Geophysical Research Abstracts
Vol. 17, EGU2015-284, 2015
EGU General Assembly 2015

Identification and Analysis of Storm Tracks Associated with Extreme Flood Events in Southeast and South Brazil

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Flood is the main natural disaster in Brazil, practically affecting all regions in the country and causing several economical damages and losses of lives. In traditional hydrology, the study of floods is focused on a frequency analysis of the extreme events and on the fit of statistical models to define flood quantiles associated with pre-specified return periods or exceedance probabilities. The basic assumptions are randomness and temporal stationarity of the streamflow data. In this paper we seek to advance the traditional flood frequency studies by using the ideas developed in the area of flood hydroclimatology, which is defined as the study of climate in the flood framework, i.e. the understanding of long term changes in the frequency, magnitude, duration, location and seasonality of floods as driven by the interaction of regional and global patterns of the ocean and atmospheric circulation. That being said, flood events are not treated as random and stationary but resulting from a causal chain, where exceptional floods in water basins from different sizes are related with large scale anomalies in the atmospheric and ocean circulation patterns. Hence, such studies enrich the classical assumption of stationary flood hazard adopted in most flood frequency studies through a formal consideration of the physical mechanisms responsible for the generation of extreme floods, which implies recognizing the natural climate variability due to persistent and oscillatory regimes (e.g. ENSO, NAO, PDO) in many temporal scales (interannual, decadal, etc), and climate fluctuations in response to anthropogenic changes in the atmosphere, soil use and vegetation cover. Under this framework and based on streamflow gauge and reanalysis data, we identify and analyze here the storm tracks that preceded extreme events of floods in key flood-prone regions of the country (e.g. Parana and Rio Doce River basins) with such events defined based on the magnitude, duration and volume of the observed flows. The storm track data built on the integrated moisture flux in the atmosphere are then classified and clustered in order to categorize the flood events and identify the common patterns and preferential modes of the storms. A composite analysis of synoptic fields of sea surface temperature (SST), surface pressure and geopotential height in the days that preceded the events is also carried out in the analysis. Preliminary results show that, for some regions, like the Parana river basin, the clusters obtained for the storm tracks are associated with distinct signatures of flood events as well as with specific anomalies in the fields of the meteorological variables analyzed, which represents a fundamental step in the development and improvement of non-stationary forecast and simulation models of flood recurrence conditional on climate states.