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COUPLED NMM-CALMET Meteorology Development for the CALPUFF Air Dispersion Modelling in Complex Terrain and Shoreline Settings

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A study was undertaken to prepare and validate high resolution three-dimensional meteorology that would be suitable for use as input into the CALPUFF/CALMET air dispersion model system in complex terrain with a shoreline. CALPUFF/CALMET is the U.S. EPA's regulatory model for long range transport and may be used for short range modelling. It is accepted as a regulatory model for short-range applications for the province of Newfoundland in Canada. CALMET is the meteorological diagnostic pre-processor part of the CALMET/CALPUFF modelling system.

The output from a meso-scale model was coupled with the meteorological pre-processor for CALPUFF for a region near the town of Belledune (New Brunswick, Canada). The advanced mesoscale WRF- NMM (Weather Research and Forecasting - Nonhydrostatic Mesoscale Model), was used in this application in a nested mode with initial horizontal resolution of 6 by 6 km that was refined down to a fine scale resolution of 2 by 2 km. The initial meso-scale model was over a large modelling domain of 1,000 by 800 km for one year of data (2009). The refined domain was 400 by 400 km. The output from the high resolution meso-scale model was used to drive the CALMET model

The main goal of this paper is to demonstrate the good performance of the CALMET in both the short (less than 50km) and long range modes in a setting that involves both complex terrain and a shoreline (land-water interface). Also, the study demonstrates improvement in the CALMET performance with fine resolution meso-scale model inputs. Long range CALMET modeling was performed for a domain of 400 by 400 km with horizontal resolution of 2 km. Short range CALMET modeling covered a domain of 30 by 45 km with 250m resolution.

The CALMET meteorological pre-processor was used in "no-observational" mode to generate representative site meteorology. The fine horizontal resolution noted above, was necessary to resolve a detailed shore line position in the vicinity of the industrial sources. Meteorological observations from three local airports in the study domain were used for the CALMET validation. The agreement between modeling and observed data is shown to be quite good and an important step to support reliable air dispersion predictions. Validation of the CALPUFF model was not performed in this study.