FMS1203S: Randomness in scientific thinking

Week 6

Statistics and Environment

Statistics and climate research

Human impacts on global warming through greenhouse gas emissions are a particular concern in climate research. Statistics can be used to address uncertainty issues such as

- ▶ Quantifying uncertainty in climate projections and in climate change impacts.
- ▶ Trend detection:
  - ▶ Is there a trend in the frequency of extreme weather events that cannot be explained as mere random variation?
  - ▶ Can we distinguish "natural" variation in climate from variation induced by human activity?
- ▶ How to combine historical records of observational data of different types, e.g., combining surrogate measures of carbon dioxide levels from ice cores from before modern measuring instruments were available with more recent data?

Sampling and measuring the environment

Sampling and measuring the environment is a task that requires considerable statistical sophistication. Common tasks include

- Design of networks and sampling methods for monitoring air quality, water quality, species abundance and other measures of the state of the environment.
- Determination on where to put a new monitoring station, or which existing monitoring stations should be shut down without too much impact on decision making.

Other improtant environmental problems

- ► Assessing site reclamation. Suppose that a site has been polluted, and that the polluter is required to clean up the site to a certain standard. How to check that this has been done? How to collect and analyze the data with statistical methods?

- ► Setting regulatory standards - what levels of a certain pollutant should be allowed in drinking water, for instance?

- ► Identifying contributions of different pollution sources. For example, different pollutants contribute to air pollution such as cars, power stations, etc., how to identify the contribution of each of the pollutants?

Readings for next week

Group one: Genton, M. and Hering, A. (2007). Blowing in the wind. Significance, 4 (1), 11-14.

Group two: Wilson, G.T. (2006). Statistics and risk in the nuclear industry. Significance, 3 (2), 59-62.

Group three: Chandler, R., Rougier, J. and Collins, M. (2010). Climate change: making certain what the uncertainties are. Significance, 7, 9-12.

Group four: Smaje, Chris (2011). The ungreen city - or the polluting countryside? Significance, 8(2), pp. 61-64.

Group five: Morgan, G. Dowlatabadi, H., Henrion, M., Ketih, D. Lempert, R. McBride, S., Small, M. and Wilbanks, T. (2009). Best practice approaches for characterizing, communicating and incorporating scientific uncertainty in decision making. US Climate Change Science Program Report, Part 3, 29-33.