Internal structure of westward migratory cloud systems with diurnal cycle in west Sumatera observed on 10 November, 2006 during HARIMAU2006 campaign

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Diurnal cycle of cloud system migration over Sumatera Island

Satellite data analysis (Yang and Slingo 2001; Mori et al. 2004)



As a next step,

ground based observation is needed.

- Internal structure of migratory precipitation system with diurnal cycle.
- Three-dimensional wind field structure in the migratory precipitation system.

Dual Doppler radar observation was held by HARIMAU project in 2006 and 2007 in the West Sumatera



Objective of this study

To describe internal structure of westward migratory cloud system with diurnal cycle using HARIMAU2006 data.

Intensive Observation (HARIMAU2006)

Observation period

26 Oct. ~ 27 Nov., 2006

Observation data

①X-band Doppler Radar (XDR) at MIA and Tiku

Time resolution : 6 minute Elevation : 18

②Rawinsonde data

at Tabing and Siberut

Time resolution: 3 or 6 hours

③Automatic Weather Station (AWS) at MIA, Tiku, Tabing, and Siberut Time resolution: 1 minute



MTSAT IR1 on Nov.10, 2006

NOV.10 14LT



NOV.10 16LT

5N

EQ

5S

95E

95E

NOV.10 18LT



NOV.11 00LT







100E

100E

NOV.10 22LT

105E

105E

Background wind on November 10, 2006



Surface wind at Tiku on November 10, 2006

Time variations of precipitation systems on 10 November, 2006

Migration of precipitation over the land

West-southwestward migration

Statistical analysis of the number and dimension of precipitation systems during HARIMAU2006

Summary

Internal structure of precipitation systems which migrated from the land to the sea off on November 10, 2006 was investigated by dual Doppler radar analysis.

Migratory mechanism of precipitation systems

The precipitation systems generated new convective cells successively in the region of sea (land) breeze front. Northwestward migration of precipitating systems in the daytime was explained by advection by environmental wind in the lower troposphere. Precipitation systems from the land to the sea off was migrated by successive generation of new convective cells in the leading edge of the precipitation systems.

Organization of precipitation systems over the sea

Precipitation systems migrating from the land and generating over the sea organized into larger precipitation system than those over the land, and the horizontal scale was more than 100 km in long axis which was on a parallel with the western coast of Sumatera Island. Statistical analysis showed that the number of large precipitation systems over the sea was more than that over the land.

Diurnal variation of horizontal distribution of precipitation systems during HARIMAU2006

Diurnal variation of the number of precipitation systems over the land and sea during HARIMAU2006

Convective activity during HARIMAU2006

Eastward migration→Southward migration

16:30-19:00LT

Steepest descent method was used to obtain the updated values of u,v,w.

The iterative process was continued until a satisfactory solution was found (observational error and mass conservation error are minimized with smoothing out the small-scale variations of u,v,w).

Root Mean Squared Error of wind velocity was less than 1 ms⁻¹

Retreaval of three dimensional wind field using 3-D variational technique (Gao et al., 1999)

Jo : Observation error : Errors due to the misfit between observations and analyses

- Jd : Weak constraint for : Anelastic mass conservation is satisfied as possible. anelastic mass continuity
- **Js : Smoothness Constraint** : Spatial Smoothing for removing small scale noise
- Jb: Background error: Relaxation to the background (rawinsonde) data

Diurnal cycle of convective activity over Indonesian maritime continent

Annual Rainfall

Evening rain & Morning rain

Mori et al. (2004, MWR)