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Mapping lateral variations of intrinsic attenuation of the crust from the coda of the noise cross correlations in Taiwan

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The lapse-time dependence of the quality factor Q_c measured from the S-wave coda of local earthquakes at frequencies above 1 Hz has long been proven effective to investigate separately the scattering and absorption properties of the crust. On the other hand, recent studies demonstrate that the Green's function retrieved from the noise cross-correlation (NCF) between two stations contains a tail of multiply-scattered waves after ballistic waves like the coda of earthquakes, the decay rate of which can therefore be also exploited for mapping of subsurface attenuation structures. In this study, we estimate frequency-dependent Q_c of the coda in the dominant period range of secondary microseisms (3-9 s) derived from the yearly-stacked NCFs between all the available station pairs separated by less than 80 km apart in Taiwan, which is known as one of the most seismically hazardous and geologically complex regions in the world. To ensure the Q_c measured by the coda at sufficiently long lapse time to be representative of the physically meaningful intrinsic quality factor (Q_i) as suggested by Calvet and Margerin (2013), we choose different onset times (t_w) of the coda at 10 or 20 s after the direct surface wave arrivals calculated by the inter-station distance divided by the average group velocity and measure Q_c as a function of the length of the coda window (L_w). The Q_c values at periods of 3-6 s and 4.5-9 s determined with different choices of t_w and the fixed L_w reveal no obvious trend with the inter-station distance. However, similar to the Q_c observations from the earthquake coda, they generally follow a transient increase with L_w at relatively short lapse times and then approach a stabilized plateau value at $L_w \sim$ 75-100 s considered as an optimal approximation of Q_i. We preliminarily map the lateral variations of intrinsic attenuation by simply distributing the determined Q_c uniformly along the corresponding inter-station path and taking the mean values of Q_c within individual $0.2^\circ \times 0.2^\circ$ cells. The results show that the Q_c variation at the shorter periods of 3-6 s is more pronounced and the lowest ($\sim$50), implying the highest intrinsic attenuation, in the Coastal Plain of SW Taiwan covered with thick sedimentary deposits. It gradually increases toward the Western Foothills fold and thrust belt in south central Taiwan and reaches the highest ($\sim$100) in the Hsuehshan Range in north central Taiwan, which seems to be correlated with the progressive increase of the metamorphic grade in the Taiwan orogen as a result of the southward-propagating arc-continent collision. Further attenuation tomography using the proper sensitivity kernels will be conducted to reveal both lateral and depth variations of the absorption properties across diverse litho-geological units in Taiwan.