Visualization of confidence in weather forecasts: ECMWF' s users ……….

Designing information to focus on what is relevant ……

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Quantifying and communicating uncertainty

Information about forecast **uncertainty** has been around for a number of decades.

Forecasters have long compared forecasts from different models, and they can now use ensemble forecasts to assess forecast uncertainty.

Ensemble systems provide a quantification of the uncertainty in a matter that is consistent with the models we use and our knowledge of the atmosphere at the start of a forecast.

Communication of this uncertainty is trickier ………
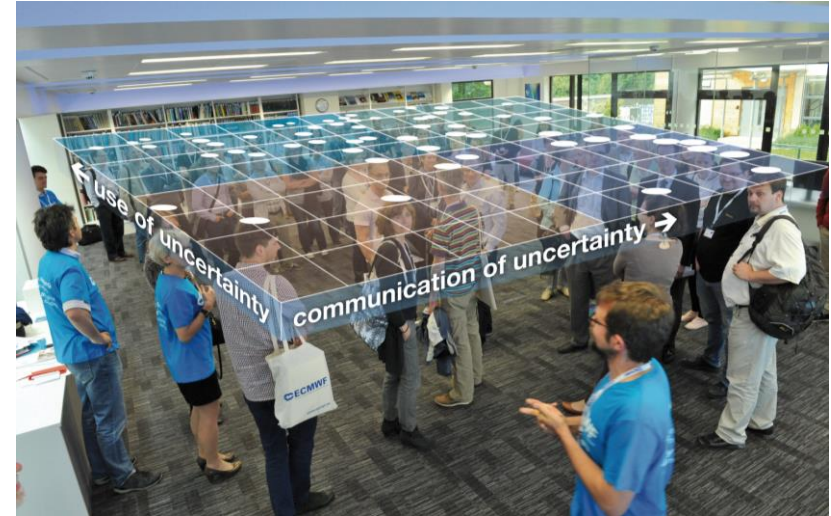
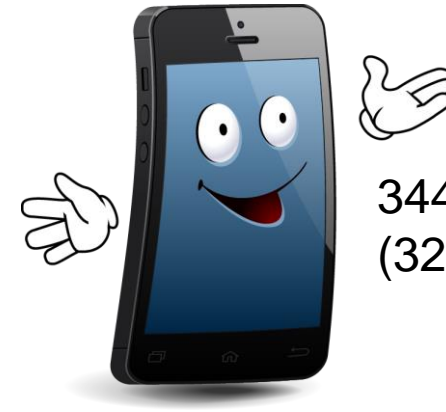|	little communication	high communication
understanding advanced	Advanced use/basic communication	Advanced use/high communication
understanding basic	Basic use/little communication	Basic use /high communication

communication

How to make sense of "big data"?

ENS output everyday: 11TB (next year it will be roughly twice as much)

344 mobile phones (32 GB)

Harry Potter : 184250 hours

Challenge:
How can we transform and visualise data so that we create knowledge and actionable information?

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How to make sense of "big data"?

"To cope with information overload we could use our eyes more … "

" …… visualizing information, so that we can see the patterns and connections that matter and then designing that information so it makes sense; or it tells us a story; or it allows us to focus on the information that is important……"

David McCandless (Data Journalist and Influencer)
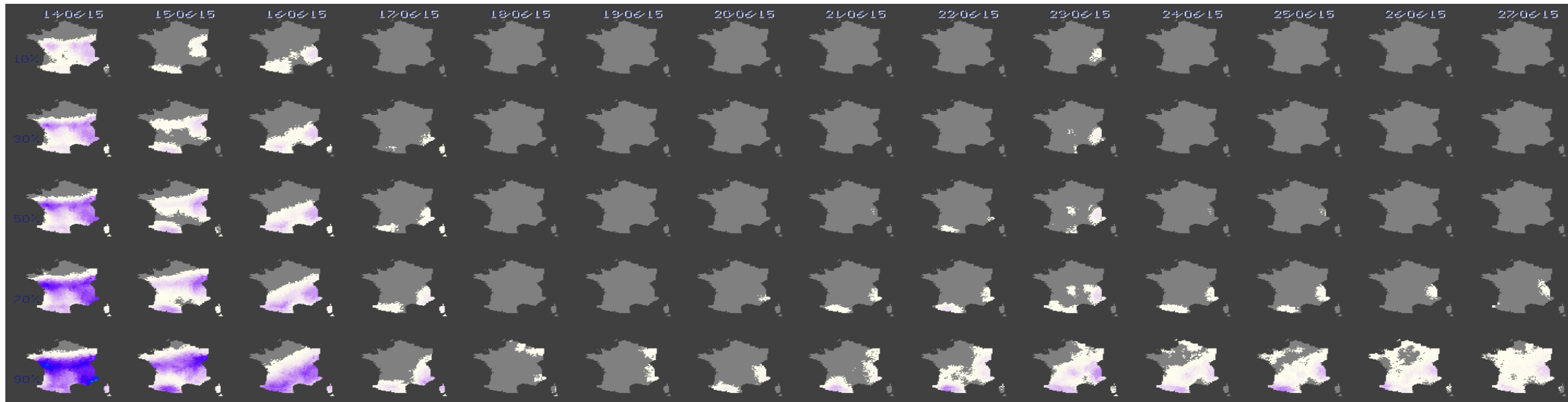
TED talk "The beauty of data visualistion" 2010

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ECMWF ENSemble Forecast: stamp maps

ECMWF ENSEMBLE FORECASTS
Monday 01 June 2015 0000 UTC ECMWF forecast t+168 VT:Monday 08 June 2015 0000 UTC
MSLP (contour every 5hPa) Temperature at 850hPa (only -6 and 16 isolines are plotted)
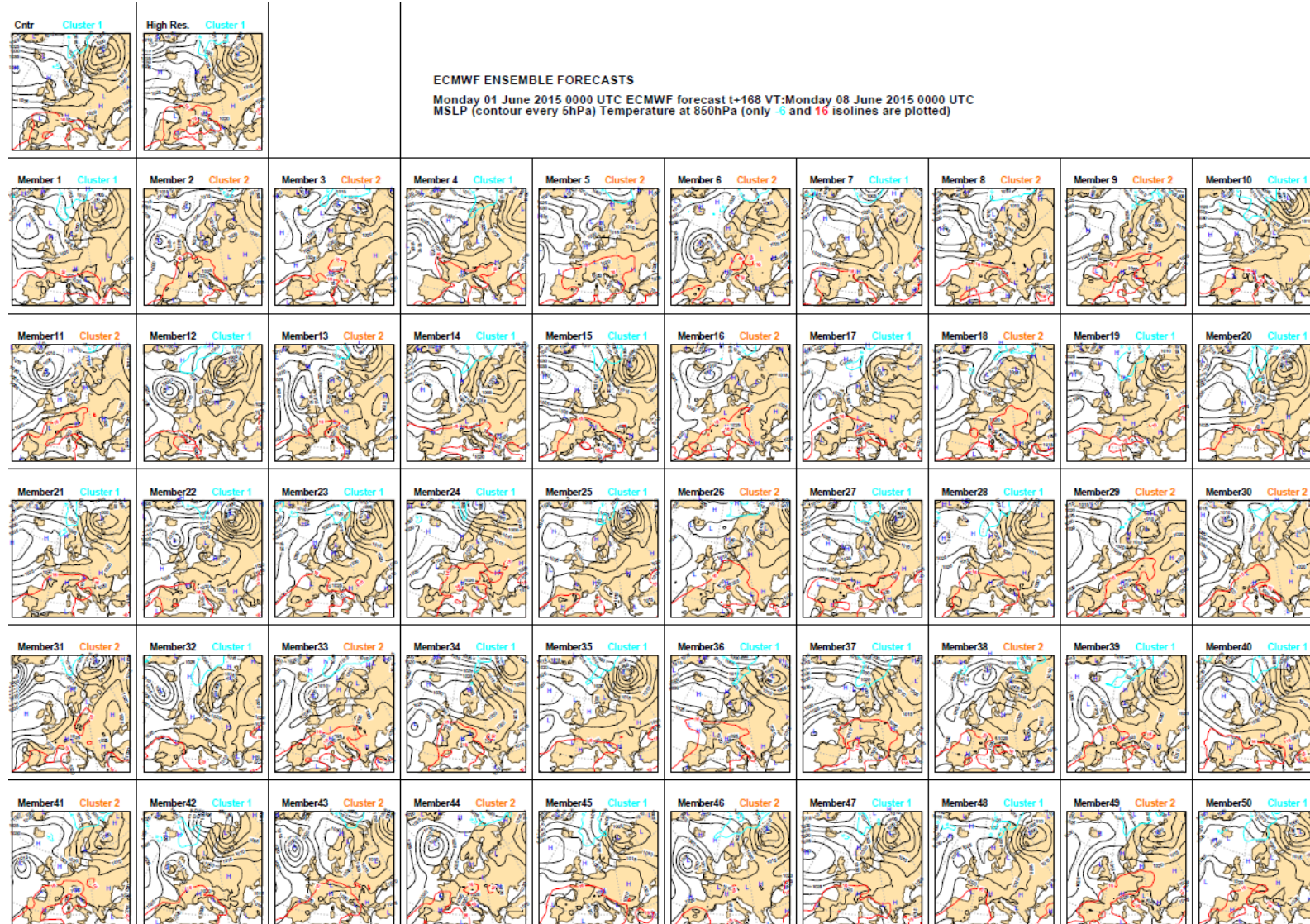
Ensemble forecast: the PDF

time →

RR24 — 90%, 75%, 50%, 25%, 10%

Tx — 90%, 75%, 50%, 25%, 10%

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(Francois Lalaurette, Meteo France)
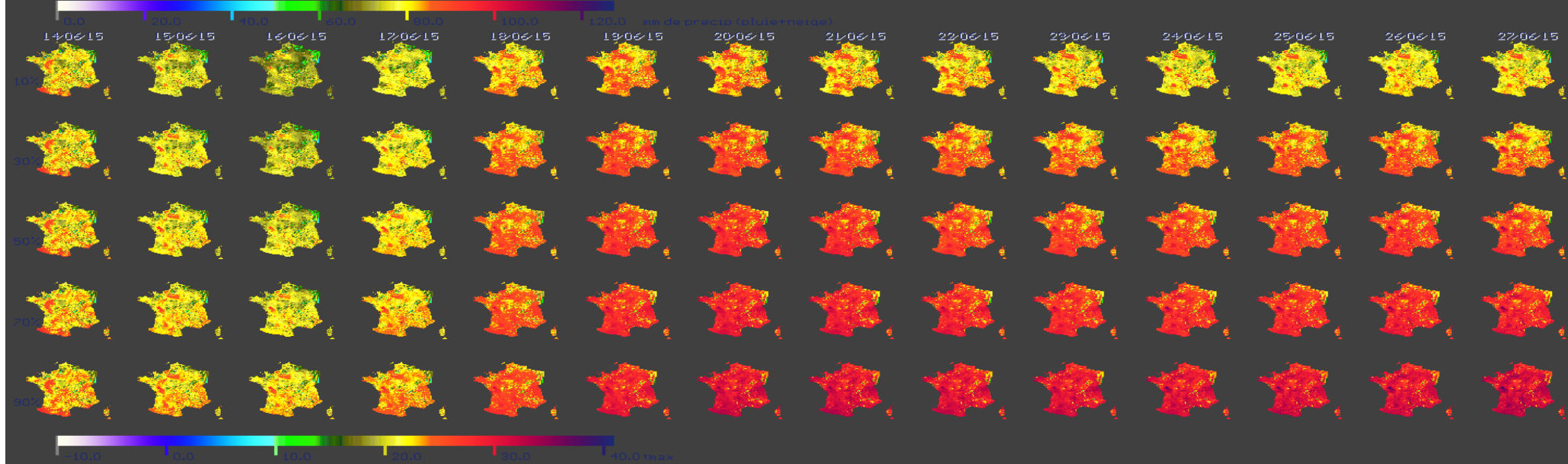
Ensemble forecast: the PDF timeseries (ENS meteogram)
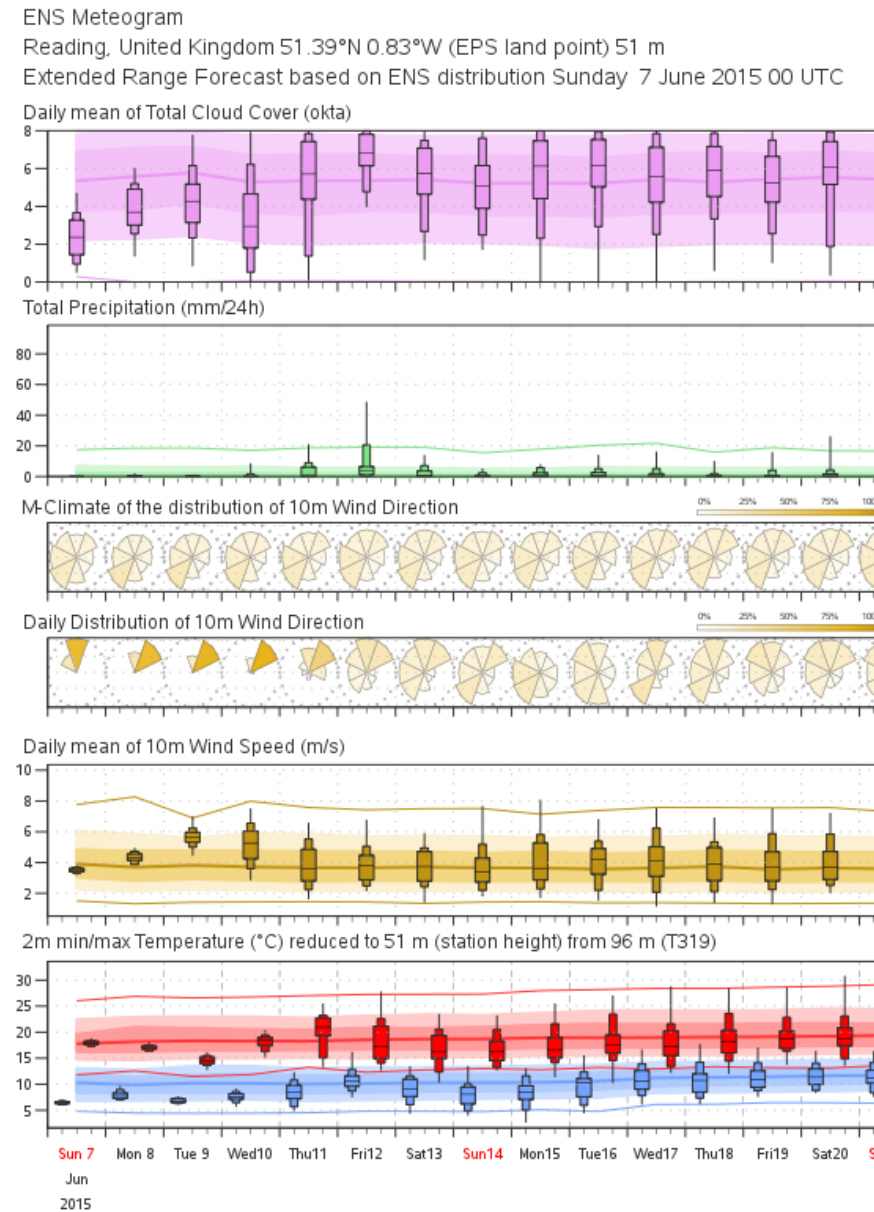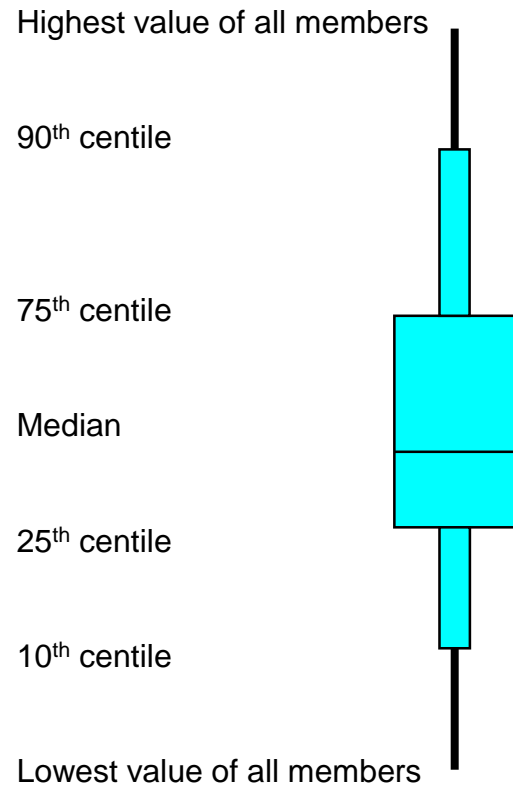
Highest value of all members

90th centile

75th centile

Median

25th centile

10th centile

Lowest value of all members

Progressive increase in complexity: Bubble plot

(a) Most likely tercile only
(b) Likelihood of most likely tercile represented by size of 'Bubble'
(c) Likelihood of all terciles
(d) Skill (ROCSS) associated with most likely tercile represented by transparency
(e) Skill associated with all terciles
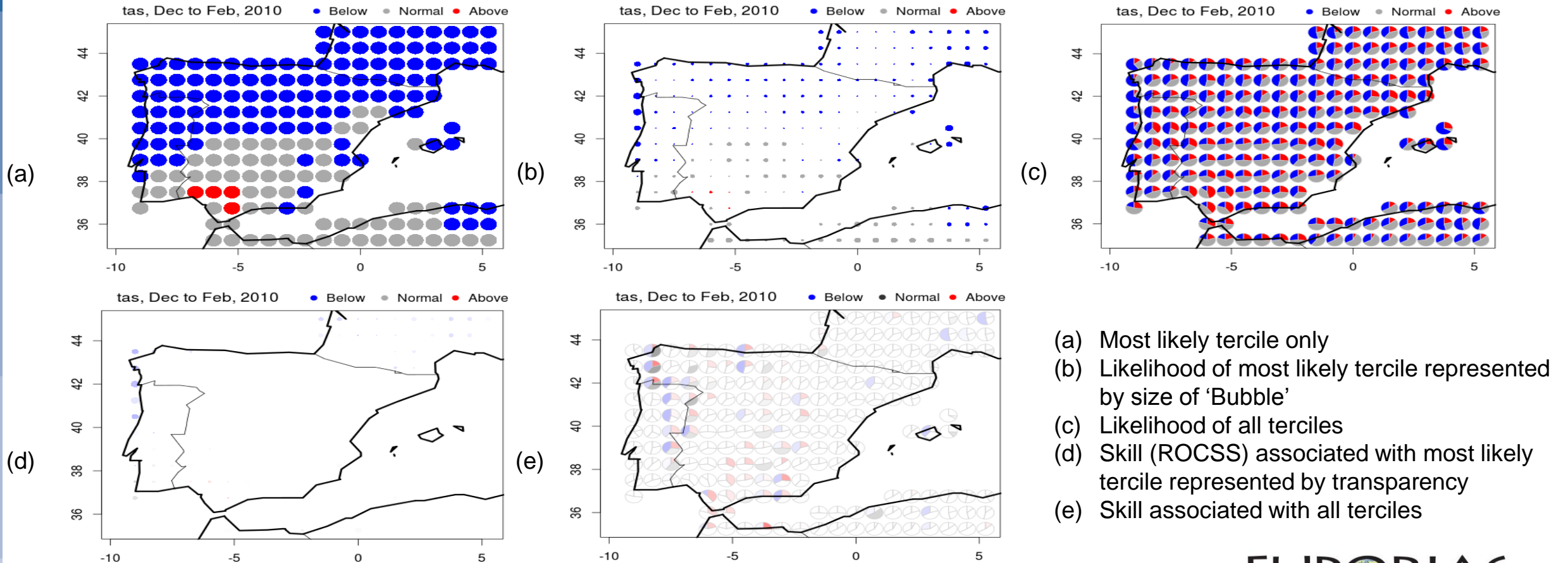
Concept proposed by Aiden Slingsby, City University
Visualisation produced by Maria Dolores Frias and Jesus Fernandez, University of Cantabria

EUPORIAS

(Andrea Taylor)

UNIVERSITY OF LEEDS

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Visualising risk: Extreme Forecast Index
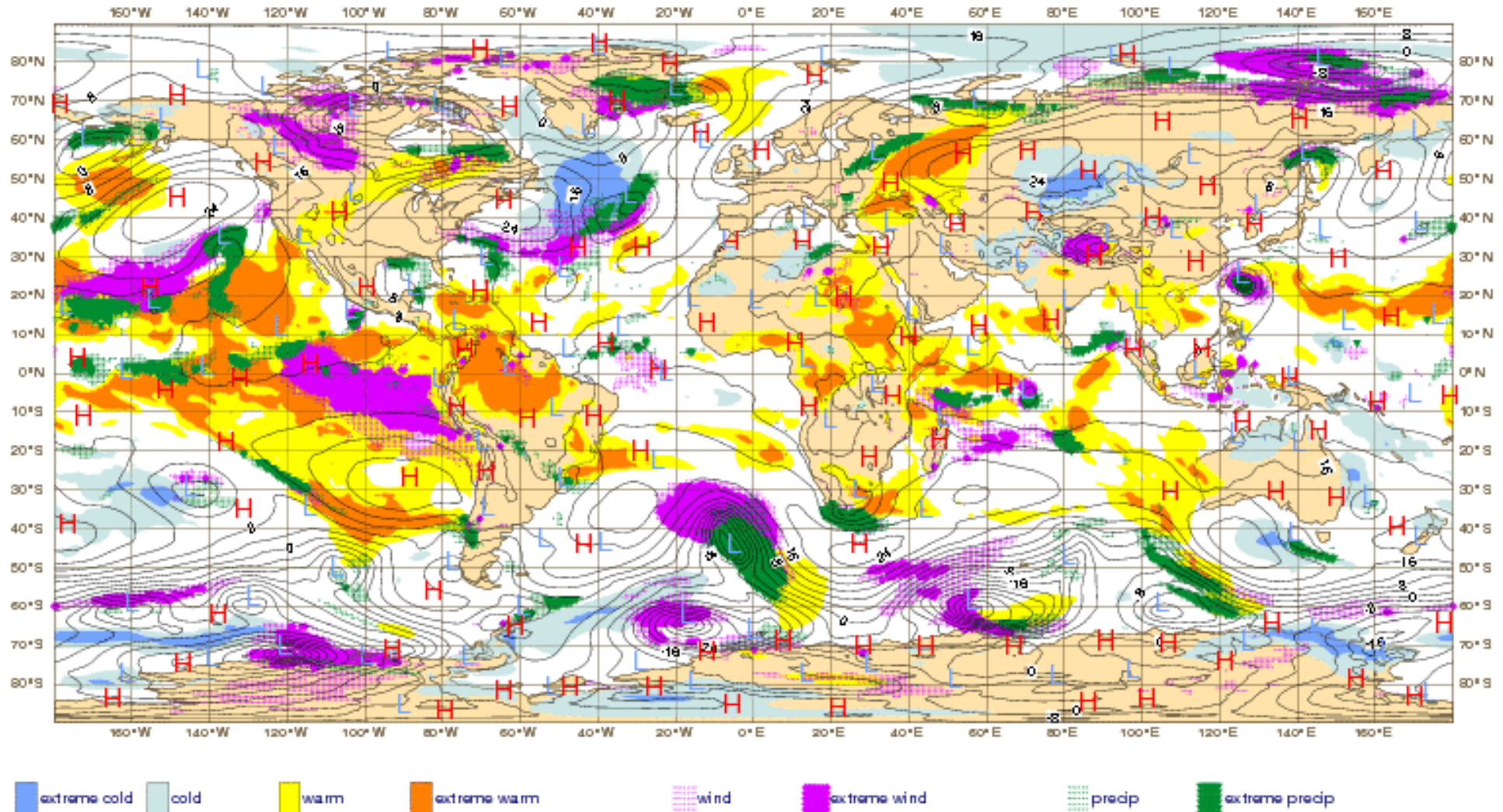
Visualising risk: EFI for severe convection

Based on CAPE and shear

More details in ECMWF Newsletter

(Autumn 2015)

(Ivan Tsonevsky, ECMWF)
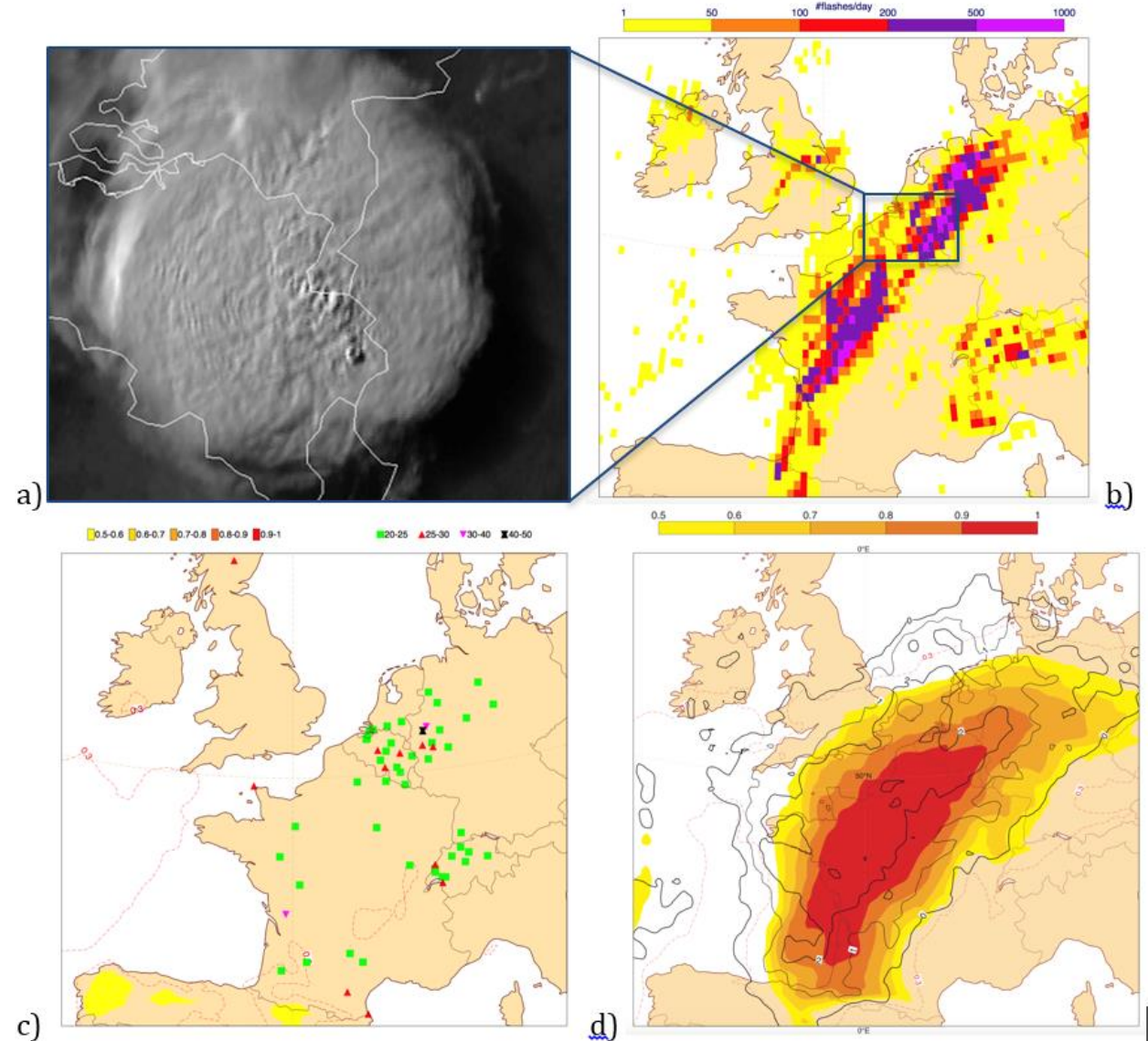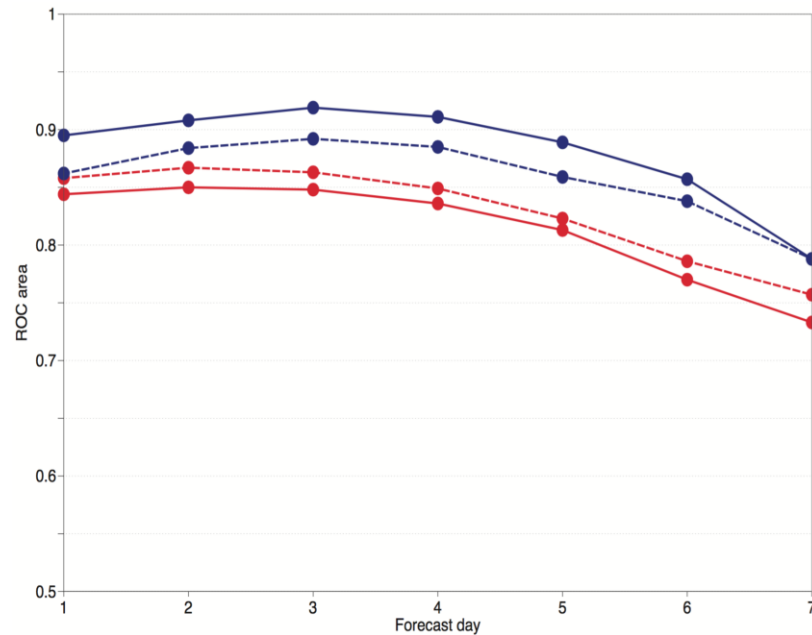
Visualising risk: Likelihood vs Impact

Impact

75%   50%   25%

clg < 180 < clg < 300 < clg
vis < 5 < vis < 8 < vis

(Hagman, Swedish Armed Forces)

Prob CAS low[%] 2015-05-13 00z+24
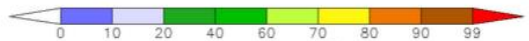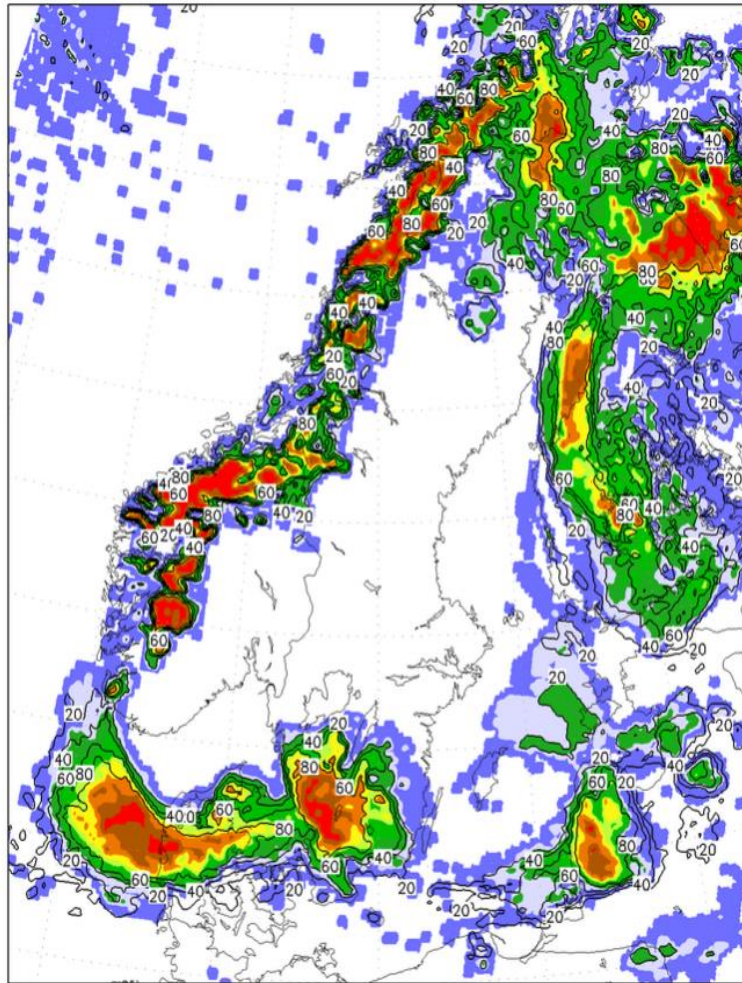
Prob for values below red thres (color) and orange thres (contour

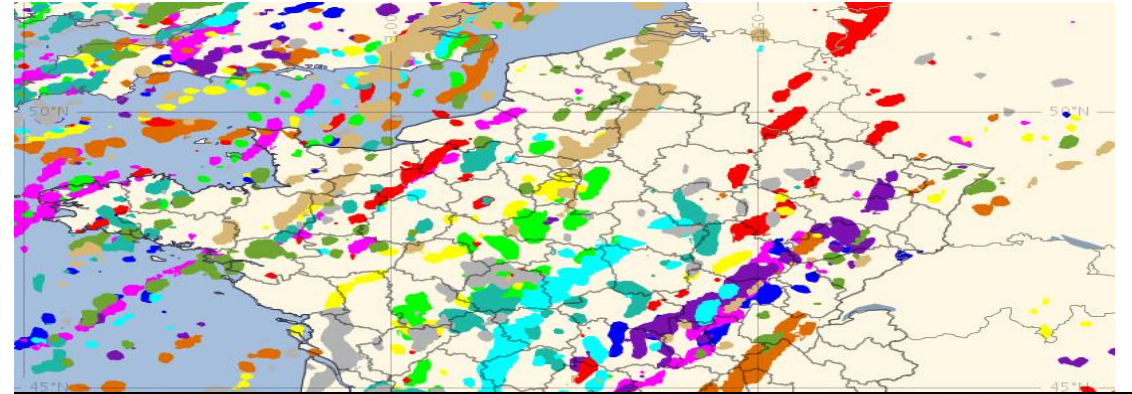*(John Millard, Flood Forecasting Centre, Env. Agency, Met Office)*

Visualising uncertainty

reflectivity Confettis isoline 2mm

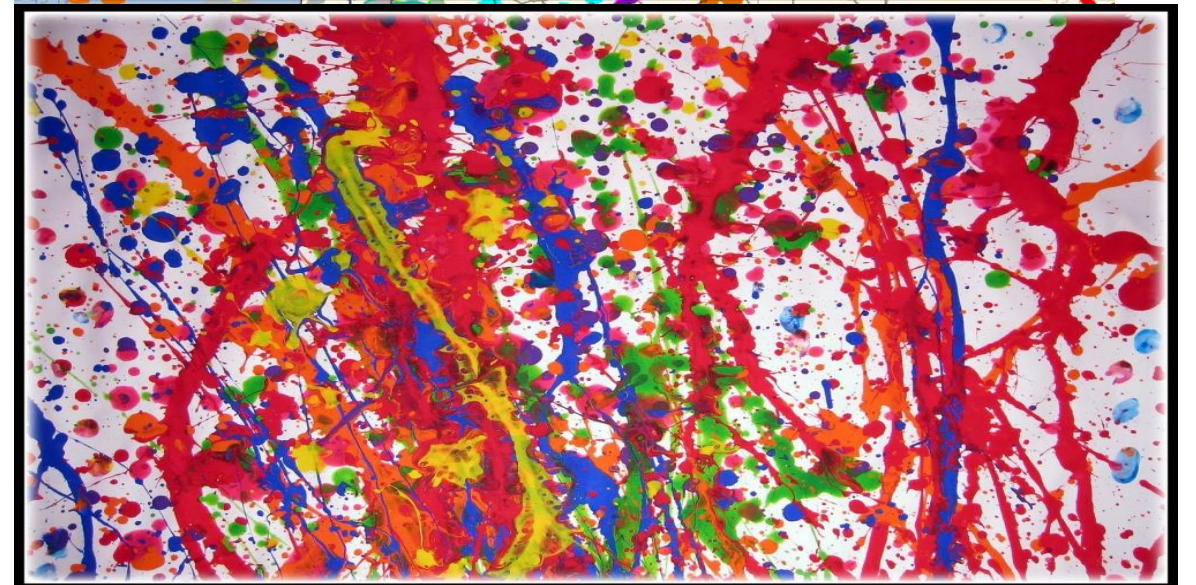PE-AROME from 08/10/2014 9h valid on 09/10/2014 13h
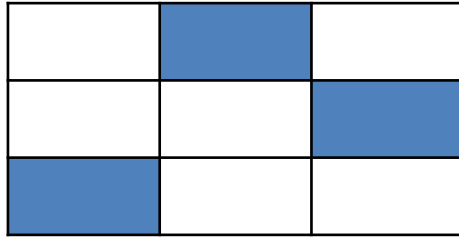
1/3

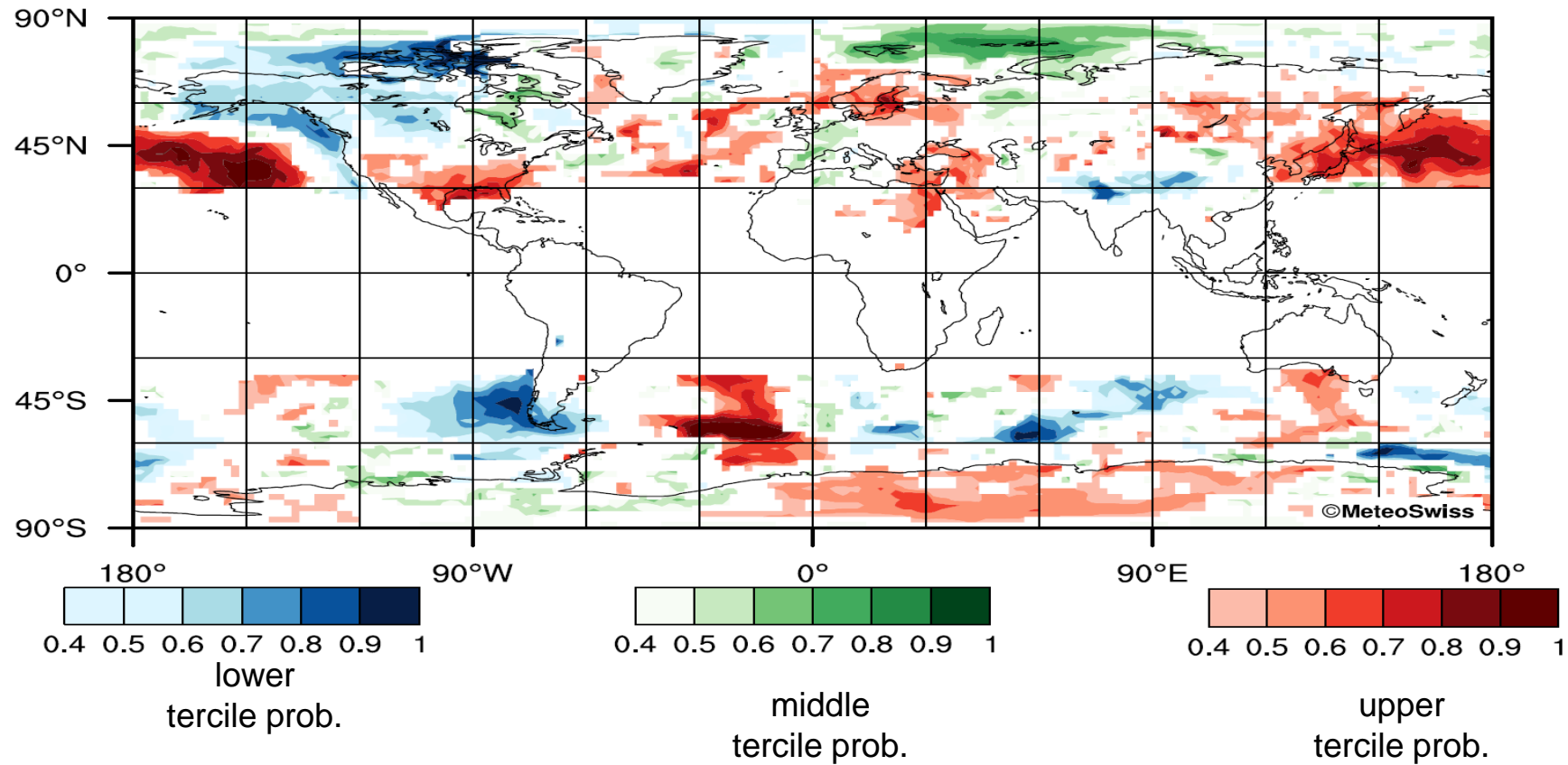**« confettis » or …**

Jackson Pollock's work ?

(Nicole Girardot, Meteo France)

Visualising confidence

Heating Degree Days (index) forecast as tercile summary

(sum of daily temperatures below a defined threshold)

ECMWF
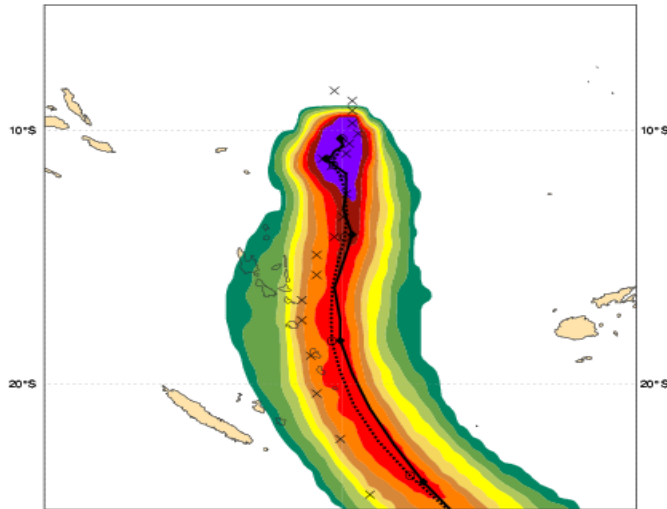EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS

(Christopher Spirig, MeteoSwiss)

Visualising confidence: Tropical cyclones

Visualising scenarios

	Thu 1 Jan	Fri 2 Jan	Sat 3 Jan	Sun 4 Jan	Mon 5 Jan	Tue 6 Jan	Wed 7 Jan	Thu 8 Jan	Fri 9 Jan	Sat 10 Jan	Sun 11 Jan	Mon 12 Jan	Tue 13 Jan	Wed 14 Jan	Thu 15 Jan	Regime Descriptions (UK)	Historic Occurrence D/J/F
Regime 1												2			4	Unbiased NWly	1.9%
Regime 2												2		2	2	Cyclonic W-SWly, returning Pm airmass	2.3%
Regime 13			2							2			2		2	Anticyclonic NWly, high SW of Ireland	4.0%
Regime 14										4	4	2		12		Cyclonic N-NWly, low near S Sweden	3.8%
Regime 15					20	61	29	2		2		6	4	10	2	Unbiased SWly, very windy NW Britain	4.9%
Regime 16																Unbiased S-SEly, high E of Denmark	2.6%
Regime 17						2										Anticyclonic E-SEly high over Denmark	4.5%
Regime 18				98	73	16	2	2			2	4	2	6	2	Anticyclonic SWly, high over N France	5.2%
Regime 19																Cyclonic Nly, low E of Denmark	3.8%
Regime 20						12	49	47	25	12	10	18	22	22	14	Cyclonic Wly, intense low near Iceland	4.5%
Regime 21							10		2		4	2	10	8	2	Cyclonic S-SWly, deep low S of Iceland	3.8%
Regime 22													2			Cyclonic Sly, low W of Ireland	3.4%
Regime 23	100	100	100		2	6		4	14	10	10	4	6	10	18	Unbiased Wly, windy in N	4.8%
Regime 24											6	2	6	4		Cyclonic Nly, low in N Sea	3.2%
Regime 25																Anticyclonic Nly, high centre Irish Sea	4.1%
Regime 26							10	39	63	41	20	16	18	27		Cyclonic NWly, low near Norway, windy	3.5%
Regime 27																Anticyclonic Ely, high in Norwegian Sea	4.0%
Regime 28																Cyclonic SEly, low SW of UK	3.7%
Regime 29												2			2	Cyclonic S-SWly, deep low W of Ireland	3.7%
Regime 30							8	31	18	12	18	33	22	14		Cyclonic SWly, deep low SE of Iceland	3.1%
Total Members	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	---	---

(Robert Neal, MetOffice)

Conclusion

It is important to use the information on uncertainty provided by models

CHALLENGE: how do
we transform weather
data into knowledge or
actionable information?

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