Flood Risk

Principal Investigator:

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Personnel:

Dr. Wei Yu	Postdoctoral fellow, CERCA (September 30, 1994 to January 31, 2000)
Dr. Lei Wen	Postdoctoral fellow, CERCA (Since November 3, 1997)
Dr. Kao San Yeh	Postdoctoral fellow, CERCA (at Environment Canada) (September 1, 1997 to September 30, 1999)
Mr. Michel Béland	Research Professional at CERCA (app. 30% of time for this project)

Description of Project

The goal of the project is to couple a high resolution regional atmospheric model (MC2) to a hydrological model (WATFLOOD) to simulate severe precipitation and flash floods. The interface between the models is a common land surface scheme. The long term goal is to formulate a flood forecasting modelling system for environmental risk management.

The atmospheric model (MC2: Mesoscale Compressible Community model) has been tested in the uncoupled mode with two land surface schemes: the traditional "force-restore" method and the Canadian Land Surface Scheme (CLASS). Simulations have been performed using the storm that gave rise to severe floods in the Saguenay region of Quebec during July 19-21, 1996. A series of 48-hour simulations of the precipitation over the flooding period has been made, with a spatial resolution of 10 and 5 km, with different treatment of land surface and cloud processes. The results are compared with precipitation measurements from surface stations. The results at 5 km clearly show the

A parallel project is being carried out with the Atmospheric Environment Service of Environment Canada, the sponsoring industrial partner, in formulating the nonhydrostatic component of the Global Multiscale Environmental (GEM) model (formerly GEF: Global Éléments Finis). This version of GEM will allow for a better high resolution simulation of precipitation systems.

It is planned to continue the MC2/CLASS coupling during 1999-2000. More tests and analyses will be done with this model. Particular emphasis will be laid on a comparison of the two land surface schemes, "force-restore" and CLASS. Additional test cases will be used to verify the model simulated precipitation against radar retrieved values, through an on-line comparison of model precipitation (MC2 and GEM) with values retrieved from the McGill University radar.

Another related project is in preparation with Hydro-Quebec. A presentation was made by Dr. Lin on March 27, 1998 for a real-time model for predicting precipitation, in partnership with Environment Canada and Silicon Graphics.

Training

Two postdoctoral fellows have been hired for this project following ncm_2 competitions. Another one will pursue his work at CERCA on related research.

Dr. Lei Wen, funded with the NSERC ncm_2 grant, began work in the fall of 1997 on the MC2 model, examining the sensitivity of the simulated precipitation, sensible and latent heat fluxes to two land surface schemes at different spatial resolutions using the 1996 Saguenay severe flooding case. A seminar entitled "The Basic Components of a Hydro-Meteorological Modelling System" was presented at CERCA on October 29, 1997.

Dr. Kao-San Yeh, with funding from Environment Canada, began work on October 1, 1997 on the verification and implementation of the hydrostatic version of the GEM model as a first step before going to the non-hydrostatic version. A seminar entitled "On Using Forward Trajectories for Semi- Lagrangian Schemes" was presented at CERCA on April 22, 1998.

The other postdoctoral fellow, Dr. Wei Yu, has been working on the overall improvement of the MC2 model for the last three years, with funding from both CERCA and CRM. Starting in 1999, his work has been integrated into the ncm_2 project with funding from CERCA.

Links with other centres and industry

This project is also related to the work of CERCA professional Slavko Vasic, to improve

with three other centres of the network : CIRANO, GERAD, CRT.A one-day workshop has been scheduled for November 25, 1999, and the Nowcasting project is supported by a grant from ncm_2 as well.

Publications

Wen, L., Yu, W., Lin, C.A., Béland, M., Benoit, R. and Delage, Y., *The role of land surface schemes in short-range, high spatial resolution precipitation forecast*, Monthly Weather Review, 1999 (in press).

Delage, Y., Wen, L. and Bélanger, J.-M., *Aggregation of parameters for the land surface model CLASS*, Atmosphere-Ocean, 37(2), 157-178, 1999.

Wen, L., J. Gallichand, A.A. Viau, Y. Delage and R. Benoit, 1998, *Calibration of the CLASS model and its improvement under agricultural conditions*, Trans. A.S.A.E. 41(5), 1345-1351.

Yu, W., C. Lin, R. Benoit and I. Zawadzki, 1998, *High resolution model simulation of precipitation and evaluation with Doppler radar observation*, Water Sci. Tech. 37(11), 179-186.

Wen, L., Gallichand, J., Viau, A.A., Delage, Y. and Benoit, R., *Calibration of the CLASS model and its improvement under agricultural conditions*, Transactions of the ASEA, 41(5), 1345-1351, 1998.

Yu, W., C. Lin and R. Benoit, 1997*, High resolution simulation of the severe precipitation event over the Saguenay, Quebec region in July 1996*, Geophys. Res. Lett. 24(15), 1951-1954.

Presentations

Wen, L., *The GUH model - - A practical engineering tool for small and medium catchment flow concentration computation*, 1999 American Geophysical Union Fall Meeting, December 13-17, 1999, San Francisco.

Wen, L., Yu, W., Lin, C.A., Béland, M., Benoît, R. and Delage, Y., *The Role of Land

1999 (invited lecture).

Lin, C.A., *Simulation of severe precipitation and flash floods (SSPFF)*, CGU Annual Meeting, Banff, May 1999.

Wen, L., Yu, W., Lin, C.A., Béland, M., Benoit and R., Delage, Y., *Impact of Land Surface Schemes and Spatial Resolution on the Simulated High-resolution Precipitation During a Flash Flood*, AGU 1998 Fall Meeting, San Francisco, California, December 6-10, 1998.

Lin, C.A., *High resolution modelling of severe precipitation events*, National Water Research Centre, Saskatoon, December 1998 (invited lecture).

Yu, W., *High resolution model simulation of precipitation and evaluation with Doppler radar observation*, City Radar, Environment Canada, July 13, 1998.

Yu, W., *High resolution model simulation of precipitation and evaluation with Doppler radar observation*, Sixth International Conference on Precipitation: Predictability of Rainfall at the Various Scales, Hawaii, June 29-July 1, 1998.

Delage, Y., Wen, L., *Aggregation of Parameters for the Land Surface Scheme CLASS*, GCIP Mississipi River Climate Conference, St. Louis, Mississipi, June 7-12, 1998.

Yu, W., *High resolution simulation of the severe precipitation events*, 31st CMOS Congress, Saskatoon, June 1-5, 1997, p. 39.

Yu, W., *The modelling of severe precipitation events using the MC2*, 22nd General Assembly of the European Geophysical Society, Vienna, 21-25 April 1997.