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Solid Earth Discussions

Interactive comment on "Seismic gaps and intraplate seismicity around Rodrigues Ridge (Indian Ocean) from time-domain array analysis" *by* Manvendra Singh and Georg Rümpker

Anonymous Referee #1

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General comments

The manuscript presents a thorough array-based analysis of seismicity surrounding Rodrigues Island in the Indian Ocean. Due to its remote location and proximity to the Rodrigues Triple junction, this data set offers interesting insights into intra-plate seismicity of an oceanic plate. The authors exploit the array geometry to estimate locations of 63 events that were not detected by global networks. They suggest a simple, but adequate way of estimating epicentral distance and use backazimuths derived from array analysis. The method is very clearly documented and well-illustrated. The results suggest some well-defined clusters of intra-plate seismicity, that are clearly located away

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Discussion paper

from any of the surrounding ridges. In addition, the authors discuss gaps in the seismicity distribution along the Central Indian Ridge, that are not closed by their additional data. While all results are clearly described, the interpretation is somewhat short and could easily be enhanced by some more information.

Specific comments

To expand the discussion of the seismicity, the authors could for example include in their interpretative Fig. 11 the age of the oceanic lithosphere to discuss whether age differences and hence differing thermal contraction could be responsible for the intraplate seismicity. Clusters 2 and 3 seem to be located in prolongation of transform zones, so this could support this interpretation. Cluster 1, in contrast, shows no apparent relation to different lithospheric ages, nor does cluster 4, which is probably rather located on the Central Indian Ridge. An important observation, that supports the interpretation of a potential melt channel between Rodrigues Island and the seismic gap 2 on the Central Indian Ridge, is the lack of arrivals from earthquakes recorded along the Central Indian Ridge south of this gap, while other earthquakes at comparable distances have been detected on Rodrigues Island. To make this more obvious, Fig. 11 could include a colour or symbol coding to distinguish between earthquakes in the global catalogue that were detected and those that were not detected. A seismic stripe-and-gap pattern in teleseismic and hydroacoustic data have for example been discussed in more detail by Escartin et al. (2008) and by Simao et al. (2010). They see a relative lack of earthquakes near magmatic centres of spreading segments, whereas segment ends at the Mid-Atlantic Ridge tend to show increased seismicity rates. This observation could provide support for the interpretation of gap 2. A regional seismicity analysis with data just south of the survey area (25°S) is presented by Tsang-Hin-Sun et al. (2016). These authors also find seismic gaps that are even somewhat clearer delineated since they use a hydroacoustic data set with lower detection thresholds. This study could therefore provide addditional evidence for the existence of the seismic gaps in the present study area. It may also be advisable, when delineating seismic

gaps along the Central Indian Ridge, to include an as long observation span as possible from teleseismic catalogues. Fig. 11 uses 18 years of data from the USGS catalogue. The reviewed ISC bulletin shows many more events in this area for the period 1970-2017. It becomes obvious that the entire section between 18°S and 20°S is relatively aseismic compared to the ridge sections to the north and south. Gap 1 and 2 seem to be separated only by one very distinct cluster of teleseismic earthquakes that potentially coincides with cluster 4. It would be interesting to see whether the seismicity of cluster 4 is swarm-like and occurs in a short time period. Earthquake swarms may point to ongoing magmatism and further support the interpretation of a melt region. At very slow spreading rates, even strong earthquakes detected at teleseismic distances may be an indicator of magmatic activity (Müller & Jokat, 2000; Schlindwein, 2012).

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