



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: Clouds, Radiation and Drought**

**Investigator: Henry Leighton**

### **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.**

**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.**

We have made major progress in our goal of characterising the cloud properties during the most recent Prairie drought, comparing those properties with those of clouds in non-drought periods, and relating anomalies in cloud characteristics to precipitation anomalies. The first step towards this analysis was the assembly of the following data sets:

Gridded monthly fields of Standard Precipitation Index (SPI) deduced from CANGRID surface data.

Surface Radiation Budget (SRB) 1° cloud data which was generated from International Satellite Cloud Climatology Project data.

There is a small but clear signal in the relationship between cloud amount anomaly and SPI, with increasingly more positive SPI (wetter than normal conditions) being associated with positive cloud anomalies and increasingly more negative values of SPI (drier conditions) being associated with negative cloud anomalies. This relationship is evident in all seasons except January and February but over snow-covered surfaces the cloud amount data must be considered less reliable. When stratified by cloud type, interestingly, the correlation between cloud amount anomaly and SPI was greatest for high cloud.

We have also looked at the temporal and spatial variability of the SPI in the period 1999- 2004 and found that the Athabasca region of Alberta, where about half of the months were classified as being dry (SPI<-0.5) was the location that had the greatest number of drought months.

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

We have published results documenting the impact of aerosol from forest fires on the clear sky shortwave and longwave radiative forcing. There are possible implications in these results for feedbacks from drought in that forest fires are obviously more frequent during dry periods. It remains to be seen what if any impact the surface radiation changes may have on drought. Of more interest will be the feedback of aerosol on cloud amount and precipitation.

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

NA

**1.2 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.**

We will analyse in greater detail the results that we have obtained so far and prepare a publication.

We will look for anomalies in other variables such as surface radiation budgets that may correlate with drought.

We will look for evidence of possible links between high aerosol concentrations either primary or secondary in the sense that the increased aerosol concentration is a consequence of dry conditions on precipitation.

We will compare our cloud anomalies with cloud anomaly results from the CRCM.

We intend to extend our studies into the adjacent drought affected regions of the US.

**2.0 Dissemination**

**2.1 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.**

Song Guo and H.G. Leighton. Satellite-Derived Aerosol Radiative Forcing from the 2004 British Columbia Wildfires. Accepted for publication in *Atmosphere – Ocean*, 2007.

Heather Greene, H.G. Leighton and R. Stewart. Cloud fields associated with the recent drought over the Canadian Prairies. Canadian Meteorological and Oceanographic Conference, St Johns, Newfoundland, May 2007