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Hydrology and Earth System Sciences Discussions

Interactive comment on "Interrelationships between MODIS/Terra remotely sensed snow cover and the hydrometeorology of the Quesnel River Basin, British Columbia, Canada" *by* J. Tong et al.

Anonymous Referee #3

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p. 3690 How representative is the Quesnel River Basin when compared with other river basins in the region and elsewhere?

p. 3692 MOD10A2 non-snow values are not classified as "one type of land use". Rather, they are classified as non-snow. Other values are possible (see the documentation at http://www-nsidc.colorado.edu/data/docs/daac/modis_v5/mod10a2_modis_terra_snow_8-day_global_500m_grid.gd.html) but land use is not considered in this product.

p. 3699 The UE errors where snow covered ground is incorrectly classified as no snow is possibly due to SNOMAP's limitations as binary snow classification. It would be useful to add some brief discussion on the potential improvements if a good fractional snow covered area algorithm had been used.

p. 3700 How does groundwater storage modulate streamflow in the basin? In some regions with highly permeable aquifers this can be a significant influence on runoff. The simplistic discussion of the relationship between snow cover and streamflow mistakenly leads the reader to infer that snowmelt occurs and directly translates into runoff. In fact, the landscape acts as a filter through will snowmelt is transmitted into soils (some of which is then used by vegetation), into shallow groundwater systems (with relatively short residence times), and into deep groundwater systems (which may have residence times on the order of years).

p. 3702 The regression relationship between temperature and SCF_50% is useful for understanding present-day relationships. However, caution should be used when attempting to use this relationship in a predictive sense for future climate scenarios. For instance, the IPCC AR4 scenarios project an increase in winter precipitation and an increase in winter temperature for this region. As the authors show, the QRB snow cover is highly sensitive to temperature. But this would not necessarily mean a decline in streamflow since with higher amounts of winter precipitation, the high elevations would see an increase in snow water equivalent. Given this same scenario, the lower elevations would likely see a decline in snow water equivalent but an increase in winter rainfall. The hydrograph would then look quite different from what would be predicted. Snow cover extent would change (less at low elevations) but the total snow water equivalent might remain the same or even increase (but it would be because of more snow at higher elevations). Also, a simple 1degC increase in temperature does not account for other meteorological and biological effects that relate to temperature such as higher relative humidity and rates of evaporation/sublimation, earlier onset of photosynthesis (and thus higher spring water use by vegetation), etc. The authors should add some

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strong and clearly worded caveats to this section of the paper to prevent these results from being misconstrued.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 3687, 2009.