Clim. Past Discuss., 11, C1502–C1507, 2015
www.clim-past-discuss.net/11/C1502/2015/

Climate of the Past Discussions

Interactive comment on "A 250 year periodicity in Southern Hemisphere westerly winds over the last 2600 years" *by* C. Turney et al.

C. Turney et al.

c.turney@unsw.edu.au

Received and published: 31 August 2015

We thank Joel for his constructive and insightful comments. The review was extremely helpful and has considerably improved the quality of the revised manuscript.

Below we respond to the points raised. 1. The interpretation of the ERA79 output (and the associated 34 years of data) is well taken. We have clarified the climate interpretation with the following statement: 'It should be noted, however, that the reanalysis product used here is only for the period commencing 1979 (the satellite era) and that different atmospheric dynamics may have been involved in the delivery of exotic pollen and charcoal to the Falkland Islands on centennial timescales.' With regards the relationship between Nothofagus and charcoal, it's important to realise that in spite of the proximity of the Falklands to South America, the input of exotic pollen remains

relatively low (<5% TLP). As described below, we argue the charcoal data is aerially-derived from Patagonia and of sufficient concentration to be more robust. The other exotic pollen types represent <0.5% TLP and can effectively be ignored as a measure of palaeo-wind strength 2. We apologise for the misunderstanding over the separation of the charcoal size. The charcoal identified in the Falkland Island's sequence is all <106μm with negligible amounts larger than this size fraction. As a result we have now summed the two charcoal curves (<50 and >50 μm) and as can be seen in the attached revised version of Figure 6, the close similarity to the record reported from Patagonia (Moreno et al., 2009) strongly argues for a South American source (as opposed to burning on the site as originally suggested). We have expanded the details and thank the reviewer for the suggestion to broaden our comparison of the data to other relevant records. 3. We have also applied the the Lomb-Scargle algorithm that computes the spectral properties of time series with irregular sampling intervals. This approach identified a 268-year peak (see attached Figure 4), indicating this periodicity is pervasive through the record regardless of the sampling method, and therefore robust. To investigate the possible role of solar variability on Southern Hemisphere westerly airflow we analysed the production rate of 14C, a cosmogenic radionuclide that is related to solar activity (Bond et al., Science, 2001). MTM analysis of the 14C dataset indicates multiple significant periodicities above the 95% significance level centred on 297 and 225 years (see attached Figure 5). MTM coherency analysis of the charcoal and 14C production rate data suggests several significant periodicities, with one centred on 289 years at the 99% significance level (Figure 5). 4. We have rewritten the interpretation of the Nothofagus pollen. As described above, all exotic pollen form a relatively small component of the total land pollen sum. As a result, whilst the exotics may provide a first-order estimate of westerly winds, we consider the relatively large amount of charcoal to provide a more robust interpretation of changing wind strength. 5. Internal variability is an important aspect of the climate system and we thank the reviewer for the suggested alternative mechanisms. These have now been incorporated into the manuscript. Ultimately, the origin of the $\sim$250 year periodicity may be

linked to postulated centennial-scale changes in climate modes of variability including the El Niño-Southern Oscillation (ENSO) (Ault et al., 2013) or Southern Ocean convection (Martin et al., 2013). However, as described above, we consider the coherence between the charcoal record and solar cycles suggests the latter is the more probable driver.

Thank you for the technical comments. All have been incorporated in the revised manuscript.

Interactive comment on Clim. Past Discuss., 11, 2159, 2015.

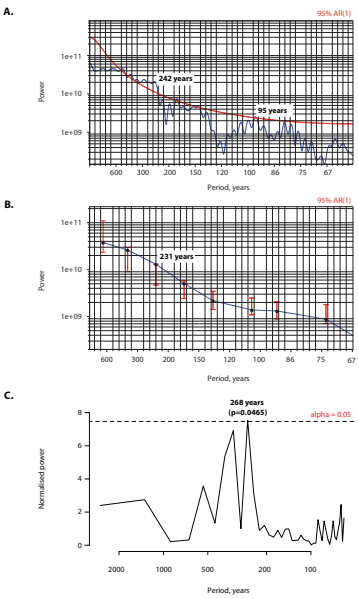

Fig. 1. Revised Fig 4

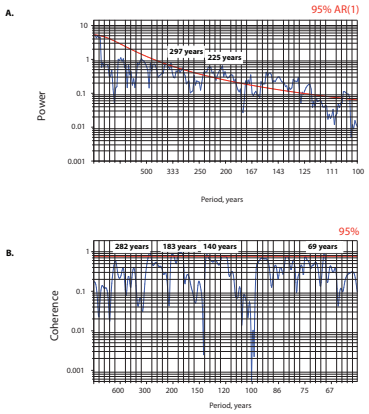

Fig. 2. Revised Fig 5

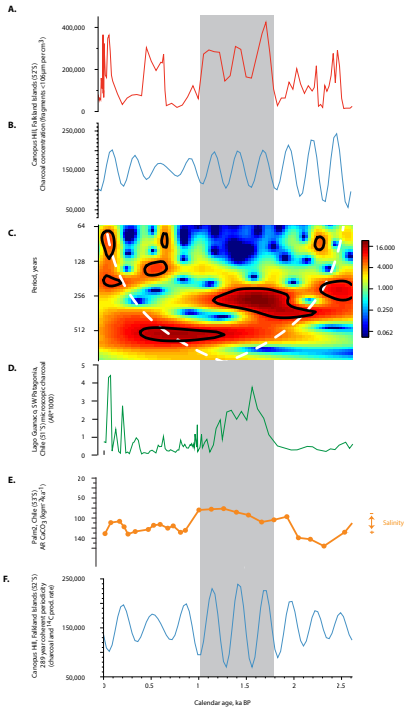

Fig. 3. Revised Fig 6