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Climate of the Past Discussions

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.

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Following the anonymous referee #1 comment, point 6 (quoted below), regarding the dating of the Kuwae volcanic event, we feel further clarification on this matter is necessary. A full response to the other points raised will be made after all submissions are received.

Anonymous reviewer #1, point 6:

"I don't buy the main claim of the paper, that Kuwae was in 1458. Gao et al. (2006)

used 33 ice core records, 13 from the Northern Hemisphere and 20 from the Southern Hemisphere. Most of the SH cores had the date in 1453. Why should one new core prove that this consensus is wrong, especially with its potential dating errors?"

This paper is not a synthesis of volcanic records in the manner of Gao et al., (2006). Synthesis of records to produce a date is difficult given the paucity of independently dated volcanic records, and the dating errors associated with those records. Gao et al., (2006) used many records to arrive at a date for the Kuwae eruption signature; however, we propose using only records that meet certain criteria with regards to dating accuracy. Dating is crucial in the case of Kuwae, as it is necessary for the ice core timescale to be sufficiently accurate to resolve - in ice core terms - a very small timeframe of 4-5 years. Layer counted records are considered more accurate than those dated using depth-accumulation estimate methods, however, require a sample resolution of 5-8 samples per year to resolve the years with confidence (Cole-Dai et al., 1997) therefore we chose to use annual layer counted records only. Additionally, independence of these records is important – they should not fix the dates of volcanic events from outside information, as this could bias the end product, and relies upon the assumption you chose the correct date for your volcanic horizons.

Examining the records used (Table 1, Gao et al., 2006), 14 of the 33 records in that table do not extend to 1450 CE. When we eliminate cores that are either not layer counted, or have had their dates "adjusted" to fit volcanic dates reported in the literature (i.e. not independent), we are left with 8 cores, including Law Dome (Palmer et al., 2001). The GRIP core has no volcanic signal detected between 1445 and 1465 CE (Gao et al., 2006). The remaining 7 cores - NGRIP, GISP2 (Zielinski, 1995), Dye-3 (Clausen et al., 1997) and Crête (Hammer et al., 1980) (NH) and Law Dome, Siple Station (Cole-Dai, et al., 1997) and DML_B32 (Traufetter et al., 2004) (SH) – have a volcanic signal that falls within the error estimate of the Law Dome date of 1458 $\pm$1 CE. Traufetter et al., (2004) attributed the large sulphate peak present in DML_B32 at 1453 CE, to Kuwae, however Ruth et al. (2007) during synchronisation of EDC to the

DML_B32 timescale using volcanic markers, used the ice date 1458 CE for Kuwae, a weighted average of the Law Dome (Palmer et al., 2001) and the DML_B32 (Traufetter et al. 2004) dating, suggesting some reservation about the DML_B32 dating of this event.

The Law Dome dating for the largest sulphate event in the last 2000 years is 1458 $\pm$1 CE. The average lag time is 1 year, suggesting a likely eruption date of 1457 CE, but considering maximum lag and potential dating error estimates, the eruption window is 1455 to 1458 CE.

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