We thank the anonymous referee for their comments, and address the main points raised.

1. The abstract and the paper say that multiple ice cores were used, but the only new analysis is of a Law Dome core. Were there multiple cores there that were averaged? The paper is very unclear about this. Other cores that were analyzed previously are compared to the new Law Dome core, but really we are only presented with one new core, I think.

The Dome Summit South (DSS) site (66°43'11'' S 112°48'25'' E) is located 4.6km southeast of the Law Dome summit, and was drilled for the 1196 metre-long DSS main ice core in 1987 CE, with drilling completed in 1993 CE. Two additional mid-length cores (DSS97 and DSS99) were drilled in subsequent years at the site to correct for inconsistencies in the data from the top 117 m of the original DSS main core. In recent years (since 1999 CE) the DSS site has been revisited and series of short overlapping firn cores were drilled in 2001, 2008 and 2009 CE (cores DSS0102, DSS0809 and DSS0910 respectively) to bring the record up to 2009 CE. Palmer at al., 2001 produced a single chemistry time series from DSS99, DSS97 and DSS down to 400 m (1300 CE), and we have applied their methods to extend the Law Dome chemistry record from 1995 CE to 2009 CE. All cores used were dated via annual layer counting. Dating is registered across core boundaries by matching seasonal features in oxygen isotopes and other chemistry species through the periods of overlap between cores. Dating across core boundaries is unambiguous and locked without error. In the event of misalignment of overlapping records, natural variability in accumulation from year to year would result in rapid loss of coherence between annual cycles.

The paper presented here is a major extension of the existing volcanic record from this site, from 1300 CE to 12 BCE. The dating of this core is an improvement on the previously available Southern Hemisphere records, and allows us to better constrain the dating of past volcanic events identified within our record. The agreement with the NGRIP volcanic record (GICC05 timescale) is a major step in producing global volcanic forcing estimates for temperature reconstructions. Additionally, sulphate depositional information from Law Dome is presented for volcanic events identified.

In order to address this and other reviewer's comments, we have added the following paragraph to explain the cores used in this study, and how the chemistry time series was produced. A supplementary table outlining more detail about the cores used has been added.

2. The authors are very unclear about how they determined volcanic peaks in their core. They say it is by "visual study." But how? Did they look visually at the cores themselves? If they analyzed a time series, what were the criteria to identify volcanic peaks?

Volcanic identification by visual examination of sulphate chemistry time series was performed on the Law Dome record between 1995 and 1300 CE by Palmer et al., 2001. Both this study and Palmer et al., 2001 defined volcanic events as departures above the mean seasonal average in the non sea-salt sulphate (nss-SO_4^{2-}) record. Palmer et al., 2001 visually compared the nss-SO_4^{2-} time series to the 695-yr (1995-1300 CE) mean nss-SO_4^{2-} seasonal cycle to identify departures from the average. In this study, we calculated the residual nss-SO_4^{2-} record by subtracting the 31-yr mean seasonal cycle before identification of events. Events longer than 6-months in duration were considered volcanic.

Volcanic deposition is inherently noisy. That is why previous studies gathered all the evidence from as many cores as they could, so as to filter out the noise. This paper uses only one core and implies that it is better than previous ones, and so deserves more attention. But the core has a dating error of possibly 4 years in one direction to 7 in another direction. Furthermore, no matter how good it is, it cannot get around the stochastic nature of snowfall or surface winds. In addition, they just happen to mention that there is a gap in their chemistry around 1453 CE, by their counting. So I see no reason to consider this core better than any others.

We disagree that volcanic signals in ice cores are inherently noisy – due to the clear presence of volcanic signatures in ice core records, volcanic events have been used as stratigraphic time markers in many ice cores, and hence used to date and synchronize ice cores (e.g. Moore et al., 1991; Delmas et al., 1992; Langway et al., 1995; Cole-Dai et al., 2000). Volcanic signals are detected because they rise above the background noise. The dating error of this core is the smallest of all current, comparable length, Antarctic ice core records. Our core has an estimated error of ±1 to 894 CE, and -7/+4 years at 23 BCE, which is smaller than the ±23 years at 186 CE for DML (Traufetter et al., 2004) and ±20 years at 176 CE at South Pole (Ferris et al., 2011). Our lower error is due primarily to the high accumulation rate (0.70 m ice equivalent/year), which allows annual layers to be clearly resolved for two reasons: first, the physical sampling constraints allows for a greater number of samples per year than in other localities, and second and most importantly, by providing stratigraphic preservation of sub-annual features in the presence of surface irregularities (e.g. dunes and erosional features). At Law Dome, precipitation events occur with sufficient frequency to preserve monthly signals (McMorrow et al., 2001; van Ommen & Morgan, 1997). Comparisons with the NGRIP ice core, on the GICC05 timescale, show the Law Dome timescale to be a maximum of 3 years different from volcanic events matched in NGRIP. The 10-month gap in our dataset around 1453 CE only affects our volcanic record. Continuous oxygen isotope and hydrogen peroxide measurements give us dating continuity through this period.

4. To compare to their new volcanic record and three older ones, the authors use tree rings. But tree rings only record local climate, and there are many influences in addition to volcanic eruptions. They need to use all the tree ring records that exist in both hemispheres to filter out local weather variations. That certain ice cores or tree rings miss volcanic events is certainly not evidence that the eruptions did not occur or cause climate change.

The inclusion of this tree ring record is a comparison between records, not a verification of our record, or theirs. The purpose of its inclusion was to demonstrate the generally good agreement between tree ring growth anomalies and ice core derived volcanic records. The discussion section was to highlight that local climate variability can cause issues with tree growth responses to volcanic events (e.g. Tambora eruption in the Salzer & Hughes, 2007 study), demonstrating ring response to a volcanic event may not necessarily be indicative of its size (see also Mann et al., 2012). This has implications when attempting to correlate magnitude of response to the size of eruption centres may not be appropriate. This is particularly important during the 1450s CE, where two eruptions in close temporal proximity took place, one clearly larger than the other (based on ice core data from both hemispheres).

The large sulphate spike in ice cores and the strong tree ring signals (usually attributed to Kuwae, Vanuatu) may not be the same event. We chose the record of Salzer & Hughes, 2007 because they used statistical methods to demonstrate a robust link between the growth anomalies they observed, and volcanics recorded in ice cores. "*Ring-width minima years can be matched with known volcanoes or ice-core volcanic signals in 44 of 51 cases (86%)"* for the last millennium. They note that agreement diminishes further back in time; however, they argue that the lack of ice core records and the decreased dating accuracy with age is the likely cause of this reduced agreement. They used a window of ±5 years for their statistical analysis to avoid dating uncertainties and lagged climate responses.

5. In Table 1 they give "event dates." Are these dates of the eruptions or dates of the volcanic sulfur layer in the ice cores? They have to specify this. If the latter, how can you compare this to tree rings? What are the differences in the lag between and eruption and the tree ring response or the time for ice deposition?

Event dates in Table 1 are ice dates – the date the volcanic event is found in our ice cores. Lag times are site specific (irrespective of the recorder) and variable from event to event, usually between 1 to 3 years. Comparing the differences in the lag times between sites is beyond the scope of this paper. Lag times for Law Dome were determined by comparing our ice date to eruption dates for volcanics with known eruption dates, as outlined in the paper. Only one event, El Chichón, Mexico, was identified as having a significantly longer than average transport delay.

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?

We do not attribute a date to Kuwae. We present circumstantial evidence for why the large eruption found in a number of cores may be linked to the Kuwae caldera; however, we state that unless a definitive linkage is found, there is no way to be certain if either of those two sulphate spikes in the 1450s CE were the result of the eruption of Kuwae.

The following comment was posted previously.

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 ±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 ±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.

7. In Fig. 1, the numbers in brackets signify event size rank. But is 1 or 5 the highest? Why is 2 larger than either of these and 4 larger than 3?

In Figure 1, 1 is the highest, 5 is the smallest event size, based on total sulphate deposition at Law Dome. Peak concentration is not necessarily a reliable indicator of eruption size. We determined eruption sizes by the total sulphate deposition associated with events. Factors such as eruption duration and accumulation during sulphate deposition affect the total amount of sulphate deposited to the ice sheet at a given site.

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