



Canadian Foundation for Climate
and Atmospheric Sciences (CFCAS)
Fondation canadienne pour les sciences
du climat et de l'atmosphère (FCSCA)

2007 DRI Progress Report

Project Title: Water and Energy Cycling Processes and Budget Assessments

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1.0 Progress (beginning January 2007 to end December 2007)

1.1 Describe progress towards meeting the project objectives for those theme areas where you have received funding for 2006-2007. How are the original milestones being met (be specific)? List the key objectives and results achieved to date as well as any relevant application(s) of the results.

1.1.1 Objectives

The overall objective of the Drought Network Initiative (DRI) is *to better understand the physical characteristics of and processes influencing Canadian Prairie droughts, and to contribute to their better prediction, through a focus on the recent severe drought that began in 1999.*

To address this overall objective, the Network is focussed on complementary and cross-cutting research objectives that correspond to the following themes:

- 1. Theme 1: Quantify the physical features of this recent drought:**
 - a) spatial and temporal features,**
 - b) flows of atmospheric and terrestrial water and energy into and through the region, and their storage and redistribution within the region.**

A comprehensive baseline climatology of water and energy budgets for the Saskatchewan River Basin, including water and energy budgets for part of the 1999-04 drought period, was developed from different datasets and results are published.

Completed quantification and analysis of spatial and temporal variability of water and energy budgets for the Prairie region including budget anomalies during major drought episodes within the 1960-2005 period by using reanalysis datasets. A paper summarizing the results is under preparation.

- 2. Theme 2: Improve the understanding of the processes and feedbacks governing the formation, evolution, cessation and structure of the drought.**

Processes governing water and energy cycling in the Prairie region were studied by using reanalysis datasets. In particular, large-scale circulation features that affect moisture

transport into the Prairies and their interactions with regional processes that govern precipitation and its recycling over the region were examined.

The dynamics of the extreme precipitation event that gave an extended break to the 1999-2004 drought during June 2002, and their implications for water and energy cycling, particularly during extreme events such as droughts and floods over the Prairies were studied.

Papers summarizing these results are under-preparation.

3. Theme 3: Assess and reduce uncertainties in the prediction of drought and its structure.

The extent to which the 1999-04 drought could be simulated in different regional climate models (including different versions of the Canadian Regional Climate Model and several other RCMs from the US and Germany) and data-assimilation system (NCEP, ERA40, NARR and GEM) were assessed and analysed. Implications of the results to improve the prediction of Prairie droughts were also investigated.

1.2. What contributions have you made, if any, to the unfunded themes of DRI.

Theme 4: Compare the similarities and differences of the recent drought to previous droughts over this region and those in other regions, in the context of climate variability and change.

Theme 5: Apply our progress to address critical issues of importance to society.

Water and energy budget anomalies for different drought periods over the Prairies were assessed and compared in the study described in (1b). The results contribute directly to Theme 4.

1.3 Describe your plans for research during the coming year and the following year and outline how the expected results will support the deliverables and goals of DRI.

To complete the journal articles summarizing the research results as well as to conduct further studies on the processes that govern water and energy cycling and the development of drought over the Prairies. Results from these activities will contribute directly to the objectives and goal of DRI.

2.0 Impacts

2.1 Describe the significance / impact of the results achieved to date and how this new knowledge has influenced research policy, enhanced research collaboration or competitiveness, or helped attract or train skilled personnel.

Possible impacts include:

- **The impact of the project on government policy development (federal, provincial or municipal);**

- **How the project has expanded contacts in partner organizations, or increased cross-disciplinary cooperation;**
- **Whether and how it has improved the reliability of predictive methods;**
- **The impact of the project on your own institution;**
- **Whether and how the project has helped increase funding from other agencies, or led to new partnerships;**
- **Any current (or potential) commercial or social applications, which the results may have;**
- **Links with international initiatives and the potential impact of these;**
- **Anticipated benefits of the work for Canadians.**

Results from assessments of credibility and reliability of different major climate datasets in representing the Prairie water and energy budgets is of fundamental importance to the applications of these datasets in Prairie drought studies. The baseline water and energy budgets can be used for validations of model simulations of Prairie droughts. The high resolution soil datasets developed in association with the water and energy budget study has been utilized to specify model soils data by several investigators from both inside and outside of DRI. Results from the project contribute directly to the EC Drought OPP. The intercomparison of RCM drought simulations made use of results from GEWEX model intercomparison studies and its results will contribute to the international CEOP Extreme initiative.

3.0 Dissemination

3.1 Provide information on dissemination of the research results (publications, including journal names and whether refereed), conference contributions, seminars, workshops or videos, websites or other methods of transferring the results.

Refereed journal articles that are related to the water and energy cycling processes and budget assessments:

Szeto, K.K., 2007: Assessing Water and Energy Budgets for the Saskatchewan River Basin. *J. Met. Soc. Jap.*, 85A, 167-186.

Szeto, K.K., 2008: On the extreme variability and change of cold-season temperatures in northwest Canada. *J. Climate*, 21, 94-113.

Conference, workshop and seminar presentations:

Szeto, K.K.: Assessing water and energy budgets for the Canadian Prairies. 2nd DRI Annual Meeting, Winnipeg, Jan, 2007.

Szeto, K.K.: Water cycling and drought development in three major NA river basins. CMOS Congress, St. John's, Newfoundland, Jun, 2007.

Szeto, K.K. et al.: RCM simulations of the 1999-2004 Prairie drought: A model intercomparison study. DRI Modelling Workshop. McGill, Sep, 2007.

Szeto, K.K.: Water cycling and the development of hydrometeorological extremes in three major NA river basins. EC Climate Research Division Seminar, Apr, 2007.

PDFs of the most of the papers and presentations are available on the DRI website. Also posted on the DRI website is the high resolution soil texture dataset.