EMS Annual Meeting Abstracts
Vol. 21, EMS2024-794, 2024, updated on 21 Jul 2024
https://doi.org/10.5194/ems2024-794
EMS Annual Meeting 2024
© Author(s) 2024. This work is distributed under
the Creative Commons Attribution 4.0 License.

Future changes in global drought fractality

Lorena Galiano[1], Robert Monjo[1,2], Dominic Royé[1], and Javier Martin-Vide[3]
[1]Climate Research Foundation - Fundación para la Investigación del Clima (FIC), C/Gran Vía 22 (duplicado), 7, 28013 Madrid, Spain
[2]Department of Algebra, Geometry and Topology, Complutense University of Madrid, Plaza Ciencias, 3, 28040 Madrid, Spain
[3]Climatology Group, Department of Geography, University of Barcelona, C/Montalegre 6, 08001 Barcelona, Spain

Drought is one of the extreme events that will be increasingly present in the context of climate change. As revealed in recent studies, meteorological droughts will become the principal factor modulating compound hot-dry events and analysis; thereof is therefore fundamental with regard to understanding future climate patterns. The average citizen knows little of geometry, but it plays an essential role in the characteristics of the droughts, by means of "fractional lengths". We analysed the fractality of the meteorological droughts under the most recent climate change scenarios. In addition, a new criterion for defining the beginning and end of meteorological droughts is established, which allows the analysis of seasonal variability. A temporal fractality measure based upon the Cantor set reveals consensual changes in the behavior of droughts worldwide. Most regions will undergo a slight increase in fractality (up to +10% on average), particularly associated with an acceleration of the hydrological cycle and the Hadley cell expansion, with a shift towards the higher latitudes of the tropical edge in both hemispheres. Geometrical measures were applied to the dry spells (<1mm) simulated by Earth System Models of the CMIP6, showing more concentrated or unequal distribution of droughts in mid latitudes. Simultaneously, the polar regions might benefit from more regular precipitation patterns. Other inequality measures, such as the indices of Gini and Monjo, showed similar results. In general terms, the earth’s climate will be more fractal in the rainfall-related patterns, which likely means that the consequences will be more catastrophic for the human population.