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Interactive comment on "A sea surface temperature reconstruction for the southern Indian Ocean trade wind belt from corals in Rodrigues Island (19° S, 63° E)" *by* J. Zinke et al.

Anonymous Referee #2

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General comments:

This paper presents two new Sr/Ca-SST reconstructions from Rodrigues Island in the south-central Indian Ocean, which contribute to our understanding of SST variability and trends in this region and their relationship to modes of climate variability (PDO, ENSO). The authors present a very rigorous assessment of the potential impact of diagenesis, corallite orientation, and Sr/Ca-SST calibration on these Sr/Ca-SST reconstructions. The results of this analysis emphasize the importance of corallite orientation and screening for diagenesis in such reconstructions, as suggested in previous work by DeLong et al. (2012), Hendy et al. 2007 (and others). However, a number of warm and cold anomalies may not be completely explained by either corallite angle or dia-

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genesis, and the authors conclude that the SST reconstruction is only reliable back to 1945. This leaves little gained beyond the instrumental record, though additional support for the importance of these issues is still an important contribution on its own. Nonetheless, I have a number of other major concerns that need to be addressed by the authors before publication:

1) Calculation of the composite: the composite was calculated by taking the arithmetic mean of the coral records from each site, yet the authors do not demonstrate strong agreement between the two coral records before compositing. The authors need to show statistics supporting the agreement between the records. E.g., what is the correlation between the two records? Based on figure 3, there appears to be disagreement between the two records such that when averaged, the variability of the composite is reduced over the interval that included the two records (relative to that of the earlier period when only 1 record is available). The two records also have opposing trends over the 1951-2005 interval (as discussed on lines 359-363)! The moderate trend of the composite (0.44 degrees) is simply a result of averaging the strong positive (1.38 degrees) and moderate negative trend (-0.49 degrees) and thus isn't physically interpretable. The climate signal also appears to be weakened in the composite (e.g., Figure A5).

2) Selection of Sr/Ca-SST calibration: the authors compute a local calibration with both in situ and gridded SST data, but then use the relationship from Corrège 2006. The justification for this is not clear from the paper. Since local SST data is available, the authors should use this calibration unless they have a valid reason not to use the in situ data.

3) Sr/Ca-SST calibration methodology: the authors should use a reduced major axis regression instead of simple linear regression to calibrate their Sr/Ca records with SST. RMA takes into account errors in both SST and Sr/Ca, which is critical given that the SST observations themselves are also imperfect (see Solow and Huppert 2004; York et al. 2004; Thirumalai et al. 2011). It is also unclear why the authors use only the

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max and min to calibrate, rather than the full record of monthly anomalies over the calibration period. Justification for this choice is needed.

4) Potential warm and cool biases in the coral records: It is unclear which of the warm and cool biases (highlighted in figure 6 and discussed on lines 414-424) were included in the composite, and which were removed. From the composite of figure 6, it looks like many of them were averaged in. Clearer justification of their inclusion is needed. Given the magnitude of these anomalies and the fact that their source is unclear (in the cases where no clear diagenesis was identified), the authors should investigate whether removing these events from the record changes their results.

Specific comments:

Lines 289-292: it is difficult to see this comparison of seasonality from figure 3. I suggest showing the period of overlap separately to demonstrate the agreement between the records

Lines 301-303: Figure 3 does not effectively portray the trends discussed here

Lines 325-327: Discuss these calibration methods earlier (when discussing the calibration approach in the methods section)

Line 329: This validation period includes part of the calibration period. Stop in 2002 to have independent calibration/validation periods.

Lines 374-394: This comparison with SST over the past 150 years is not a very useful exercise given the paucity of data at this site (as shown in figure A2). The authors seem to be using the agreement with the instrumental data over the full record to support their reconstruction, but this reasoning is circular (we need a coral reconstruction because there aren't enough observations, but then we use the observations to validate our record). Stick to the well observed period for the calibration/validation exercise. It is very possible that some of these discrepancies between the Sr/Ca-SST and SST are due to biases in the SST record.

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Line 412: see also Sayani et al. 2011

Lines 412-413: What about dissolutionâĂŤany indication that dissolution could explain these discrepancies (e.g., see Sayani et al. 2011âĂŤwho show that dissolution is associated with low Sr/Ca anomalies/warm biases)?

Lines 434-436: Recommend performing a running correlation analysis to test this.

Lines 522-526: other potential drivers of these discrepancies? E.g., see Alpert et al. 2015

Line 602-607: corals may have acclimatized or adapted to the high temperature variability. A number of studies have shown that corals in sites that have high temperature variability may be less susceptible to bleaching (e.g., Thompson and van Woesik 2009, Donner 2011). This variability is now usually taken into account when calculating the thermal stress thresholds to predict bleaching (e.g., Kleypas et al. 2015), as this approach has been shown to better predict observed bleaching patterns (e.g., Logan et al. 2012); this should be used instead of the conventional degree heating weeks threshold on lines 605-607.

Lines 611-612: citation?

Figure 8 caption: this caption needs to be reworded. It is hard to follow what is in each panel.

Figure 9: why divide the analysis into these periods? This needs to be justified somewhere. If the goal was to compare among different phases of the PDO & ENSO (which from the text appears to be the goal), then the authors should select periods that line up with the phases of these modes.

Figure 2: change the color scheme so that the lines in 2a are differentiable

Figure 7: the markings denoting corallite angle are not clearâĂŤwhere do the transitions occur, at the end of the lines? May be clearer if brackets are used to denote the

sections with different corallite angles

Figure A1: change the color scheme so that the black lines are differentiable

Figure A4: what is the difference between the figures on the left and right? This is not indicated in the caption, and it is not clear from the figure. Clarify in caption.

Technical corrections:

Lines 384-387: reword

Line 432: long-term

Line 548: closest agreement to

Table A1 caption, line 977: change “in brackets” to “in parentheses”

References:

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