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# Coastal heavy rainband formed along Sumatera Island, Indonesia, observed with X-band Doppler radars during HARIMAU2011 campaign

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Coastal heavy rainbands (CHeRs) are widely identified over Asian monsoon region (e.g., Western Ghats, Bay of Bengal, Gulf of Thailand, and western Philippines) by satellite observations. Some of them are explained by synoptic wind-terrain interaction (Xie et al., 2006 JC) because they are anchored along mountain ranges face to southwest direction and predominant during boreal summer southwesterly monsoon season. Most Asian megacities are located in coastal regions, thus they have much chance to be suffered from torrential rainfall embedded in CHeRs which may cause flash floods in downtown cities and landslides in mountainous regions. Moreover, rainfall amount over the coastal land varies quite largely if those CHeRs change their lateral location a little, therefore water resource management for social community is seriously sensitive to their variability.

Satellite observations show that CHeRs are modified by various kinds of environmental variations, e.g., diurnal, intraseasonal, monsoonal, ENSO, and IOD. However, climatology, structure, and mechanism of CHeRs have not been examined in detail from mesoscale points of view because there are quite few studies based on ground based radar observations. Previous studies (e.g., Mori et al. 2004 MWR; Yamanaka et al. 2008 JDR; Wu et al. 2007 SOLA) showed most CHeRs in Indonesia are identified along coastlines where convective diurnal variation is predominant, and coastal heavy rain are brought mainly in the nighttime observed with a radar-profiler network deployed by Hydrometeorological ARray for Intraseasonal variation (ISV) - Monsoon AUtomonitoring (HARIMAU) project. In addition, they are confirmed even in the seasons when the wind-terrain interaction cannot explain them well. These results suggest that CHeRs are formed by not only the synoptic wind-terrain effect but also mesoscale convections which developed nocturnally everyday along coastlines.

We carried out the HARIMAU2011 campaign observation over Sumatera Island, Indonesia, during 01-31 December 2011 in collaboration with CINDY and DYNAMO to study the CHeR formed along the southwestern coastline of Sumatera Island by using X-band Doppler and dual polarimetric (DP) radars, intensive soundings at two stations, disdrometers, and surface observation network. Two MJOs (MJO-2 and -3) were identified which passed over Sumatera Island during the campaign period. We divided the period into four phases: MJO-2 active (phase-I), MJO inactive (phase-II), MJO-3 active (phase-III), and MJO inactive (phase IV). CHeRs organized by a lot of mesoscale convections were observed throughout the period, however, those convections developed mainly over the coastal sea, coastal land, and both coastal sea and land, during phase-I, -II, and -III, respectively. Diurnal cycle of convections was not clear during the phase-I and -II. Whereas, that during the phase-III was clearly observed and a lot of convections were identified which migrated from the coastal land to sea during the night. Radar observations showed CHeRs were formed by both convections, a) generated originally over the coastal land in the evening and developed in the night after migrated into the sea, b) generated over the coastal sea in the night and developed independently. Environmental conditions including MJO activity and local circulations were also examined in terms of CHeR formation process.