Final Technical Report

DOE Award No.: DE-SC0005473
Awarded to: University of Louisville

Project Title: Atmospheric Science Program at the University of Louisville
PI: Timothy E. Dowling

Date of Report: February 1, 2014
Performance Period: 15 September 2010 to 14 September 2013

We have completed a 3-year project to enhance the atmospheric science program at the University of Louisville (est. 2008). The goals were to complete an undergraduate atmospheric science laboratory (Year 1) and to hire and support an assistant professor (Years 2 and 3). Both these goals have been met on schedule, and slightly under budget. Hence, the project is a success.

The following indicates some highlights made possible by this grant:

The website for the program is http://louisville.edu/atmosphericscience

The undergraduate atmospheric science laboratory (Natural Sciences Bldg., Rooms 117 and 119) houses a 9-seat synoptic meteorology computer lab (Fig. 1) plus a conference-table area.

Figure 1. University of Louisville Atmospheric Science Laboratory

The assistant professor we hired is **Dr. Jian Du-Caines**, who came to Louisville from a postdoctoral position in Cambridge University, England. She earned her PhD at

New Brunswick, Canada and is an expert on middle-atmosphere dynamics, specializing in tides, planetary waves, and vertical coupling. Dr. Du-Caines made the transition from the term assistant professor position supported by this project into a full, tenure-track assistant professor in September 2013. Her early progress review was positive, and included praise for her research and for her efforts at curriculum development, particularly the two-semester synoptic meteorology sequence, which includes the program's culminating undergraduate experience.

This grant supported Dr. Du-Caines' salary for two years and research start-up, and also supported one summer month in 2013 for the PI (Dr. Dowling), for a collaborative project with Du-Caines. The latter, together with U. Louisville colleague M. Bradley from the Dept. of Mathematics, was presented at the Fall 2013 AGU meeting. The following lists the conference proceedings, publications, and papers in preparation that have been supported by this project.

Conference presentations:

Du, J., Dowling, T. and Bradley, M.E. Potential Vorticity vs. Bernoulli streamfunction in Earth's atmosphere: Implications for shear stability. AGU 2013 fall meeting, San Francisco, CA, USA, December 9-13.

Du, J., Ward, W. E., and Beagley, S (2013). Atmospheric diurnal tides from the nudged extended Canadian Middle Atmosphere Model – CMAM20. CEDAR meeting 2013, Boulder, CO., USA, June 22-June 28.

Du, J., Ward, W. E., and Beagley, S (2013). Atmospheric diurnal tides from the nudged extended Canadian Middle Atmosphere Model – CMAM20. IAGA Assembly, 2013, Merida, Mexico, August 26 -31.

Du, J. Ward, W. E. (2012) Stationary planetary waves in the extended CMAM. 39th COSPAR Scientific Assembly, july 14-22, 2012, Mysore, India.

Publications to date:

Du, J., Ward, W. E. Polar tidal signatures and their non-linear interactions with the stationary planetary waves in the extended Canadian Middle Atmosphere Model (CMAM), *Journal of Geophysical Research,* submitted.

Davis, R.N., J. Du, A. K. Smith, N. J. Mitchell, W. E. Ward (2013). The diurnal and semidiurnal tides in the tropical mesosphere over Ascension Island (8S, 14W) and their comparison with CMAM and WACCM. *Atmospheric Chemistry and Physics*, 13, 4785-4837.

Du. J., F. Cooper, S. Fueglistaler (2012). Statistical analysis of global variations of atmospheric relative humidity as observed by AIRS, *Journal of Geophysical Research,* 117, D12315, doi:10.1029/2012JD017550.

Papers in preparation:

Du, J., Ward, W. E, Bradley, M.E. Stationary planetary waves and gravity wave drag in the mesosphere and lower thermosphere (MLT) region.

Du, J., Dowling, T. and Bradley, M.E. Potential Vorticity vs. Bernoulli streamfunction in Earth's atmosphere: Implications for shear stability. *J. Atmos. Sci.*

In closing, this was a timely earmark that helped our new atmospheric science program make it through the recent recession. Our gatekeeper course, PHYS 361 Atmospheric Thermodynamics, has 15 students enrolled this Spring 2014, which is a strong increase and a healthy sign of our program's continued growth. We wish to thank the politicians and administrators who supported this project, which is making a significant impact on the region. A simple recent example of this impact is the front-page story recently run by the Courier-Journal (Fig. 2).

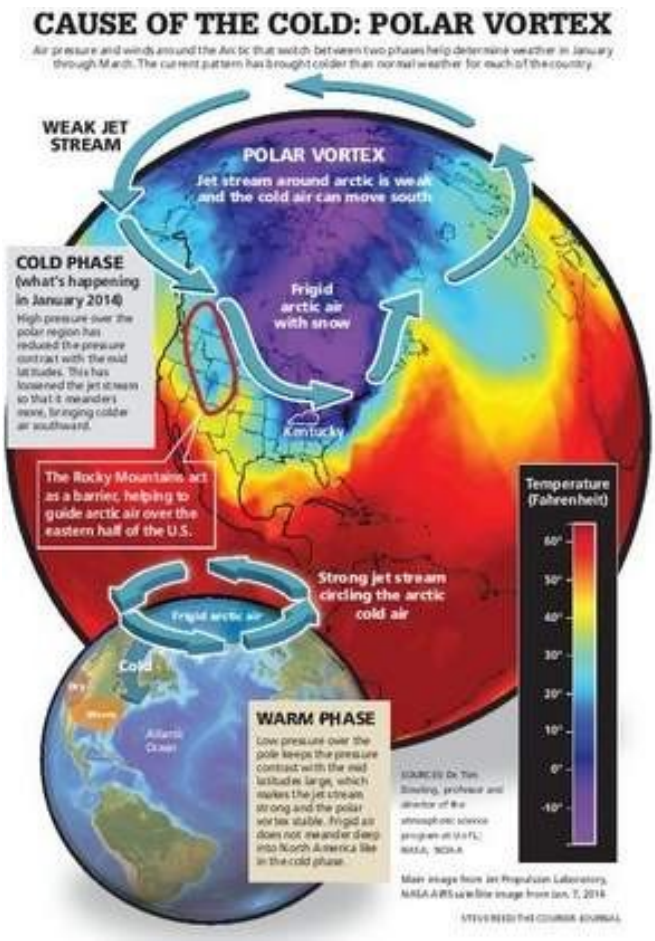

Figure 2. Graphic from Courier-Journal front-page story, 24 January 2014