

# **Prairie Hydrological Model Study**

*Short Progress Report 22 February 2008*

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This is a short update on progress since early November 2007.

Work has focussed on three major research topics and on outreach to the Smith Creek community via an open house in Langenburg in November, 2007:

- i) improvement to the CRHM-PHM model so that it can simulate the hydrology of prairie wetland basins and changes due to drainage
- ii) improvement of instrumentation and programming of the Smith Creek meteorological station and network including telemetry to a web site.
- iii) measurement of fall wetland water levels, fall soil moisture and winter snow water equivalent at various land cover types, sub-basins and regions in Smith Creek and characterizing recent and historical water and land cover using remote sensing.

## Improvements to CRHM – Prairie Hydrological Model

A new development in CRHM-PHM (see Figure 1) is the ability to link typical sub-basins as Representative Basins (REB). REBs characterize well drained, wooded, wetland, lake sub-basins and then are linked by CRHM using a kinematic wave routing system with allocation for network wetlands and lakes. The ponding routines in CRHM have also been improved so that sub-hydrological response unit (HRU) depressional storage is represented realistically. Within-basin routing now has a Muskingum routing option which permits setting routing characteristics based on basin properties. Improvements have also been made to the soil moisture routines, evaporation calculations and snowmelt routines. Changes to the soil routine permit an HRU to be declared a “pond” which can drain slowly or display “fill and spill” behaviour as observed at the St Denis wetlands.

## Improvement of Smith Creek Meteorological Station and Network

A website is now running that displays recent Smith Creek observations (see Figure 2). This is fed by a telemetry system using a digital cell phone interface with the station datalogger. The data not only improve data quality by informing investigators when there is a problem but provide a unique set of surface meteorology, snow depth, precipitation, soil moisture and temperature data for Smith Creek residents, farmers and the interested public. [http://www.usask.ca/hydrology/ch\\_researchpj\\_smith.htm](http://www.usask.ca/hydrology/ch_researchpj_smith.htm) .

## Measurement of Fall and Winter State Variables

Through the summer and fall a rain gauge and pond water level network was operated in Smith Creek (see Fig. 3). This was removed upon “freeze-up”. Just before freeze-up

pond levels were measured and soil moisture was measured along transects of differing land cover and location in the basin. In the winter, snow water equivalent has been measured along snow survey transects at locations close to the soil moisture and pond surveys. This will continue through the snowmelt season. In addition, historical aerial photographs have been identified and analysis of satellite imagery continues. This information is being compiled in a GIS database.

#### Issues

LiDAR DEM – it is desirable to obtain a high resolution digital elevation model for Smith Creek, such as that possible with a LiDAR survey. Such information would permit a much more reliable calculation of water flow direction and storage and provide a baseline for further changes in drainage in the basin. While the cost of LiDAR is high, it might be possible to include Smith Creek in LiDAR surveying of nearby areas. The scientists ask the Committee to identify any opportunities to obtain LiDAR for Smith Creek including funding support for the same.

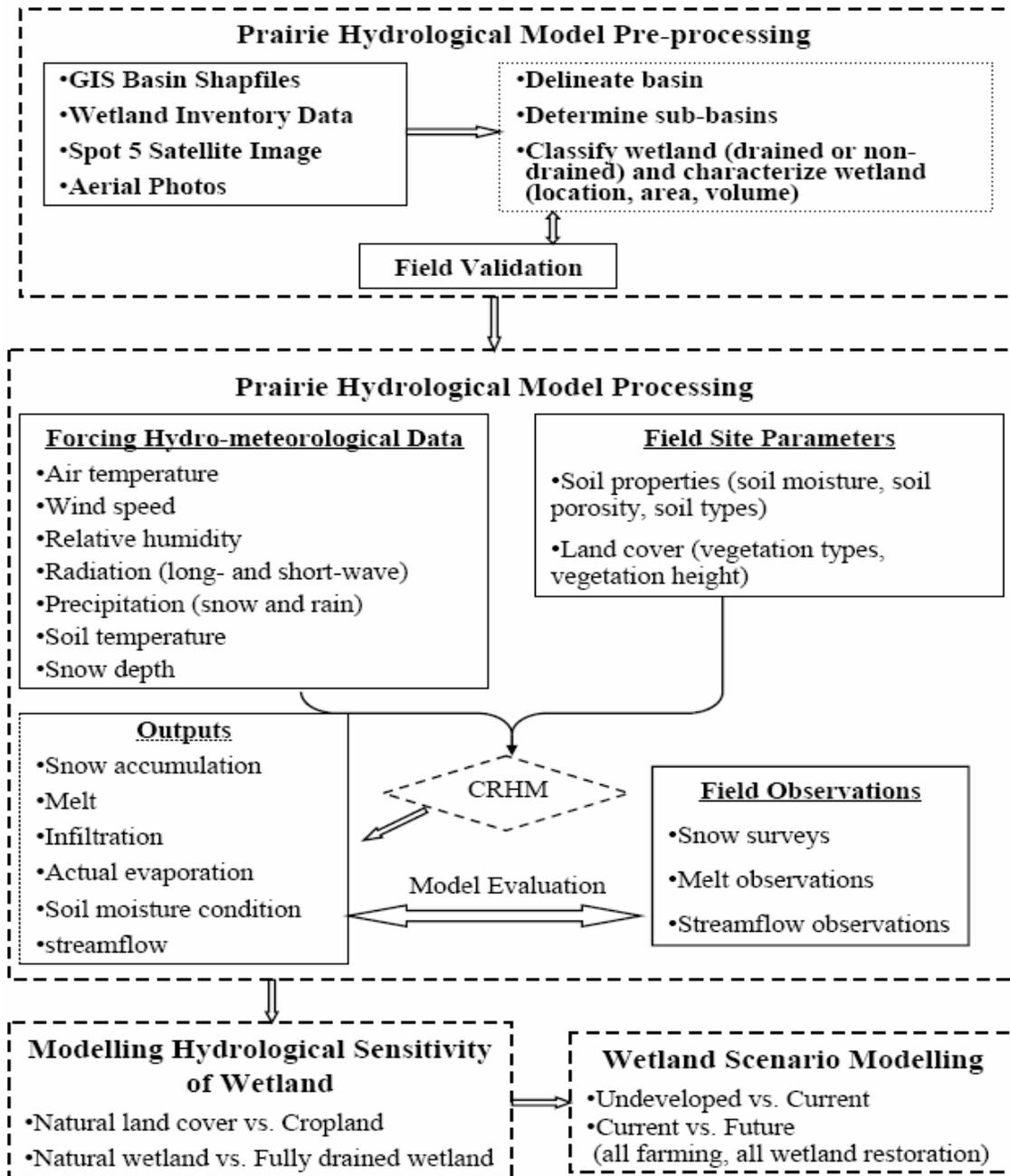


Figure 1. CRHM-PHM methodology

## Daily Climate Values - Smith Creek

Friday, February 22, 2008 8:23:42 PM

### Yesterday's Daily Max and Mins

#### Air Temperature (C)

max/time of max      **-9.0**      2/21/2008 12:02:55 PM

min/time of min      **-26.1**      2/21/2008 1:29:30 AM

#### Relative Humidity (%)

max/time of max      **84**      2/21/2008 8:25:25 AM

min/time of min      **57**      2/21/2008 12:03:55 PM

### Precipitation

Snow depth (cm)

**26**

Daily Total Precipitation (mm)\*

**0.0**

\*water equivalent

### Yesterday's Average Values

	<u>Depth</u>	<u>15 cm</u>	<u>30 cm</u>		
Soil Temperature		<b>-5.3</b>	<b>-4.3</b>	Air Temperature (C)	<b>-15.5</b>
Soil Moisture (%)		<b>8</b>	<b>19</b>	Relative Humidity (%)	<b>75.6</b>

Note: soil moisture is invalid when soil temperature <0C

Figure 2. Website of Smith Creek Meteorological Station output.

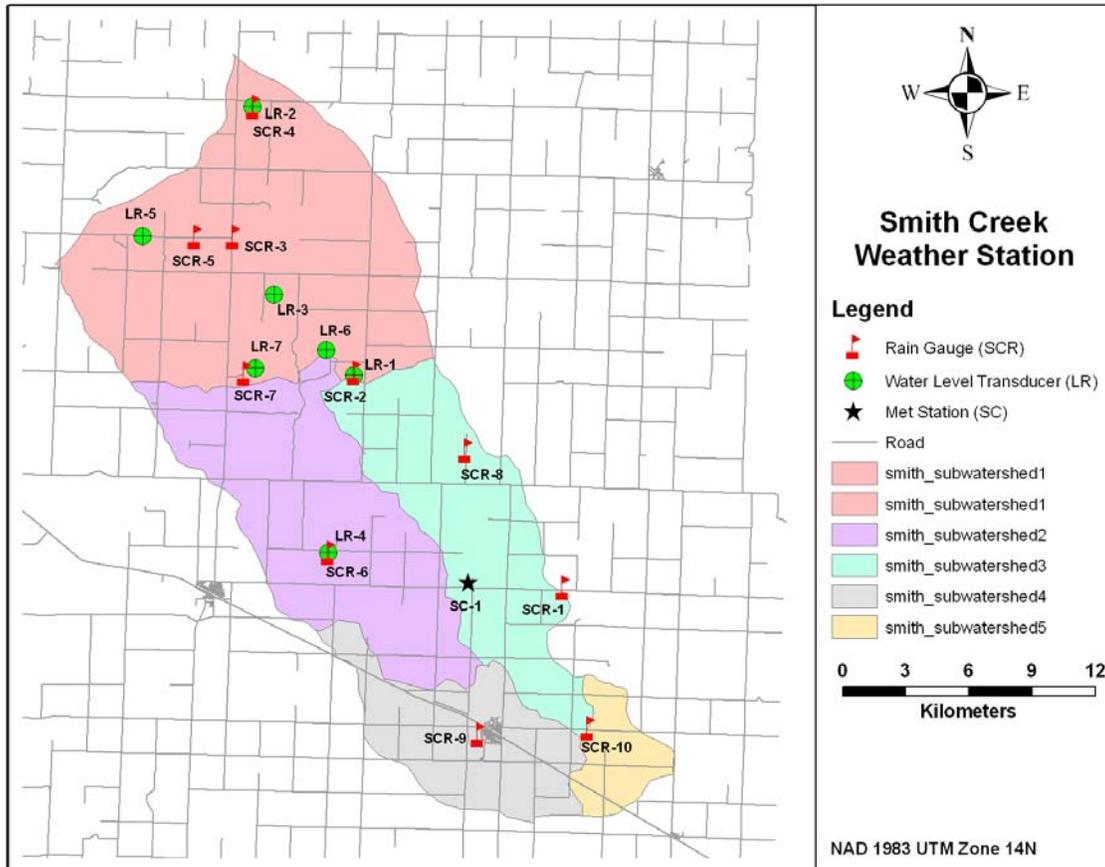


Figure 3. Smith Creek sub-basins, rain gauge network, pond level network and meteorological station location.