Final Report for Partners Project

University: State University of New York, College at Brockport

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Type of Project (Partners or Cooperative): Partners

Title: A Climatological Study of Coupled Upper-Level Jet Streaks in the Northeastern U.S.

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Section 1: Summary of Project Objectives

The primary objectives of this Partners collaboration include:

1. Identifying an appropriately-sized study area over the northeastern U.S. over which to study occurrences of upper-level (250-hPa) jet streak coupling during the cold season (1 October-31 March) for the period from 1993 to 2003.

2. Examining coupled jet occurrences in the North American Regional Reanalysis (NARR) dataset.

3. Compiling various statistics based on these occurrences, including preferred date/time of coupling, average/maximum wind speeds associated with the jet streaks, and relative location and distance between the jet streaks.

4. Segregating the occurrences into weak dynamic (cyclone=s [if present] MSLP > 1000 hPa and open mid-tropospheric wave) and strong dynamic (cyclone=s MSLP # 1000 hPa and significant mid-tropospheric trough) categories.

5. Creating composite plan-view and cross-sectional analyses of numerous atmospheric parameters based on the weak dynamic and strong dynamic cases.

6. Presenting educational seminars to the staff of WFO Buffalo.

Section 2: Project Accomplishments and Findings

During the last 1.5 years we have accomplished the following tasks:

1. Examined the NARR dataset for occurrences of coupled 250-hPa jet streaks. Out of approximately 150 potential episodes, about 40 were selected (based on the occurrence of significant precipitation in the vicinity of the coupled jet region).

2. Separated the selected episodes into weak dynamic and strong dynamic cases, with an approximate 50-50 distribution between the two categories.

3. Examined each of the 40 selected episodes via numerous atmospheric parameters, including (but not limited to):

- 250-hPa height, wind speed, ageostrophic wind vectors, and divergence
- 500-hPa heights, absolute vorticity, and omega
- 850-hPa heights, isotachs, and equivalent potential temperature advection
- mean sea-level pressure (MSLP)
- low-level frontogenesis
- 24-h precipitation amounts

4. Established the most likely time of jet coupling for each episode, and compiled data for the time periods six and 12 hours prior to coupling.

5. Created composite plan-view analyses for the weak dynamic and strong dynamic cases, based on the time of coupling and the prior six- and 12-hour periods.

6. Established an appropriate cross-sectional axis cutting through the appropriate entrance and exit regions of the jets, and created cross-sectional composite analyses in a fashion similar to the plan-view composite analyses.

7. Presented four posters on specific cases at regional and national conferences.

8. Presented an invited talk on warm-season elevated thunderstorms to the staff of WFO Buffalo.

Section 3: Benefits and Lessons Learned: Operational Partner Perspective

The impetus for the collaborative effort between the university and operational communities increased the knowledge for the operational forecast staff at NWS Buffalo. The results of the research were presented in staff meetings at the NWS office and lessons learned from the research will be used in winter weather forecasting in the

future. In particular, the knowledge gained from the weakly forced coupled upper level jet composites will be a tremendous aid to the forecast staff, since these types of events are notoriously difficult to anticipate.

As a result of the training provided to the forecast staff, a set of procedures was developed for use in the Advanced Weather Information Processing System (AWIPS) that display cross-sections of jet streams to diagnose the potential coupling of those jets and their impact on the sensible weather. In addition, an Intranet web site for the Diagnosis of Coupled Upper Level Jet Streams was constructed and made available to forecast staff. The site acts as a real time reference for the forecaster to compare their current winter weather situation to the composite analyses of weakly forced vs. dynamic coupled jets that were developed during the COMET Project.

Finally, a plan was put forth to incorporate the lessons learned from this COMET Project into a web-based training module for the entire meteorological community. The NWS office will be working over the winter months with Scott Rochette and Chad Gravelle using software called "Articulate Presenter" to develop the module. Articulate Presenter has a proven track record as the delivery vehicle for the successful national training of the NWS forecasters during the Advanced Weather Operations Course (AWOC) for both Severe and Winter weather. The goal of this plan is to bring the research gleaned from the COMET Partners Project to the entire operational meteorological community.

Section 4: Benefits and Lessons Learned: University Partner Perspective

Scott M. Rochette and Chad M. Gravelle presented four posters at the 29th and 30th Annual Meetings of the National Weather Association (NWA) and the 30th and 31st Northeastern Storm Conferences.

Dr. Rochette teaches the synoptic sequence and the mesoscale meteorology course at SUNY Brockport. This project was initiated by a query during a map discussion, and the results of the study have already been incorporated into the appropriate coursework.

Based in part on Chad's experiences as an undergraduate research assistant, he was accepted into the graduate program at Saint Louis University, where he is currently working on a Master's degree in meteorology under the supervision of Drs. James T. Moore and Charles E. Graves. He started in 2005 as a research assistant for the Cooperative Institute for Precipitation Systems (CIPS).

At this time, the results of this study are being incorporated into two poster presentations that will be given at the 31st Annual Meeting of the National Weather Association in Cleveland (October 2006). It is also our intention to prepare at least one manuscript for publication in *National Weather Digest*, based on the results of the composite analyses. We are also preparing a manuscript for *NWD* based on two episodes of unlikely heavy snowfalls resulting from jet streak coupling.

An indirect benefit stems from the composite study itself. The compositing was done on

software co-developed at Saint Louis University (SLU) by the academic PI (during his doctoral studies). The software has since been updated by Dr. Chuck Graves at SLU. During a visit to SLU, the academic PI and his (now graduate) research assistant suggested improvements for the software, which were then implemented by Dr. Graves Based on these updates, Graves will update their in-house diagnostic software (SLUBREW). It is the intention of the academic PI to import these software packages for use by the faculty and students of SUNY Brockport.

Section 5: Publications and Presentations

Rochette, S. M., C. M. Gravelle, and T. A. Niziol, 2006: The influence of jet streak interaction on the Northern Plains heavy snow event of 21 January 2005. Presented in poster session, 31th Annual Northeastern Storm Conference, Saratoga Springs, NY, Lyndon State College Chapter, Amer. Meteor. Soc.

Gravelle, C. M., S. M. Rochette, and T. A. Niziol, 2005: The role of coupled jet streaks in a Midwestern heavy snow event. Presented in poster session, National Weather Association 30th Annual Meeting, St. Louis, MO.

Rochette, S. M., T. A. Niziol, and C. M. Gravelle, 2005: Examination of forcing mechanisms leading to a surprise heavy snow event. Abstracts, *30th Annual Northeastern Storm Conference*, Burlington, VT, Lyndon State College Chapter, Amer. Meteor. Soc., 62.

Rochette, S. M., and T. A. Niziol, 2004: 11 inches of snow from an Alberta clipper?! Post-analysis of an unlikely heavy snow event. Presented in poster session, National Weather Association 29th Annual Meeting, Portland, OR.

Section 6: Summary of University/Operational Partner Interactions and Roles

This was a unique project for the academic PI in many respects. It was his first project completed with the NWS PI, which established a solid working relationship between SUNY Brockport and the WFO Buffalo. It is our intention that this project served as the beginning of a long and fruitful partnership between the two parties.

In addition, this study has rekindled a working relationship with the academic PI's graduate alma mater, which he hopes to maintain.

The only major issue that surfaced during the study was time. The academic PI works for an undergraduate-only institution, which means a heavy teaching load. Significant

progress was planned for the summer of 2005, but health issues affecting both himself and his immediate family impeded the advancement of the study. In addition, the NWS PI was promoted to the MIC position at his WFO, thereby curtailing his availability (but not his enthusiasm for the project). The effect of these issues was significantly lessened by the efforts of our undergraduate research assistant, who was (and still is) integral to the project. In our opinion, he acted as a co-PI on this project.