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Updated Magnitude Scales for Mars

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About one year after the successful deployment of the InSight (Interior exploration using Seismic Investigations, Geodesy and Heat Transport) very-broadband seismometer on the Martian surface and the identification of several hundreds of seismic events in the current InSight catalogue, we revise the pre-launch magnitude relations in Böse et al. (2018) to account for the seismic and noise characteristics observed on Mars. The data collected so far indicate that (1) marsquakes are characterized by energy between ~0.1-10Hz; (2) neither surface-wave nor secondary phase arrivals have yet been identified; and (3) a class of high-frequency events exists that are visible mainly as an increased excitation of the 2.4Hz mode. In view of these observations, we up-date scaling relations for the spectral and body-wave magnitudes, and introduce a new magnitude scale for high-frequency events. We use these relations to determine that the magnitudes of events in the current InSight catalogue range between 1.0 and 4.0.