Researchers create tool to improve the forecasting of extreme rain events

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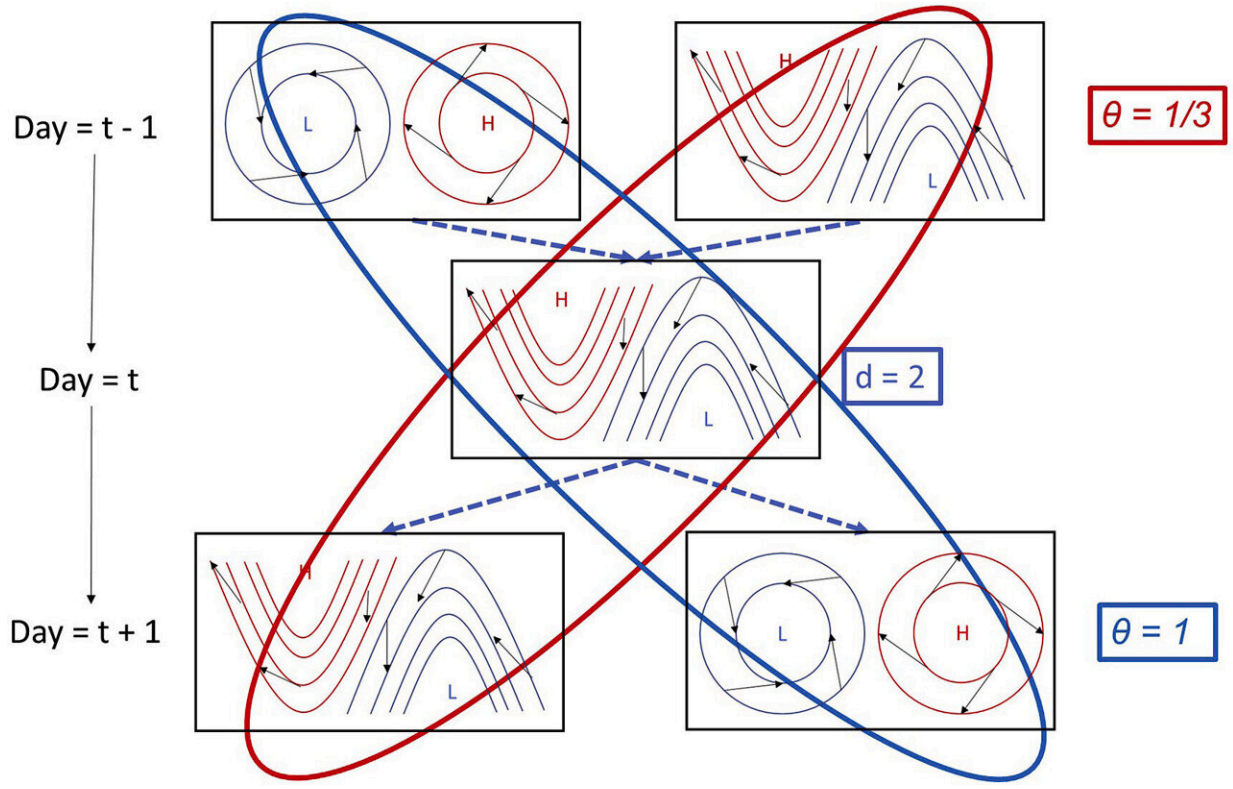

An intuitive schematic of d and θ computed for tentative atmospheric states. The local dimension (d) is related to the number of possible patterns preceding and following the state being analyzed at day t (here, d = 2), and θ is the inverse of the persistence. When the Red Sea Trough persists for three days (red ellipse), then θ = 1/3. If the synoptic configuration changes every time step (blue path), then θ = 1. Credit: *Weather and Climate Extremes* (2023). DOI: 10.1016/j.wace.2023.100564

Driven by global warming, the emerging climate crisis has in recent years included a rise in the frequency and intensity of extreme rain events, leading to loss of life and of property. A new research study, led by Dr. Assaf Hochman and by doctoral student Tair Plotnik at the Institute of Earth Sciences at the Hebrew University, investigated the factors influencing our ability to forecast extreme rain events, towards developing tools that can improve the forecasting of such events in the very near future and help prevent disasters.

Extreme rain events, particularly those that cause flash floods in the south and east of Israel in spring and fall (such as the floods in Nahal Tzafit in April 2018 that claimed the lives of 10 young people), are particularly difficult to forecast even a short while in advance. Dr. Hochman and his team have studied the factors that affect our ability to predict extreme rain events of this type, which are linked to what is known as an "active" Red Sea Trough.

In this study, the research team—which also includes Elizabeth-Ruth Shehter, Dr. Shira Raveh-Rubin, and Dr. Leehi Margaritz-Ronen of the Weizmann Institute of Science, and Dr. Francesco Marra of the University of Padova in Italy—used an extensive database belonging to the European Center for Medium-Range Weather Forecasts (ECMWF) to examine all extreme rain events that have occurred since 1979, and to sort them into hard-to-forecast and easy-to-forecast categories.

They found that one of the factors preventing optimal forecasting of extreme rain events is the simultaneous entry into Israel of air masses from the south and from the north, due to the significantly different characteristics of each.

A mathematical tool developed by the research team can improve forecasting even in difficult cases, so that in the near future, it will be possible to predict the extremity of rain events in Israel with a high

degree of accuracy, and subsequently also in other parts of the world. This capability will enable decision-makers to prepare for such events, and thus save human lives and significantly reduce the damage the events cause.

Dr. Hochman explained the study findings: "The study, and the tool we subsequently developed, allow us to examine the factors that create extreme rain and thus to forecast the conditions in which extreme rain events will develop. Using this kind of tool will likely save lives, as in the future, it will allow the authorities to predict extreme rain events and to prepare for them properly. As we have seen, such events can cost human lives."

Dr. Hochman added that "We plan to collaborate with the Israel Meteorological Service and other large forecasting institutions around the world, in order to operationalize our unique new approach."

More information: Assaf Hochman et al, The sources of extreme precipitation predictability; the case of the 'Wet' Red Sea Trough, *Weather and Climate Extremes* (2023). DOI: 10.1016/j.wace.2023.100564

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