LSE CATS CENTRE FOR THE ANALYSIS OF TIME SERIES

cats@lse.ac.uk

FLOOD & COAST 2016
Risk, Resilience & Response in a Changing Climate
Telford International Centre, UK
23 - 25 February, 2016
Convened by: Environment Agency

Just Enough Decisive Information: Flexible Response via GLIMPSE

Leonard A. Smith
London School of Economics &
Pembroke College, Oxford

GLIMPSE

blue green CITIES

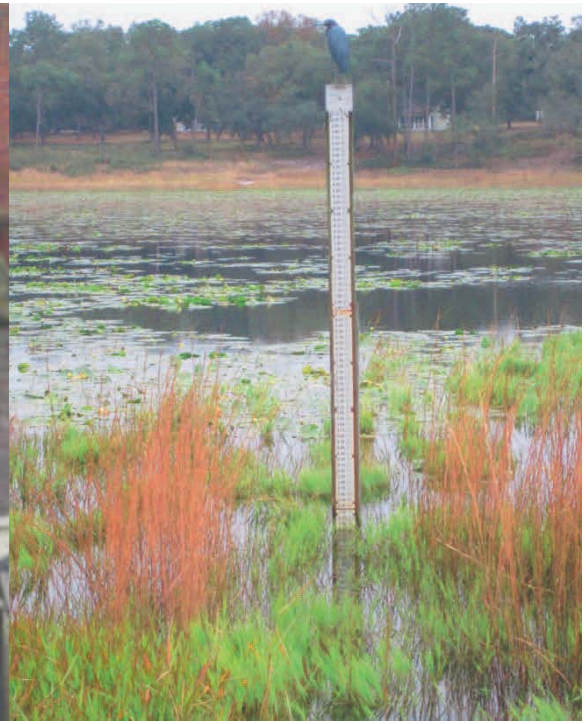
ReCoVER

Approaches to Risk Management of the Large Scale in the Long Range Include:

Select and Build to a Probability Isopleth
from the Best Available Prediction/Projection

or

Focus on Your Vulnerabilities,
Base lines and Flexible Response



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Weather-proof or Weather-wise?

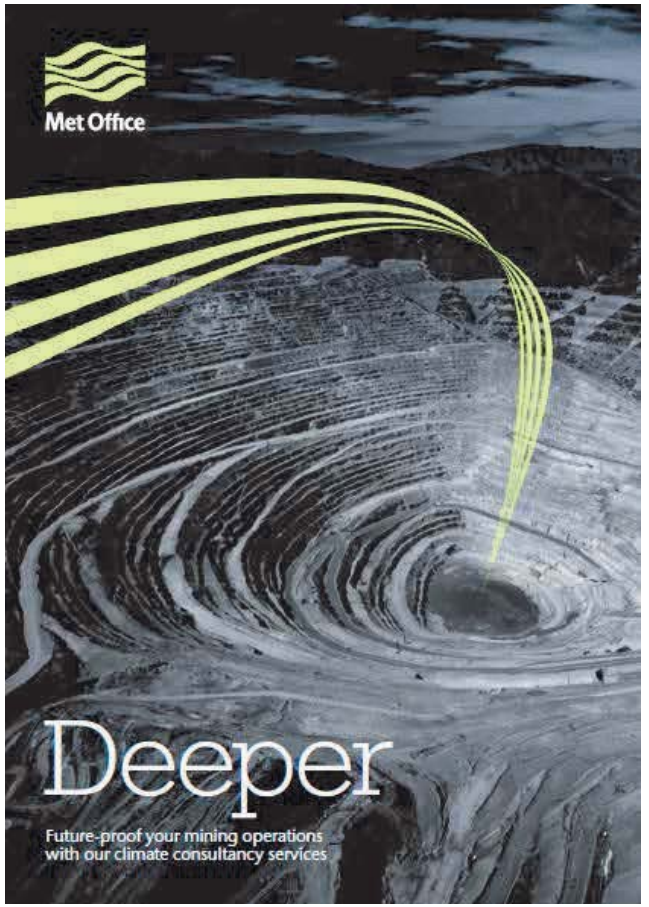
"**Increasingly**, precise, short-term, extremely local forecasts can help..."

http://www.ibm.com/ibm/ideasfromibm/science/092506/

Businesses can respond to build resilience and climate-proof their interests.

acclimatise
managing your climate risks

UK Climate Impacts Programme



"Weatherproof?", "Climateproof?", "Futureproof?"

or

Just Enough Decisive Information (JEDI)?

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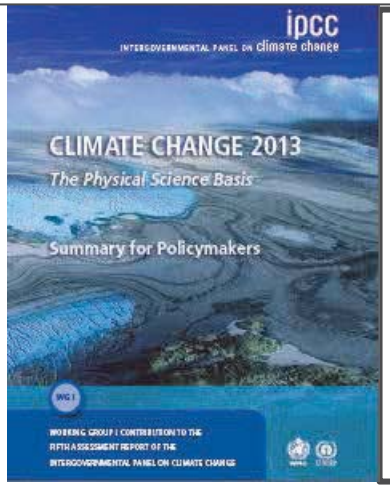
https://www.ipcc.ch/report/ar5/wg1/docs/WGIAR5_SPM_brochure_en.pdf

- Increase of global mean surface temperatures for 2081–2100 relative to 1986–2005 is projected to *likely* be in the ranges derived from the concentration-driven CMIP5 model simulations, that is, 0.3°C to 1.7°C (RCP2.6), 1.1°C to 2.6°C (RCP4.5), 1.4°C to 3.1°C (RCP6.0), 2.6°C to 4.8°C (RCP8.5). The Arctic region will warm more rapidly than the global mean, and mean warming over land will be larger than over the ocean (*very high confidence*) (see Figures SPM.7 and SPM.8, and Table SPM.2). {12.4, 14.8}



The IPCC believes that real-world Global Mean Temperature is "likely" (~66% chance) to be in "the range" of model-land GMT.

That suggests there is a significant chance the 2080 real-word 20 year averaged GMT will be outside the range of the models.

What is your performance target threshold?
1 in 25? 1 in 200? 1 in 10000?

Imagine (for the next 8 min) today's models cannot deliver robust probabilities at that level.
What are your (rational) options?

Probability of a Big Surprise ($GMT_{2081\text{-}2100}$) > ~one in ten
< ~one in four

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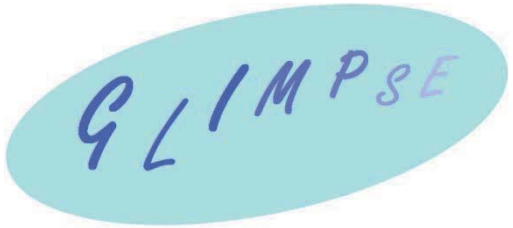
When the "best available" long-range forecast is thought neither adequate for purpose nor robust …



Gauging the Limitations of Imperfect Model Prediction with Sculpted Ensembles

...consider building for a flexible response with reliable early warning, and being happy for a mitigation pathway.

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For more information, please write cats@lse.ac.uk

Build Now to Avoid Vulnerability
Act Then to Cover in Real Time

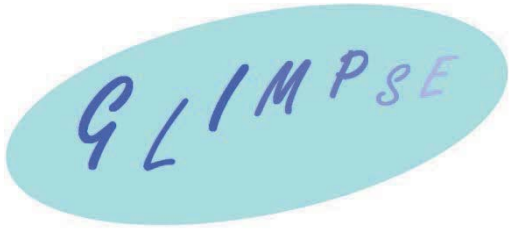
Turn off Coastal Infrastructure (rather than harden it)

Deploy Timely Defences Well in Advance

Insure on the (Glimpse) Forecast

Reinsure on Early Warning

Regulate in Light of GLIMSE



Gauging the Limitations of Imperfect Model Prediction with Sculped Ensembles

Weather models in 2050 will be rather better than today's...

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GLIMPSE is Feasible

Modern methods of data assimilation allow us to "assimilate" possible futures, deepening potential storms, identifying both risks and critical observations.

Du, H. and Smith, L.A. (2014) 'Pseudo-orbit data assimilation part II: assimilation with imperfect models', *J Atmos Sci*, 71 (2), 483-495.
Smith L.A., Du, H. and Wheatcroft E. (2016) 'Using PDA to GLIMPSE Hazardous Weather in the Long Range.' .

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How would we view Flood Risks differently given a week to deploy defences?

What can we protect?
What scale of **Blue-flexible-Green** (BFG) can we exploit?
Where can the initial saving justify the delayed (insured) costs?
And what about regulation?

And what are the rational alternatives?

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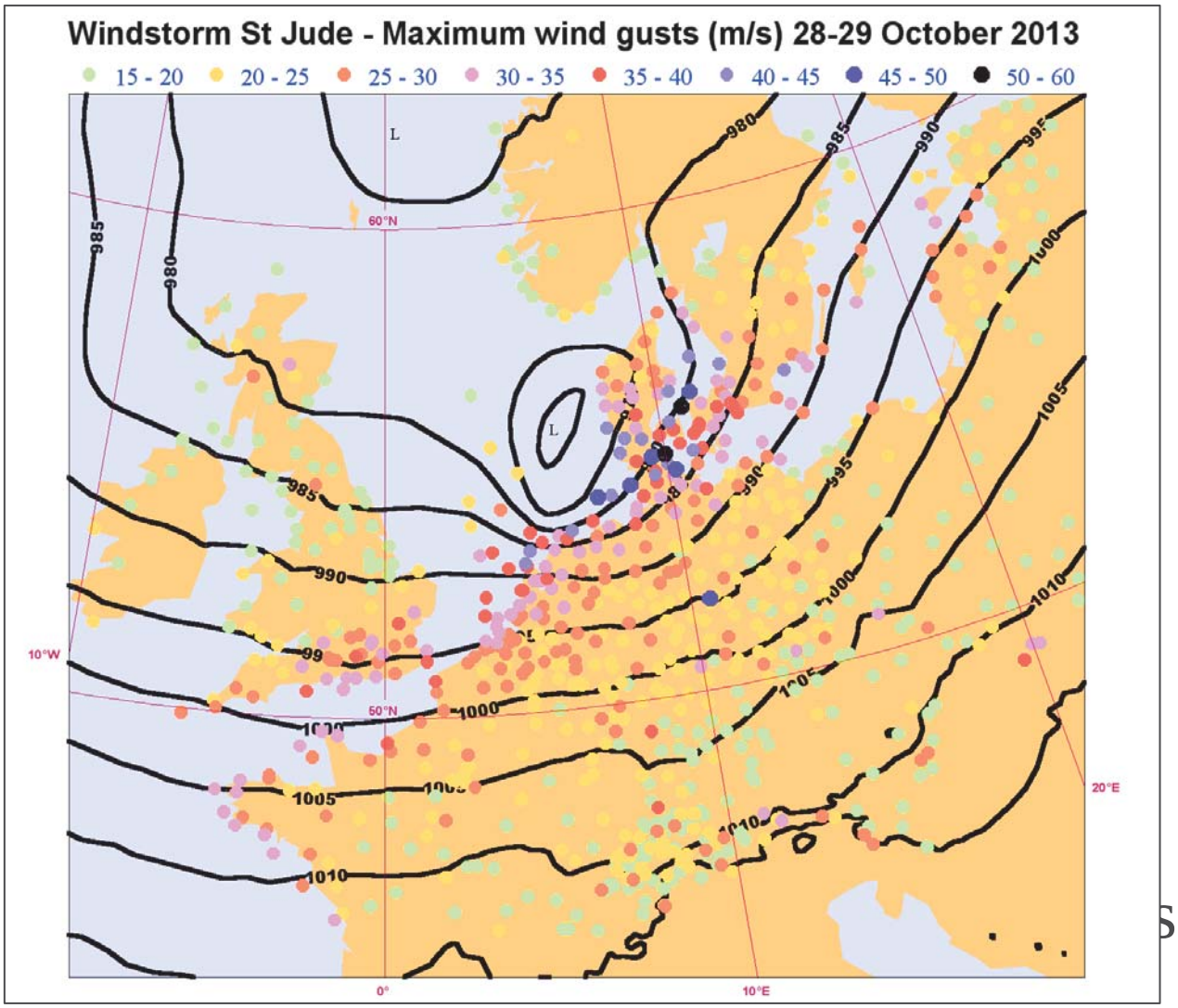
Foreseeing the St Jude Storm



(Many thanks to ECMWF for the postage stamp maps that follow.)

Today early warning is good even without Glimpse

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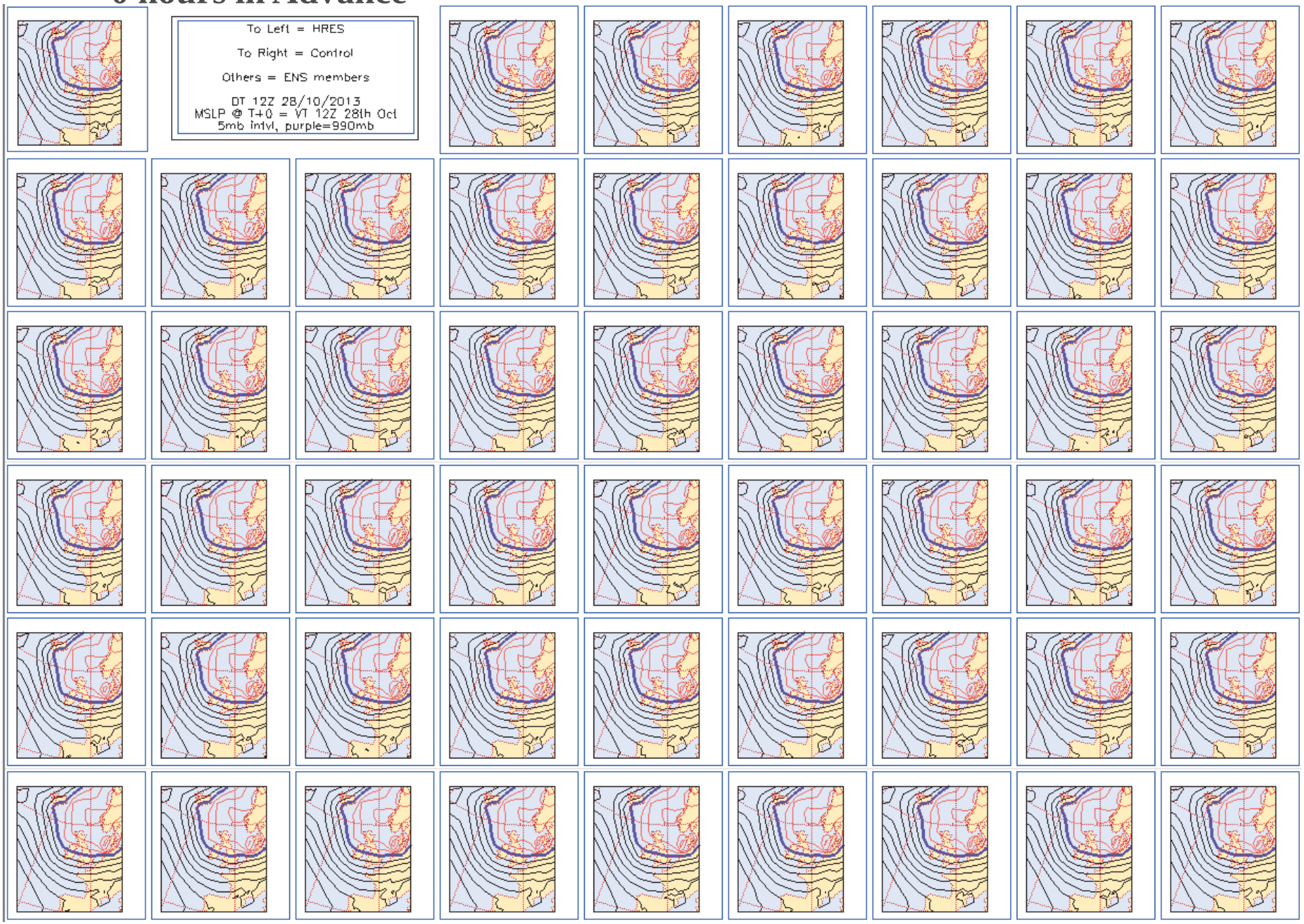
0 hours in Advance



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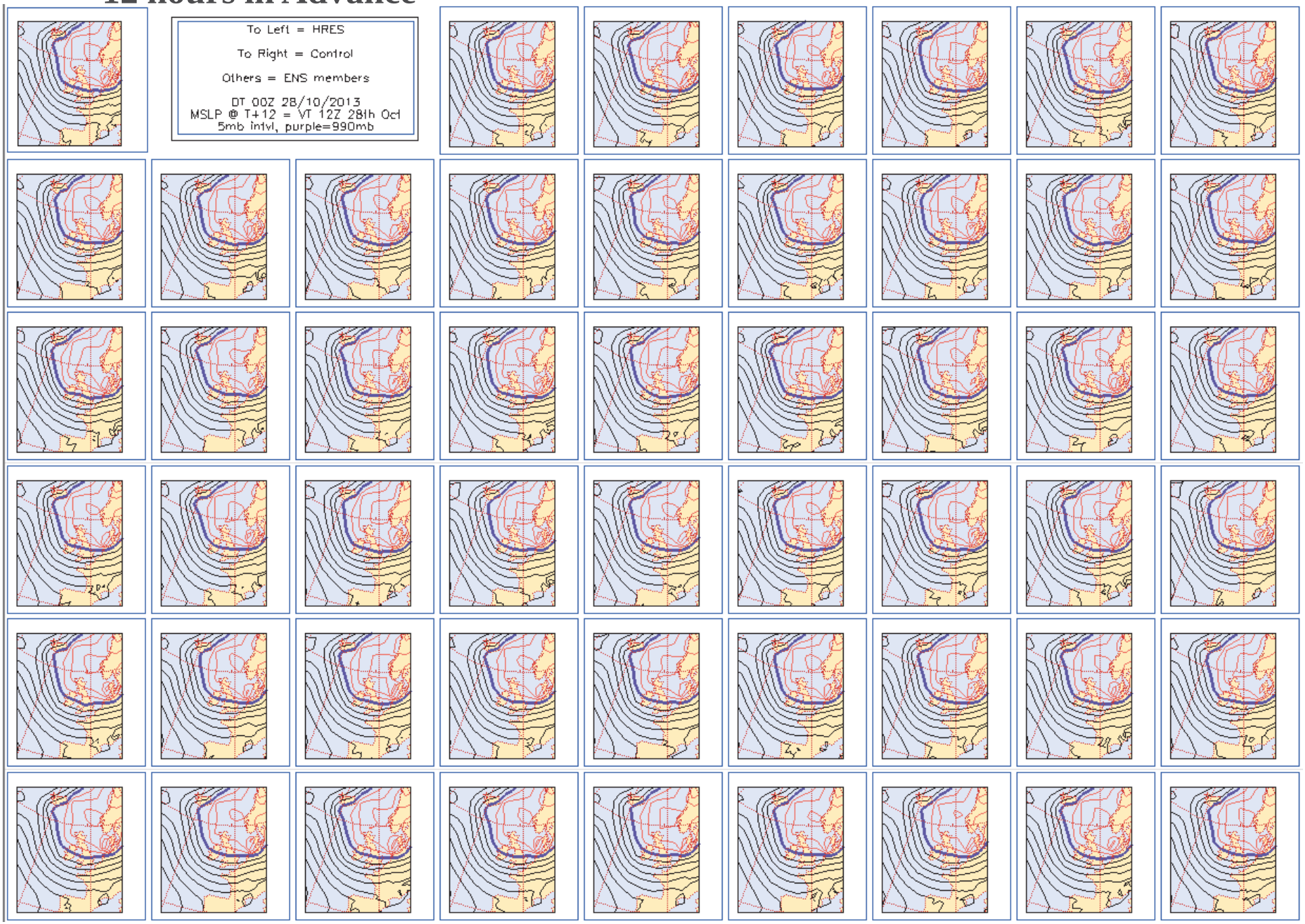
12 hours in Advance



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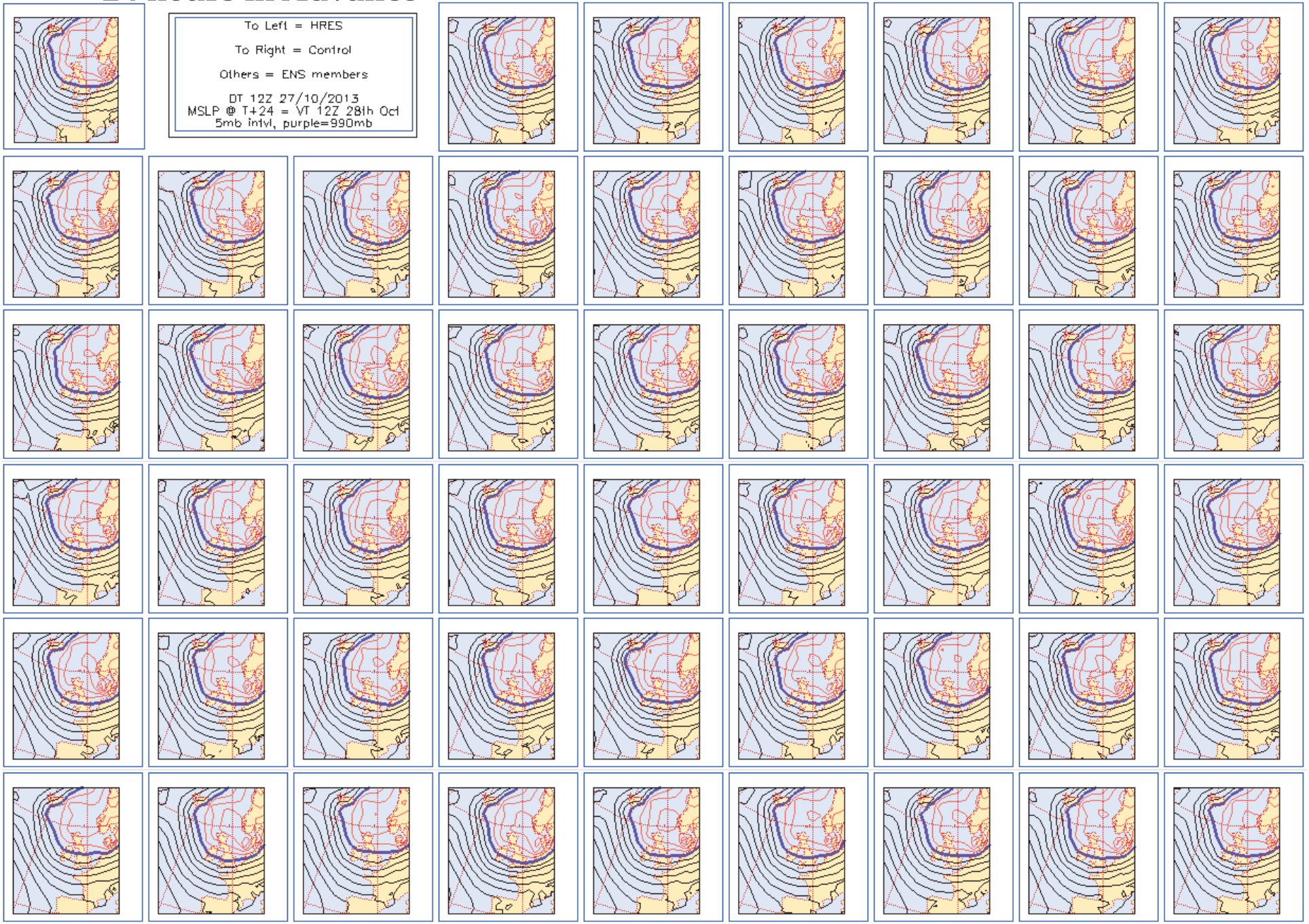
24 hours in Advance



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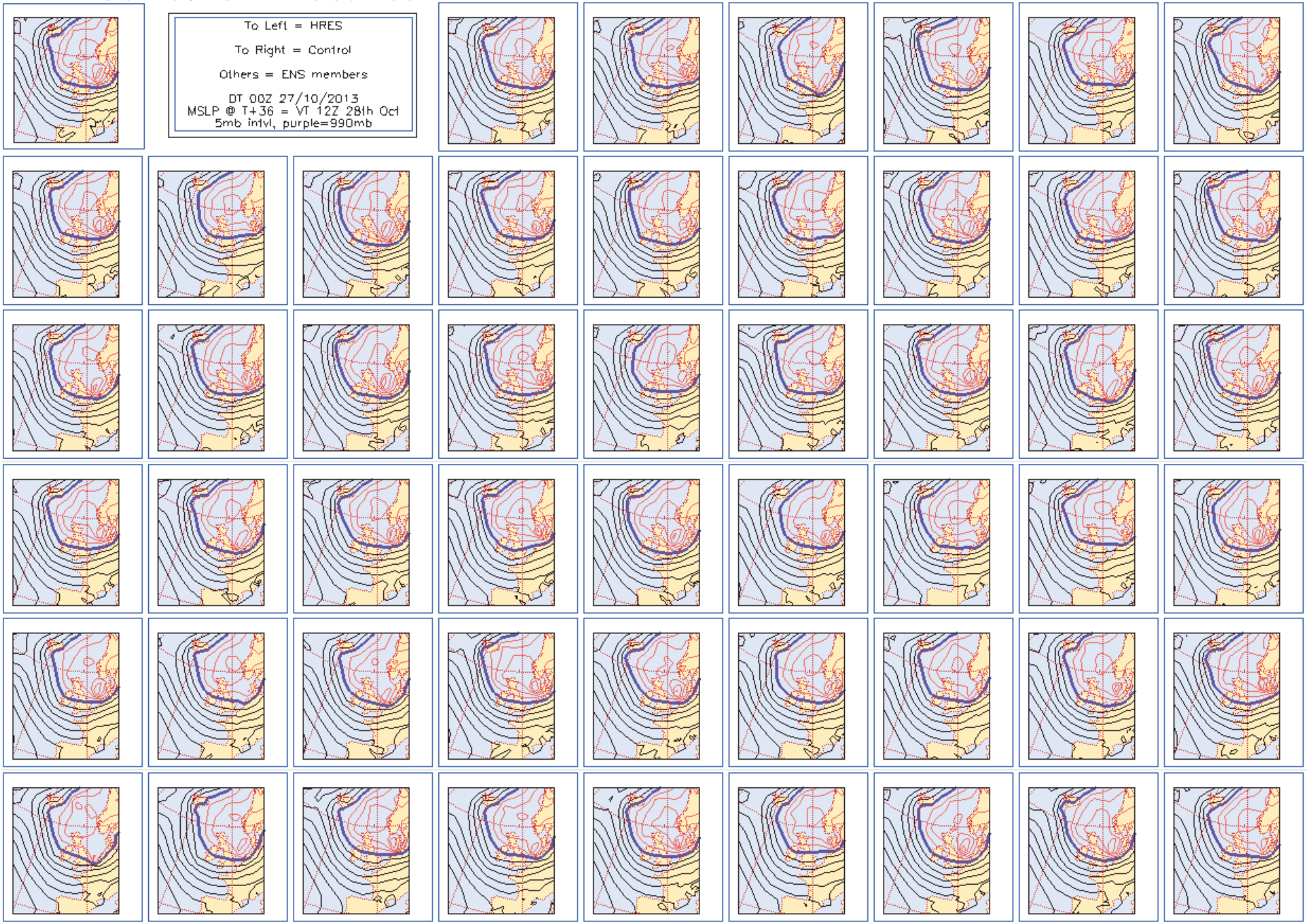
36 hours in Advance



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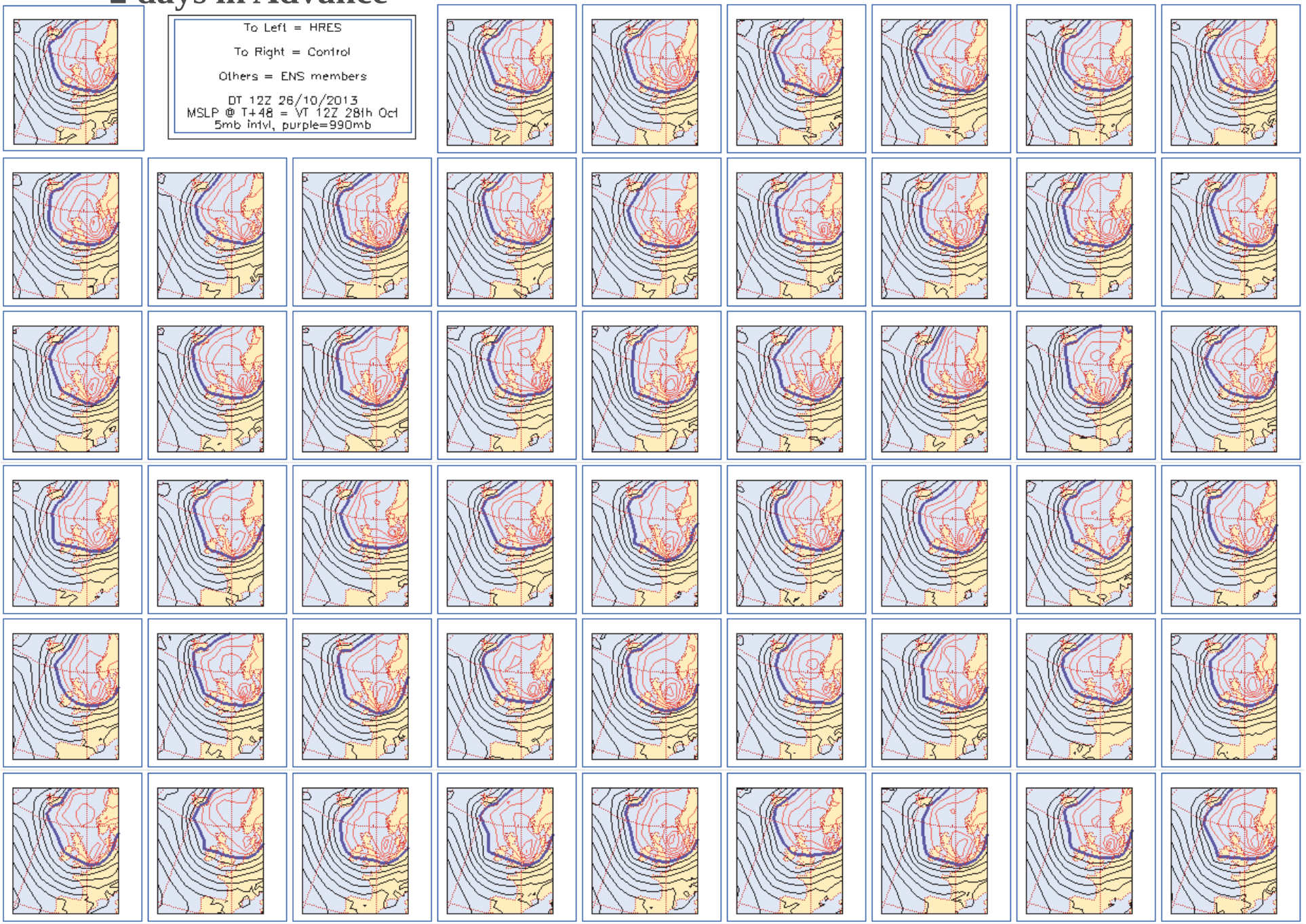
2 days in Advance



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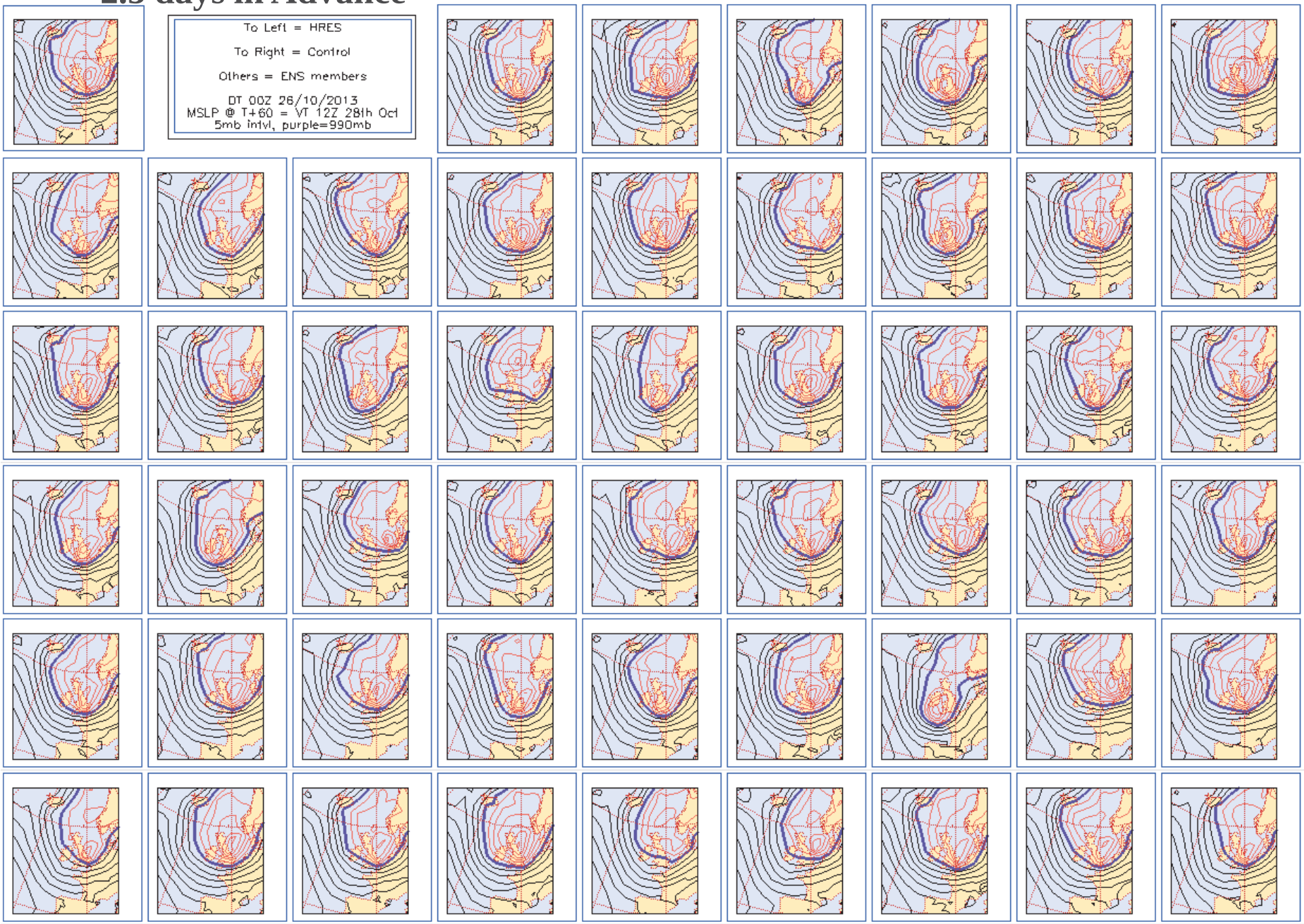
2.5 days in Advance



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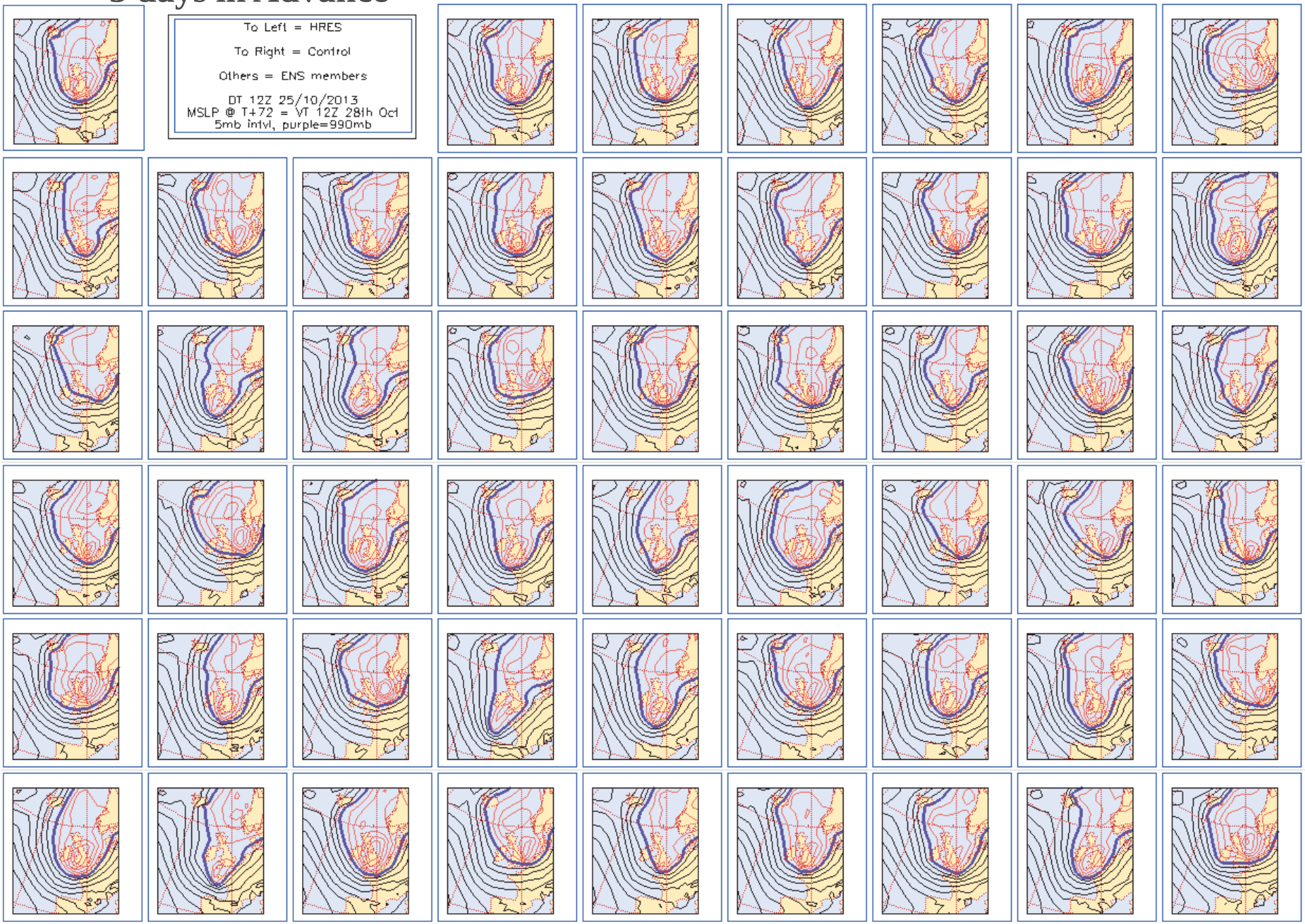
3 days in Advance



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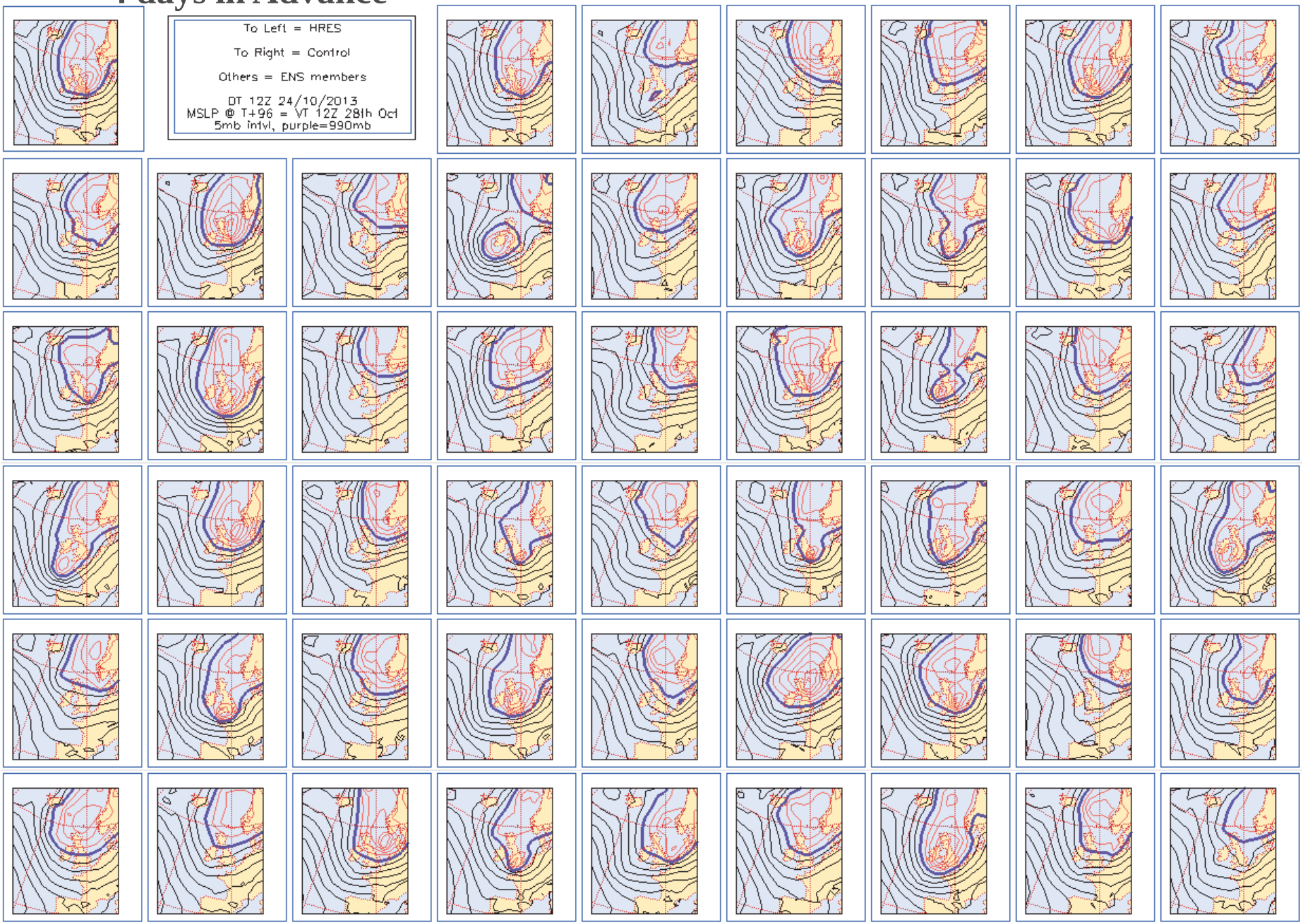
4 days in Advance



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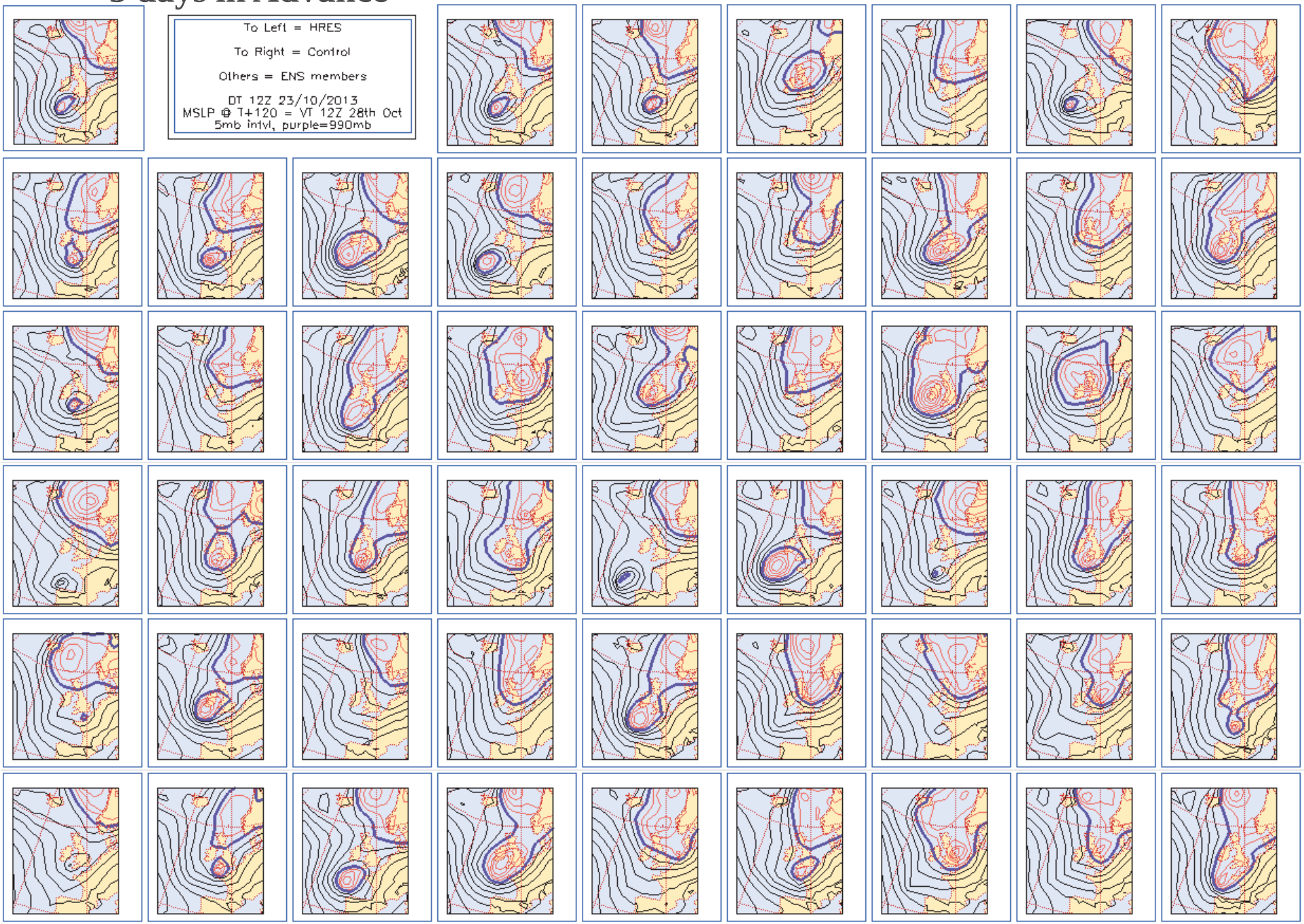
5 days in Advance



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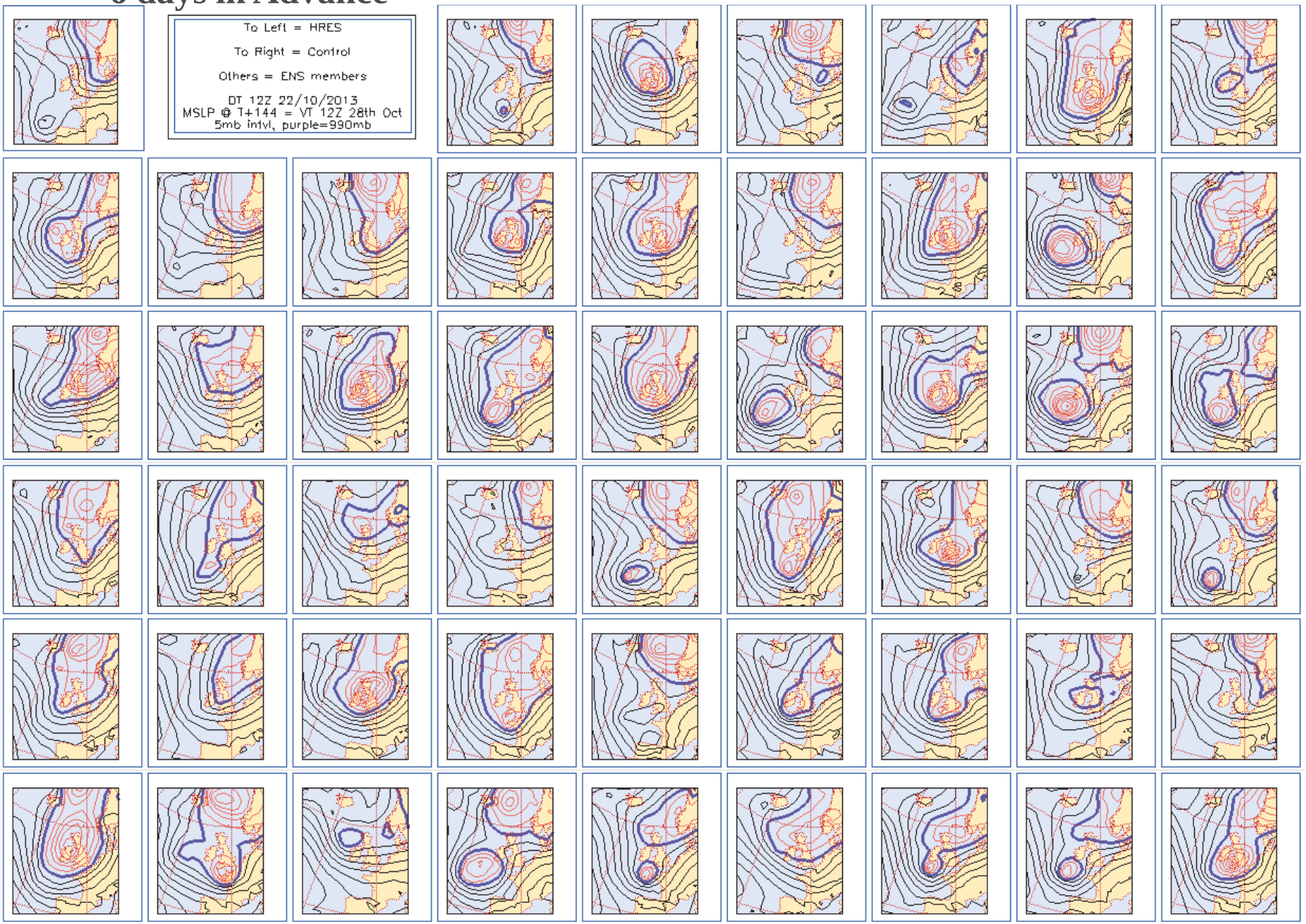
6 days in Advance



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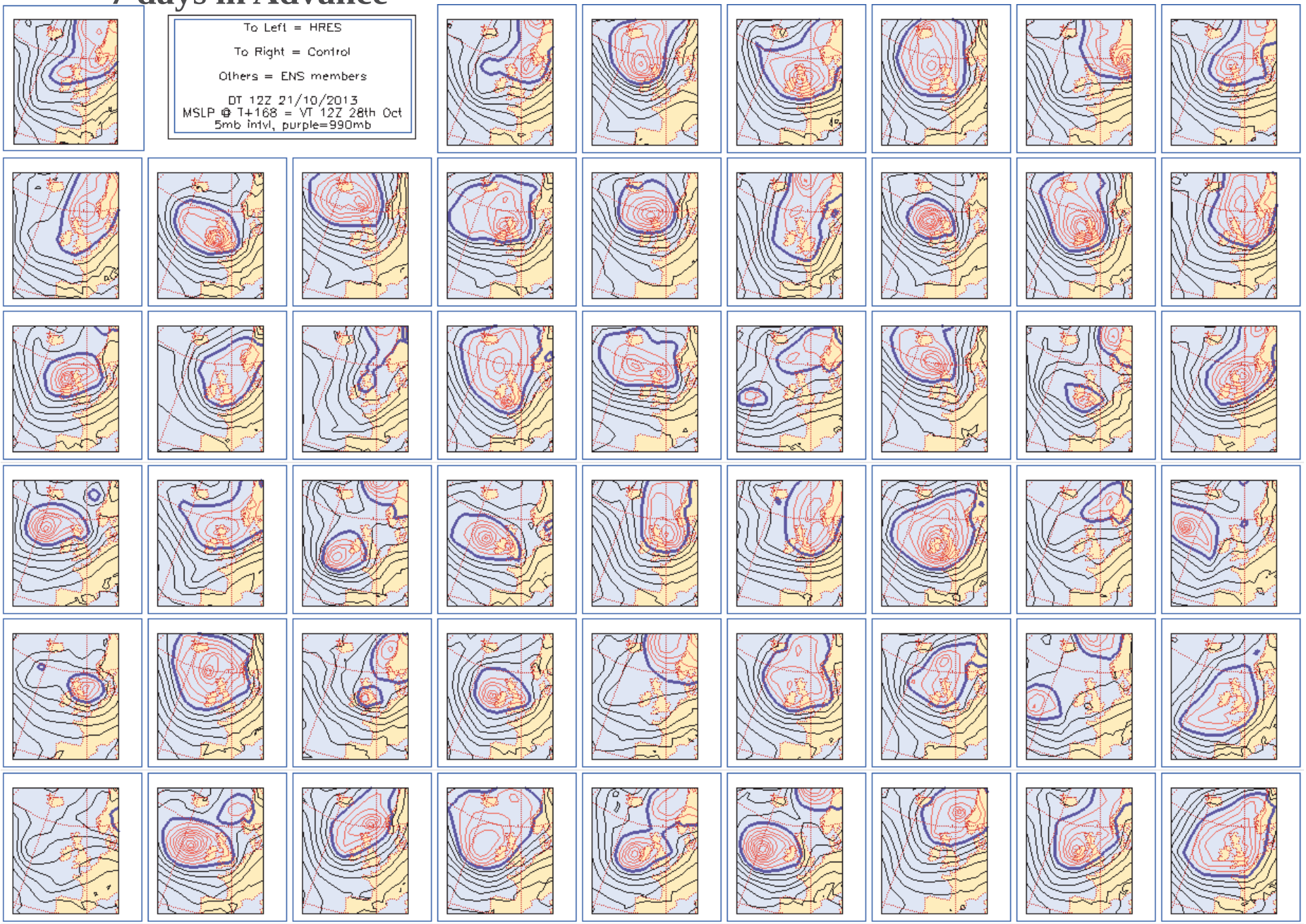
7 days in Advance



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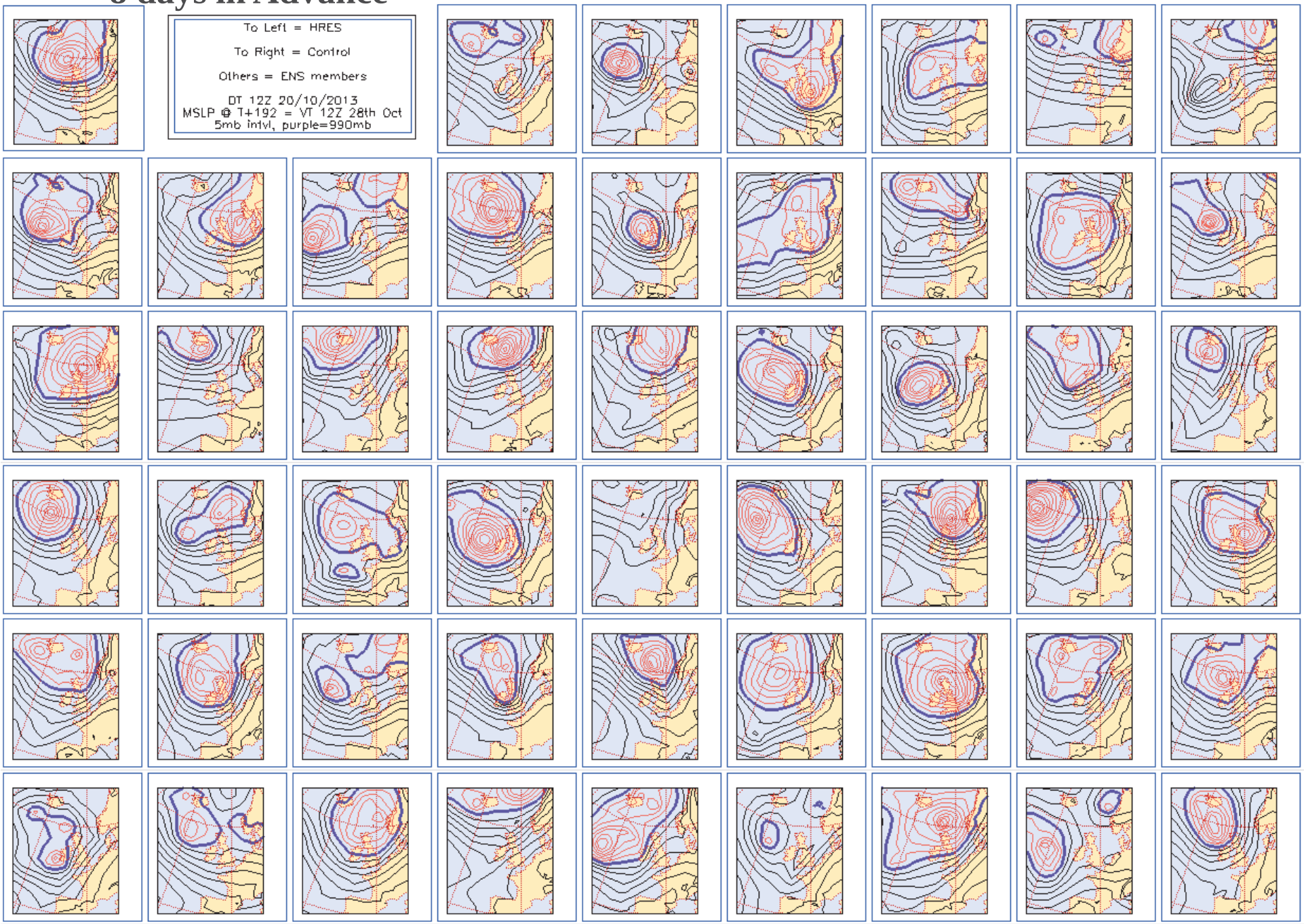
8 days in Advance



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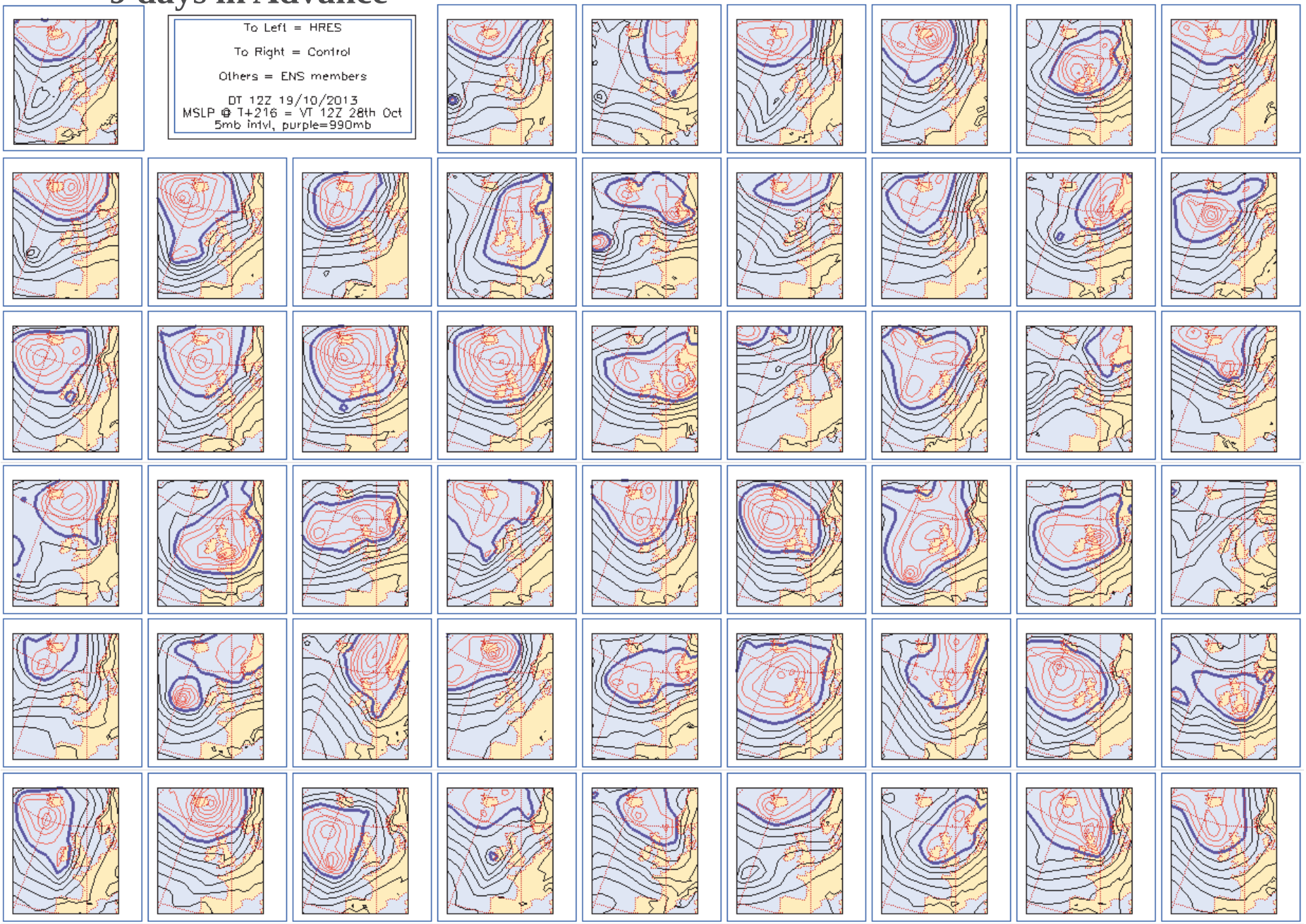
9 days in Advance



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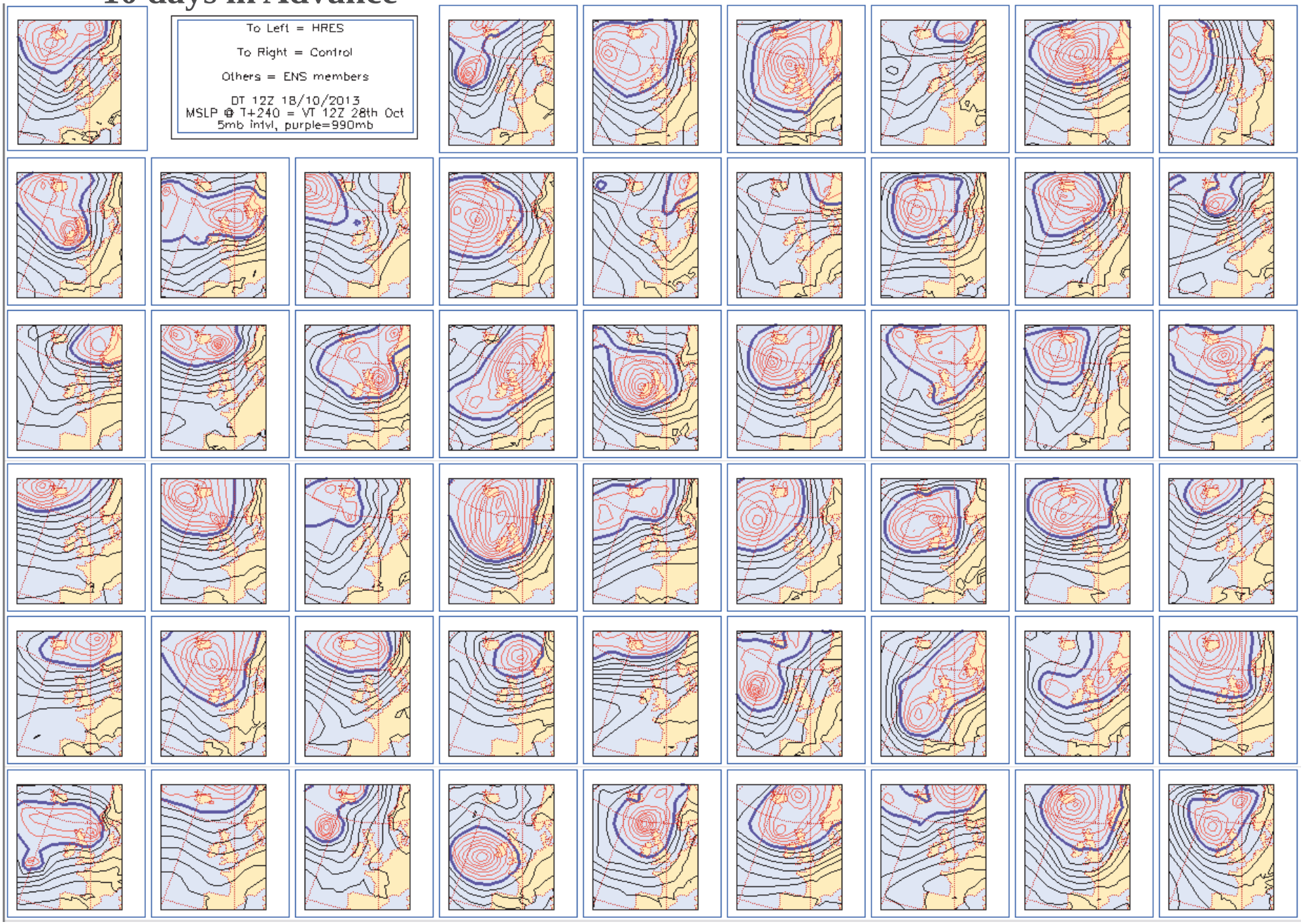
10 days in Advance



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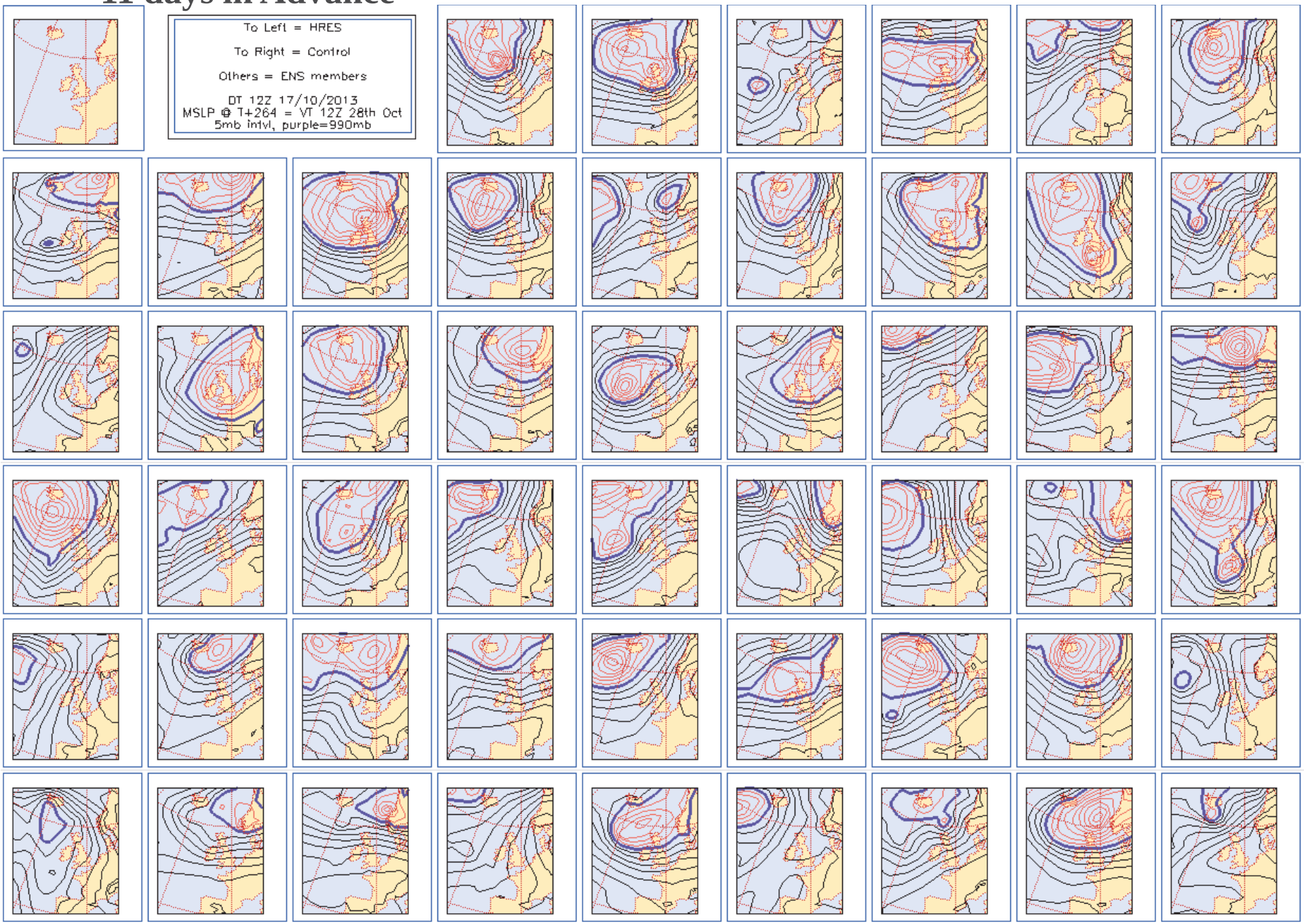
11 days in Advance



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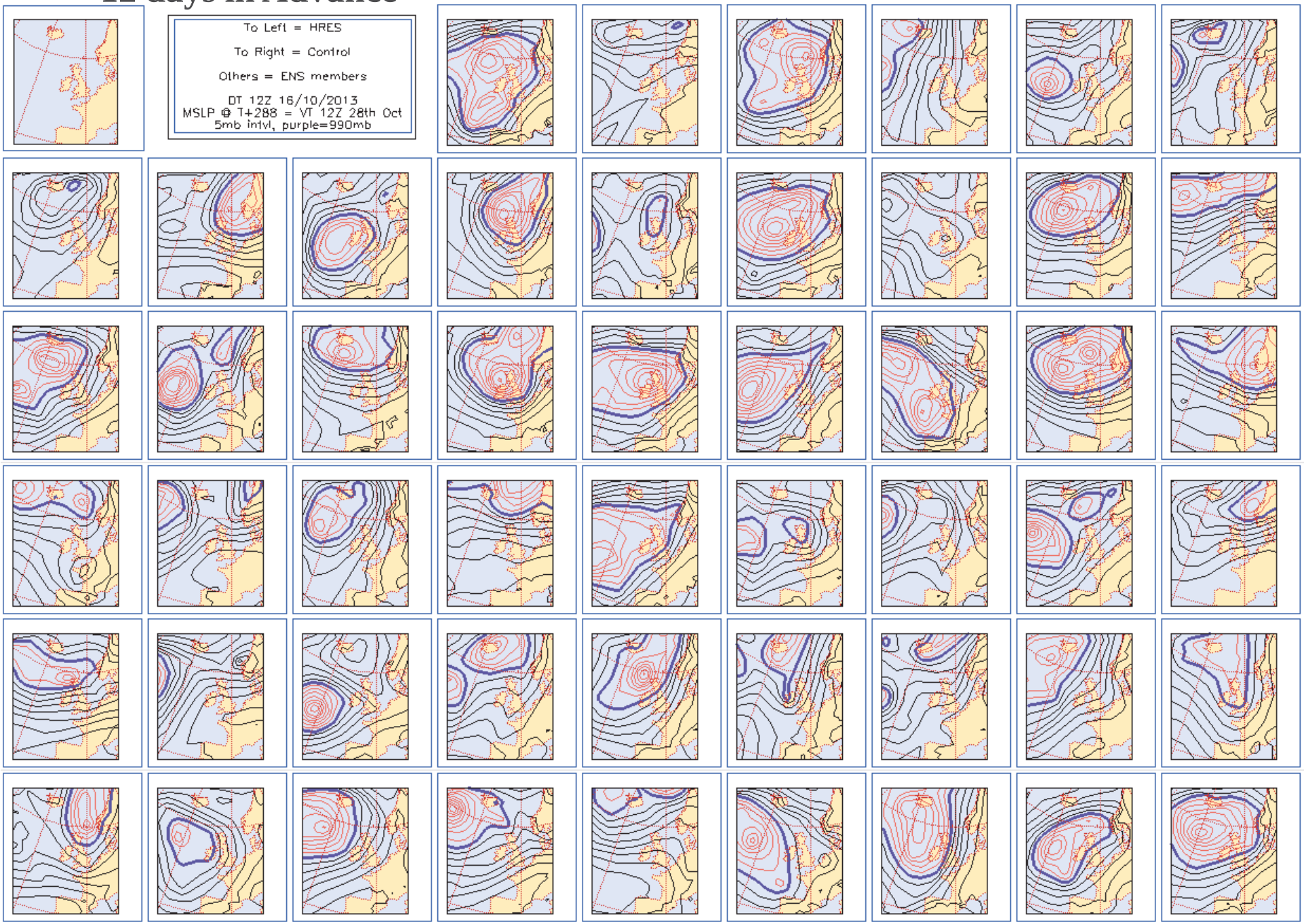
12 days in Advance



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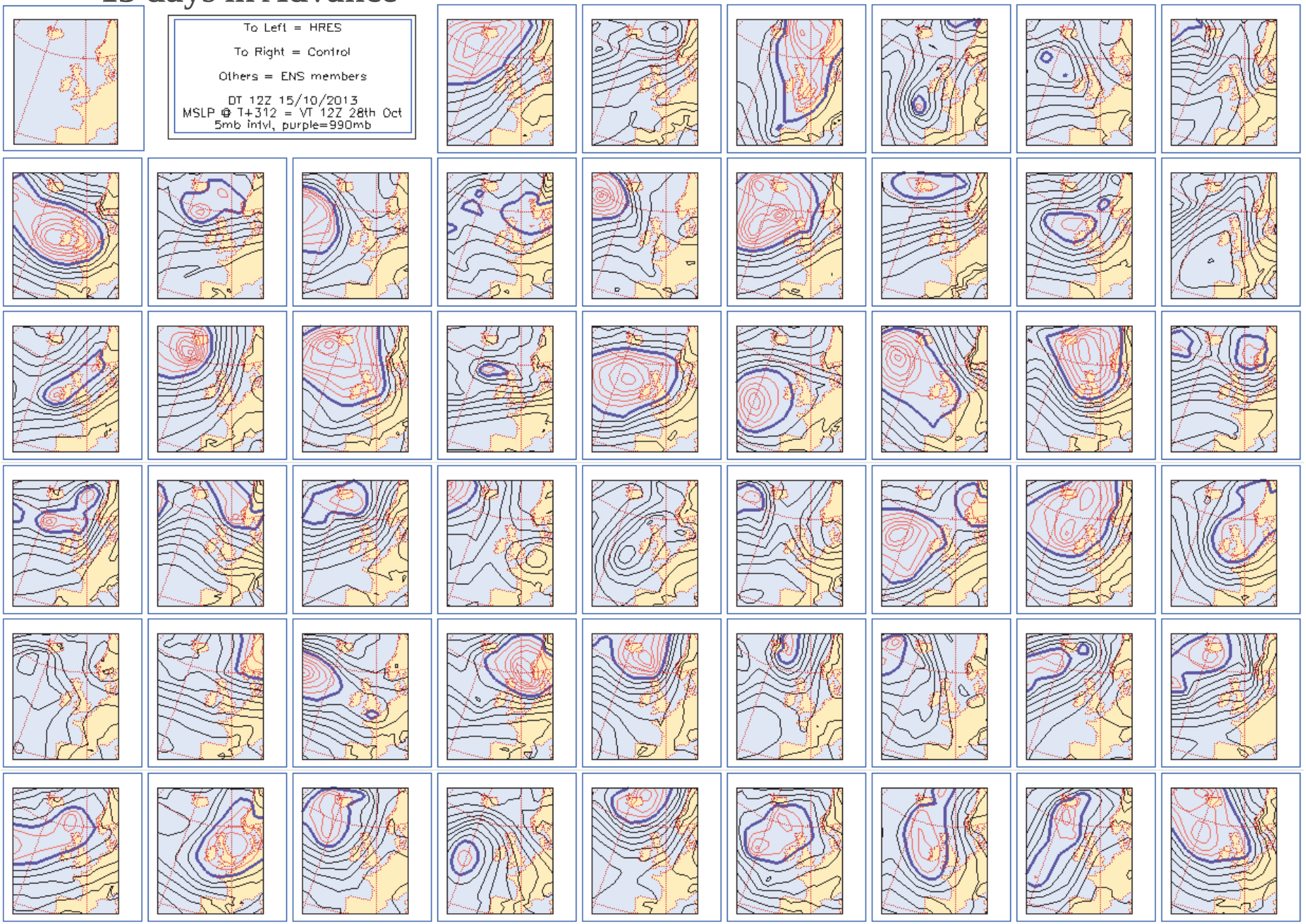
13 days in Advance



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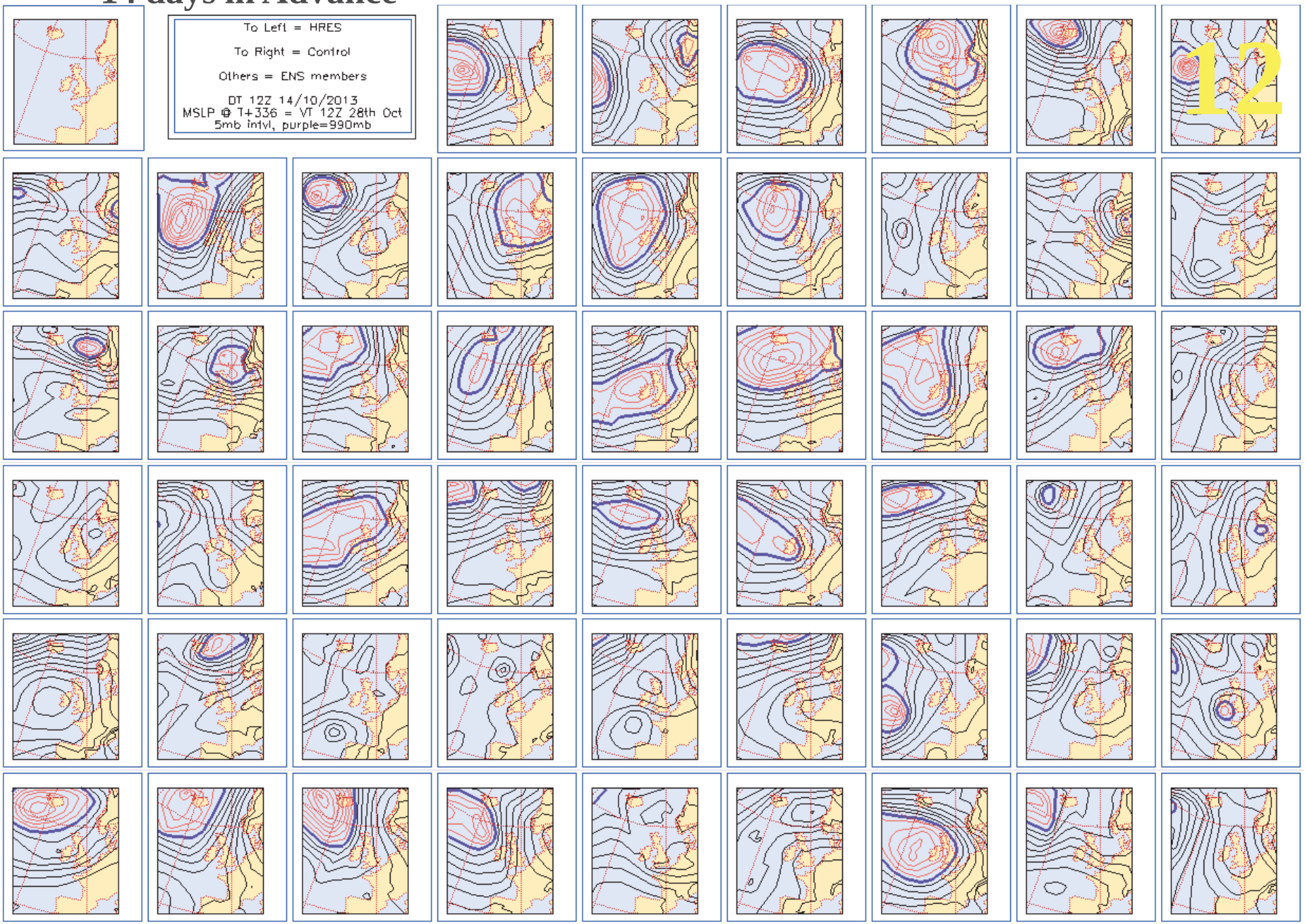
14 days in Advance



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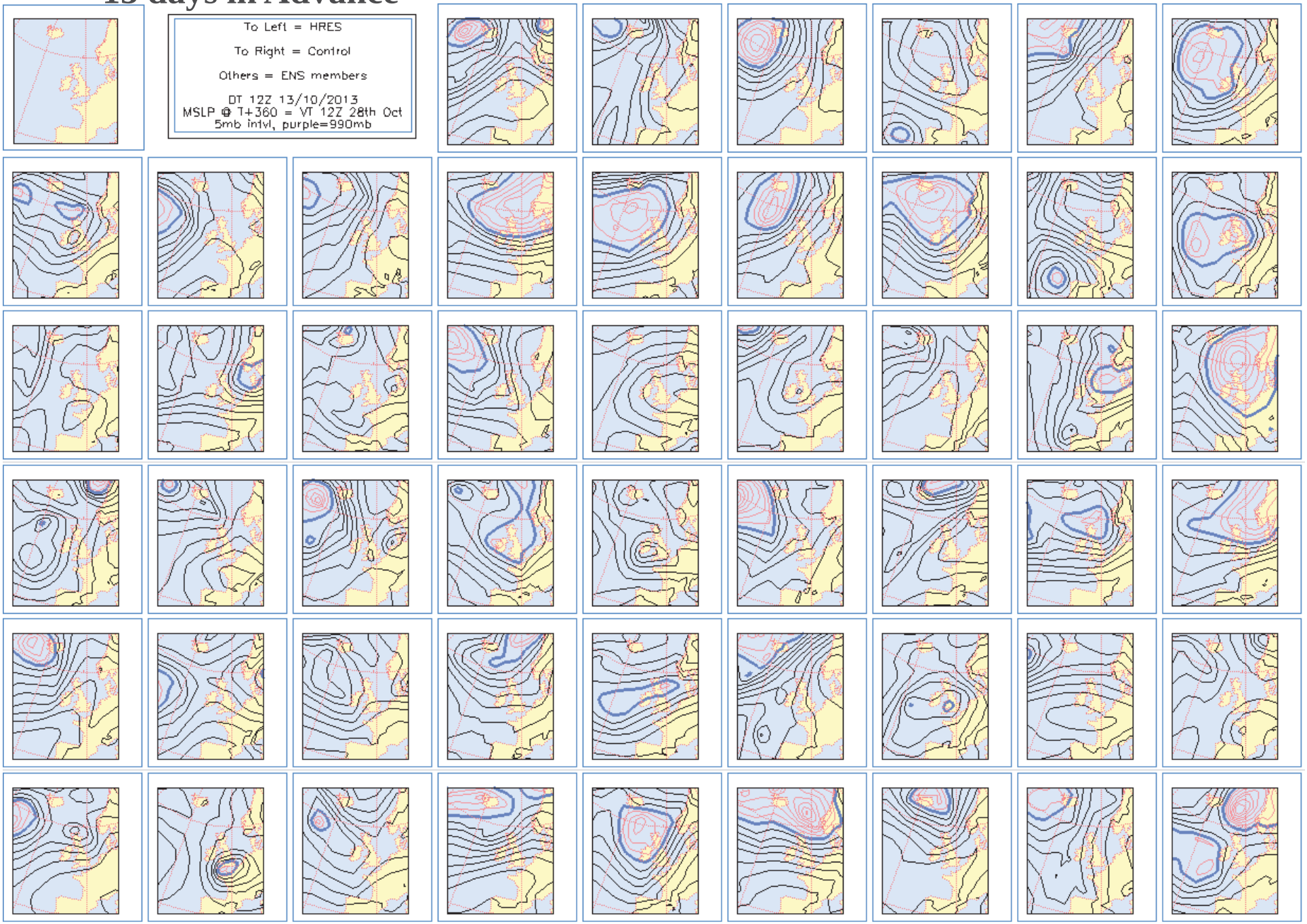
15 days in Advance



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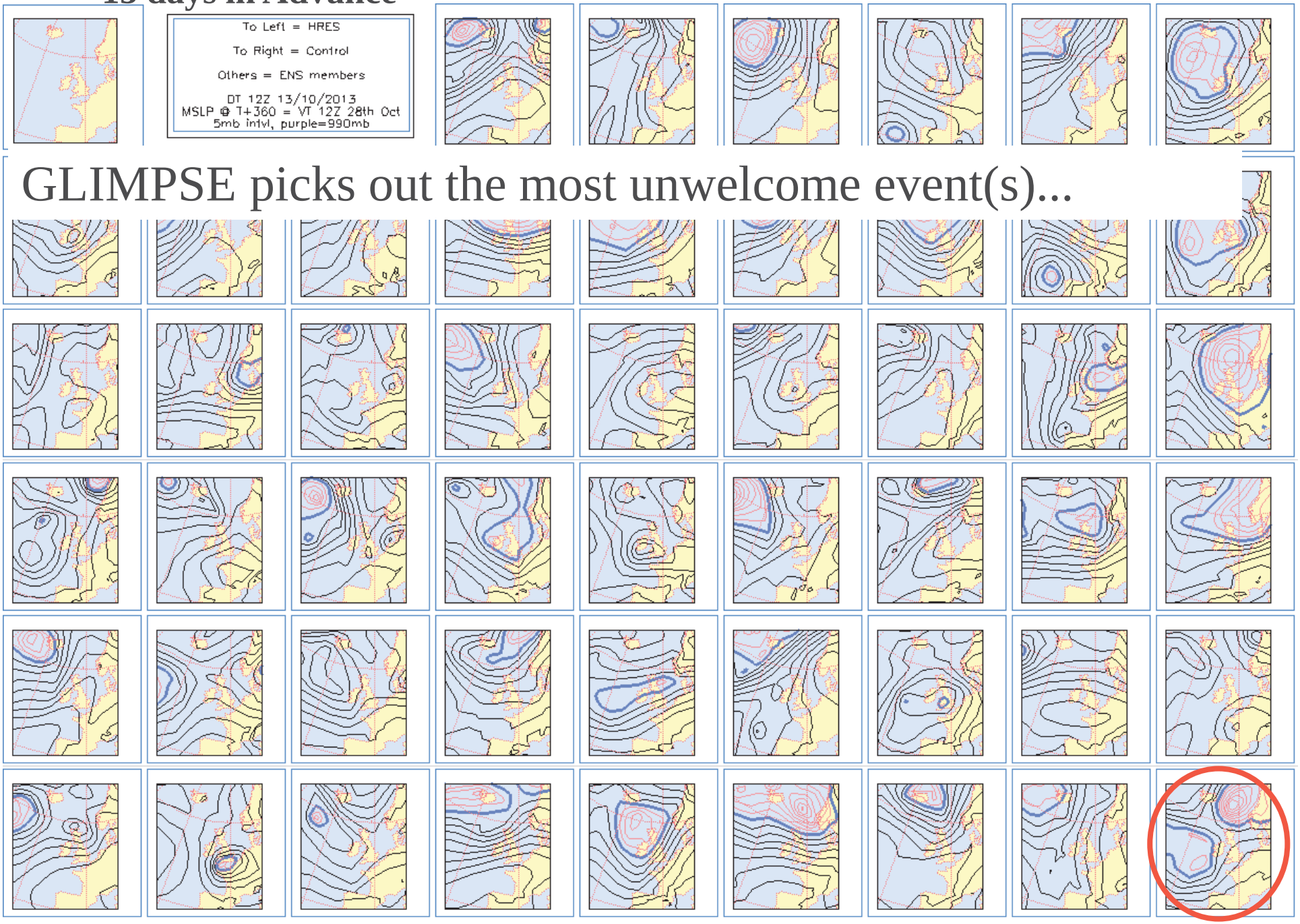
15 days in Advance



GLIMPSE picks out the most unwelcome event(s)...

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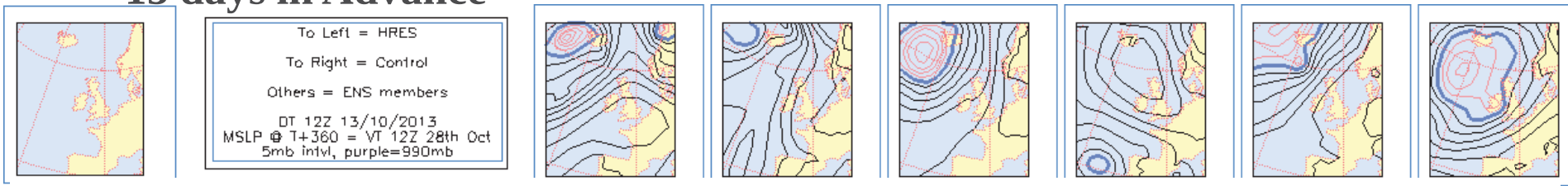
15 days in Advance



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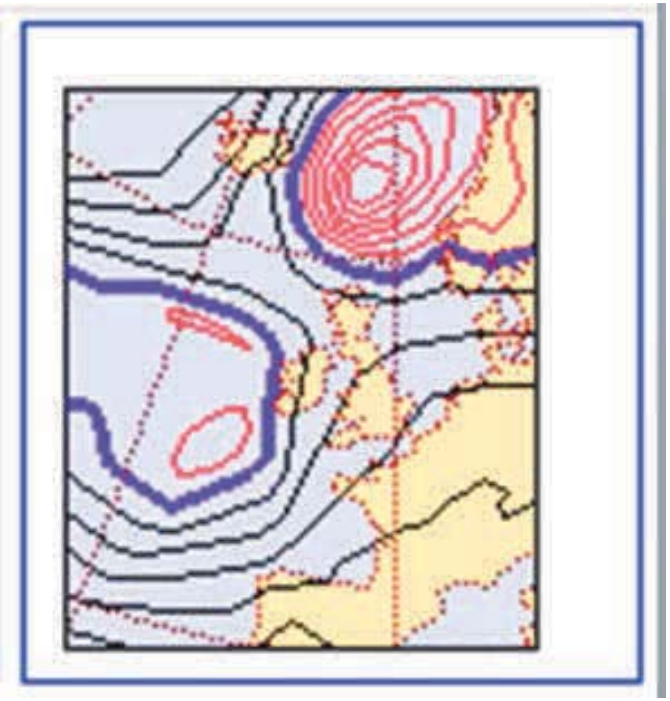

... and uses PDA to assimilate a model-future with something even worse, should it exist.

It may not be possible to assign probabilities to these events *a priori*.

(but then, we cannot do that with current ensemble members either!)

And there are **many** one-in-one-hundred-year events to learn from, and to practice on, every year (somewhere in the world).

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Alternatives?

I welcome the suggestion of other alternatives!

No alternative approach will feel as comforting or appear as rational as building to meet a known one in one hundred / two hundred / ten thousand event

But we know **we do not know** the one in ten event for 2060 with any real confidence.

And if the Prob(BS) far exceeds our target threshold...???

Through GLIMPSE, the Just Enough Decisive Information approach aims to consider the science of the future in fighting the challenges of the future, focusing on flexible response and affordable, farsighted build today. No-proofing

Where might we use this approach?

And, of course, much of the world is not adapted to today's climate

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Questions?

(Answers also welcome)

For more information please write cats@lse.ac.uk

and come to the BlueGreen Stand (A9) this afternoon!

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