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The Impact of Clouds, Land use and Snow Cover on Climate in the Canadian Prairies

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This study uses 50 years of hourly measurements of air temperature, relative humidity, daily precipitation and snow cover, as well as observations of opaque cloud cover from 13 climate stations across the Canadian Prairies to analyse biosphere-atmosphere interactions. We will provide examples of the coupling between climate and clouds, as well as land use and snow. We will present how clouds affect the seasonal diurnal cycles of air temperature and humidity, and will show how agricultural land use, particularly summer fallowing, which is an agricultural management practice that has decreased significantly in prevalence over the past 4 decades on the semi-arid Canadian Prairies whereby a plot of land is left uncropped throughout a growing season, can modify the seasonal diurnal cycle of temperature and humidity. During the growing season in regions of the Canadian Prairies where up to one fifth of the land area has been converted from summer fallow to annual cropland, relative humidity and cloud cover have increased, while maximum temperature and diurnal temperature range have decreased. We will also demonstrate the tight coupling between air temperature and snow cover during the winter transition periods. During this time, the air temperature falls by 10 ˚C with the first snow fall in the Canadian Prairies, whereas an increase in temperature of similar magnitude can occur during snow melt. As a result, we find that for every 10% decrease in days with snow cover over the Canadian Prairies, the mean October to April climate is warmer by about 1.4 ˚C. All these results will demonstrate how long-term hourly climate data can provide a solid observation basis for understanding the coupling of physical processes at the land surface. Such information should eventually help to improve the parameterization of small-scale processes in atmospheric modelling.