南極昭和基地上空対流圏下層における水平風変動

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Lower-tropospheric horizontal wind variability over Syowa Station, Antarctica

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Characteristics of lower-tropospheric horizontal wind variability over Syowa station (69 degrees S, 39 degrees E) in the Antarctica are investigated by using high vertical resolution data of the routine radiosonde observation by the Japan Meteorological Agency for January 2011 to January 2014. We particularly consider the intensification of northeasterlies which is sometimes observed in the lower troposphere, usually below the 1.5 km altitude, and lasts for 1–2 days.

It has been described that the prevailing surface wind direction at the Syowa Station is northeasterly throughout the year. One of the main causes of these northeasterly winds is orographic effects. Since the Syowa station is located on an island to the west of the steeply rising edge of the Antarctic continent, the katabatic wind from the continent has westward component and also southward component due to Coriolis effect (Sato and Hirasawa, 2007). Another is low pressure systems developing on the equator side of the station. There are some features that are not simply accounted for with both mechanisms in the above mentioned northeasterly intensification.

Statistical analyses show that variances of the zonal and meridional wind components are maximized at the altitude of 1.2 km and 8 km, and minimized around the altitude of 3 km. At the 1.2 km altitude, increased power spectral density is observed around period of 3 days. Phase differences between zonal and meridional wind components below the 2 km height are distributed in the vicinity of 0 degree, consistent with that prevailing wind is northeasterly. Cospectrum between meridional wind component and temperature is significantly negative in periods longer than 3 days, and especially large in the vicinity of the period of 7 days. On the other hand, the cospectrum is small in periods shorter than 3 days, suggesting that these components have large amplitude of horizontal wind components but do not contribute to the net meridional heat transport.

It is found that the northeasterly intensification in the lower troposphere is often accompanied by an elevated temperature inversion layer at similar altitudes. The inversion layer is sometimes observed as an enhancement of the echo power of PANSY radar when the layer is located higher than the altitude of 1.5 km. We expect detailed examination of the phenomena using the PANSY data.