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Scientific Theme: Atmospheric Dynamics and Forecasting

NOGAPS-ALPHA Simulations of the 2002 Southern Hemisphere Stratospheric Major Warming, D. R. Allen, L. Coy, S. D. Eckermann, J. P. McCormack, G. L. Manney, T. F. Hogan, and Y.-J. Kim, *Mon. Wea. Rev.*, **134**, 498-518, February 2006.

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Summary

Stratospheric sudden warmings are common in the Arctic winter stratosphere, but before 2002 were unheard of in the Antarctic. A new version of the Navy Operational Global Atmospheric Prediction System (NOGAPS) forecast model, which extends to higher altitude and includes improved initialization and representation of physical processes, is used to forecast the 2002 Antarctic major warming, and to explore the underlying tropospheric mechanisms for the warming and the affect of those processes on the skill of the forecasts. The model captures the main features of the warming in forecasts up to six days long. Examination of underlying tropospheric fields shows that energy propagating up from a blocking pattern over the South Atlantic was important in forcing the warming. For forecasts of six days or less, this blocking pattern was already in place, and the model thus did not need to predict it. Additional sensitivity tests with different initialization fields shows the advantages of the improved model, and of initialization with improved analyzed fields now available. The combination of a higher model top, better physical parameterizations, and better initial conditions yields better forecasting skill over that previously possible.

This research benefits society by improving our ability to forecast the troposphere/stratosphere system, our understanding of factors that influence the skill of the forecasts, and our knowledge of the mechanisms forcing stratospheric sudden warmings. These are key to understanding the coupling between the stratosphere and troposphere, and to improving our ability to predict weather and climate throughout this coupled system.

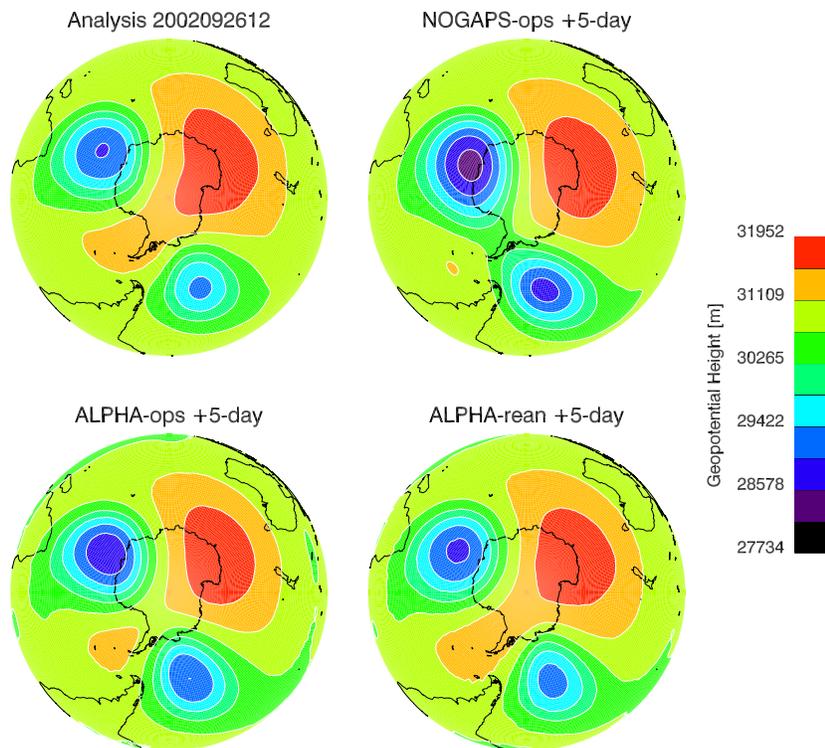


Figure 12. Maps of geopotential height in the middle stratosphere (10 hPa, near 30 km) for 26 September 2002, when the polar vortex (blues) split during the Antarctic major warming, from (top to bottom, left to right) the analyzed meteorological data, the original NOGAPS model, the new model version, and the new model version with improved initialization fields. The latter two forecasts show significant improvements over the older model.