Can We Really Trust Long-Range Weather Forecasts?

Confessions of a Rogue Forecaster

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The 'Official' Forecast

Met Office warns of cold winter potential

For winter 2005-06, defined in this case as December, January and February, the Met office forecasts the NAO to be negative, indicative of a colder and drier winter for northern Europe and the UK. Specifically, the government forecast predicts this winter to be amongst the coldest third of winters between 1950 and the end of the last century.

Predicting the weather though is not the most precise of sciences, and the Met office calls the skill of its forecast "reasonable but by no means high," and goes on to say that in hindsight, its forecasts were able to correctly predict the sign, positive or negative, of the NAO 66pc of the time.

A scientist at the Met Office said that the experimental forecast was "a slight advantage over not knowing anything at all," adding that, "eventually we believe it will be possible for people...to make profitable use of this information."

3

"… not knowing anything at all …"
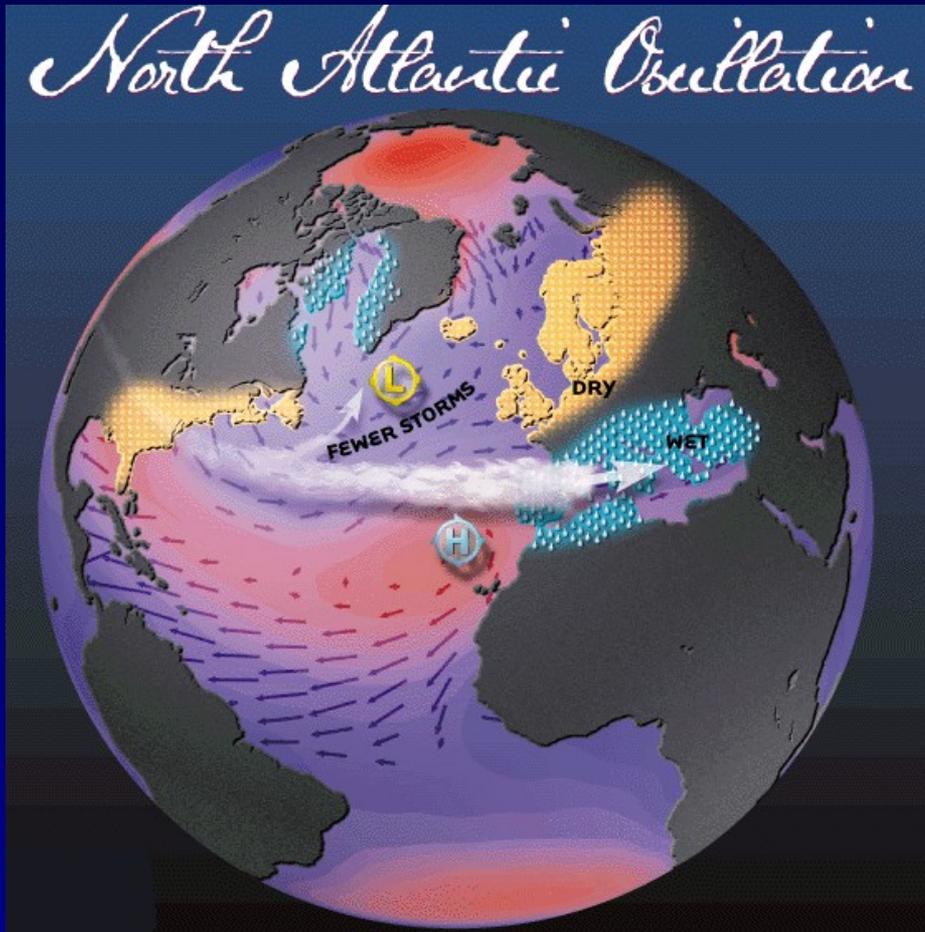
The North Atlantic Oscillation (+)
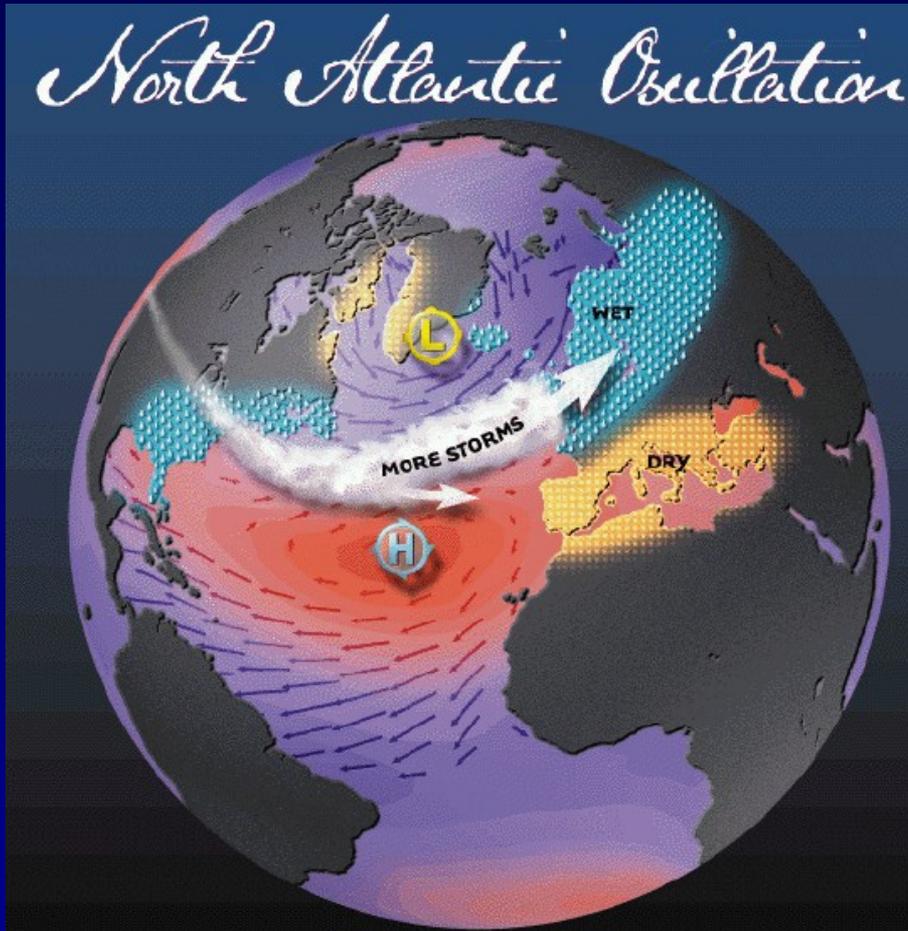
Positive Index phase

- Subtropical high pressure centre stronger and Icelandic low deeper than normal.

- More and stronger winter storms crossing the N Atlantic on a more northerly track.

- Mild and wet winters in N Europe. Cool and dry winters in S Europe.

Source: http://www.ldeo.columbia.edu/NAO/

5

The North Atlantic Oscillation (-)


Negative Index phase

- Subtropical high and Icelandic low weaker than normal.

- Fewer and weaker winter storms crossing the N Atlantic on a more west-east pathway.

- Cold and dry winters in N Europe. Mild and moist winters in the Mediterranean.

Source: http://www.ldeo.columbia.edu/NAO/
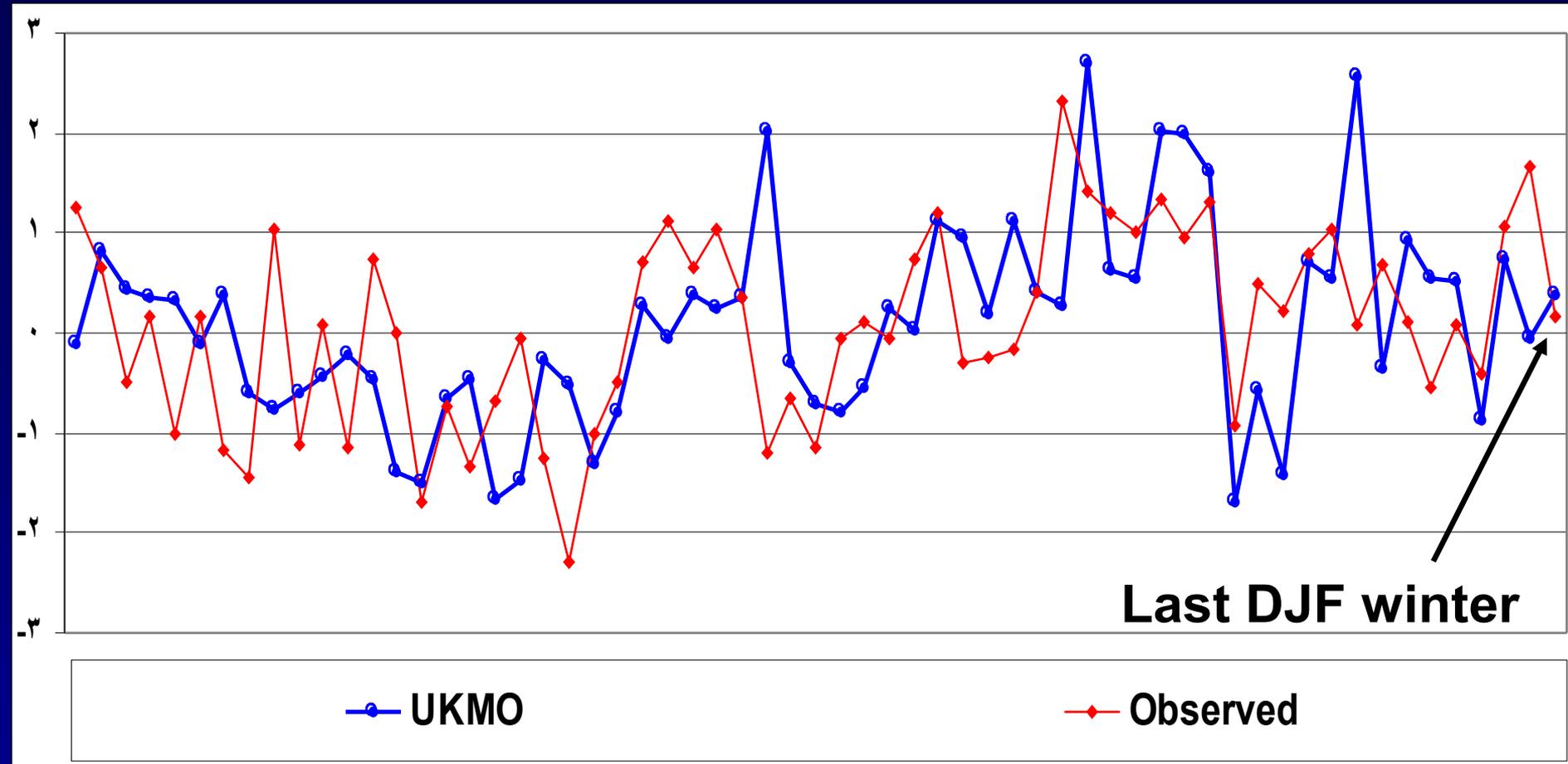
Examples of NAO Time-Series

- Principal Components (Met Office - DJF)

Winter NAO Index from 1948/9 until 2008/9

Coin biased to positive side

Coin biased to negative side
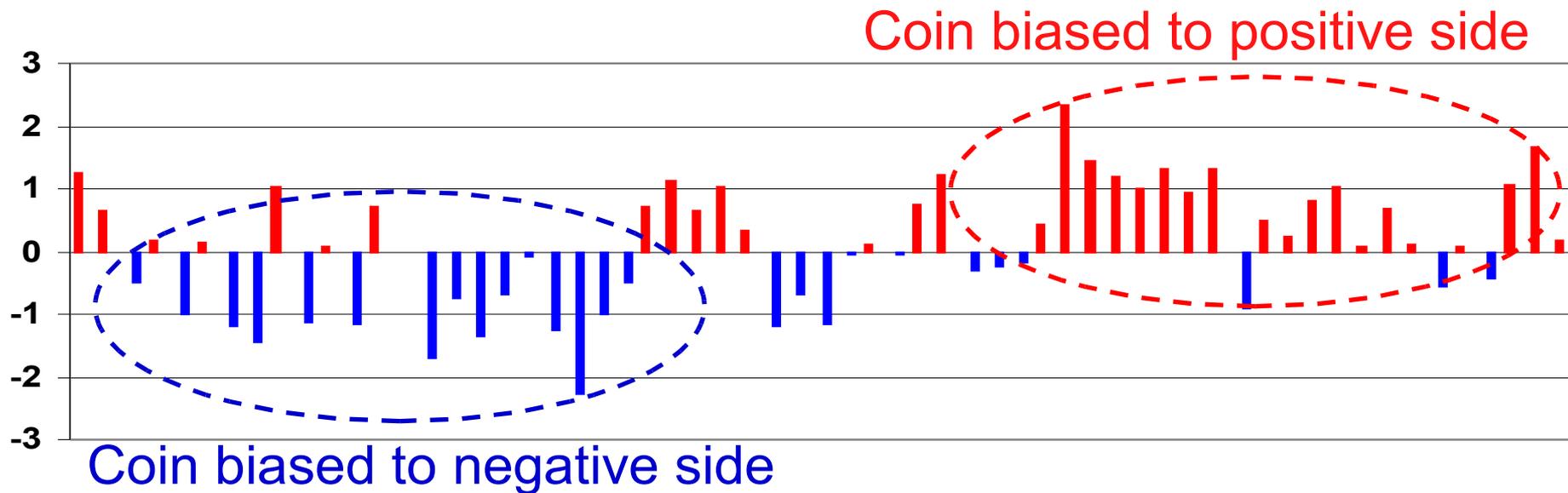
Source: Dr Adam Scaife, UK Met Office

The Met Office NAO Forecasts

**Last DJF winter**

UKMO — Observed

Source: Dr Adam Scaife, UK Met Office

Scientific Foundation

- Evidence of a physical link between N-Atlantic SSTs and winter NAO
  - Rodwell *et al.*, 1999: *Oceanic forcing of the wintertime North Atlantic Oscillation and European climate*. Nature, **398**: 320-323.

- Model based on a maximal covariance analysis of N-Atlantic SSTs in May and 500 hPa geopotentials in next DJF winter.
  - Rodwell and Folland, 2002: *Atlantic air-sea interaction and seasonal predictability*. Q. J. R. Met. Soc., **128**: 1413-1443.

MA-2 Forecast

Last DJF winter

MA-2　　　Observed
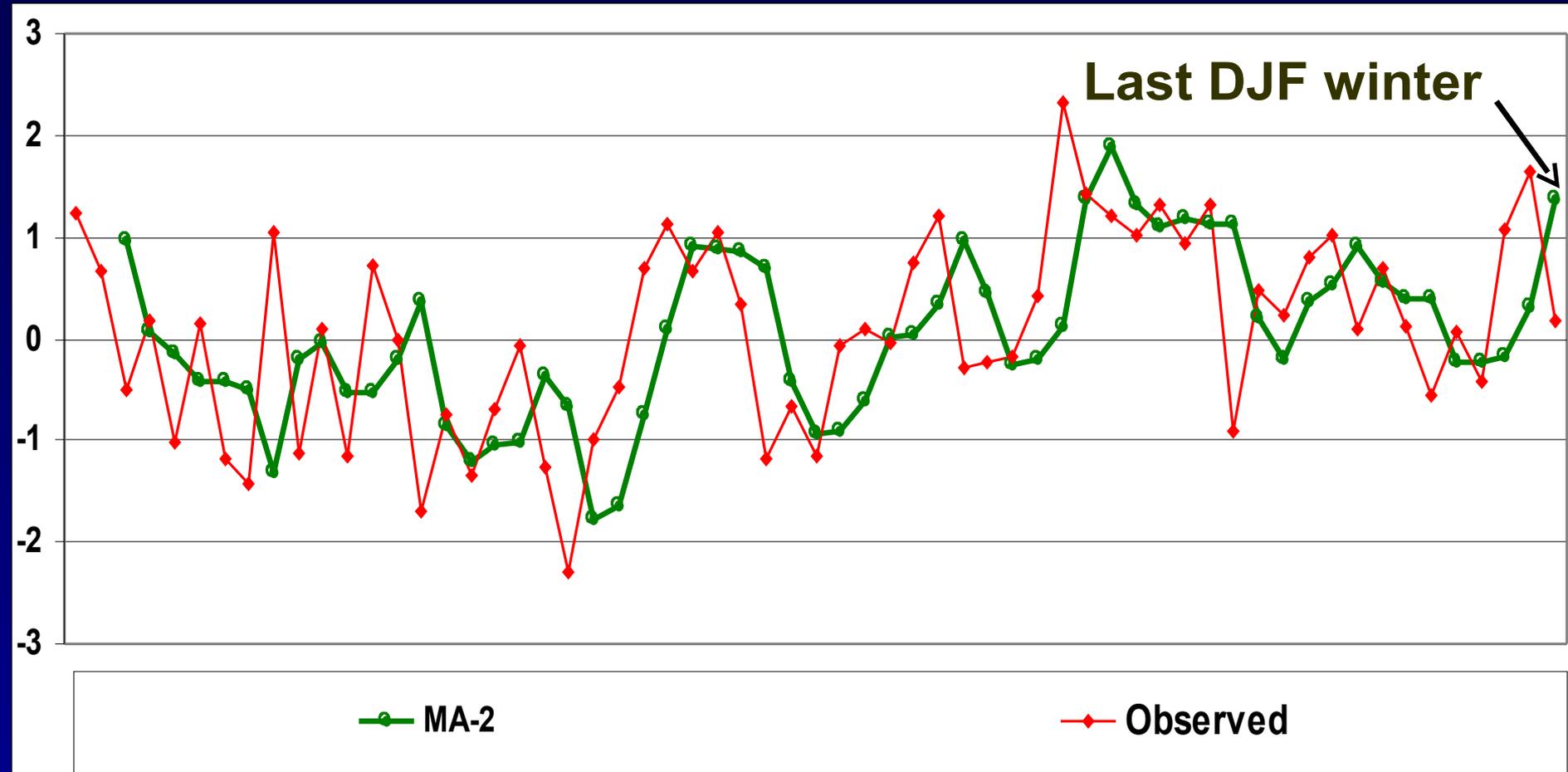
Source: The Rogue Forecaster

Scientific Foundation

- Physics: Zip!

- Model: Predict the average of the NAO indices of the two preceding winters (MA-2).

$$NAO_i = \frac{1}{2}\left(NAO_{i-1} + NAO_{i-2}\right)$$

$$= NAO_{i-1} - \frac{1}{2}\left(NAO_{i-1} - NAO_{i-2}\right)$$

Performance Statistics

UKMO not better than MA-2, so no real benefit <u>for the decision maker</u>!

Metric	Met Office	MA-2
Percent Correct for Sign (PC)	0.68	**0.69**
Hit Rate NAO+ / NAO-	0.69/ 0.67	0.69 / **0.70**
False Alarm Rate NAO+ / NAO-	0.33 / 0.31	**0.30** / 0.31
Odds Ratio Skill Score	0.63	**0.68**
Bias	0.01	**0.00**
Mean Absolute Error (MAE)	0.86	**0.74**
Mean Squared Error (MSE)	1.07	**0.89**
Correlation Coefficient (CC)	0.42	**0.43**

(Calculated from 1950/1 to 2008/9, i.e. over 59 DJF winters)

Conclusions

- PC is not adequate to assess the performance of NAO sign forecasts!
  - Too sensitive to the base rate! (*The Finley Affair…*)
- A good benchmark should be 'proper'!
  - Simple random forecasts are not adequate here because they disregard the observed persistence;
  - Simple persistence ignores the observed variability.
- Can we really trust long-range weather forecasts?
  - First make sure verification results and their interpretation can be trusted!

Thank You!