

Interactive comment on “Seasonal speed-up of two outlet glaciers of Austfonna, Svalbard, inferred from continuous GPS measurements” by T. Dunse et al.

P. Christoffersen (Referee)

pc350@cam.ac.uk

Received and published: 30 January 2012

This paper by T Dunse et al. presents GPS records from two outlet glaciers in the remote Austfonna ice cap in northeast Svalbard. The records show large seasonal fluctuations as well as contrasting behavior in two drainage basins. In Basin-3, seasonal speed-up occurs rapidly and tapers out gradually, and the speeds were substantially higher in 2009-10 compared to 2008-09. At Duvebreen, the speed-ups occurs and declines rapidly, and speeds were similar during the two different melt seasons. The manuscript is very well written and the results are presented in figures of excellent quality. I recommend publication after very minor technical corrections.

C1870

1. A comment on size and dimensions. The size and maximum height of Austfonna is almost always referred to as 8000 km² and 800 m, respectively. Given the detained work of recent years, I think it would be helpful to add more precise characteristics. Please be precise.

2. A comment on velocity. The GPS velocity data is compared against the InSAR velocities from the early 1990, as reported in Dowdeswell et al. (1999). I suggest mentioning also the InSAR velocities derived by others, e.g. Bevan et al. (Ann. Glaciol., 2007) and Moholdt and Kaap (2011, + Thesis?). Make sure the inferred change between the early 1990s and 2008-10 is real, i.e. that the comparison of InSAR snapshots and continuous GPS records is valid.

3. A comment on outlet glacier behavior. The discussion on water system vs. deformation of basal sediment is very interesting. It is clearly relevant due to the different behavior recorded in the two drainage basins. I wonder whether a more explicit distinction could be made, i.e. whether Duvebreen could be interpreted to behave similar to mountain glaciers controlled by drainage system evolution, while Basin-3 is influenced more directly by basal slipperiness controlled by sediment yield strength? Similar observations are made in Greenland (see e.g. Howat et al., JGlac, 2010) - a link worth mentioning at least briefly.

Minor issues:

Title: Why use 'inferred' when the speed-up is measured?

3425/18: Add a sentence on the delayed effect from diffusion of elevation change.

Section 2.2: The surge record cited seem anecdotal? The out-of-balance velocity described in paragraph 2 may be the more convincing argument for cyclical variability. Consider merging the two paragraphs. Add newer velocity data if possible.

Section 2.2: Add newer velocity data if possible.

Section 3.2: The PDD results should be described in the Results section, not here.

C1871

3435/13: New paragraph?

3435/19: After '... ice-bed coupling.', you could add a sentence saying that the lack of response to hydrological inputs could be caused by full saturation of the basal sediment, i.e. that the added extra water has no or only little effect (which is different from assuming that the hydrological system accommodates the water). This extra comment would be relevant given the discussion in the following paragraph.

3435/23: Add 'delayed' between 'hence' and 'local'

3437/19: replace 'his' with 'their'.

3438/10-11: Is this difference influenced by the different techniques used? Make sure the comparison of InSAR snapshots and continuous GPS records is valid.

Interactive comment on The Cryosphere Discuss., 5, 3423, 2011.