

***Discussion of session on
Confronting Global Climate Change***

**Richard Smith, University of North
Carolina**

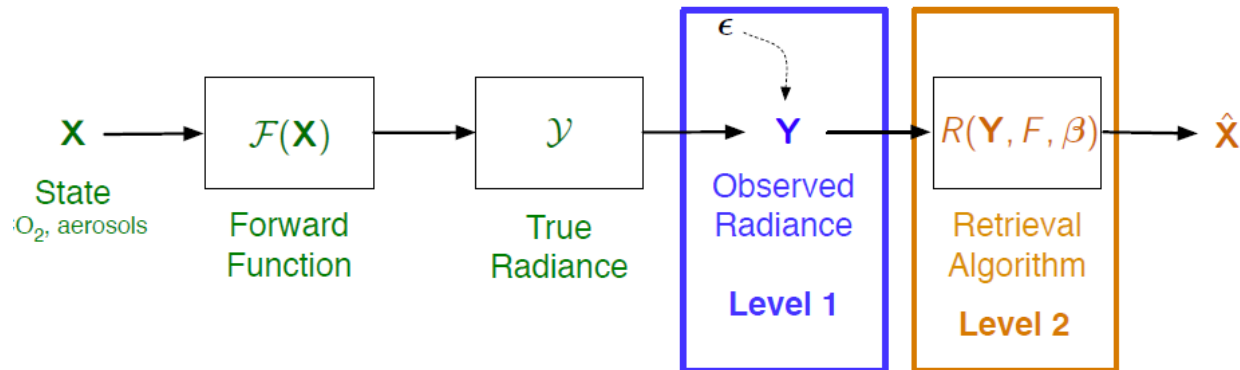
**Joint Statistical Meetings
Washington, DC, August 10, 2022**

Questions for Bo Li

- Comparing two climate models for equality of return levels across space
- Focus on simultaneous testing problem
- Some technical questions:
 - Return levels at a fixed T or is it feasible to model across T as well?
 - Spatial dependence: is Schlather max-stable process the right model?
 - Asymptotic dependence or asymptotic independence between different sites?
- Correction of FDR procedure: how wrong would we be if we just applied the Benjamini-Hochberg formula without correcting for dependence?
- Your example at the end: is it reasonable to expect a reanalysis and a historical climate model to be equivalent?
- This seems a very technical approach. Do you think you could explain it to climate scientists?

Questions for Jon Hobbs

- The technical problem is what applied mathematicians call an inverse problem



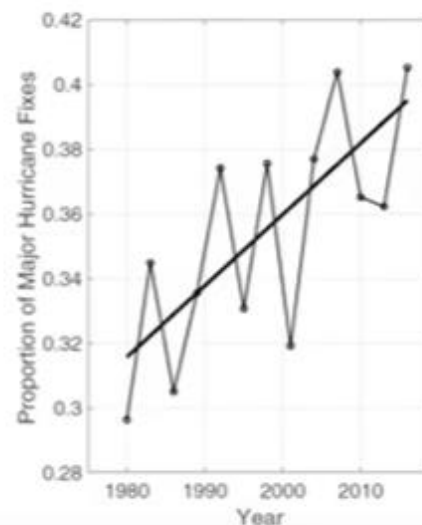
- If everything was linear and Gaussian, we would do Kalman filtering
- Optimal Estimation (geosciences): combine KF with crude Bayesian ideas
- What would a real Bayesian do?
- Over the past several years, Jon and his collaborators have made huge steps towards solving such problems, but my impression is they are not quite there yet. “Simulation-based UQ” seems a new approach to answering that question
- My main question to Jon is how close he feels we are to solving this problem with a fully Bayesian analysis, how scalable such solutions are, and: is this in fact the right way to think about these problems?

Questions for Robert Lund

- Robert is the world's leading expert on changepoint detection! This talk was another excellent demonstration of that.
- But like Bo's talk, I'm not sure what the message should be for climate scientists
- Does this really refute the idea that hurricanes are becoming more intense?
 - The usual question that arises whenever you accept a null hypothesis: does this prove there was no change?



Satellite-derived proportion of major hurricane fixes



Time series of fractional proportion of global major hurricane estimates to all hurricane estimates for the period 1979–2017. Each point, except the earliest, represents the data in a sequence of 3-y periods. The first data point is based on only 2 y (1979 and 1981) to avoid the years with no eastern hemisphere coverage. The linear Theil–Sen trend (black line) is significant at the 98% confidence level (Mann–Kendall P value = 0.02). The proportion increases by 25% in the 39-y period (about 6% per decade).

Kossin et al., *PNAS*, 2020

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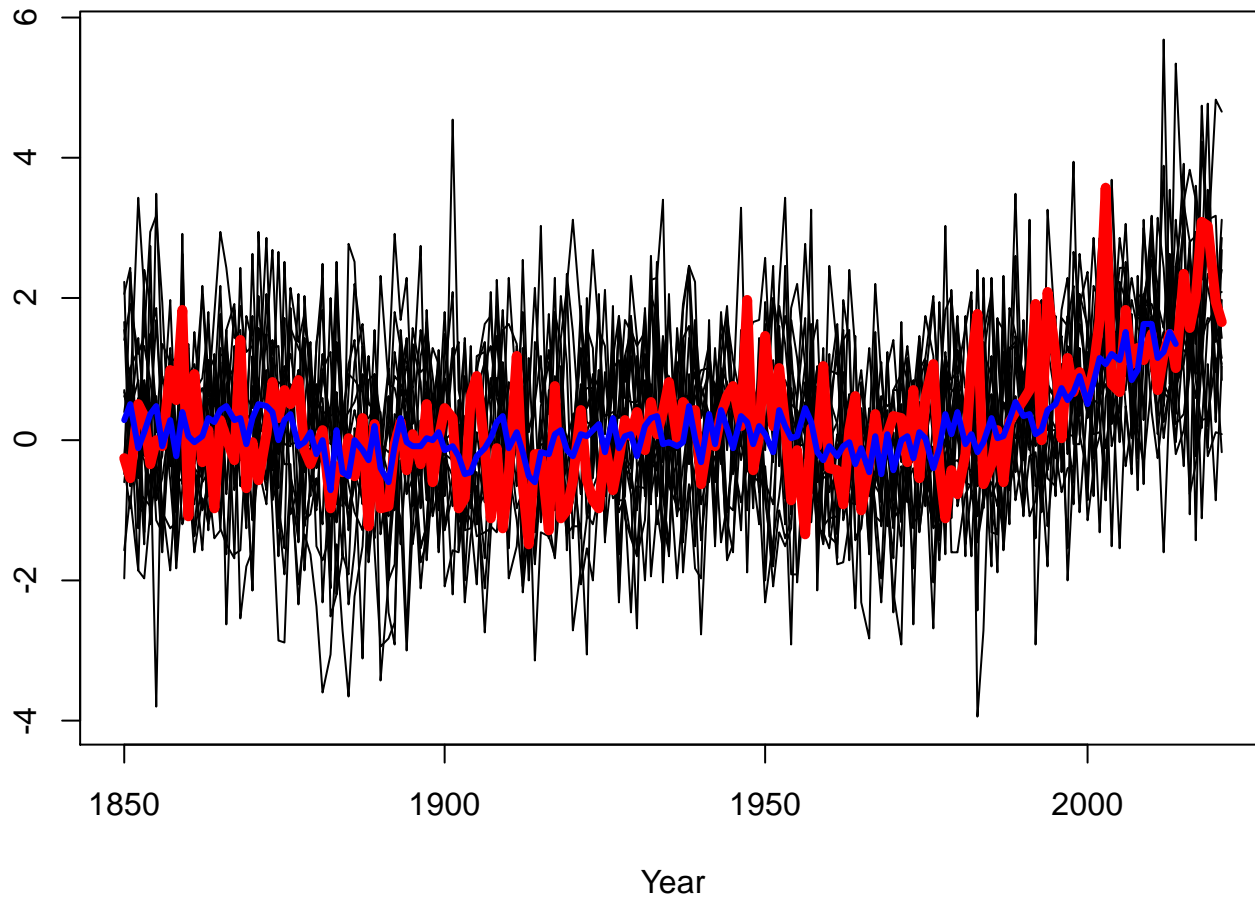
EARTH AND ENVIRONMENTAL STEWARDSHIP

Questions for me

- On July 19, 2022, Heathrow Airport, London, recorded a daily high temperature of 40.2 C (104.4 F)
- Based on data available prior to 2022, what is the probability of a temperature in London exceeding 40.2C?
 - In 1900?
 - In 2022?
 - In 2100?

Approach

- Downloaded data from Heathrow back to the 1930s; calculated annual temperature maxima (where available)
- Computed summer average temperatures across a region of southern UK and nearby parts of Europe (regional summer means)
- Downloaded data from 19 climate models (CMIP6) and calculated the equivalent model-based quantities



Extreme Temperature Probabilities in London

