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Plain Language Summary: The heavy rainfall event in July 2020 over Kyushu Island, Japan is analyzed focusing on a hierarchical structure. Before the rainfall event, an upper tropospheric trough, a mesoscale depression, and a sub-synoptic scale cloud system prepare an environment favorable for organized precipitation systems bringing a large precipitation amount. At the rainfall event, a mesoscale convective system with moist absolutely unstable layers (MAULs) develops in Kyushu, causing the disastrous rainfall event. These results suggest that the rainfall event is characterized by a hierarchical structure such that the organized precipitation system causing the rainfall event develops under the environment generated by the upper-tropospheric trough, the sub-synoptic scale cloud system, and the mesoscale depression.

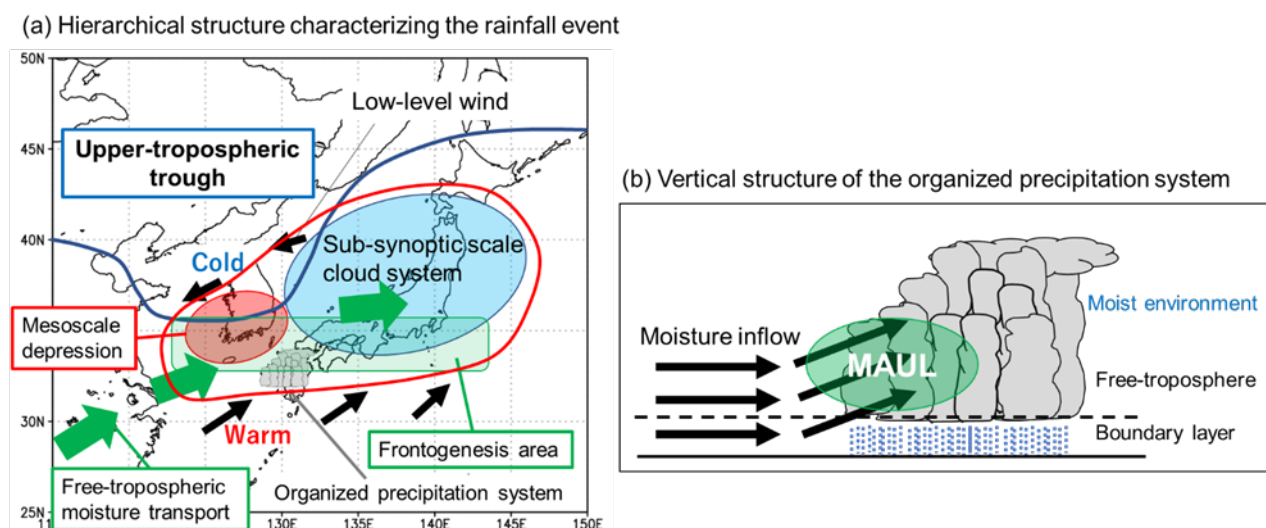


Figure 1. Schematics of (a) the hierarchical structure characterizing the heavy rainfall event, and (b) Vertical structure of the organized precipitation system. Note that MAUL designate moist absolutely unstable layer.

- A hierarchical structure associated with the heavy rainfall event in July 2020 over Kyushu is analyzed.
- An upper tropospheric trough, a mesoscale depression, and a sub-synoptic scale cloud system contribute to moistening the atmosphere and increasing baroclinicity around Kyushu before the rainfall event.
- An organized precipitation system with MAUL develops in the prepared environment, causing the rainfall event.