Temporal nonstationarity

It seems that the most usual approach to deal with 'non-stationarities' in extremes is to allow for parametric changes in time for a GEV distribution. Linear trends on GEV parameters are a first step and had shown practical use to assess long term changes in climate/weather extremes. On the other hand, there has been some work in using Generalized Additive Models and also state-space models to accomodate for smooth/non-linear parameter change. An interesting idea is to apply 'Hidden Markov Models' to represent change points in time and 'cluster' structure. A state-space model can account for seasonalities with time-varying amplitudes. In general, it is unclear that in analyzing time series of extremes that arise in weather and climate, these perhaps more flexible models are more useful than simple linear trends. What kind of model comparison tools are available to learn about this?

There is a need for models with distributional changes and in particular with different shape parameters but one has to be carefull about estimating this shape parameter. It was recommedend that one first models changes in location, then location/scale and finally consider location/scale/shape. Should we model trends directly in term of time or as a function of covariates? Beyond parameter changes, should we also consider temporal dependence in extremes? How does one represent temporal dependence in extremes for weather and climate data?