Geophysical Research Abstracts, Vol. 9, 01416, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01416

Spatial extent of influence on glacier mass balance of North Atlantic circulation indices

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The North Atlantic Oscillation NAO and four similar large-scale circulation indices have an effect on glacier mass balance that is distributed latitudinally rather than on a maritime-continental basis. The relation between the index and mass balance is linear in that neglecting months when the index is below a threshold value affects the correlations very little. The indices correlate with mass balance strongly positively in Scandinavia (12 glaciers) and Iceland (8), moderately negatively in the Alps (13) and Pyrenees (1), and negligibly in Svalbard (3). Glacier to glacier correlation of mass balance reflects this pattern but with notable exceptions: positive between Scandinavia and Iceland and between the Alps and the Pyrenees; moderately negative between Scandinavia and the Alps and Pyrenees, but negligible between Iceland and the Alps and Pyrenees; negligible between Svalbard and all other regions. There were pronounced 1988-1989 and 1995-1996 shifts in the circulation indices and a weaker 1981-1982 shift. Weakness of the Scandinavia-Alps correlation is manifested by (1) negligible change in Scandinavia at time of big negative 1981-1982 shift of balance in the Alps, especially the eastern Alps, and (2) negligible change in the Alps at times of big positive 1988-1989 shift or big negative 1995-1996 shift in Scandinavia.