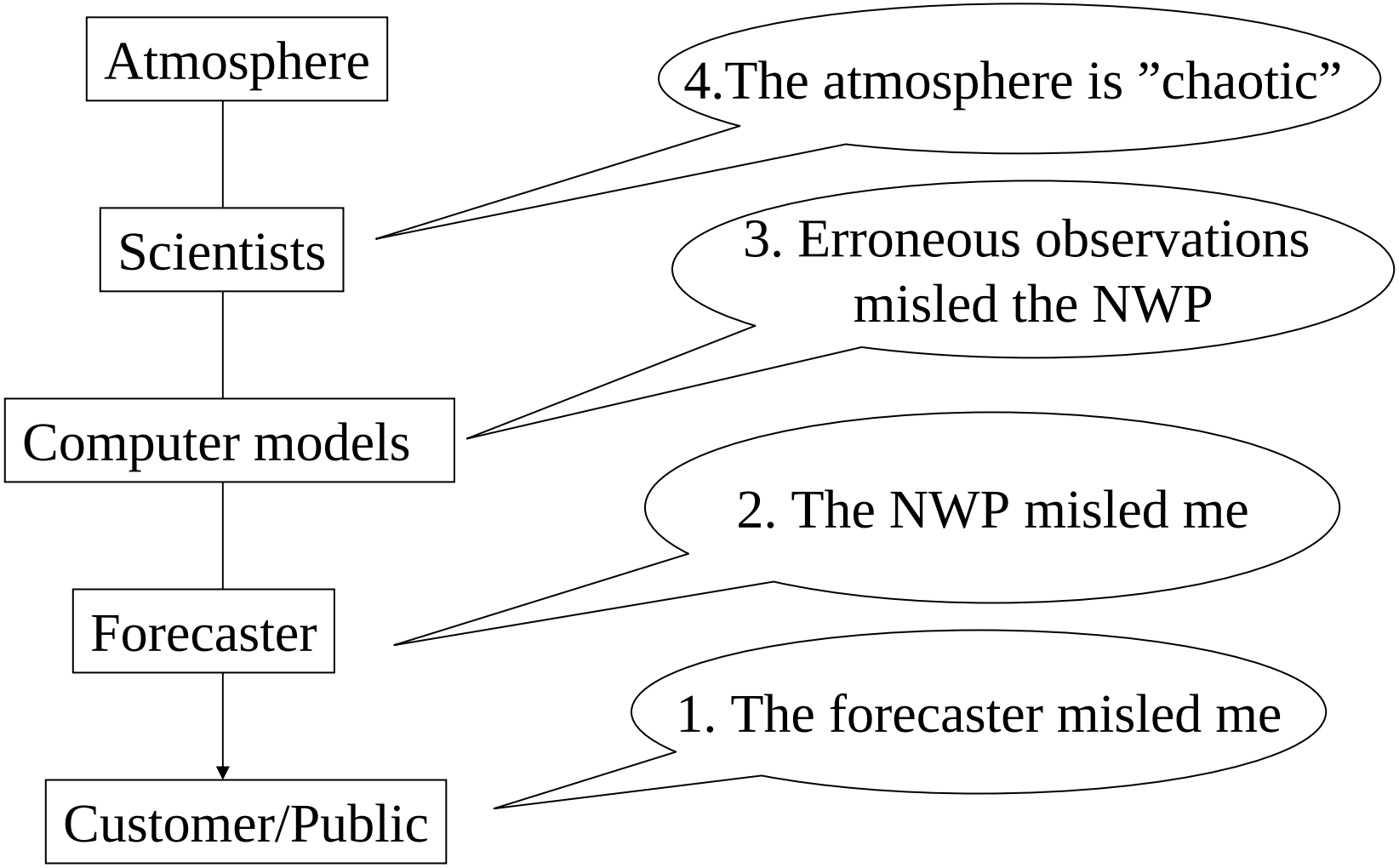
IV Use of probabilities

3. Problems communicating probabilities

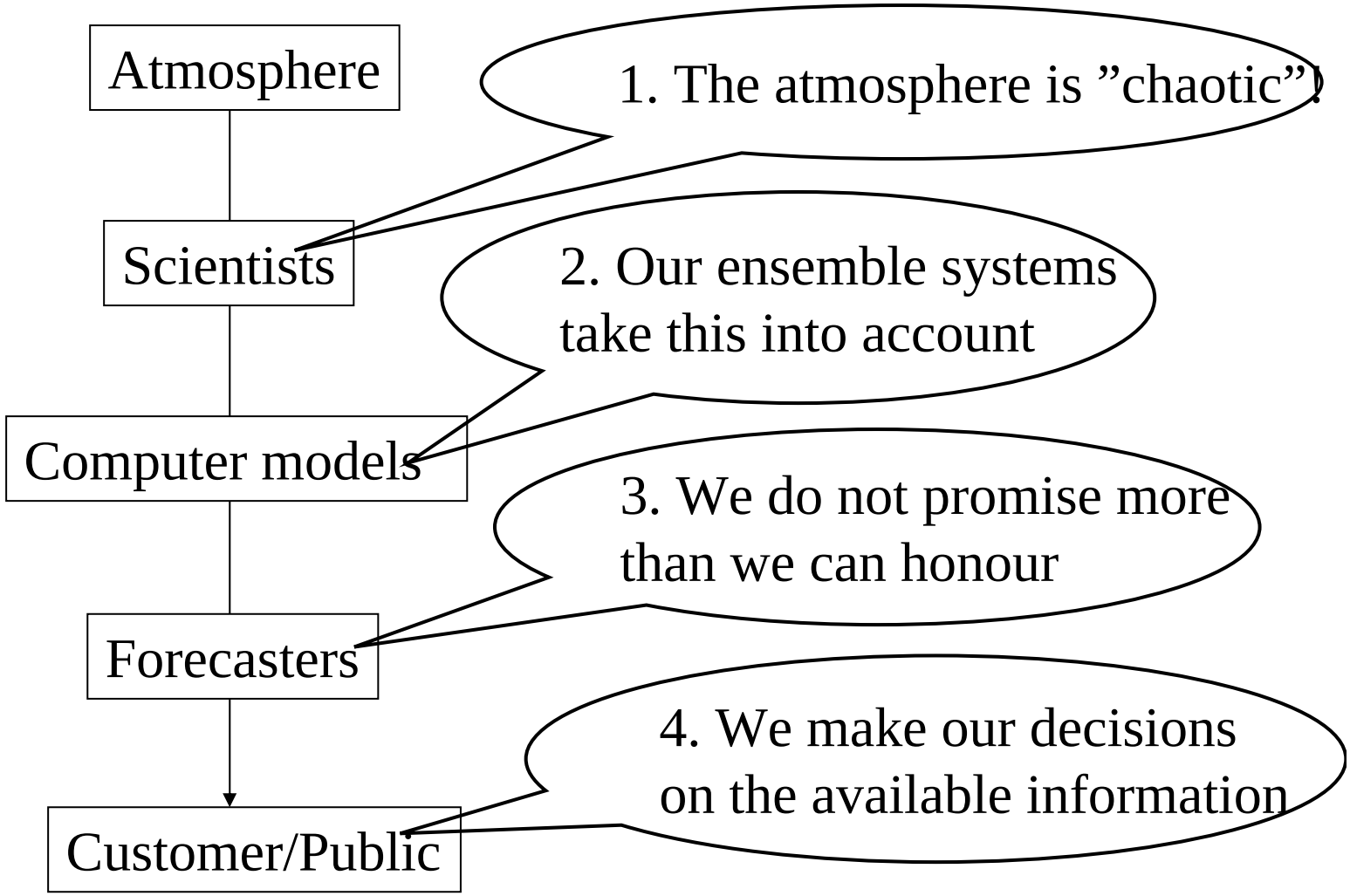
IV.3. Probabilities are controversial for several reasons

Probability forecasting is politically controversial because it leaves the decisions to the decision makers and they will be unable to blame some external source

”The Blame Game” or ”The Passing of The Buck”



The future attitude of *responsibility*



Three attitudes to probabilities among us meteorologist:

1. The **politically incorrect** meteorologist says: - *I do not like probabilities!*

2. The **politically correct** meteorologist thinks: - *I do not like probabilities. . . .*

   . . .but he says: - *The EPS is a revolutionary invention and as many forecasts as possible should be presented in probabilistic form* **(knowing that the public in the end will not understand)**

3. The **practical** forecaster (like AP) thinks and says: - *I highly value the probabilities and I will make them a basis for my forecasting – but I will not necessarily mention the "p-word" or show percentage numbers*

From 100% qualitative to 100% quantitative probability communication

1. Filtered information
2. The framing effect
3. Body language
4. Meteorological scenarios
5. Quasi-probabilistic
6. Numerical non- or quasi probabilistic
7. 100% probabilistic

IV.3.1 Filtered information

AP (in Bracknell 1975): *-I always understand and remember your Radio 4 forecasts for the UK!*

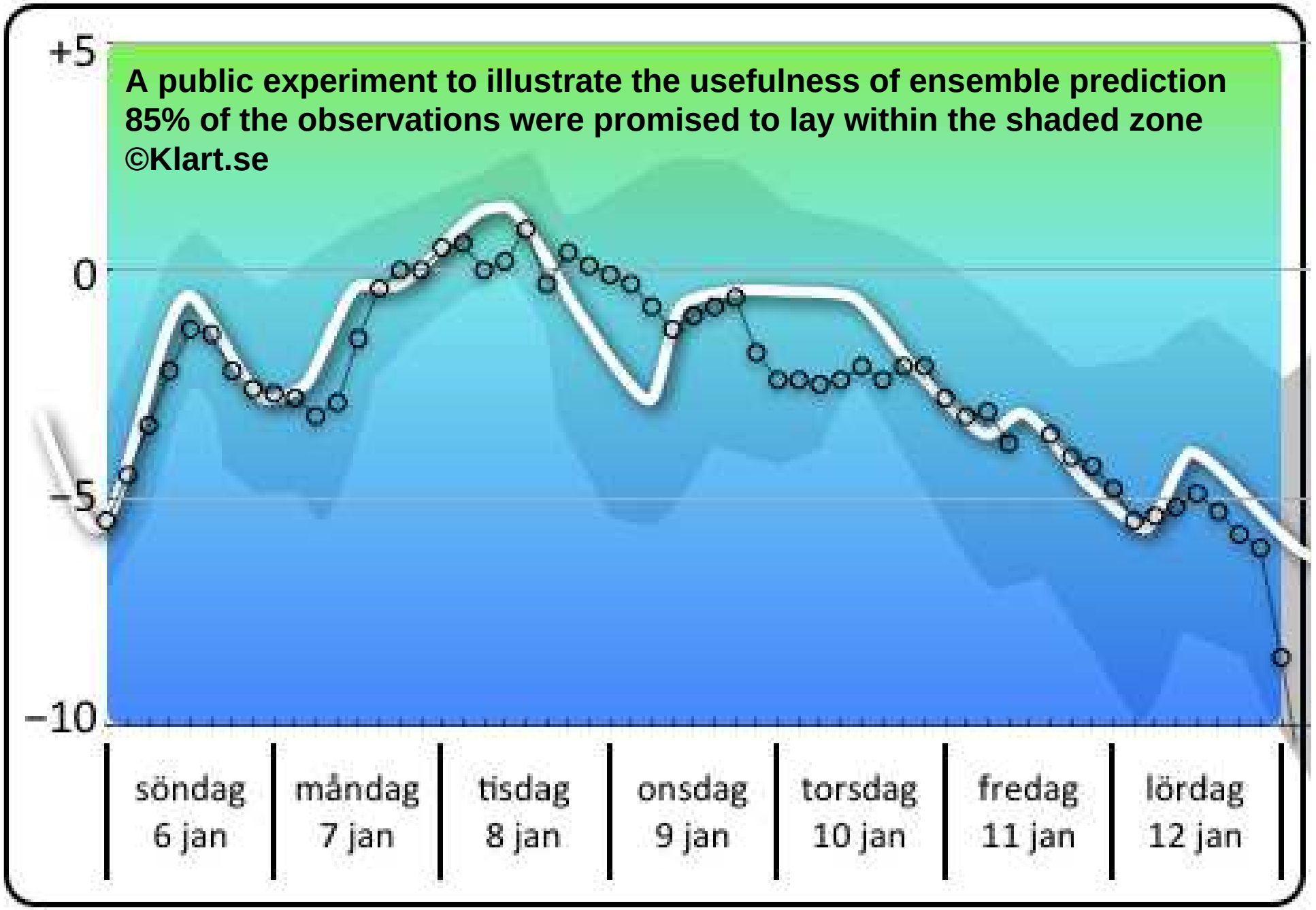
Met Office meteorologist: *-We have a rule not to use more than 30-35 words on radio forecasts.*

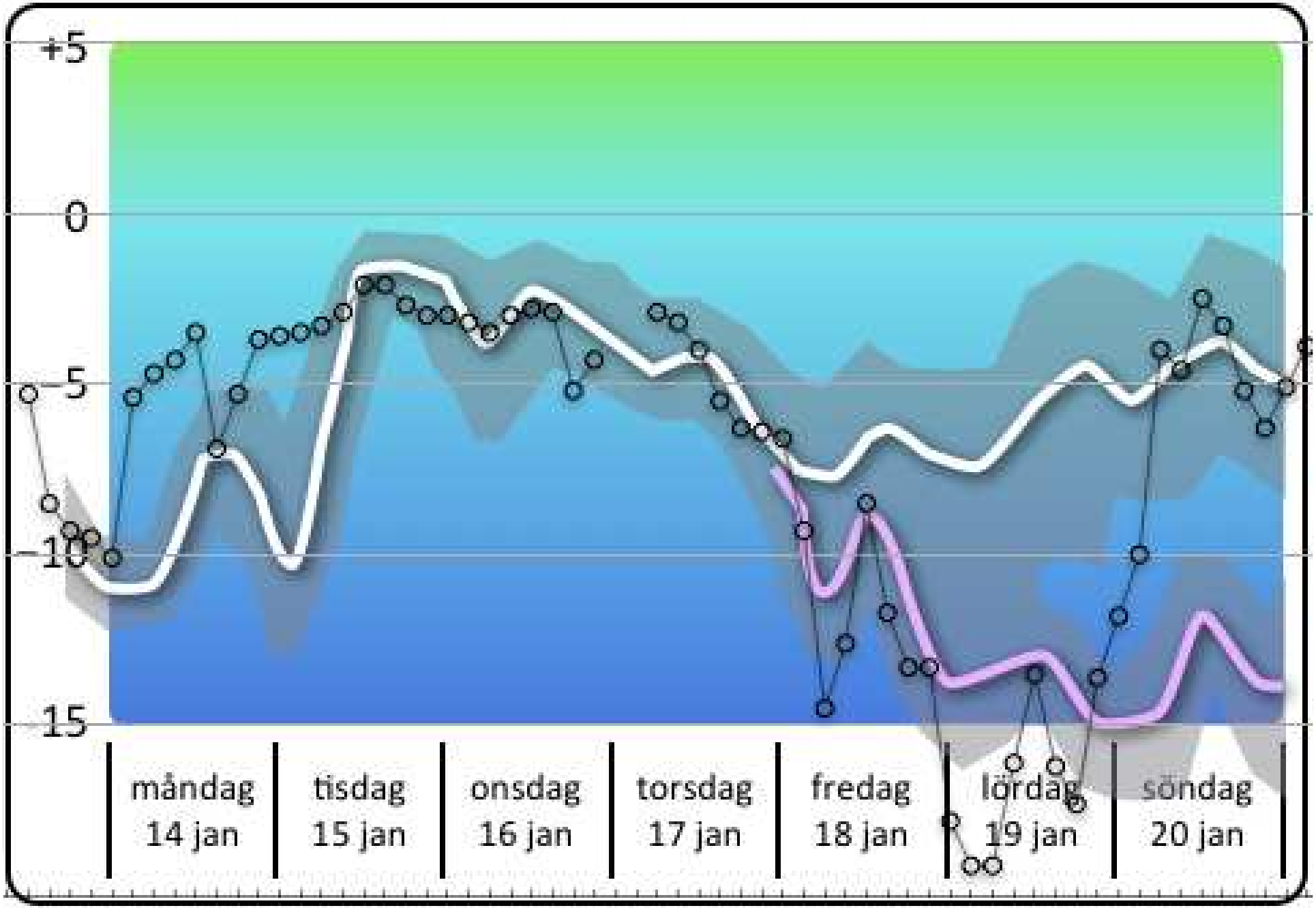
Filtering away less predictable and less important information makes the forecasts. . .

1 . . easier to understand and remember

2 . . appear more consistent and thus more trustworthy

3 . . verify better since less reliable details have been removed


A public experiment to illustrate the usefulness of ensemble prediction
85% of the observations were promised to lay within the shaded zone
©Klart.se
+5
0
−5
−10
söndag 6 jan
måndag 7 jan
tisdag 8 jan
onsdag 9 jan
torsdag 10 jan
fredag 11 jan
lördag 12 jan


+5
0
−5
−10
15
måndag
14 jan
tisdag
15 jan
onsdag
16 jan
torsdag
17 jan
fredag
18 jan
lördag
19 jan
söndag
20 jan

IV.3.2. “The framing effect”

People react differently
to a statement like:

“-There is a small risk of rain”

than to

”- A great chance of dry weather”

The famous half empty/full bottle

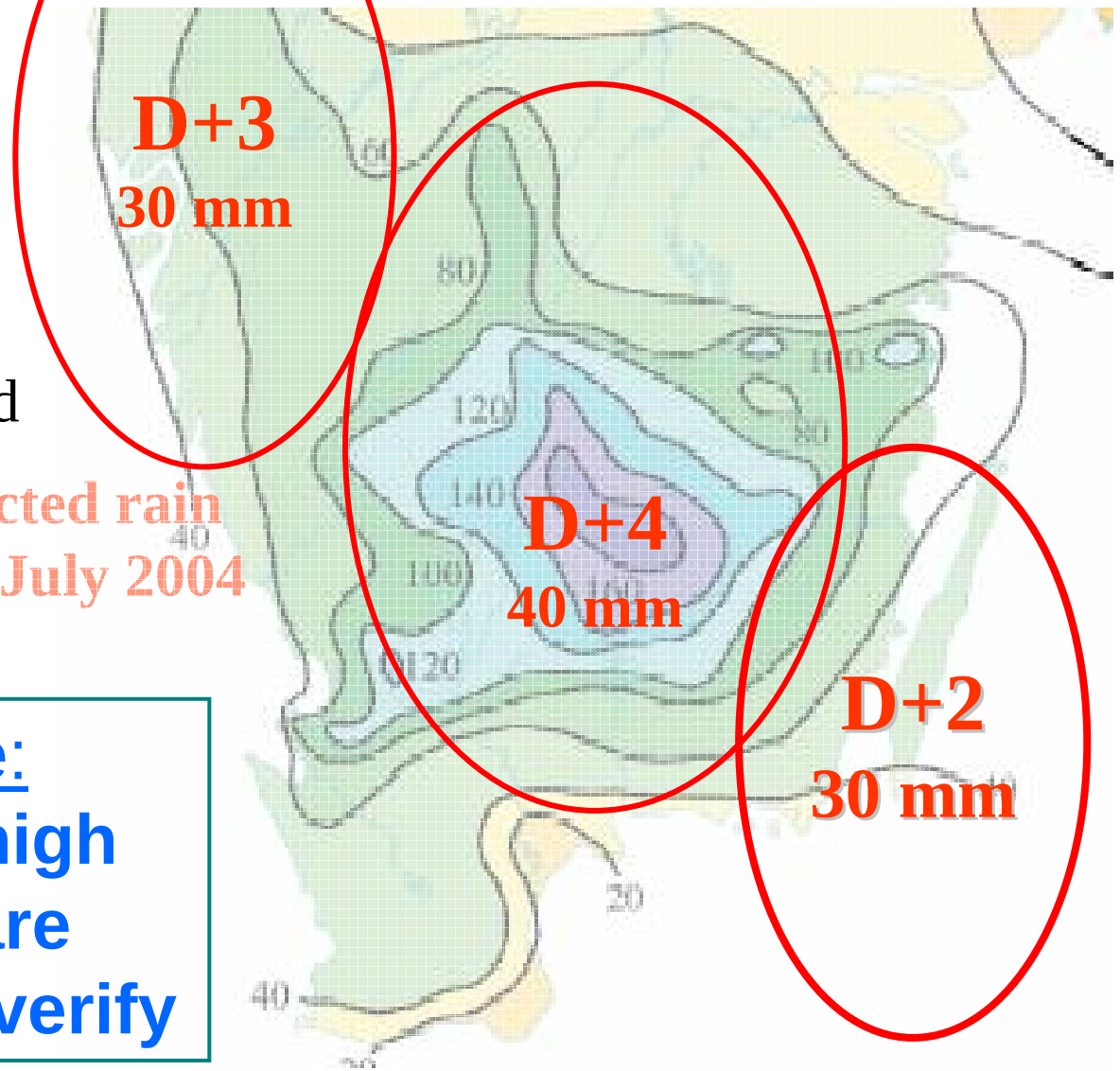
The greater the area or longer the period, the higher the probabilities

Warning for severe thunderstorms:

The authorities did not react appropriately to modest warnings for **ts** for individual places but only for a strong warning for the whole region

A case of over-confident and detailed forecasts from the (SMHI) meteorological service) which left the public and clients very confused

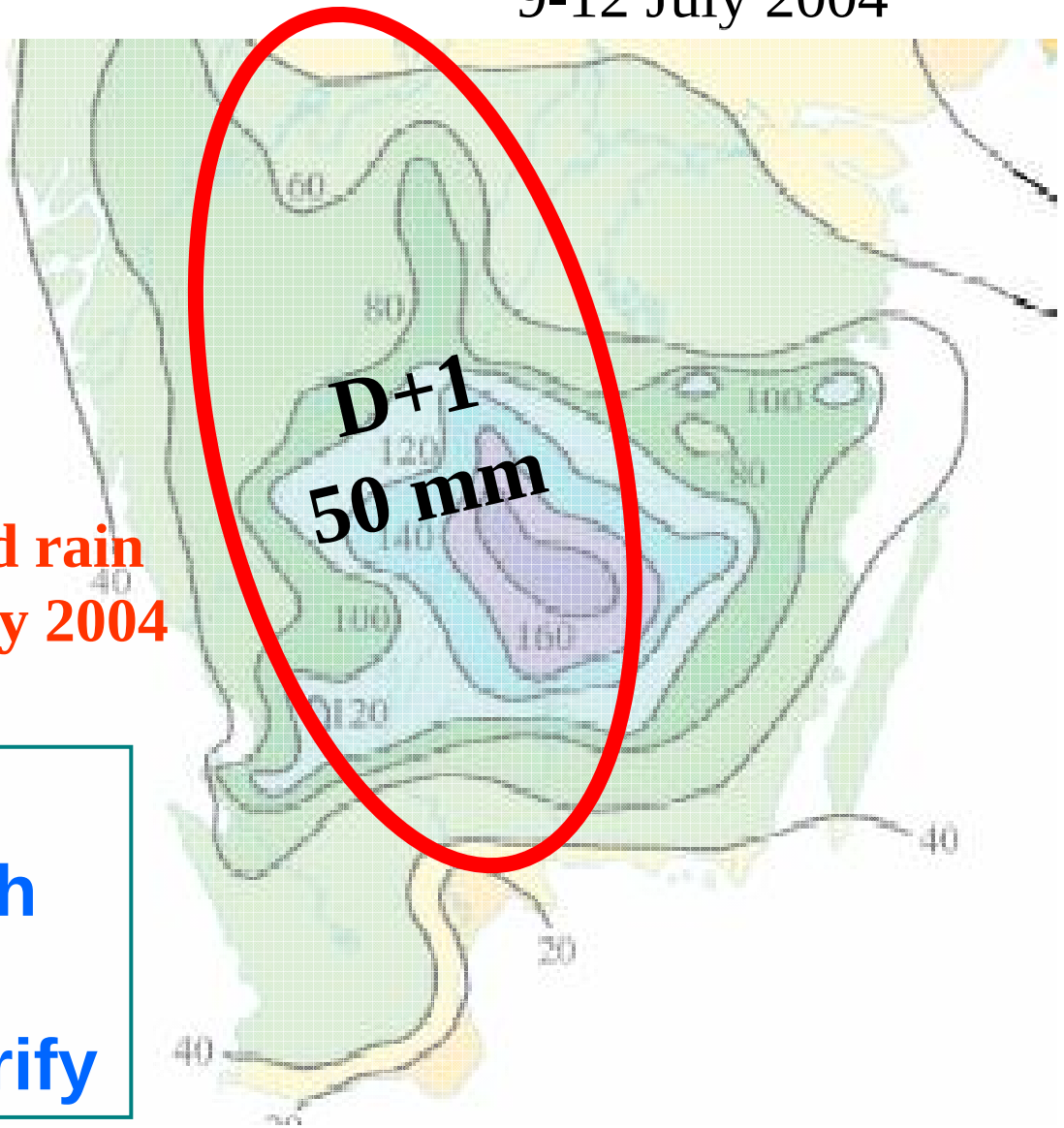
Observed rain
9-12 July 2004



Sense morale:
Details and high confidence are fine - if they verify

A case of over-confident and detailed forecasts from the (SMHI) meteorological service) which left the public and clients very confused

Observed rain
9-12 July 2004

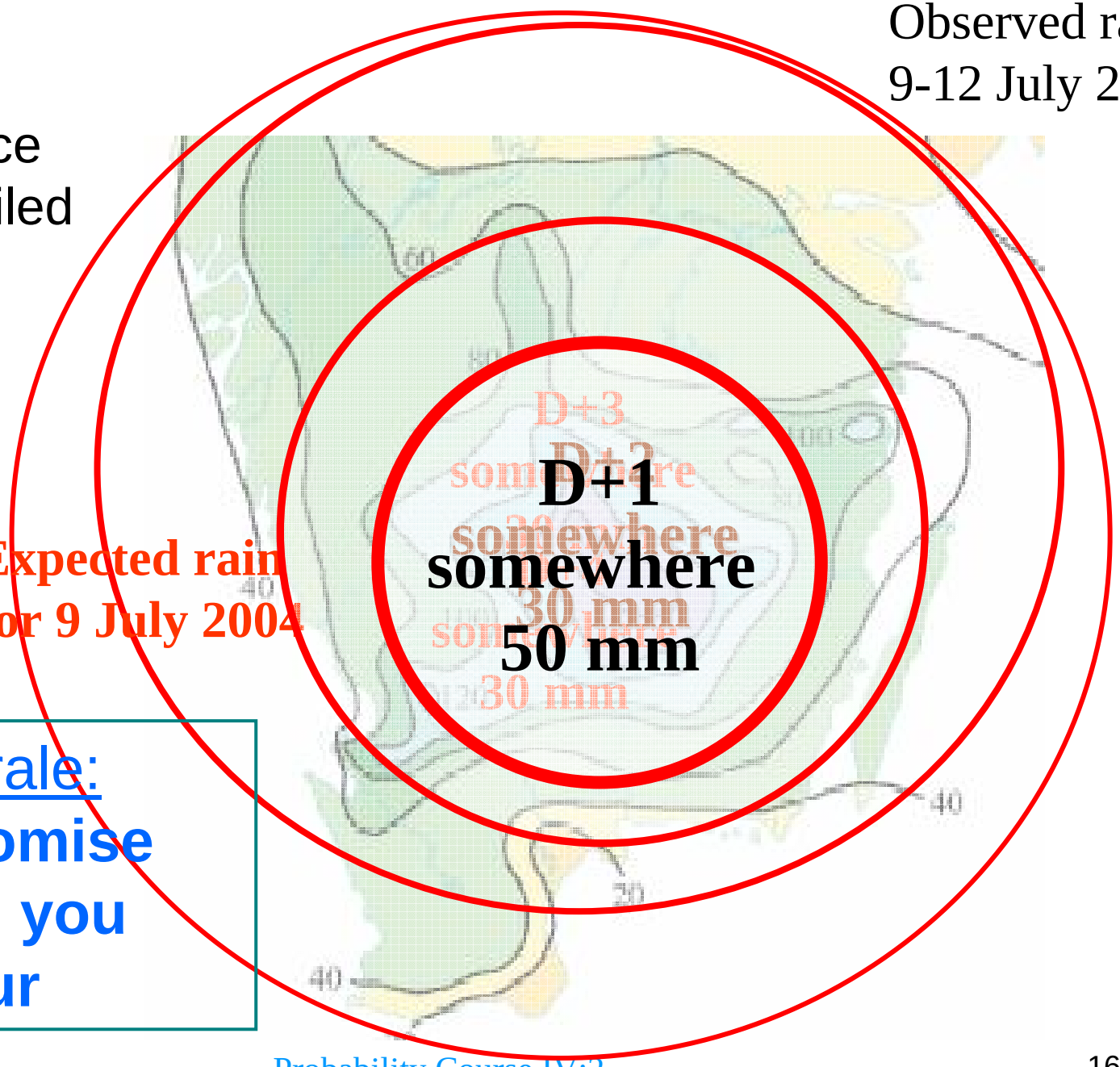


Expected rain for 9 July 2004

Sense morale:
Details and high confidence are fine - if they verify

The SMHI hydrological forecast service was less detailed and confident and therefore kept the confidence of their clients throughout

Observed rain
9-12 July 2004



Sense morale:
Do not promise more than you can honour

IV.3.3. Use body language and/or colloquial language

…or 20% risk of snow in the Scottish Highlands

…or 80% risk of thunderstorms in southern Finland

IV.3.4. Meteorological scenarios

By telling a “story” the forecaster implicitly conveys a probability while at the same time displaying his knowledge and experience:

1. Cold air from Greenland will arrive, but a developing low over the British Isles might push it away.

   or

2. The low clouds will disperse and give frost. However, close to lakes and rivers, the clouds might stay…

3. **Don’t say**: ***“The EC and US models indicate a cold outbreak, but the UK model keeps the mild weather. And they have been rather “jumpy” lately. . . . .”***

The 16 December 2011 weather problems

The way the Met Office and BBC forecasters handled the weather situation was **“very well received by senior managers in the BBC and the Met Office….and had been praised by the section of government which is responsible for the Met Office. “**

No direct surveys of public opinion were made, **“but informal feedback has been positive.”**

When the forecasters haven't got a clue . . .

	Obs rain	Obs dry
Fc rain	**20**	**10**
Fc dry	**10**	**60**

It is not uncommon that weather forecasters are very uncertain, indeed do not really know what will happen

This happened to the British weather forecasters in mid-December 2011

In mid-December 2011 great uncertainties in the predictions of the track of a severe storm:

D+8 forecast 7 December

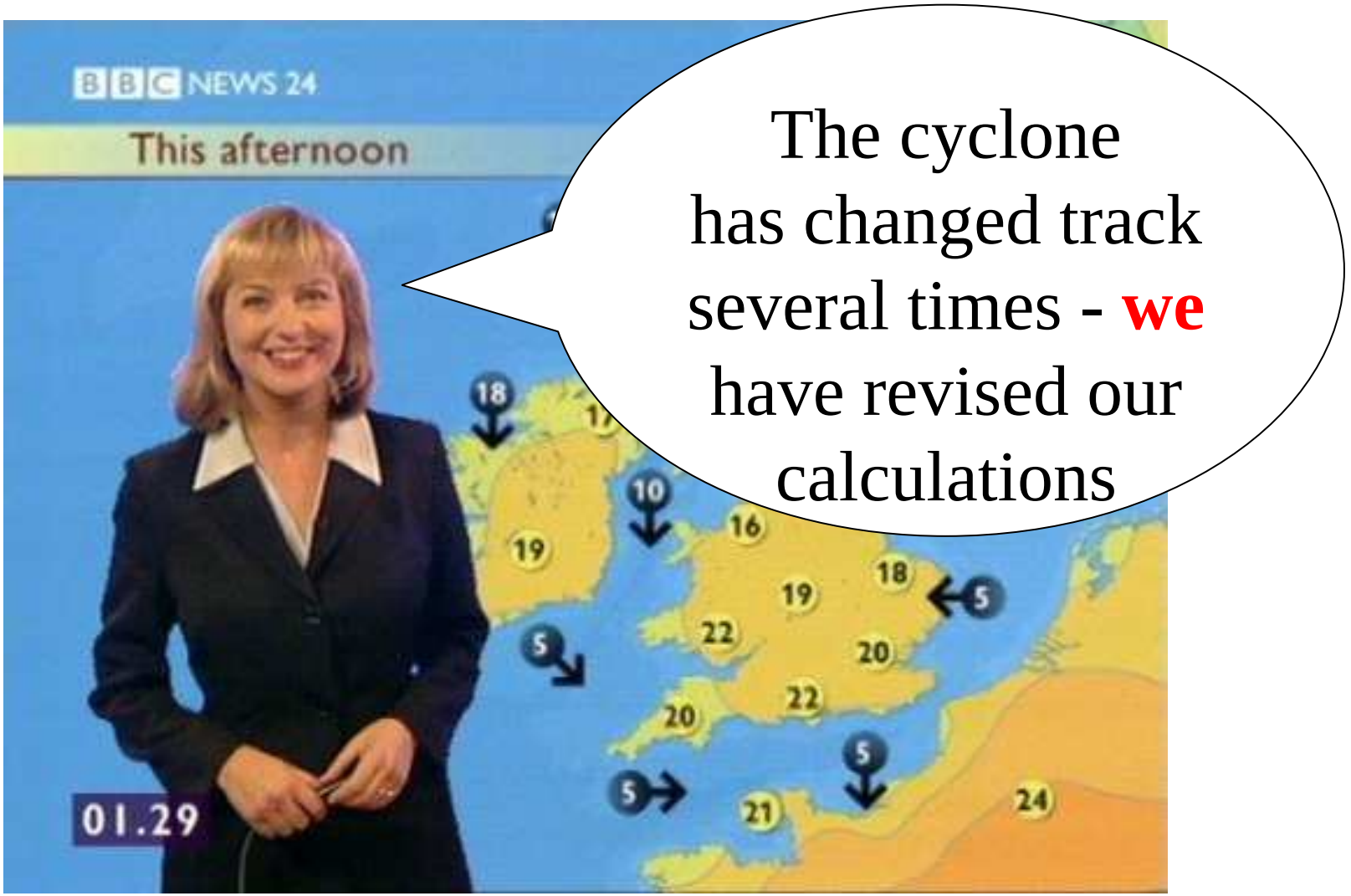
D+5 forecast 10 December

D+6 forecast 9 December

D+7 forecast 8 December

The jumpiness and uncertainty continued on D+4, D+3 and D+2

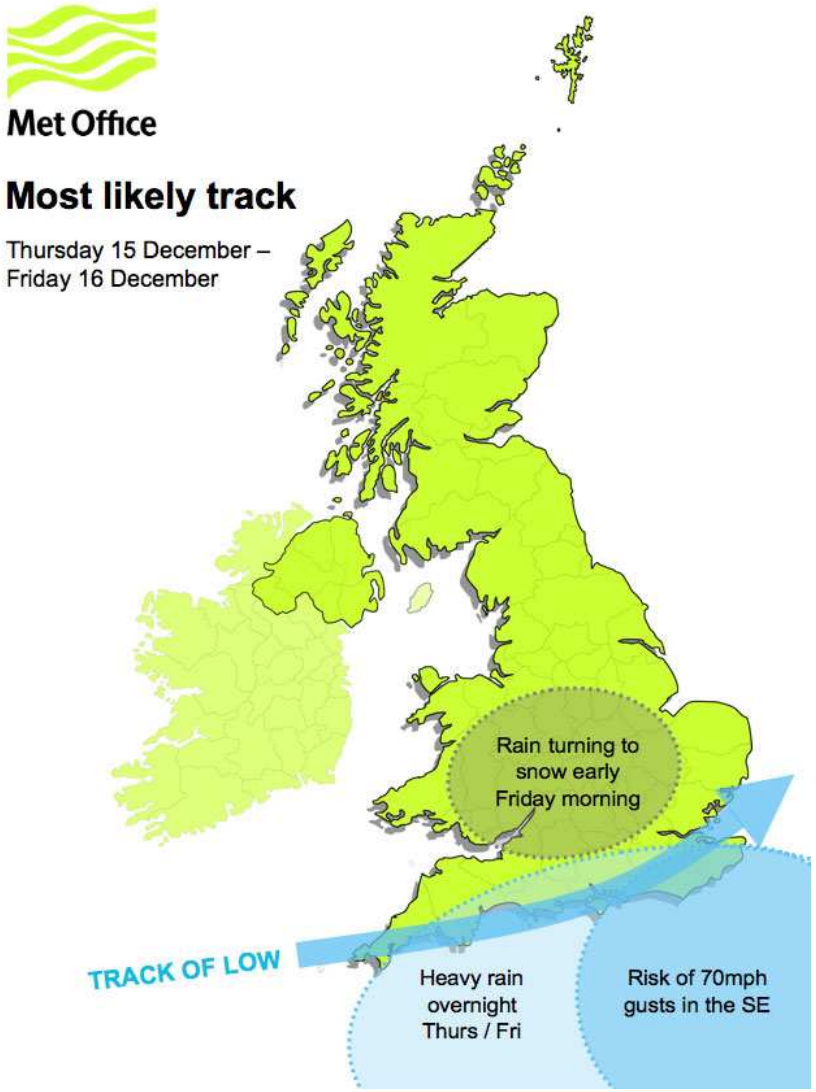
They took an active responsibility for the problems

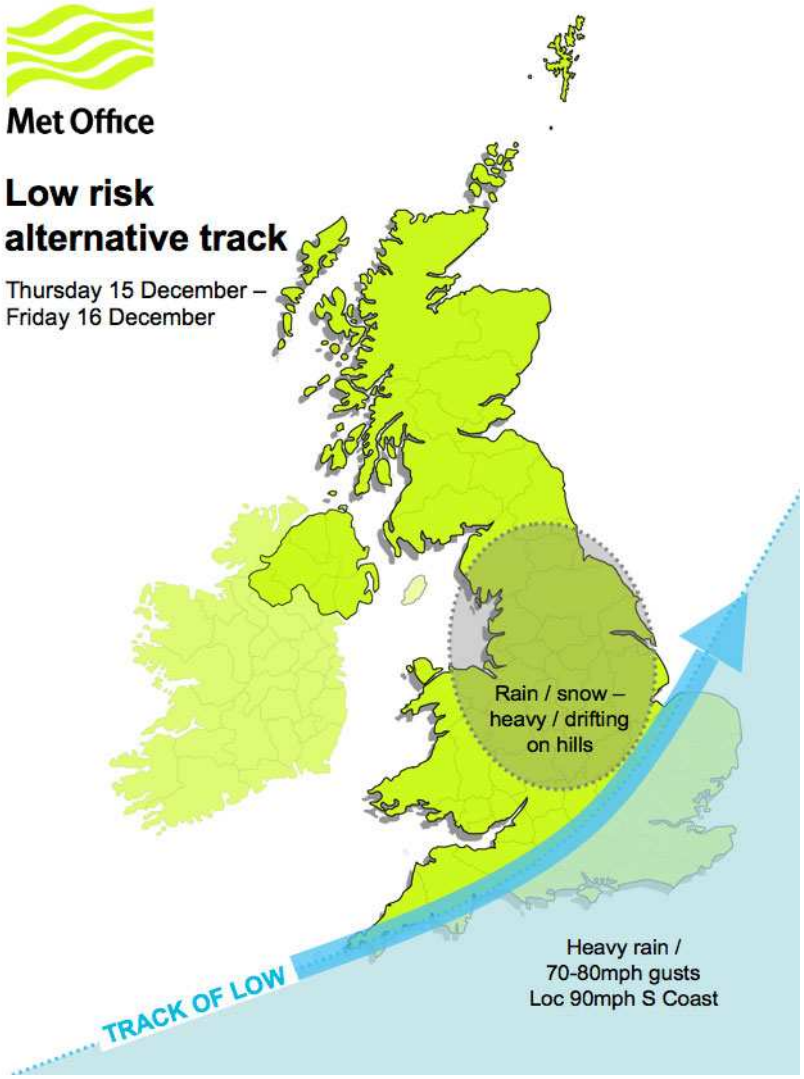


“Some terrible weather will threaten us on Thursday-Friday”

The BBC forecasters avoided going into detail and did not show any isobar maps

They gave the background to the uncertainty, *they told a story*





In an uncertain situation:

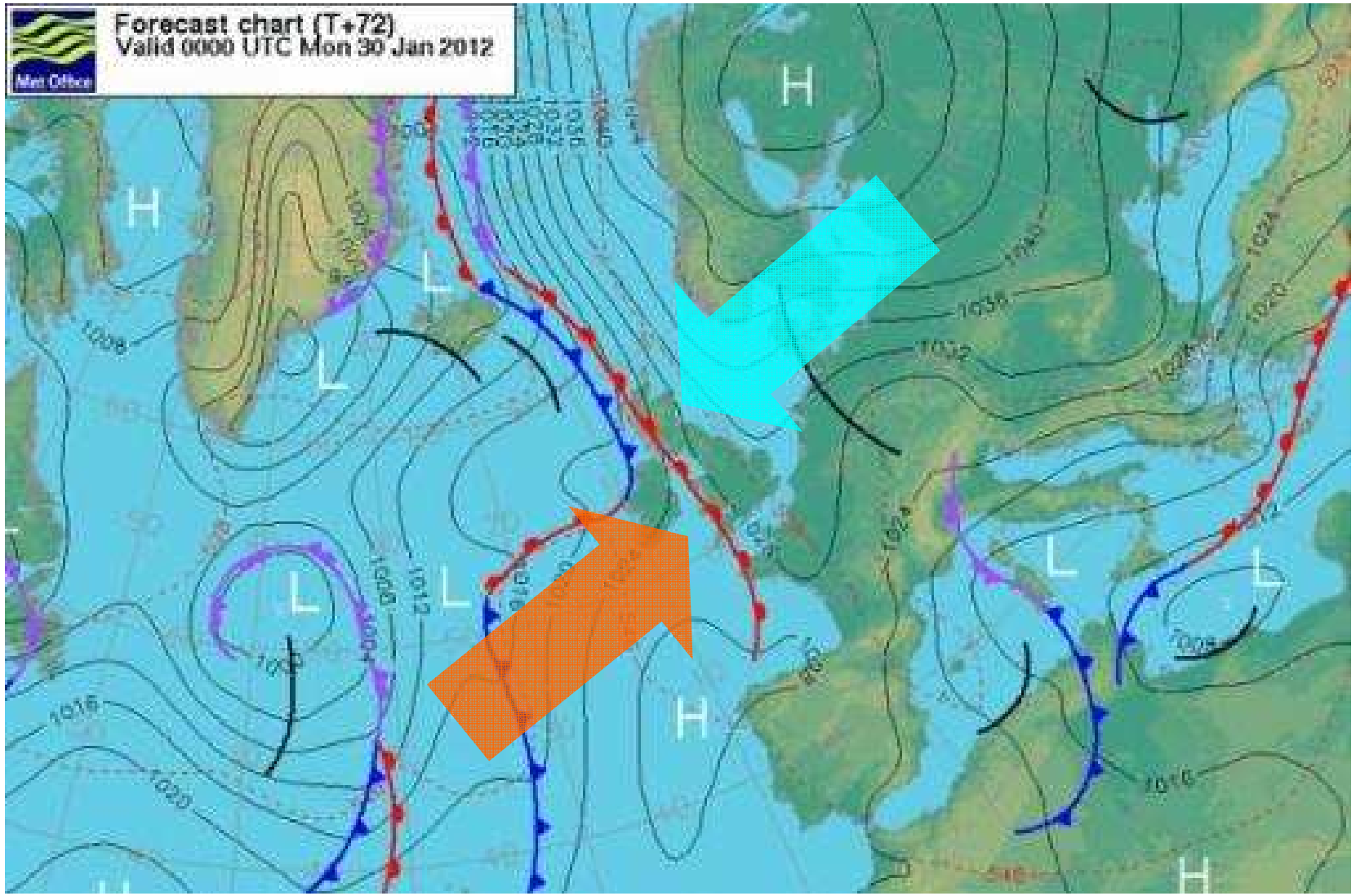
-Avoid categorical, deterministic forecasts:

1. **Do not fool yourself - and others:**
   Acknowledge uncertainty and concentrate your skill at trying to estimate it

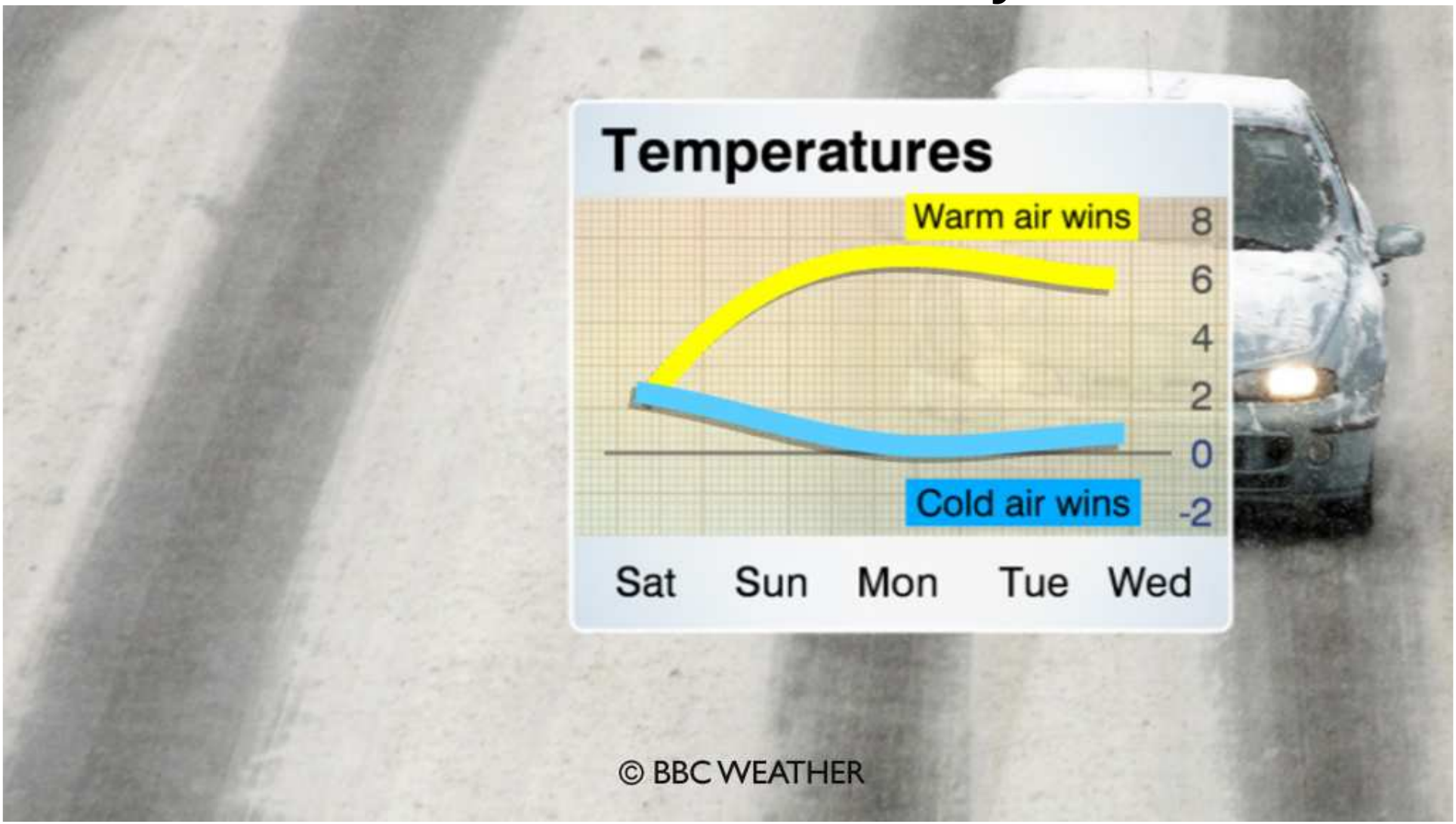
2. **Be in control: Present the situation as "difficult", rather than "uncertain" – and never blame the "computer"!**

3. **Communicate the message: Probabilities or "story telling" - help the end-user to understand and make optimal decisions**

The Met Office repeated the approach 1 ½ month later



The Met Office and the BBC honestly showed their uncertainty



IV.3.5. Quasi-probabilistic

The **frequentist statisticians** started by specifying a probability and thereafter defined the appropriate confidence interval likely to include the truth

Bayesian statisticians started by defining a creditability interval and thereafter defined the appropriate probability that the truth would be within the interval

The frequentist approach

Assume a priori a tacit 70% probability:

"The temperature will be 25-29℃"

(Alternatively 27℃ ± 2℃)

"It will rain 10-20 mm today"

(Alternatively 15 mm ± 5 mm)

"The wind will be NW 6-12 m/s"

(Alternatively 9 m/s ± 3m/s)

The Bayesian approach

Pre-fix the intervals:

"With a probability of 70% the temperature will be between 25-30℃"

"It will rain between 10-20 mm today with a probability of 60%"

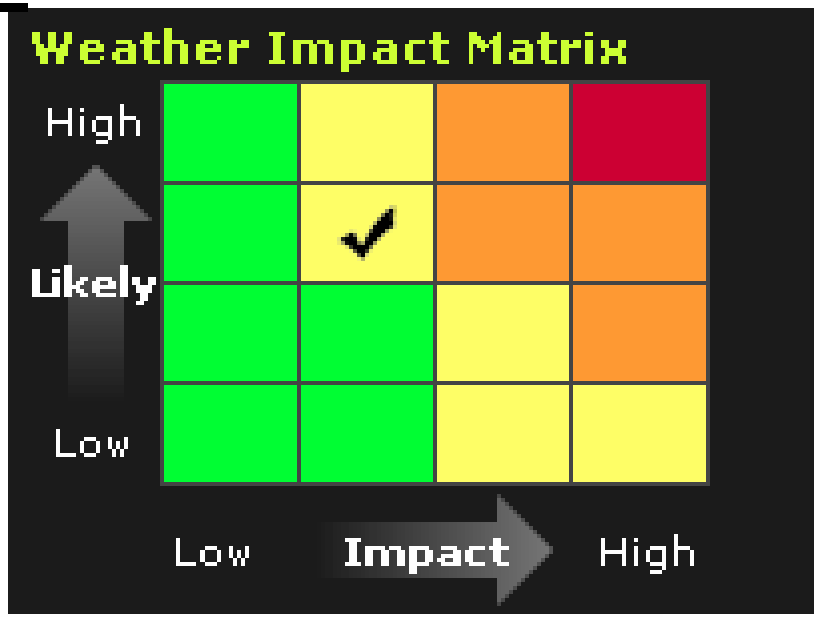
"The wind will be NW between 5-10 m/s with a 80% probability"

The Bayesian approach

Drawbacks: More information (interval + probability) and people will not realise the trick with pre-fixed intervals

Impact matrices

Issued Thursday valid Saturday



The Met Office warning system

Odds?

e.g. **4-1** instead of **20%**

Tests in the UK were not positive

VI.3.6. The importance of base rate

On a dark and rainy afternoon, on a bus in central London AP overhears a pair of nice ladies speak in a language he is familiar with.

AP: - Oh, you speak Portuguese!

The ladies are enchanted that their language is recognized by a non-speaker. Now AP makes his great mistake:

- You, being from sunny Portugal must be dismayed by the weather here in England?

But they were from Brazil!

10 times more populous

The importance of the base rate

People often forget to consider the base rate
(if you hear people speak Portuguese in e.g. London, they are most likely from Brazil!)

Probability statements can be better understood by reference to the base rate

The base rate in meteorology is the climatology

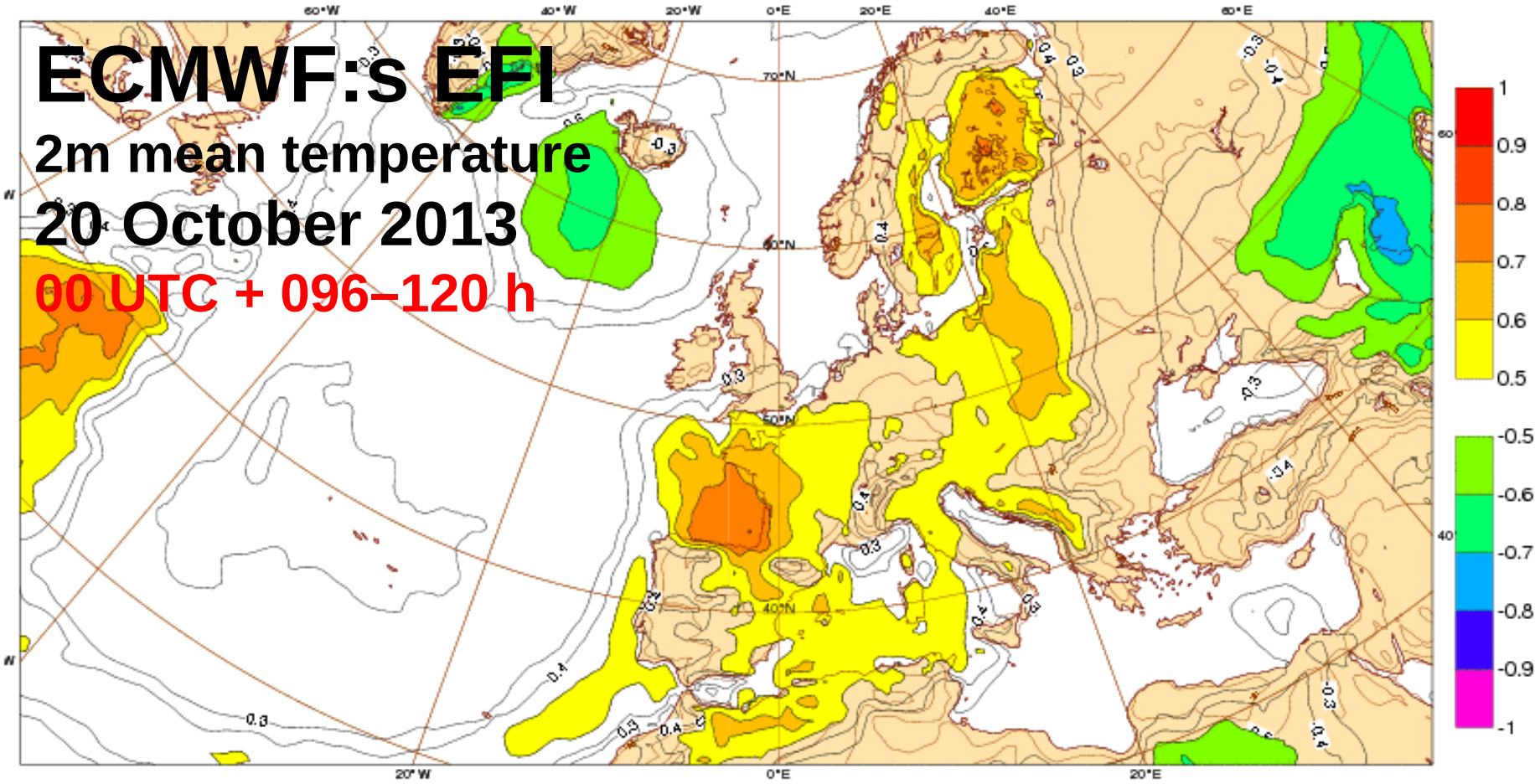
The use of base rate again

50% probability means different things

1. Tossing a coin:**“50-50? I do not know”** **50%**
2. Snowfall in Rom:**“50% very high risk!”** **2%**
3. Sunshine in Rom:**“50% is a low risk!”** **80%**

It all depends on the “base rate”

The ECMWF:s Extreme Forecast Index (EFI) relates the probabilities to the climatology



The EFI does not tell how **likely** something is, only its degree of **extremity**

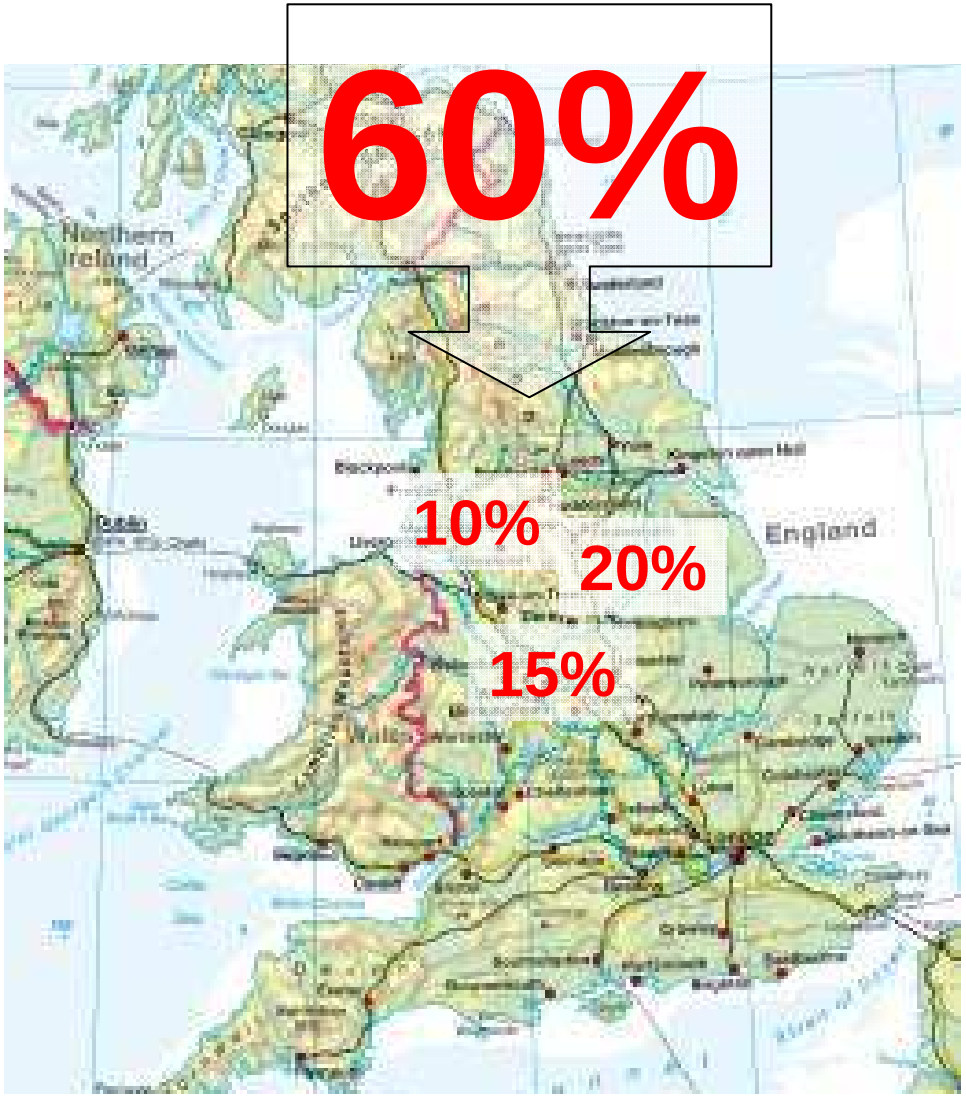
IV.3.7. 100% probabilistic

But is it just a matter of handing out percentage values??

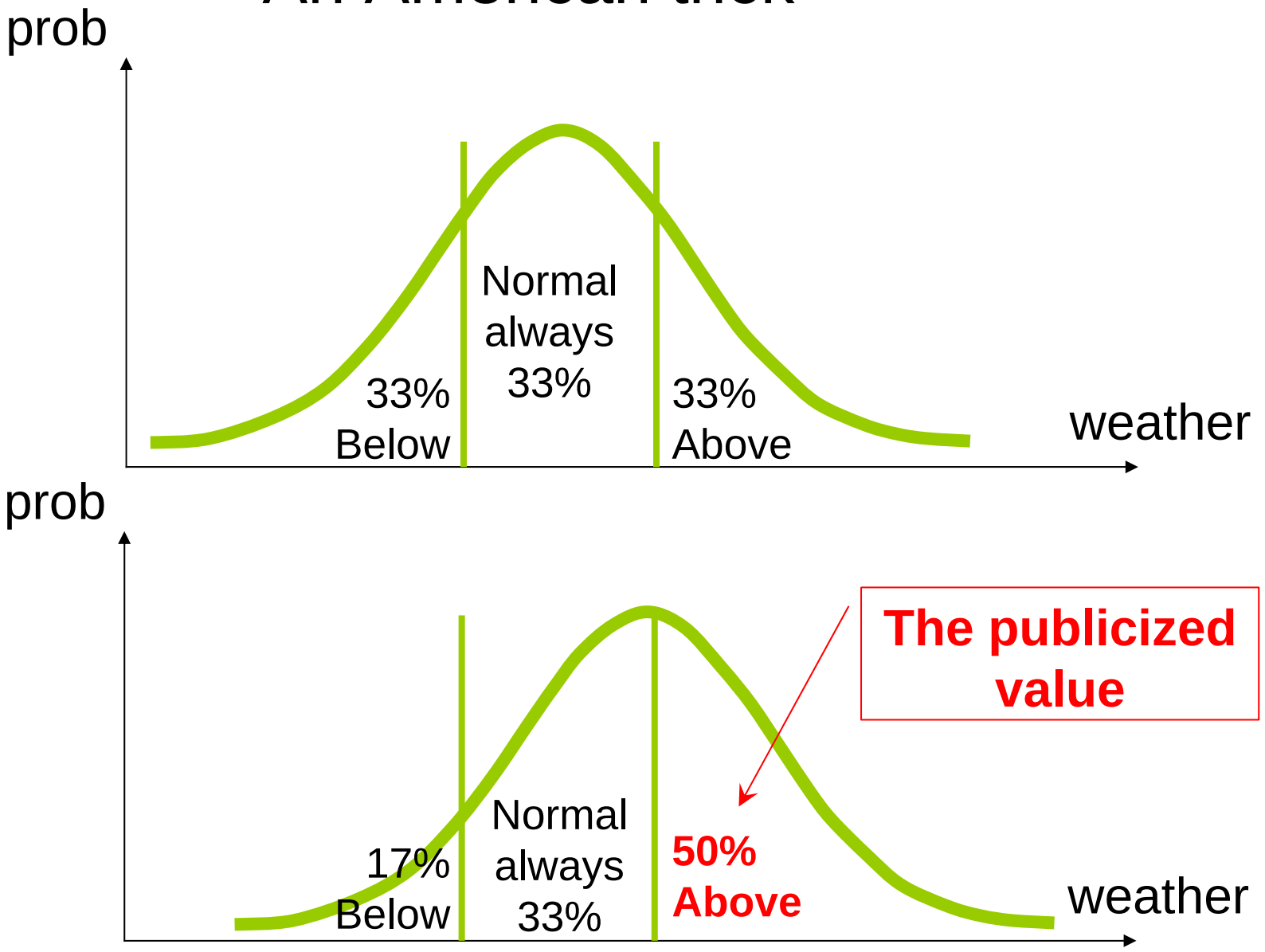
55% **15%** **40%** **75%** **25%** **30%**

More advanced framing effects:

The authorities reacted more appropriately to a probability forecast of 60% for a whole region than to 10-20% for individual locations



An American trick



END