Dynamical effect of topography of Aso caldera on “Matsubori-kaze”

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A strong local wind called "Matsubori-kaze" often blows in the west of Aso caldera, located in the western part of Japan. Matsubori-kaze is likely to cause damage to crops by strong winds, so it is desirable to elucidate its three-dimensional flow field and mechanism. Aso caldera is one of the largest caldera in the world. The central part of the western rim of the caldera is lower in elevation than the northern and southern part (col). Tateno gorge is embedded in the central part of the col. Matsubori-kaze blows at the west exit of Tateno gorge. Dynamical effect of the unique topography of Aso caldera on the local wind is very interesting. In this research, in order to reveal the mechanism of Matsubori-kaze, we observed Matsubori-kaze, and analyzed the flow field in detail using WRF (Weather Research and Forecasting Model).

We observed strong winds at the west exit of Tateno gorge on April 10, 2017. WRF model reproduced the observed Matsubori-kaze well. The numerical simulation showed strong downward wind over the western rim. Therefore, it was considered that Matsubori-kaze was a downslope windstorm from the rim. Furthermore, we compared the flow field at the onset and the peak time of Matsubori-kaze. At the onset of Matsubori-kaze, no hydraulic jump occurred on a transect through the center of the col in the rim, whereas a hydraulic jump occurred on a transect through the edge of the col in the rim. It is considered that the col suppressed hydraulic jump. On the other hand, during the peak time of Matsubori-kaze, no hydraulic jump occurred even on a transect through the edge of the col in the rim. This is because the flow shifted to the linear regime, owing to increasing inflow velocity with approach of an extratropical cyclone to Aso caldera.