Visual monitoring and surface wind analyzing clarified the importance of sea and valley wind in causing sudden shower in mountain basin

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Matsumoto basin is a mountain basin located 180 kilometers west-northwest of Tokyo. The Northern Japan Alps is a mountain range which is located on the west side of the basin, and a river valley leads into the southern part of the basin. In this basin, east-west-lined shower clouds occasionally occur and move to the north, causing sudden showers. I decided to study the relationship between sudden showers and surface wind through long-term visual monitoring, in addition to analyzing AMeDAS (Automated Meteorological Data Acquisition System) data.

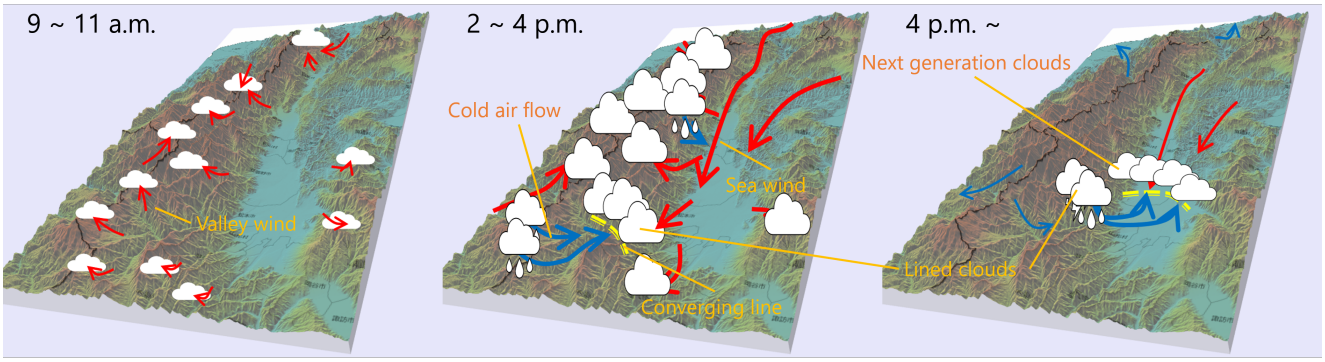
From July 11 to September 4, 2018, time lapse cameras at 5 points around the basin monitored the clouds. The surface wind patterns were classified using the shortest path algorithm from the data taken at 22 AMeDAS points around the basin from 2010 to 2017. The relationships between the states of clouds and the wind patterns have concluded that cloud formation on the ridge is caused by the valley wind.

From August 9 to August 16, 2018, daily changes in atmospheric instability were observed on the 2,310 meter high mountain ridge. These changes have shown that the development of the clouds on the ridge is caused by moist air brought by the sea and valley wind, which makes the atmosphere on the ridge unstable.

The monitored and radar-detected precipitation data showed that the cloud lines are caused by convergence of cold outflow from the clouds above the mountains and the warm, moist sea wind. This lined clouds moves to the north because it also causes cold outflow and form a new line toward the north, the direction from which the sea wind comes.

A similar pattern is also found in Phoenix, Arizona which is in a basin surrounded by mountains and also has effect of the sea wind in rainy season, with sudden showers caused by the same mechanism as in Matsumoto basin. Therefore, this mechanism can apply to showers in any other mountain basins.

Keywords: sudden shower, mountains, sea wind



A) Development of valley wind and Formation of clouds on the mountain ridges

B) Blowing of sea wind into Matsumoto basin and Beginning of sudden shower on the ridge

C) Cold air flow by lined shower clouds and sea wind cause new lined clouds.

