Geophysical Research Abstracts
Vol. 12, EGU2010-4926, 2010
EGU General Assembly 2010
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Extreme drought conditions over NE Iberia in early 19th century (1812-1825) and its possible relationship to major volcanic eruptions

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Potential changes in the frequency, persistence and intensity of climate extremes (e.g. heat waves, heavy precipitation and drought) are reported as key determinants of future impacts and vulnerability. The more information about behavior and temporal variability of such extremes in the past, the more accurate will be the projections in the future.

In this work, an analysis of a mega-drought detected over NE Iberia in early nineteenth century is made using two climatic information sources: instrumental and proxy data. First, a unique rainfall series of Barcelona covering the period 1786-2009 has been used. Here, data characteristics and metadata of the series is shown, especially for the early period (1786-1843), that have been recently detected and digitized. Second, in order to support and validate the instrumental series, proxy data from historical documentary sources obtained in four locations in Catalonia are also investigated.

Severe climatic drought conditions have been detected during the 1812-1825 period, being especially significant in winter and autumn seasons. Around the sub-periods 1812-13, 1815-17 and 1822-24 three different pulses where the conditions were extremely dramatic are detected. A similar mega-drought (intensity and duration) has not been detected in the whole 1786-2009 period.

An analysis of the atmospheric dynamic processes responsible for these conditions is made based on the forcing effects of three coincident large volcanic events: unknown (1809), Tambora (1815) and Galunggung (1822). It is well-known that great low latitude explosive eruptions have a potential impact on climate via radiative effects (surface temperature cooling) but also by means of dynamical forcing, i.e., Arctic Oscillation/Northern Annular Mode (AO/NAM) or North Atlantic Oscillation (NAO) reinforcement (e.g. Robock, 2000; Shindell *et al.*, 2004; Fisher *et al.*, 2007). A potential cause-effect relationship is pointed out between both phenomena: major volcanism and drought conditions over Iberia.

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