

Interactive comment on “An independently dated 2000-yr volcanic record from Law Dome, East Antarctica, including a new perspective on the dating of the c. 1450s eruption of Kuwae, Vanuatu” by C. T. Plummer et al.

Anonymous Referee #3

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This paper presents a 2000-yr record of Southern Hemisphere volcanism recorded in ice cores from Law Dome site, East Antarctica. It is a follow up study by Palmer et al. [2001] who discussed a high precision volcanic record over the last 700 years. In this study special emphasis is placed on the mid 15th century Kuwae Eruption. The authors provide evidence for two separate eruptions during the period 1450–1460 CE, which will complicate the precise assignment of the Kuwae eruption. The topic of the paper is within the scope of Climate of the Past. However, there are a couple of things that need to be clarified and/or more elaborated, so I recommend publication after the

C669

authors have addressed the comments given below

Special comments:

The introduction needs some reworking. It is not clear to me what are the major goals of this study in particular what besides the length of the record are the main differences to Palmer et al. (2001). I think the author should already emphasize in the introduction that the Kuwae eruption represents at present one of the largest uncertainties in the volcanic forcing reconstruction for the last Millennium. A compilation of forcing reconstructions for the third phase of the Paleoclimate Modelling Intercomparison Project (PMIP3) (Schmidt et al., 2011; 2012) presents two annual volcanic forcing reconstruction Gao et al. (2008) and Crowley et al. (2008). Largest differences between both data sets in magnitude and timing exist for the Kuwae eruption in the mid 15th century (Fig4. Schmidt et al., 2011, supplementary material Schmidt et al., 2012)), which requires highly precise dating of this special volcanic event.

In the abstract and in the introduction multiple ice cores are mentioned. How many and which ice cores are used from Law Dome. This should be clearly elaborated in the paper.

In the discussion about the dating of the Kuwae eruption the authors tend to generalize their findings for Law Dome for the whole SH. The authors claim for example that the SH ice cores show only one signal. However, one can see in Fig 3 of Gao et al. (2006) that some SH ice cores show two peaks SP2001c1, DML-B32 and with a certain time lag also Siple station (page 1579, line 22). Furthermore they state that there is a lack of a SH signature of the 1453 CE event (page, 1580 line 3) which is not correct as other ice core records show a signal at this time (Gao et al., 2008, Ferris et al., 2011).

page 1570, line 10 the aerosols are also deposited via dry deposition

page 1573, line 16 “visual study”, please explain

page 1573, line 27 How large are these differences, within the range of uncertainty ?

C670

page 1578, line 23,24 How does this small gap influences your findings and how small is small?

Table 1 It might be good to indicate also the dating errors from the other ice core records as well.

References:

Crowley, T. J., Zielinski, G., Vinther, B., Udisti, R., Kreutz, K., Cole-Dai, J., and Castellano, E.: Volcanism and the Little Ice Age, *PAGES Newslett.*, 16, 22–23, 2008.

Ferris, D. G., Cole-Dai, J., Reyes, A. R., and Budner, D. M.: South Pole ice core record of explosive volcanic eruptions in the first and second millennia A.D. and evidence of a large eruption in the tropics around 535 A.D., *J. Geophys. Res.*, 116, 1–11, doi:10.1029/2011JD015916, 2011.

Gao, C., Robock, A., and Ammann, C.: Volcanic forcing of climate over the past 1500 years: An improved ice core-based index for climate models, *J. Geophys. Res.*, 113, 23111–23126, doi:10.1029/2008JD010239, 2008.

Gao, C., Robock, A., Self, S., Witter, J. B., Steffenson, J. P., Clausen, H. B., Siggaard-Andersen, M.-L., Johnsen, S., Mayewski, P. A., and Ammann, C.: The 1452 or 1453 A.D. Kuwae eruption signal derived from multiple ice core records: Greatest volcanic sulfate event of the past 700 years, *J. Geophys. Res.*, 111, D12107, doi:10.1029/2005JD006710, 2006.

Palmer, A. S., T. D. van Ommen, M. A. J. Curran, V. Morgan, J. M. Souney, and P. A. Mayewski (2001), High-precision dating of volcanic events (A.D. 1301–1995) using ice cores from Law Dome, Antarctica, *J. Geophys. Res.*, 106(D22), 28,089–28,095, doi:10.1029/2001JD000330.

Schmidt, G.A., Jungclaus, J.H., Ammann, C.M., Bard, E., Braconnot, P., Crowley, T.J., Delaygue, G., Joos, F., Krivova, N.A., Muscheler, R., Otto-Bliesner, B.L., Pongratz, J., Shindell, D.T., Solanki, S.K., Steinhilber, F., and Vieira, L.E.A.: Climate forcing reconstructions for use in PMIP simulations of the last millennium (v1.0), *Geosci. Model Dev.*, 4, 33–45, doi:10.5194/gmd-4-33-2011, 2011.

C671

Schmidt, G.A., Jungclaus, J.H., Ammann, C.M., Bard, E., Braconnot, P., Crowley, T. J., Delaygue, G., Joos, F., Krivova, N.A., Muscheler, R., Otto-Bliesner, B.L., Pongratz, J., Shindell, D.T., Solanki, S.K., Steinhilber, F., and Vieira, L.E.A.: Climate forcing reconstructions for use in PMIP simulations of the Last Millennium (v1.1), *Geosci. Model Dev.*, 5, 185–191, doi:10.5194/gmd-5-185-2012, 2012.

Interactive comment on *Clim. Past Discuss.*, 8, 1567, 2012.