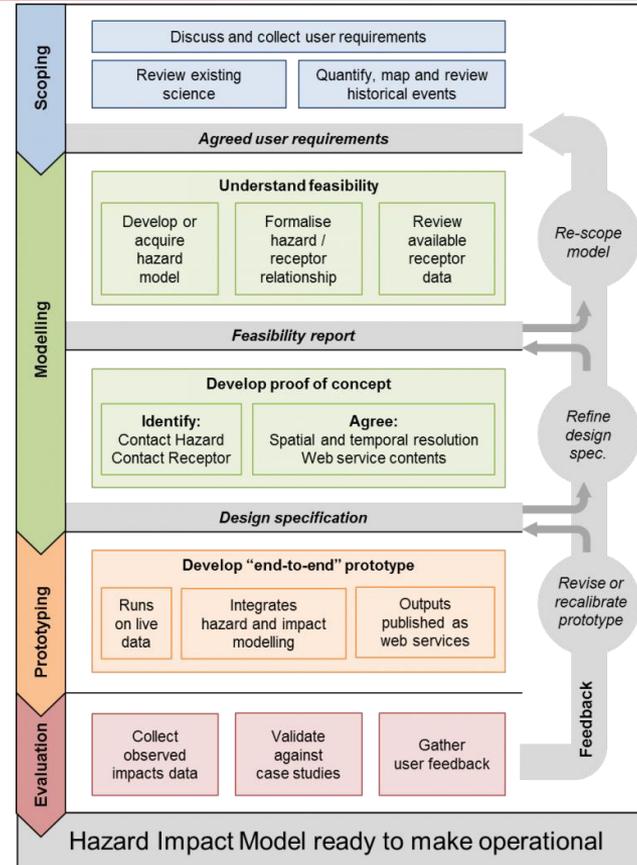
Impact library 1km cells

Grid-to-Grid model 1km resolution



Using the Hazard Impact Framework

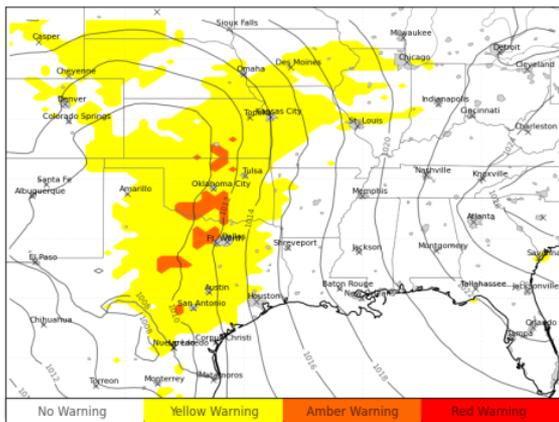
Natural Hazards Partnership
Hazard Impact Framework:
First Edition



EPS-W USA: 23rd/24th May 2015



EPS-W MOGREPS-G 18 GMT run on Tue 19 May 2015
Overall warning colour for 24hr precipitation
Valid for the 24hrs up to 13 CDT on Sun 24 May 2015
(18 GMT on Sun 24 May 2015 T+120 hours)

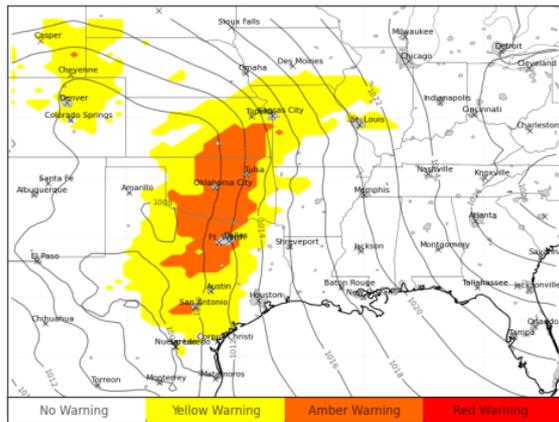


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5 days out



EPS-W MOGREPS-G 06 GMT run on Thu 21 May 2015
Overall warning colour for 24hr precipitation
Valid for the 24hrs up to 13 CDT on Sun 24 May 2015
(18 GMT on Sun 24 May 2015 T+84 hours)

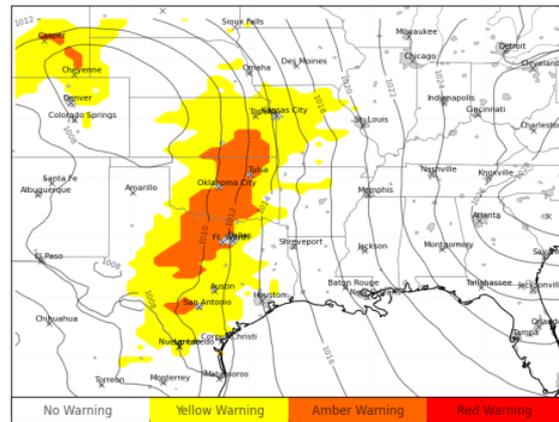


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3.5 days out



EPS-W MOGREPS-G 06 GMT run on Sat 23 May 2015
Overall warning colour for 24hr precipitation
Valid for the 24hrs up to 13 CDT on Sun 24 May 2015
(18 GMT on Sun 24 May 2015 T+36 hours)



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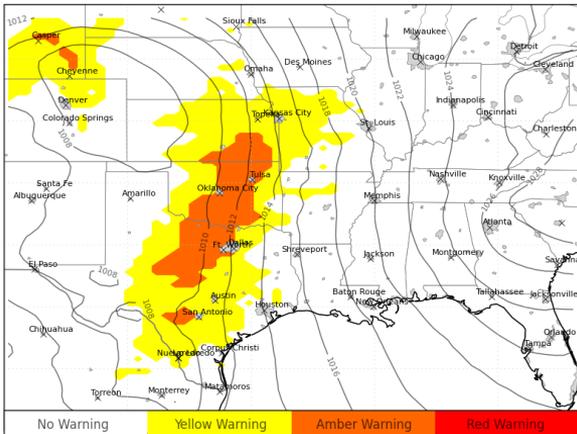
1.5 days out

Uses MOGREPS-G 24hr rainfall totals
33km resolution

EPS-W USA: 23rd/24th May 2015



EPS-W MOGREPS-G 06 GMT run on Sat 23 May 2015
Overall warning colour for 24hr precipitation
Valid for the 24hrs up to 13 CDT on Sun 24 May 2015
(18 GMT on Sun 24 May 2015 T+36 hours)

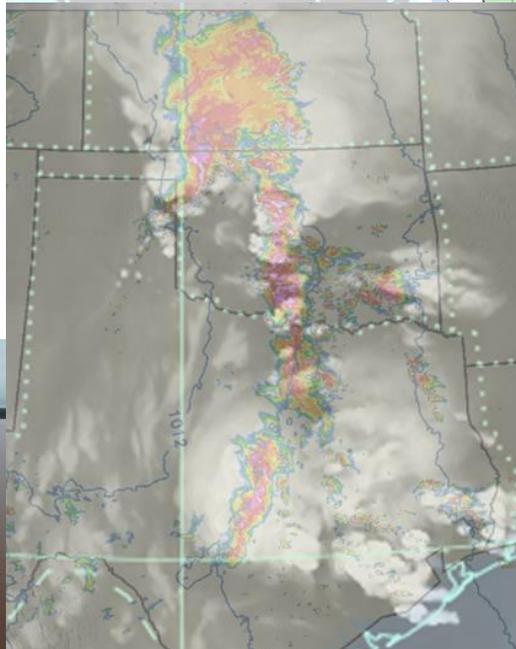


This Weekend

A slow-moving weather system with abundant moisture will bring heavy rainfall across portions of the Central and Southern Plains Saturday. Soils in the region are already saturated from recent rainfall, so flash flooding and river flooding is likely. Meanwhile, below normal temperatures settle over the northeast, with freeze warnings across much of New England into Saturday.

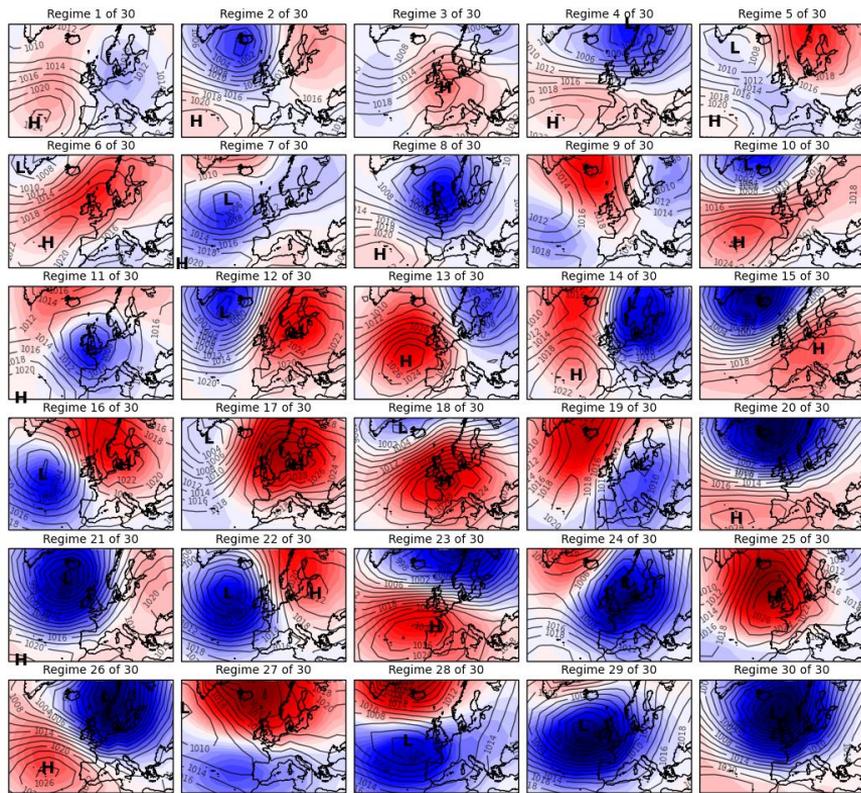
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378.7mm in 24 hrs recorded
EPS-W didn't get the intensities correct but did do well spatially

Regime Analysis and the Decider tool



	Wed 2 Dec	Thu 3 Dec	Fri 4 Dec	Sat 5 Dec	Sun 6 Dec	Mon 7 Dec	Tue 8 Dec	Wed 9 Dec	Thu 10 Dec	Fri 11 Dec	Sat 12 Dec	Sun 13 Dec	Mon 14 Dec	Tue 15 Dec	Wed 16 Dec	Regime Descriptions (UK)	Historic Occurrence N/D/J
Regime 1											2			2		Unbiased NWly	2.0%
Regime 2											4	4	2			Cyclonic W-SWly, returning Pm airmass	2.8%
Regime 3								2	2		4		4			Anticyclonic SWly, ridge over N France	2.3%
Regime 4									2	2		6				Unbiased Wly	2.7%
Regime 5																Unbiased S-SEly, high over Scandinavia	2.7%
Regime 6																Anticyclonic, Azores high ext.	2.8%
Regime 7												2	6	4	4	Cyclonic SWly, low WNW of Ireland	2.2%
Regime 8										2	4	6	4	2	2	Cyclonic W-NWly, low near Shetland	3.1%
Regime 9										2	4	4			2	Anticyclonic N-NEly, high near Iceland	2.6%
Regime 10													2		2	Anticyclonic W-SWly, slight Azores ridge	3.4%
Regime 11													4	2		Cyclonic, low centred over southern UK	2.4%
Regime 12									2	4		2	2		2	Anticyclonic Sly, high over Poland	4.2%
Regime 13								2		6	16	10	6	8	2	Anticyclonic NWly, high SW of Ireland	4.4%
Regime 14											10	12	12	8	6	Cyclonic N-NWly, low near S Sweden	4.0%
Regime 15	100	51	84		2	18		6	12	4	6	6	8	4	8	Unbiased SWly, very windy NW Britain	4.8%
Regime 16												2	2	2	2	Anticyclonic S-SEly, high E of Denmark	2.7%
Regime 17									4	6	2	4			2	Anticyclonic E-SEly high over Denmark	4.3%
Regime 18						6	18	55	39	25	12	10			6	Anticyclonic SWly, high over N France	4.7%
Regime 19														4	4	Cyclonic Nly, low E of Denmark	4.0%
Regime 20			10	100	76	31			2	2		6	8	8	4	Cyclonic Wly, intense low near Iceland	4.1%
Regime 21										2	4	2	6	14	12	Cyclonic SWly, deep low S of Iceland	3.8%
Regime 22												2			2	Cyclonic Sly, low W of Ireland	3.2%
Regime 23		49	6		18	41	80	25	27	31	20	12	6	2	4	Unbiased Wly, windy in N	4.1%
Regime 24												2	12	14	14	Cyclonic Nly, low in N Sea	3.2%
Regime 25								6		6	6	6	2		4	Anticyclonic Nly, high centre Irish Sea	3.6%
Regime 26					2	4				6	8	8	2	6	14	Cyclonic NWly, low near Norway, windy	3.4%
Regime 27																Anticyclonic Ely, high in Norwegian Sea	3.7%
Regime 28													2			Cyclonic SEly, low SW of UK	2.8%
Regime 29												2	2	4	2	Cyclonic S-SWly, deep low W of Ireland	2.9%
Regime 30					2						2	2	8	12	4	Cyclonic W-SWly, deep low SE of Iceland	3.0%
Total Members	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	---	---

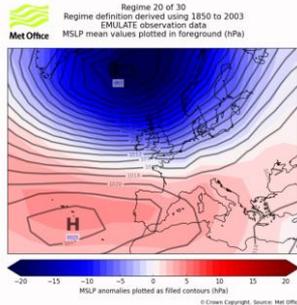
Relating regimes to rainfall

Daily rainfall totals by regime
(1931-2015)

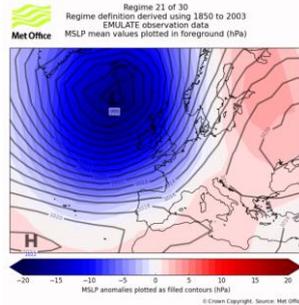
Average number of days per year
each regime exceeds a percentile
climatology.

Given a regime occurrence,
probability that daily rainfall will
exceed percentile

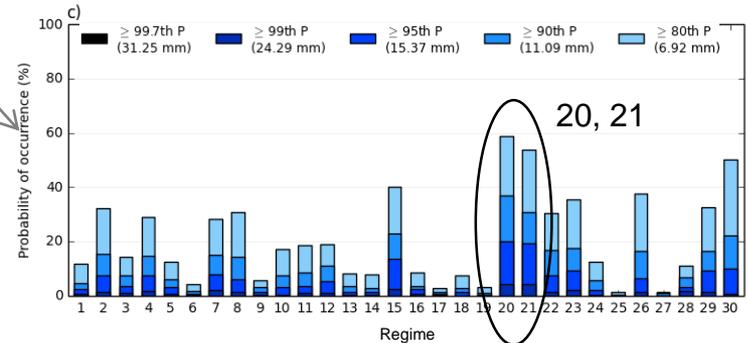
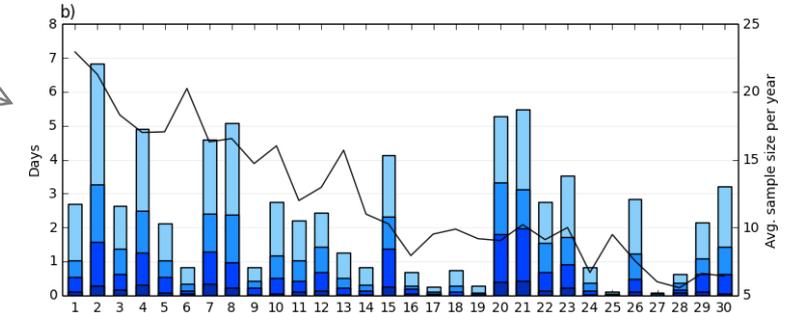
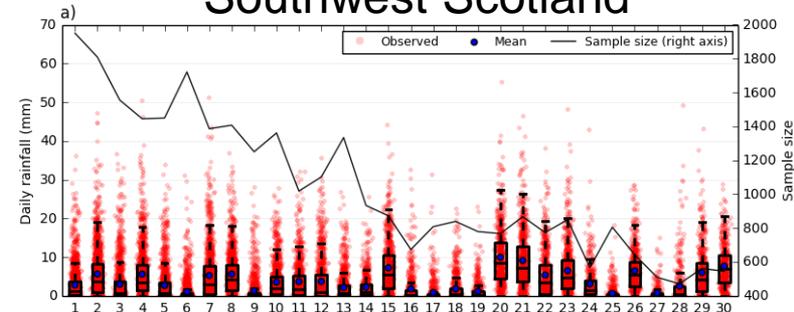
Regime 20



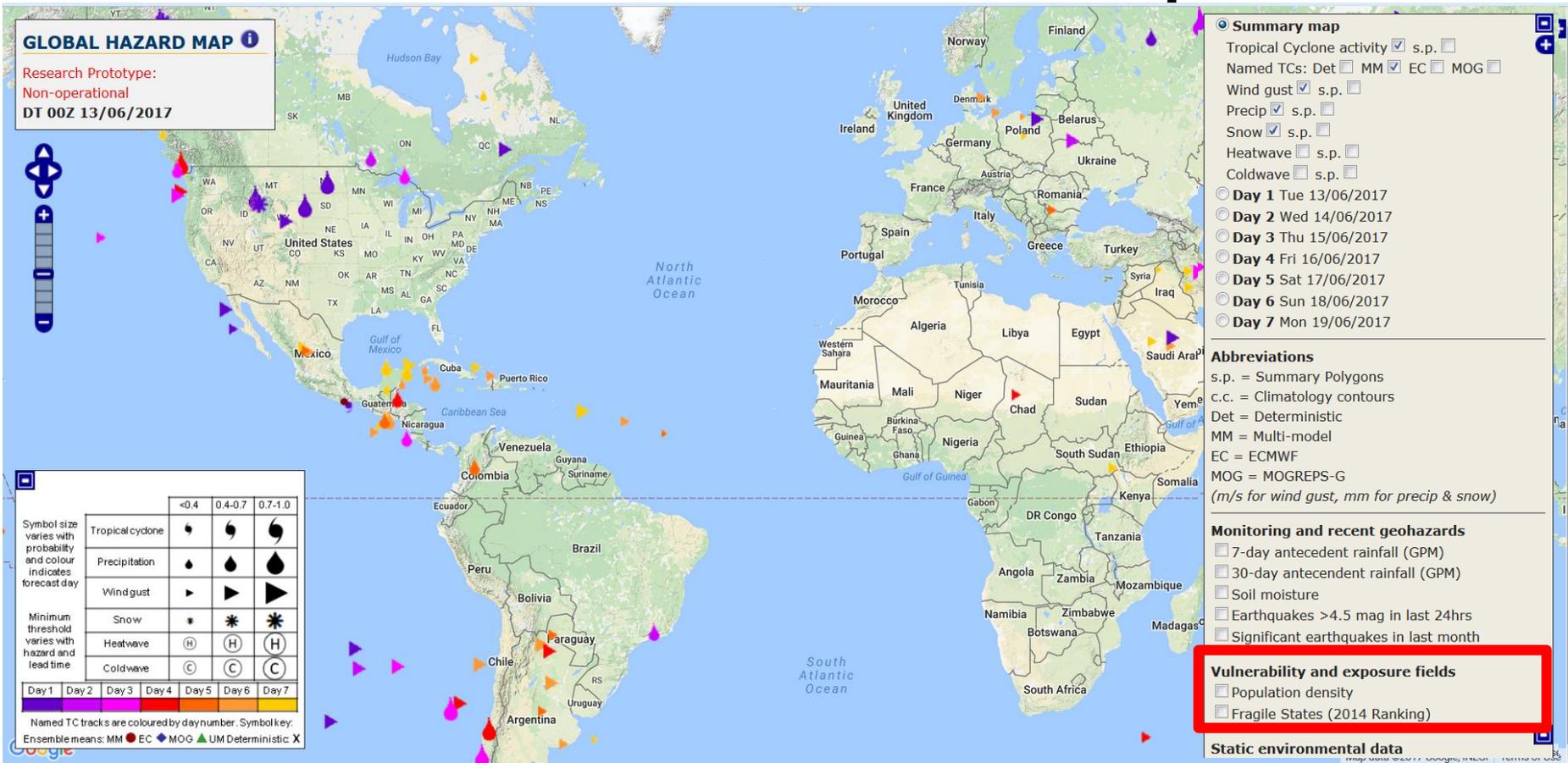
Regime 21



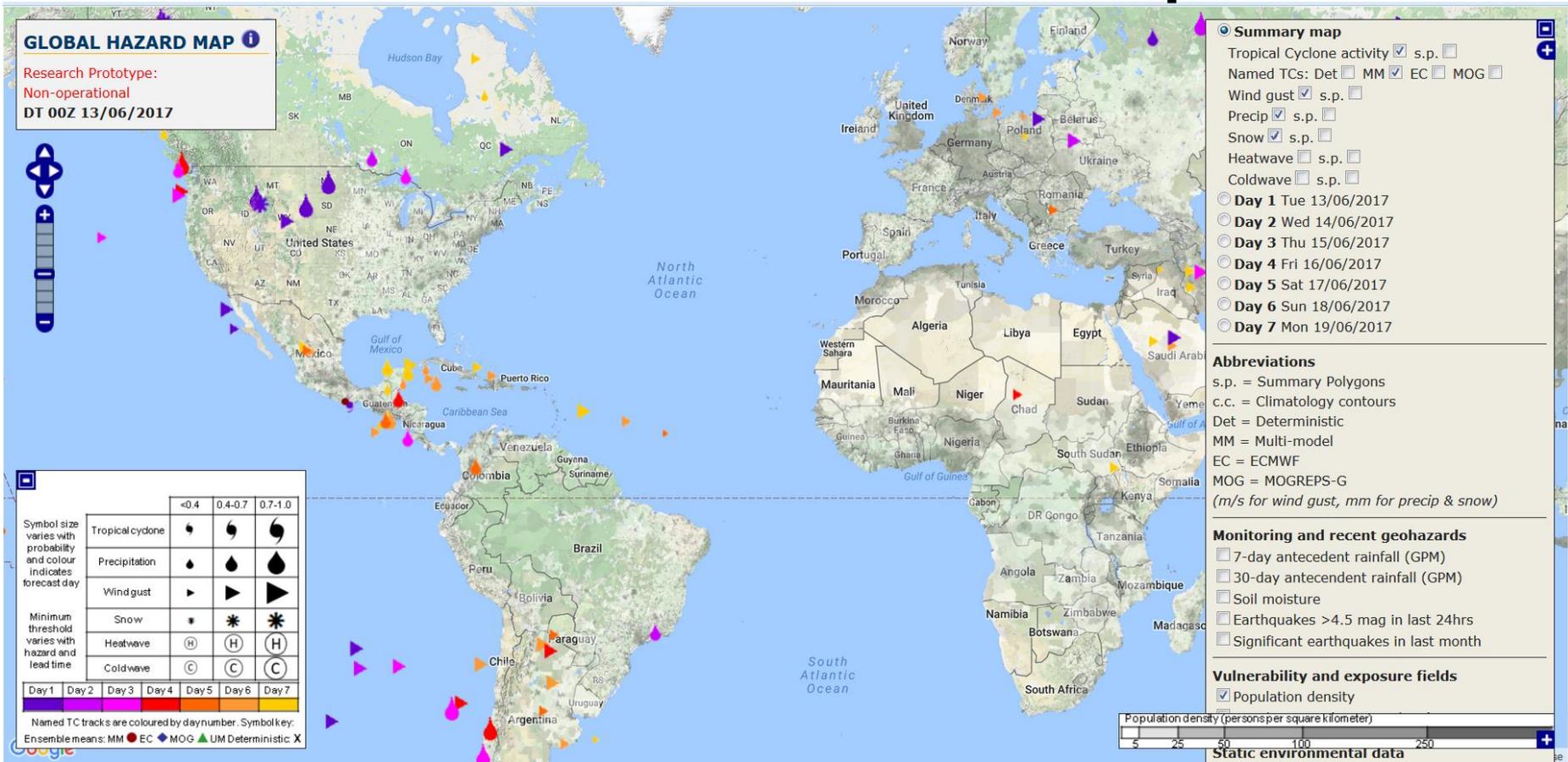
Southwest Scotland



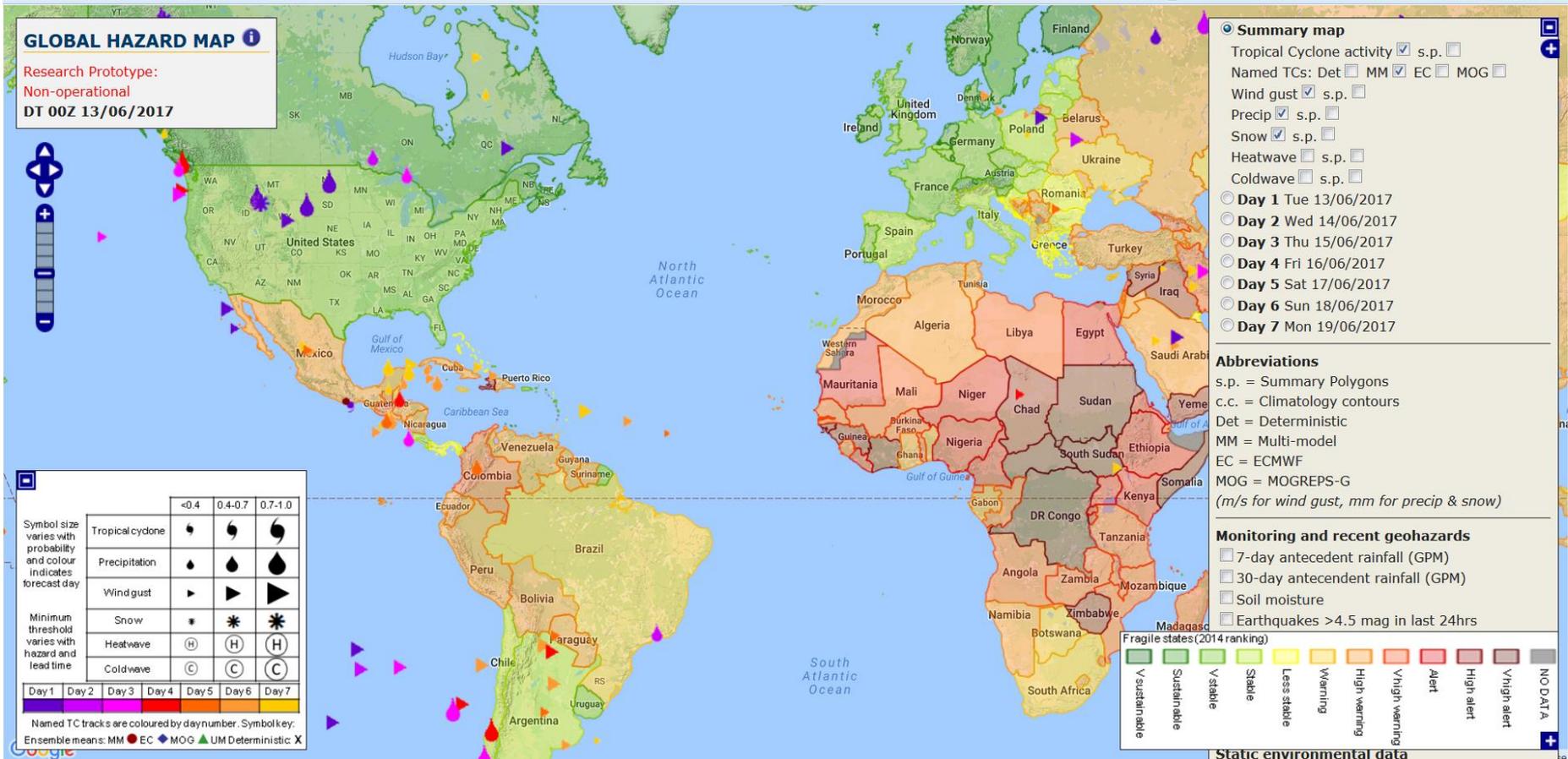
Global Hazard Map



Global Hazard Map



Global Hazard Map



For Discussion

Using ECMWF global ensemble forecasts for impact modelling and forecasting

- Is this something that should be done? Is there a user need?
 - Explicit modelling – like VOT and SWF
 - Warnings including impact – like EPS-W
 - Overlays – like Global Hazard Map
- High resolution vs. lower (global) resolution
- How would this improve forecasts, advice or information?
- Which impacts or hazards would be most useful?
- **Can you, as a group, identify one key opportunity for impact model development exploiting the ENS?**

For Discussion

Using ECMWF global ensemble forecasts for impact modelling and forecasting

- What are key impacts in your country? Wind, flood, snow/ice, storm surge, lightning, volcanic ash/gases, landslides, avalanches, fog/low visibility, wildfire,
- How important are impact based forecasts/warnings in your country?
- How important are *early* warnings in your country?
- Is this something that should be done? Is there a user need?
 - Explicit modelling – like VOT and SWF
 - Warnings including impact – like EPS-W
 - Overlays – like Global Hazard Map
- High resolution vs. lower (global) resolution
- How would this improve forecasts, advice or information?
- Do we need very high resolution or can we calibrate effectively (using M-climate, analogs etc)
- Opportunities for downscaling global ensembles?
- How can we as a community (ECMWF Members and Users) best exploit ENS for high impact storms?
- **Can you, as a group, identify one key opportunity for impact model development exploiting the ENS?**