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Modelling the interactions of the Cordilleran and Laurentide ice sheets

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The Last Glacial Maximum (LGM) occurred between 23,000 and 19,000 yr BP. The geologic record indicates however, that the Cordilleran Ice Sheet (CIS) in western North America reached its maximum extent after the LGM. The inception of the CIS occurred over high mountain regions in British Columbia ∼30,000 yr BP, followed by rapid growth and up to a four-fold increase in ice volume between 21,000 and 17,500 yr BP when it attained its maximum extent. In contrast, the much larger adjacent Laurentide Ice Sheet (LIS) rapidly grew from an intermediate size to a maximum extent along most of its margin by ∼26,000 yr BP and substantial ice retreat did not commence until ∼16,500 yr BP. The apparent asynchronous timing of the advance and retreat of the adjacent ice sheets has led to hypotheses that invoke climatically determined changes in mass balance induced by interactions between the LIS and CIS to explain their latePleistocene dynamics. We have performed a series of sensitivity experiments with nested global and regional atmospheric models to isolate and quantify the potential climatic effects that may have been associated with the CIS and LIS. We simulated the climate and computed the mass balance of the ice sheets for nominal boundary conditions (SST and ice) of 30,000 yr BP, the LGM, and post-LGM. Our results demonstrate that both mean climatic conditions and climatic feedbacks between the two ice sheets played important roles in determining their advance and retreat his-

tories. We further find that changes in sea surface temperature in the western Pacific Warm Pool may have been an additional control on the mass balance.