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Grace data over Canada and post-glacial rebond

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The 2003-2005 Grace gravity data over Canada clearly shows a zone of positive trend, situated around the Hudson bay but, on the west side, it extends southward, down to southern Manitoba. If this trend reflects post-glacial rebond, it is in good agreement with the presence of a large ice dome west of Hudson bay, during the last glacial maximum, as proposed in the ICE5G model. However, other data indicative of the vertical motion over a decadal time-scale (GPS, land gravity measurements) do not indicate a large present-day uplift West of Hudson Bay.

The level of lakes has increased between 2003 and 2005 by 1m in southern Manitoba (lakes Winnipeg, Winnipegosis) and by 50cm in surrounding areas. Once corrected for this mass increase over the lakes and for snow cover variations, the 'southern Manitoba' GRACE-trend high disappears suggesting present-day uplifts of similar amplitude East and West of Hudson bay and a former Keewatin ice-sheet smaller than previously proposed.

The total volume of LGM ice-sheets being constrained by the far-field sea-level data, reducing the LGM ice volume over Canada imposes an increase of the LGM ice volume elsewhere, most likely over Antarctica. The estimate of present-day melting over Antarctica from Grace data relies strongly upon the post-glacial rebond 'correction' and must in turn be revised. However, we show that other factors such as taking into account a 'burger' rather than a 'Maxwell' viscoelastic rheology can also greatly affect the post-glacial rebond signal over Antarctica.