



The hydro-geomorphological event of December 1909 in Iberia: social impacts and triggering conditions

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According to the Disaster database (Zêzere et al., 2014), a Disaster event is a set of flood and landslide cases sharing the same trigger, which may have a widespread spatial extension and a certain magnitude. The Disaster event with the highest number of floods and landslides cases occurred in Portugal in the period 1865-2010 was registered between 20 and 28 December 1909. This event also caused important socioeconomic impacts over the Spanish territory, especially in the Douro basin and in the northern section of the Tagus basin. Despite such widespread impact in western Iberia there is no scientific publication addressing the triggering conditions and the social consequences of this disastrous event. Therefore, this work aims to characterize the spatial distribution and social impacts of the December 1909 hydro-geomorphologic event over Iberia. In addition, the meteorological conditions that triggered the event are analysed using the 20 Century Reanalysis dataset from NOAA and rainfall data from Iberian meteorological stations.

The historical data source used to analyse the event of December 1909 in Portugal is the Disaster Database (Zêzere et al., 2014). This database contains detailed data on the spatial location and social impacts (fatalities, injuries, missing people, evacuated and homeless people) of hydro-geomorphologic disasters (flood and landslide cases) occurred in Portugal (1865-2010) and referred in newspapers. In Spain the data collection process was supported by the systematic analysis of daily newspapers and using the same entry criteria of the Disaster database, to ensure data integrity and enable comparison with Portuguese records.

The Iberian Peninsula was spatially affected during this event along the SW-NE direction spanning between Lisbon, Santarém, Porto and Guarda (in Portugal), until Salamanca, Valladolid, Zamora, Orense, León, Palencia (in Spain). The social and economic impacts of the December 1909 disaster event were higher on the 22nd of December mainly associated to severe floods generated in the Douro and Tagus hydrographic basins.

The atmospheric circulation during the December 1909 and prior months was assessed at the monthly, daily and sub-daily scales. This was achieved with the 20th Century Reanalysis from the National Oceanic and Atmospheric Administration/Earth System Research Laboratory Physical Sciences Division (NOAA/ERSL PSD), where several fields were analysed related to both surface and different tropospheric levels. Results show that, between 20 and 22 of December, a low pressure system become stationary over the North Atlantic Ocean near Azores, moving towards the British Isles and its frontal system affected the Iberian Peninsula on the 21 and 22 of December. The intense precipitation observed on the 22nd of December was also associated to a combination of wind and specific moisture characteristics at 900hPa (concentrated in a quite narrow strip) clearly suggesting the presence of an Atmospheric River.

Compo, G. P., et al. (2011) The twentieth century reanalysis project. *Quart. J. Roy. Meteor. Soc.*, 137A, 1–28

Zêzere, J. L., et al. (2014) DISASTER: a GIS database on hydro-geomorphologic disasters in Portugal. *Nat. Hazards*, 71: 1029-1050

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