The Cryosphere Discuss., 5, C996–C999, 2011
www.the-cryosphere-discuss.net/5/C996/2011/

The Cryosphere Discussions

Interactive comment on "Spatial and temporal variability of snow accumulation in Dronning Maud Land, East Antarctica, including two deep ice coring sites at Dome Fuji and EPICA DML" *by* S. Fujita et al.

Anonymous Referee #2

Received and published: 26 September 2011

This paper presents new data of surface mass balance collected during Japanese-Swedish traverse along East Antarctica Ice Divide. The main tools used in this study are pits and firn cores analysis integrated by snow radar and satellite image analysis. The paper contributes to ongoing debate concerning the estimation of uncertainty in the measurement of spatial and temporal variability in snow accumulation. An exhaustive discussion of the spatial and temporal variability of snow accumulation is given, covering the last eight millenniums.

In my opinion, this paper is an excellent and essential review of the surface mass

balance along East Antarctic Ice Divide between EDML and Dome Fuji, advancing significantly the knowledge of this area.

The manuscript subject is very appropriate for The Cryopshere and data are very important, referencing and introductory discussion are adequate. Interpretations and conclusions are adequately supported by the result. My main concern is interpretation of wind impact on SMB. Previous authors point out the correlation of slope along wind direction with SMB, but slope along wind direction is very different with surface topographical slope along the traverse route used by Authors. Moreover the traverse is at ice divide ore closer and generally is not subject to katabatic wind. As point out by authors, the orientations of surface snow relief agree with orientation and rotation of storm track. On my opinion is more correctly to speak leeward and downward (shadow effect) respect to storm track or maritime moisture source as point out by authors Par 4.3.1. Relationship between SMB and wind is quite different at ice divide and along the ice sheet slope, where katabatic wind has very strong impact on SMB due to erosion/ablation process. Analogous condition of shadow effect occurs at Dome C (Urbini et al., 2008). Authors should take in account the difference between wind erosion due to katabatic wind and source of moisture/shadow effect and modify the text and figures appropriately. In addition, Authors should improve the readability of manuscript with merge and condense generally the manuscript and in particular Paragraphs 2.2.3, 2.2.4, 2.2.5, postpone to a future manuscript the analysis of backscatter VHF radio waves and relation with SMB, withdraw fig 3 and backscatter from others figures.

Specific Comments:

I would suggest to use everywhere ice divide instead of ridge, also in the title I would suggest to use as location "East Antarctic ice divide between EPICA EDML and Dome Fuji."

Authors should homogenise or specify the difference between subsurface radar signals, snow radar, GPR. Snow radar and GPR are normally used as synonymous in

SMB study.

2067/25 Why do you use time lag difference between Agung and Pinatubo eruption?

Paragraph 2.2.3-2.2.4-2.2.5, should be merge and provide information on resolution, uncertainty, investigation depth, scan rate, samples per trace.

2069/10 uncertainty of horizon dated, and impact on SMB.

Paragraph 2.2.3-2.2.4-2.2.5, previous authors use to merge density profile along the traverse (Eisen et al., 2008) to convert TWT in depth, why do you use only Dome Fuji? Density profile is correlated to snow accumulation, temperature and wind condition, these climatological conditions are quite different along the traverse.

Ii is not clear between 2070/25 and 2071/6, has previous firn core data been used? or data from compilation of Rotschky et al., 2007? Interpolation data are not reliable reference.

Par. 2.3 Comparison between prevalent wind direction >10 m/s from model (e.g. ERA 40, NCEP-2, JRA-25, ERA-Interim reanalysis) and surface relief observation could be useful in the discussion.

2075/1-5 and 2080/10-13 Ice divide and dome are singular features on ice sheet glaciological condition (SMB, ice flow, surface topography etc.), so we must aspect smoother condition respect to ice sheet escarpment (south traverse).

2075/19-20 should be taken in account also the difference due to ice flow and upstream condition of SMB.

2077/4-5 surface relief directions are different between spring and summer. Could be the difference observed from A28 and A23 due to summer survey?

2078 Analysis of wind system should be taken in account the difference between ice sheet slope (Watanabe, 1978) and ice divide (Birnbaum et al., 2010; van As et al., 2008).

2079/12-15 It is obvious also if density profile is different, withdrawn

Paragraph 4.3.1 Compare the gradient along ice divide from Dome C and Vostok (urbini et al., 2008), and shadow effect at Dome C and wind impact at Talos Dome.

2081/16 shadow effect of DML-B?

2083/17-21 PR6.9 map does not agree with SMB between M and EDML, this point should be stressed.

Par. 4.3.3 and figure related. Several papers point out that wind ablation is determined by surface slope along the wind direction, I would suggest the Authors to provide also this information along the traverse using digital elevation model and sastrugi direction or atmospheric model.

Par 4.4 Data from US-Norway traverse must be analysed (Anschutz et al., 2009) and compared for temporal variability.

Par 5 modify the conclusion taking in account difference between wind erosion and shadow effect.

Par 4.3.3 Fig. 9 Could be the difference between av. of 44 yr and GPR data at point M due to change ice divide position and related shadow effect position? See also Conway and Rasmussen (2009) and Urbini et al. (2008).

Interactive comment on The Cryosphere Discuss., 5, 2061, 2011.