Moisture transport to Syowa Station and Dome Fuji Station, Antarctica

Kazue Suzuki[1]; Takashi Yamanouchi[1]; Naohiko Hirasawa[1]; Hideaki Motoyama[1]

[1] NIPR

In this study, we will discuss the characteristics and seasonal variations of the air transport routes comparing clear and snow weather condition. Additionally, comparing the routes of moisture transport to Syowa Station and Dome Fuji Sation, the differences of transport between the costal region and the continental interior would be indicated, so we could give many information of moisture transport in the high latitude region.

We calculated the air transport to the point at 500 and 850 hPa over Syowa Station, and the point at 500hPa over Dome Fuji Station, for 5 days using NIPR trajectory model and ERA-40 Reanalysis Data in 1990-1999. The NIPR model computes a kinematic trajectory in the 3-D wind fields. The data resolutions are 2.5x2.5 in the horizontal and 4-times daily. We assorted backward trajectories using the cloudiness and the weather conditions obtained by ground-based observations. We defined clear condition when cloud amount was zero, and snow condition when cloud amount was more than 8.5 and the present weather was snow, respectively.

At 500 hPa over Syowa Station, many trajectories come from Atlantic Ocean with eastward and upward advections decreasing water vapor amounts for the snow condition On the other hand, for the clear condition, air parcels are transported from the continental interior with downward advections. At 850hPa, for the snow condition, a lot of air parcels also came with upward advections from Atlantic Ocean. However, for the clear condition, many air parcels traveled over the ice sheet for long time, so their water vapor amounts were small.

The distributions of mean geopotential height and their anomalies from 20-year daily averages for the snow and clear conditions at 850 hPa, are similar to that at 500 hPa. Cyclonic disturbances developed west side of Syowa Station in the snow condition, on the other hands, they developed east side in the clear condition. Therefore, for the snow condition, the air parcels came to Syowa Station easterly from Atlantic, and they came to westward for the clear condition. It is suggested that the moisture is mainly brought to Syowa Station closely associated with the activity of disturbances from Atlantic Ocean.

For the snow condition, trajectories that reach to Dome Fuji Station, came upward before arriving, such as the case of Syowa Station. However, the differences of trajectories were not clear between snow condition and clear condition . Both of them came from over ocean and the ice sheet. The residence times of trajectories in the snow condition were longer over ocean than the ice sheet, though those in the clear condition were shorter over ocean than the ice sheet. The reason for small differences must be due to the location of Dome Fuji Station. The station is located at high altitude (about 3800m) and higher than surrounding area of the ice sheet. It is therefore that air parcels could come to Dome Fuji Station from any directions. Such a background would affect the routes of air parcels to have little differences between snow condition and clear condition.

Comparing the case of Syowa Station, differences of the atmospheric circulation patterns between the snow condition and clear condition are not clear. Reijimer et al. (2002) examined the moisture transport routes and origins for Dome Fuji Station using snowfall produced by ERA-15 Reanalysis Data. Though their moisture transport routes and our results have similar features, the origins are slightly different. Indeed, our results of moisture transport origins have higher ratios in the continental interior. It is suggested that the observed weather information might include more local snow phenomena. Therefore, the origins of Reijimer et al. (2002) might express snowfall event by large-scale disturbances only.