Geophysical Research Abstracts, Vol. 8, 02460, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02460

Acceleration of the Arctic Water Cycle

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Trends and feedbacks in Arctic hydroclimatology are explored from station observations and a land surface model. Our analysis of the Lena river basin in Siberia shows canonical acceleration of the hydrologic cycle and amplification of warming, despite several apparent paradoxes. Data analysis shows that though most warming in the Lena is occurring when the ground is covered by snow, increases in frozen precipitation are contributing to permafrost melting by increasing soil insulation. Hydrologic baseflow is increasing due to a deepening active layer. A deeper active layer holds more soil moisture and is leading to increasing evapotranspiration (shown in the model), increased hydrologic baseflow (modeled and observed), and increased summer cloudiness (observed). Changes in clouds are cooling summer days but warming summer nights, melting additional permafrost. Earlier onset of snowcover in autumn traps the modest summer warming, further deepening the active layer. These observed and modeled feedbacks point to an increasingly wet Arctic.