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Hydroacoustic observations of Two Contrasted Seismic Swarms along the Southwest Indian Ridge in 2018

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In 2018, two earthquake swarms occurred along segments of the ultra-slow Southwest Indian Ridge (spreading rate: 14-15 mm/a). The first swarm is located at the spreading-ridge intersection with the Atlantis Fracture Zone and comprises 9 Mw > 5.0 events (GCMT catalogue) and about 227 lower magnitude events (ISC catalogue), spanning over 9 days (July 10-18). The second crisis is more of a cluster of events focusing near a discontinuity, 220km away from the Indian Triple Junction and comprises 6 Mw > 5 events (GCMT) and 87 lower magnitude events (ISC catalogue), spanning over 30 days (September 28 to October 27). All focal mechanisms (GCMT) indicate normal faulting for both swarms. These two swarms are examined using hydroacoustic records from the OHASISBIO network with 7 to 9 autonomous hydrophones moored on either side of Southwest Indian Ridge.

The first swarm initiates with a Mw=4.9 event (July 10 2018, 03h55) which triggers numerous events with an average of ~250 events per day for the first three days (July 10to 12), propagating in the NE direction. After this, the seismic activity ceases down along with a sparse distribution of events until another burst of activity initiating after July 15, lasting for 3 days and comprising of several high intensity events. Overall, this swarm includes ~1100 hydroacoustic events spanning over 13 days.

The second swarm, further east, starts with two events, Mw=5.5 and 5.6 (Sept. 28 2018, 6h21 and 7h06), followed by a few discrete events. After 3 days, a dense cluster of events initiates with a Mw=5.4 event (October 1st, 18h16) and lasts for 7 days (~415 events per day) and decreases till the end of October. Two additional sub-swarms occur on October 1st and on October 6, both propagating towards the NE. Several other high intensity events occur October 10, after which seismic activity propagates towards the SE and fades away until October 27. Overall, this swarm includes ~5000 hydroacoustic events spanning over 33 days.

The number of events per day is thus larger for the second swarm than for the first one. Also, event source levels are in average smaller in the second crisis than in the first one. Further analyses of these characteristics, along with the different geographical and time distribution of the ~6000 acoustic events (vs ~300 events in the land-based catalogues), provide insights on the onset and on the tectonic or magmatic origin of these two contrasting swarms.