

Atmospheric model development initiative at UP receives the Stanley Jackson Award

By Dr Francois Engelbrecht

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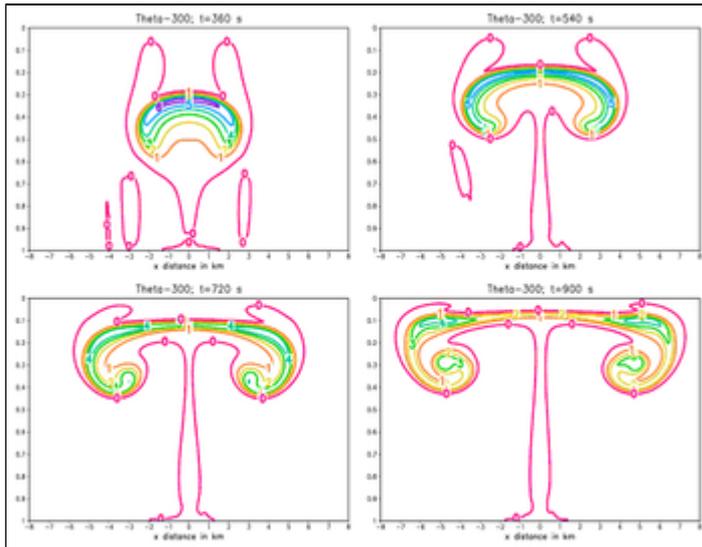


Figure 1: A warm bubble rising in an isentropic environment as simulated by NSM.

Over the last few years researchers at the Department of Geography, Geoinformatics and Meteorology (GGM) at the University of Pretoria, in collaboration with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia, have developed a new atmospheric model that can be used to study the processes occurring within thunderstorms at high spatial resolution.

With the onset of the rainy season over the summer rainfall region of South Africa, people living on the Highveld have been seeing the familiar sight of towering Cumulus cloud, which gradually grow to become rumbling thunderstorms producing rain and lightning. Over the last few years, researchers at the Department of Geography, Geoinformatics and Meteorology (GGM) at the University of Pretoria, in collaboration with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia, have developed a new atmospheric model that can be used to study the processes occurring within thunderstorms at high spatial resolution.

Dr. Francois Engelbrecht of Department GGM, together with Dr. John McGregor of the CSIRO and Prof. Hannes Rautenbach of GGM, have recently received recognition from the South African Society for Atmospheric Sciences (SASAS) for this local modeling effort. The Stanley Jackson Award for the best published paper contributing to the atmospheric and oceanic sciences in South Africa during 2007 has been awarded to them for the paper entitled "On the development of a new nonhydrostatic atmospheric model in South Africa". The paper was published in the South African Journal of Science.

Although atmospheric models developed at overseas institutions are applied widely in South Africa, the local development of such models has not received much attention over the last two decades. The recent effort at UP to locally develop an atmospheric model aims to break this trend. The new model is based on a set of nonhydrostatic differential equations that describes atmospheric motion on a wide range of spatial scales, including the small-scale updrafts and downdrafts occurring within thunderstorms. The equations are solved numerically, with a time-split semi-Lagrangian technique. The model employs a terrain-following coordinate based on the full pressure field, which makes it feasible to conveniently incorporate the effects of topography on airflow within the model formulation. The new model has been named the "Nonhydrostatic Sigma-coordinate Model (NSM) (Engelbrecht, 2006).

The figure shows an NSM simulation of a warm convective bubble, which rises in a colder environment because of its positive buoyancy. With the nonhydrostatic dynamics of the model, convective storm features such as splitting thunderstorms, the merging of cumulus cells and the growth of updrafts within environments with vertical wind shear may be studied. The first simulations over realistic topography have also recently been performed, when the model was applied to simulate airflow over Cape Point (Engelbrecht, 2008). The latest research involving the NSM involves the inclusion of parameterization schemes for convective rainfall, radiation and boundary layer processes in the model formulation. The eventual application of the model to operational numerical weather prediction is also envisaged.

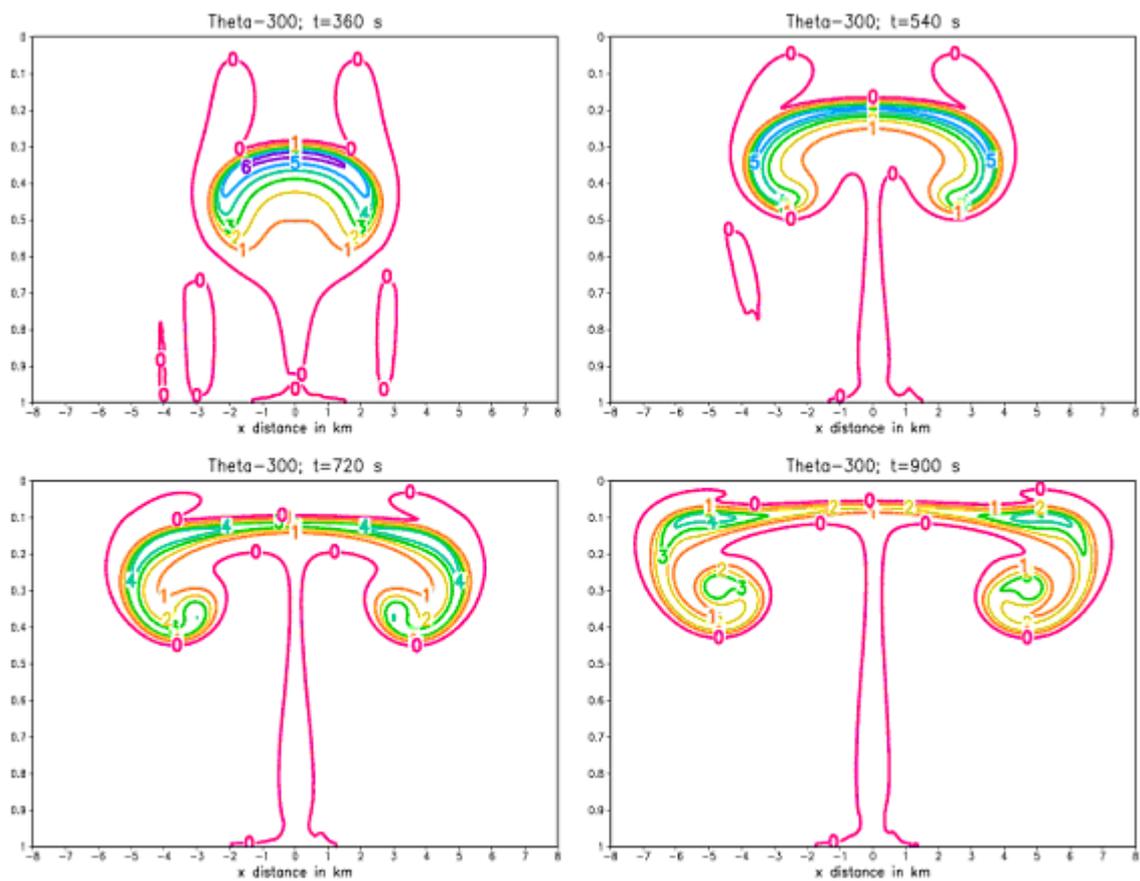


Figure 1: A warm bubble rising in an isentropic environment, as simulated by NSM. The vertical axis covers the region.

References

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