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Noise on broadband Ocean Bottom Seismometers (OBS) from the German (DEPAS) and French (INSU) instruments pools as recorded in the RHUM-RUM project

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A long-standing discussion in the OBS community is about the influence of OBS design on noise levels of seismic records. We present results from the RHUM-RUM experiment in the Indian Ocean.

RHUM-RUM is a German-French seismological experiment based on the sea floor surrounding the island of La Réunion, western Indian Ocean. RHUM-RUM's central component is a 13-month deployment (Oct 2012 to Nov 2013) of 57 broad- and wideband ocean bottom seismometers (OBS) and hydrophones over an area of 2000x2000 km^2 surrounding the hotspot. The array contained 48 wideband OBS from the German DEPAS pool and 9 broadband OBS from the French INSU pool. It is the largest deployment of DEPAS and INSU OBS so far, and the first joint experiment. Therefore it allows to compare the performance of these distinct instrument types in different ocean-floor environments. The INSU seismic sensors stand away from their OBS frames, whereas the DEPAS sensors are integrated into theirs.

At long periods (>10 s), the DEPAS seismometers are affected by significantly stronger noise than the INSU seismometers. On the horizontal components, this can be explained by tilting of the frame and buoy assemblage, e.g., through the action of ocean-bottom currents. However, the long period noise level on the vertical components suggests that the DEPAS intruments are also affected by significant self-noise of the CMG-40TOBS seismometer itself. By comparison, the INSU instruments (Trillium 240OBS sensors) are much quieter at periods >30 s and hence better suited for long-period studies.

The trade-off of the instrument design is that the integrated DEPAS setup is easier to deploy and recover, especially when large numbers of stations are involved or fast deployment/recovery of the instruments is desired (e.g. active experiments). Additionally, the wideband sensor has only half the power consumption of the broadband INSU seismometers.

This presentation also reviews network performance and data quality: Of the 57 stations, 46 and 53 yielded good seismometer and hydrophone recordings, respectively. The 19,751 total deployment days yielded 18,735 days of hydrophone recordings and 15,941 days of seismometer recordings, which are 94% and 80% of the theoretically possible yields.