Geophysical Research Abstracts
Vol. 15, EGU2013-9192-1, 2013
EGU General Assembly 2013

A global drought climatology for the 3rd edition of the World Atlas of Desertification (WAD)

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A new version of the World Atlas of Desertification (WAD) is being compiled in the framework of cooperation between the Joint Research Centre (JRC) of the European Commission and the United Nations Environment Programme (UNEP). This initiative aims at mapping the global land degradation and desertification, as well as introducing the reader with complex interactions of geo-physical, socio-economic, and political aspects that affect the environmental sustainability. Recurrent extreme events resulting from climate change, such as more severe droughts, combined with non-adapted land use practices can affect the resilience of ecosystems tipping them into a less productive state. Thus, to describe the effects of climatological hazards on land degradation and desertification processes, we computed a World drought climatology that will be part of the 3rd edition of the WAD and will replace and update to 2010 the results presented in the 2nd edition in 1997. This paper presents the methodology used to compute three parameters included in the WAD drought climatology, i.e. drought frequency, intensity and duration, and discusses their spatio-temporal patterns both at global and continental scales.
Because drought is mainly driven and triggered by a rainfall deficit, we chose the Standardized Precipitation Index (SPI) as the drought indicator to estimate our climatological parameters. The SPI is a statistical precipitation-based drought indicator widely used in drought-related studies. We calculated the SPI on three different accumulation periods: 3 months (SPI-3), 6 months (SPI-6), and 12 months (SPI-12), in order to take into account meteorological, agricultural, and hydrological drought-related features. Each quantity has been calculated on a monthly basis using the baseline period between January 1951 and December 2010. As data input, we used the Full Data Reanalysis Version 6.0 (0.5˚x0.5˚) of gridded monthly precipitation provided by the Global Precipitation Climatology Center (GPCC) of the Deutscher Wetterdienst (DWD). This dataset was selected after an extensive quality check on data reliability, homogeneity, and physical consistency.
We defined the drought frequency as the number of months with SPI below -1 out of all months in different periods of 10-15 years between 1951 and 2010. For the drought intensity we analyzed the drought events with at least 3 consecutive months with SPI below -1. The drought duration is defined in an operative way: a drought starts when SPI first falls below -1 and it ends when it turns back positive (i.e. >0) for at least 2 consecutive months. The results show that in the last two decades, as compared to the long-term normal conditions, the regions most affected by drought events were Congo and Central Africa, North-Eastern China, the Australian South-Eastern coast, and the Middle East. In general, an increase in duration and intensity of drought events was found for almost all the Northern Hemisphere. We also focused on some regional case studies dealing with drought events in the Mediterranean region, the Horn of Africa, and South America in the last 15 years