

Research agenda for extreme value analysis of climate events

Climate science area:

Comparison of climate model output to data

*what does a grid square mean

-depends on numerical solution scheme

-can depend on more processes than are observed (eg regional temperatures)

-is a better descriptor of an area around the grid square than the precise grid square

*distribution of weather needs to be compared to distributions from the climate model. One can borrow spatial strength from nearby stations to predict grid square observation, or use spatial regression tools to predict station observations from model output. Statistical issues here include developing tools for multivariate two-sample comparisons,

*spatiotemporal correlation structure in model vs data (scale issue must be addressed)

*finding (by moving backwards in time) initial conditions that manage to keep a model "close" to data for, say, 30 years (even if that could be done only for parts of the world it would enhance the believability of GCMs)

Need to develop appropriate skill measures, possibly focusing on large-scale features.

Use of climate models to:

* generate testable hypothesis about weather data changes

* get an idea of future frequencies of particularly dangerous combination of factors, not all of which need to be extreme (eg rain on frozen ground leads to flooding)

* inform (say, as prior distributions, or as a "climate classifier") extreme value analyses

* downscale large-scale GCM features (which are more reliable) to smaller scales (a statistical problem is how to downscale distributions). One may also consider upscaling (of data), requiring development of tools for optimal combination of distributions

Extreme value research problems:

Peak over threshold methods for spatial and multivariate extremes

Conditional multivariate methods given one extreme variable

Viewing index methods as exceedance outside convex manifold

Can EVT be used to study events with extreme consequences, such as trends in onset of frost?

Dealing with extremes in vector block extremes that occur at different times during the block

Developing screwedness functional theory (related to index methods above)

Using the point process representation of max-stable processes to develop more tractable multivariate extremes models

Maybe it would be worthwhile to form a group looking at the analysis of heat waves (of course, there are many groups looking at this, but maybe our combinations of expertise could add something to the mix), Some of the issues involved with heat waves are also relevant for forest fires.