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Interactive comment on "Non-climatic signal in ice core records: lessons from Antarctic mega-dunes" *by* A. Ekaykin et al.

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This paper presents field observation of megadune (East Antarctica) to understand the surface-atmosphere interaction processes that lead the snow accumulation process of the megadune and paleo reconstruction using ice core. The main tools used in this study are ground penetration radar, stakes, firn core, and snow sample measurements. The paper contributes to the estimation of uncertainty in the measurement of spatial and temporal variability in snow accumulation and their implication paleoclimate records.

The manuscript subject is very appropriate for "The Cryosphere", data, interpretation and referencing are adequate, conclusions is supported by the results.

However there are some issues and the manuscript must be improved:

In the manuscript the Authors do not distinguish megadune from others wind-glazed morphologies and transversal dune (see Frezzotti et al., 2002a, Scambos et al., 2012, Das et al., 2013). The wind-glazed morphologies are located over steep bedrock topography beneath relatively steep surface topography (>4 m/km). Megadune, as also the authors pointed out, is conventionally used to describe the specific dune field observed only in the central East Antarctica, mainly in the southern part of East Antarctic ice divide. Megadune forms a system of parallel rideges with the wavelength of 2-5 km and amplitude of 2-8 m. Megadune are different from that described by Pettre in Adelie Land, Anschutz and Eisen in DML etc or in WAIS etc. Wind crust in megadune area is not controlled by steep bedrock topography as pointed out previous paper (Frezzotti et al., 2002a), but it appear to be formed by an oscillation in the katabatic air flow leading to a wave-like variation in net accumulation (Frezzotti et al., 2002b). The wind-waves are formed at the change of slope along wind direction, in response to the buoyancy force, in strongly stable environments with light winds, and might be related to a natural resonance. Authors should distinguish the different morphologies (megadune, wide glazed area, transversal dune etc.) and relative snow accumulation process, chemical and isotopic properties in the introduction paragraph and elsewhere.

Frezzotti et al., 2005 already pointed out that the reconstruction of past climates based on firn/ice cores drilled in areas with high snow accumulation spatial variability (>10%) is complicated. In megadune areas the distortion of recordings is characterized by a snow accumulation periodicity. The length of periodic variations due to megadunes depends on ice velocity and snow accumulation, and can therefore vary in space and time, and they suggested that an ice core downwind of the megadune area could provide information about the periodicity induced by megadunes in deep ice cores.

The distortion of megadune in paleo-record is characterised by the periodicity respect to the other distortion coming from wind-glazed surface.

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In detail:

Pettre et al., 1986; Anschuutz et al., 2006 and 2007; Eisen et al., 2005; Fujita et al., 2002; Gow and Rowland, 1965; Whillans, 1975; Dolgushin, 1958; Vladimirova and Ekaykin, 2014; Black and Budd, 1964; Goodwin, 1990; Black and Budd, 1964; Ekaykin et al. (2002), Frezzotti et al. (2007), Fujita et al. (2011), Hamilton (2004), Kaspari et al. (2004), Richardson et al. (1997), Rotschky et al. (2004); Dixon et al., 2013; Neumann et al., 2005; van der Veen et al., 1999 have studied wind crust or transversal dune area, no megadune.

Pag 6911 Line 20, the dune does not redistribute the snow, is the wind. Dune is an eolian morphology, no an eolian process.

Pag 6917 line 10-15. Frezzotti et al., 2002b have evaluated the SMB in megadune area on the base on the GPR layer at 12 m, which is the SMB average since Tambora (around 185 yr). Could the authors provide similar evaluation from GPR and compare with two years stake measurements?

Pag 6917 line 27 Anschutz et al., 2006 is not in megadune area, the SMB, slope and wavelength is an order of magnitude different from Vostok megadune.

Pag 6918 line 1-27 and Fig 3, on the base of stake measurements: 1.5 m of integrated sample represents between 10 to 100 yrs of snow accumulation. The ∂D isotopic composition is less negative in low accumulation area, and does not appear enriched in heavy isotope, whereas ∂O17 appear depleted in the leeward part close to MD00. Paragraph 3.2 The peculiarity of megadune process is the upstream migration (Frezzotti et al., 2002b). Megadune internal structures suggest that they are prograding windward with time and the ice is flowing downhill, so their surface position are teorethical "sagnant" whereas the buried megadune flowing downhill at ice sheet velocity (2 m/yr). The two velocities (upstream migration and ice velocity) have opposite direction and different module. Arcone et al., 2005 referes to other structures.

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Pag 6922 line 20-23, Benoist et al., 1982 have drilled at old Dome C site, that is not at Dome position and it is about 55 km NE of real Dome C site. Dome site is characterised by absence of local variation of topography with absence of wind crust and very low spatial snow accumulation (see Frezzotti et al., 2002a, Urbini et al., 2008; Fuijta et al., 2011; Das et al., 2013). Frezzotti et al., 2005 and Proposito et al., 2002 show the spatial variability in snow accumulation at 5 km distance using GPR and ice core along Terra Nova Bay Dome C traverse, and stressed the implication for paleoclimatic reconstruction.

Pag 6924 line 10-15. The glazed surface area at change of slope along wind direction presents in very short distance very high spatial variability in snow accumulation, more than megadune. For post depositional process studies these site are more useful because the distortion of megadune is characterised by the periodicity and complicate the interpretation of process due to the ovelapping of periodicity process.

Due to the importance of research and the difficulty to collect data in Antarctica I recommend to accept manuscript with mayor revision.

Interactive comment on The Cryosphere Discuss., 9, 6909, 2015.