Mathematical model developed 100 years ago used to improve weather and climate models

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Credit: Delft University of Technology

"The Russian mathematician Andrei Markov (1856–1922) could never have suspected that his Markov chains would be used for weather and climate models more than a century later," says Jesse Dorrestijn, who saw an opportunity to improve the models that describe the cloud formation process, using a scientific work from long ago. Dorrestijn did his PhD research at Centrum Wiskunde & Informatica (CWI), with the

Royal Netherlands Meteorological Institute (KNMI) en TU Delft. On Thursday 8 September, he is defending his PhD at TU Delft on this subject.

Cloud formation

The formation of clouds in warm conditions (convective clouds) is currently a weak link in weather modelling. Cloud formation is an extremely complex process. There are huge numbers of transitional situations in which clouds may only just form or not at all. Dorrestijn has developed a new method for describing these critical transitional stages based on Markov chains. Using this method, he is able to calculate percentage chances for the formation of clouds in a given location under changing conditions. This makes it possible to describe the likelihood of clouds forming in the models in a more natural manner.

Observational data from Australia

To develop this weather model, Dorrestijn used many gigabytes of observational data from the rain radar in Darwin, Australia. This enabled him to improve the weather and climate models used to predict cloud formation, not only for the climate in Australia, but for every type of climate around the world. In the tropics in particular, clouds that can develop into rain showers can deliver quite a deluge of rain water. Accurately representing clouds in weather models is of great importance for both national and international weather forecasting and for climate research.

More information: Stochastic Convection Parameterization: repository.tudelft.nl/islandor … ?collection=research