Geophysical Research Abstracts,
Vol. 11, EGU2009-10569-1, 2009
EGU General Assembly 2009


# Spring floods prediction with the use of optical satellite data in Québec

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The Centre d'expertise hydrique du Québec (CEHQ) operates a distributed hydrological model, which integrates a snow model, for the management of dams in the south of Québec. It appears that the estimation of the water quantity of snowmelt in spring remains a variable with a large uncertainty and induces generally to an important error in stream flow simulation. Therefore, the National snow and ice center (NSIDC) produces, from MODIS (Moderate Resolution Imaging Spectroradiometer) data, continuous and homogeneous spatial snow cover (snow/swow-free) data on the whole territory, but with a cloud contamination. This research aims to improve the prediction of spring floods and the estimation of the rate of discharge by integrating snow cover data in the CEHQ's snow model.
The study is done on two watersheds: du Nord river watershed (45,8°N) and Aux Écorces river watershed (47,9°N). The snow model used in the study (SPH-AV) is an implementation developed by the CEHQ of the snowmelt model of HYDROLTEL in is hydrological forecast system to simulate the melted water. The melted water estimated is then used as input in the empirical hydrological model MOHYSE to simulate stream flow.
MODIS data are considered valid only when the cloud cover on each pixel of the watersheds is less then 30%. A pixel by pixel correction is applied to the snow pack when there is a difference between satellite snow cover and modeled snow cover. In the case of model shows to much snow, a factor is applied on temperatures by iterative process (starting from the last valid MODIS data) to melt the snow. In the opposite case, the snow quantity added to the last valid MODIS data is found by iterative process so that the pixel's snow water equivalent is equal to the nonzero neighbor minimum value.
The study shows, through the simulations done on the two watersheds, the interest of the use of snow/snow-free product for the operational update of snow water equivalent with the objective to improve spring snowmelt stream flow simulations. The binary aspect (snow/snowfree) of the data is however a limit. Alternatives are discussed (passive microwave data).

Keywords : satellite snow cover data, MODIS, satellite data integration, snow model, hydrological model, stream flow simulation, flood.