Dry soils make for a stormy brew

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Credit: AI-generated image (disclaimer)

Water: about 60 % of our body weight is made up of it; it is the body's principal chemical component. Every system in our body depends on it; it carries nutrients to our cells and it takes toxins out of vital organs. Without it we couldn't survive. It also acts in a similar way for the Earth. The Global Water Cycle plays a central role in global atmospheric circulations, controlling the global energy cycle (through latent heat) as well as the carbon, nutrient and sediment cycles. Recent research

indicates that afternoon storms are more likely to develop when soils are parched. The study was funded in part by the WATCH ('Water and global change') project, which was backed with EUR 9.9 million under the 'Sustainable development, global change and ecosystems' Thematic area of the EU's Sixth Framework Programme (FP6).

The research team included scientists from across the European Union, including France, the Netherlands, Austria and the United Kingdom, and was led by Dr Chris Taylor from the Natural Environment Research Council (NERC) Centre for Ecology & Hydrology in the UK. Their research, which has been published in Nature, examined hydrological processes across six continents.

The results compiled by the research team have important implications for the future development of global weather and climate models, models which may currently be simulating an excessive number of droughts. The scientists examined imagery from weather satellites which track the development of storm clouds across the globe. When they matched up where new storms appeared alongside images of how wet the ground was, they were somewhat surprised.

Dr Taylor explained: 'We had been looking at storms in Africa and knew that rain clouds there tended to brew up in places where it hadn't rained in the previous few days. We were surprised to see a similar pattern occurring in other regions of the world such as the US and continental Europe. In those less extreme climates, with more vegetation cover, we expected the soil wetness effect would be too weak to identify.'

The researchers then compared their observations with six global weather and climate models used to simulate climate change. What they discovered surprised them. They found that existing climate models do the wrong thing, triggering rain over wetter soils.
What this implies is that climate models that currently exist are more

likely to go into a vicious circle whereby dry soils decrease rainfall, leading to even drier soil conditions, and so on. The paper concludes that fixing this problem is a priority for scientists developing the climate models.

Dr Taylor added, 'Both heat and moisture are critical ingredients for rain clouds to build up during the afternoon. On sunny days the land heats the air, creating thermals which reach several kilometres up into the atmosphere. If the soil is dry, the thermals are stronger, and our new research shows that this makes rain more likely.'

Co-author Dr Françoise Guichard from CNRM-GAME (CNRS and Meteo-France) said, 'We need to improve climate models so that we get a better idea of what global climate change will mean on smaller regional scales over land.'

The WATCH project brought together the hydrological, water resources and climate communities to analyse, quantify and predict the components of the current and future global water cycles and related water resources states; evaluated their uncertainties; and clarified the overall vulnerability of global water resources related to the main societal and economic sectors.

For more information, please visit: WATCH www.eu-watch.org/

NERC Centre for Ecology & Hydrology www.ceh.ac.uk/

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