

## ***Interactive comment on “High resolution 900 yr volcanic and climatic record from the Vostok area, East Antarctica” by E. Yu. Osipov et al.***

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Response to Anonymous Reviewer #2

Reviewer 2: The manuscript subject is appropriate for the Cryosphere and data are very important, however there are some issues and the manuscript must be improved. My main concerns are the following issues: the stratigraphic link between the snow/firn pit/core, the evaluation of nssSO<sub>4</sub> background, the comparison of volcanic record between the firn cores, the comparison with only the record of SP, DC, and RP and absence of comparison with others East Antarctica volcanic record, the snow accumulation variability with others records and the general trend in Antarctica, the interpretation of Na record is not well described and analysed.

C898

Authors: Thank you for your valuable remarks. We will take them into account when correcting the manuscript.

R2: Figure 3 should show the 4 volcanic records and their overlap and link.

A: Yes, it will be corrected and overlapped intervals will be shown on the Figure.

R2: All the pit/cores analysed are in an area of 1.4 km, where snow precipitation and post deposition process, dry deposition and wind process (glaciological process), must be very similar, therefore the background value of sulfate concentration must be very similar. The nss SO<sub>4</sub> background value should be calculated by averaging concentrations over the all pit/cores, after excluding samples clearly associated with volcanic events.

A: Yes, we partially agree with this. However these cores cover different time intervals with the changing natural background. Therefore previously we calculated the background for each core separately. In the reworked manuscript we intend to discuss both approaches in the methodological part.

R2: The Vostok record should be compared also with others inland East Antarctica volcanic record Dome A (Jiang et al., 2012), Dome Fuji (Igarashi et al., 2011), SPQML (Anschütz et al., 2011) cores, and coastal record Princess Elizabeth Land and Lambert Glacier (YM85 Takahashi et al., 2009, G15 Moore et al., 1991; DT-401 Ren et al., 2010) Talos Dome (Stenni et al., 2002), DML (Sommer et al., 2000, Karlóty et al., 2000) and Law Dome (Plummer et al., 2012). The difference of amount of volcanic signal observed between the cores should be more analysed and discussed, also inside the Vostok area where the different record overlaps.

A: Thank you. We intend to expand the list of compared volcanic records from inland Antarctica including the mentioned papers.

R2: The snow accumulation temporal variability must be compared at least with the closer site (DC, DA, DF), and general trend in Antarctica (Monaghan et al., 2006; Frez-

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zotti et al., 2013), moreover the previous study at Vostok (Ekaykin et al., 2004) pointed out that the that the snow accumulation and isotope periodicity are correlates with the Pacific Decadal Oscillation index, implying a climatic teleconnection between central Antarctica and the tropical Pacific. New studies point out the correlation of tropical pacific with climate of Antarctica (ex. Fogt and Bromwich, 2006, Ding et al., 2011b; Schneider et al., 2012; Frezzotti et al., 2013). Discussion of snow accumulation VS record could improve the value of manuscript.

A: Thank you for the suggestion. We will provide more detailed discussion on this matter.

R2: The interpretation of Na record is not clear, the different in Na concentration is similar to the snow accumulation variability, the record should be analysed and discussed in more detail or deleted.

A: We will make it more clear in the renewed manuscript.

R2: Snow accumulation unit must be mm we yr-1 everywhere. The uncertainty related to the source of errors should be described.

A: We agree. The uncertainties of snow accumulation will be calculated.

R2: Abstract and everywhere: The snow accumulation is calculated from 1259 and 2010, it is not clear on the base of which data has been evaluated the accumulation <1260. The date of 1093 from the sample bottom is an estimation of age and relatively snow accumulation is a loop discussion. The last dated reference is 1260, the older age and snow accumulation are extrapolated.

A: We noted that (page 1965, line 5-6) "Below the lowest stratigraphic marker in each core the average accumulation rate of overlaying horizons has been used". Of course, the extrapolation was used to estimate ice core age below the 1260 horizon.

R2: Pag 1963 line 9 and 10 warm instead of worm.

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A: Thank you. This misprint will be corrected.

R2: Pag 1965 line 9-19; The counting of years using Na record is not compatible with sample rate (2-3 cm) and with wind redistribution at site (Ekaykin et al 2004; Eisen et al., 2008), for an annual resolution at least occurs 8-10 sample, instead of 2 or 3. Moreover the value of 32+2 mmwe yr-1 is more than 30% of value of Pinatubo-2010 (24.9 mm we yr-1). Value in the text and table must identical.

A: We agree that 2-3 samples per year are not enough for reconstruction of definite seasonal signal. In the corrected manuscript we will present measured accumulation at Vostok for this time interval and discuss the quasi-record in more details. Value of 32+/-2 means number of years in the VK-55 firn core but not snow accumulation (page 1965, line 15).

R2: At pag 1968 line 8-9 is pointed out "that mixing of snow layer in Vostok area is estimated to be not more than 7-8 yr at least ..." this is not compatible with the year counting.

A: Yes, see comment above.

R2: Pag 1965 line 24 and 25; see comment.

A: Our comment was done above.

R2: Pag 1966 line 14 and 15; 1230-1270 and 1410-1460 are arbitrary interval of the volcanic eruptions and not interval of increased sulfate content.

A: We think that these are similar notions as volcanic eruptions lead to increased sulfate content in snow.

R2: Pag 1967 line 11-12; VR does not content more volcanic event if appropriate background is used.

A: It will be discussed in the corrected manuscript. And see comment above.

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R2: Pag 1967 line 29; The presence of core gaps of 42 yr must be describe in length, age and gaps interval.

A: Thank you for suggestion. In will be provided in table 1 and the text.

R2: Pag 1968 line 5 V12 (1809)

A: Thank you. This misprint will be corrected.

R2: Pag 1969 line 11; 1259-1600 AD

A: Strictly speaking you are right as the rates between 1093 and 1259 are extrapolated.

R2: Pag 1970 line 21 and 22; spatial variability is analysed in more detail in Eisen et al 2008 and reference within and others papers (Dome A Ding et al., 2011a, Wang et al., 2013; Dome Fuji Kameda et al., 2008 Fujita et al., 2011; Dome C Urbini et al., 2008 etc.).

A: Thank you. We will take into account in the re-worked manuscript.

R2: Pag 1970 line 25; which is the source of 24.7 value? at page 1965 is 32

A: The matter is that 24.7 is the value of snow accumulation and  $32 \pm 2$  age of the core VK-55. See our comment above.

R2: Pag 1974 line 4; confront with Frezzotti et al., 2013 and reference within.

A: If you mean that we did not use this paper we will take into account its reference in the discussion in re-worked version.

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