Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)
©2011. Japan Geoscience Union. All Rights Reserved.

HTT034-01 Room:201A Time:May 24 16:30-16:45

Comparative study on Antarctic ice sheet surface temperature derived from MODIS LST Product and AWS

Rigen Shimada[1*], Tomoaki Kitayama[2], Fumihiko Nishio[3]

[1]Chiba University, [2]JAMSTEC, [3]CEReS, Chiba University

Recent studies of Antarctic climate change showed that ice sheet near surface temperature is raised by ice sheet surface temperature derived from satellites and Atmospheric surface temperature observed by stations and Automatic Weather Station (AWS).

Two types of temperature are different from the view of radiation balance, however, often used on same time and confused in these studies. In addition, their difference is not considered.

In this study, we show the difference and structure of Antarctic ice sheet near surface temperature from same point and same time comparison of ice sheet surface temperature derived from MODIS Daily Land Surface Temperature Product (MODIS LST Product) and Atmospheric surface temperature observed by AWS.

MODIS LST Product estimates land surface temperature based on split window method using thermal infrared bands. Spatial resolution is 1km and its automatic geometric correction accuracy has improved.

Automatic Weather Station set on the whole region of Antarctica by AMRC, Wisconsin University, and so on. And it is observing Atmospheric surface temperature, pressure, wind speed and wind direction per 10 minutes of 3 meters height. In this analysis, we use 90 points Atmospheric surface temperature since 2002 to 2009.

As a result, ice sheet surface temperature is lower than Atmospheric surface temperature. This difference shows inverse temperature structure from ordinary one in troposphere and it changes seasonally. Especially, the difference is large in summer season night time and winter.

It is considered that the difference is caused by surface inversion layer occurred to balance of solar radiation and radiational cooling. Because, MODIS LST Product is ice sheet surface temperature, however, AWS is Atmospheric surface temperature of 3 meters height. So, their difference of observation height causes temperature difference.

The difference is classified to latitude. Low latitude area, temperature difference is same as the features on whole region. On the other hand high latitude area, temperature difference almost doesn't change during a day.

It is considered that the difference of latitude is caused by changing of solar radiation quantity with changing of solar height.

We simulated that solar radiation quantity (G(h)) on whole points during a year from the equation from Paltridge and Platt (1976).

G(h) = 29.7 ? 298 sin h ^(1/2) + 1542 sin h (h: solar height)

As a result, low latitude area, solar radiation quantity is changing intensely in summer season, midnight sun season. So, temporally surface inversion layer is occurred in summer night time, small solar radiation quantity season. And stable surface inversion layer is occurred in winter, polar night season.

On the other hand, high latitude area, solar radiation quantity is hardly changing in summer season, in other words steady solar radiation exists. So, surface inversion layer is disappeared in summer season because of steady solar radiation. And stable surface inversion layer is occurred in winter same as low latitude area.

To summarize, ice sheet surface temperature derived from satellites and Atmospheric surface temperature observed by observation are different and the difference is changing seasonally because of surface inversion layer. And the features of difference are greatly affected by latitude because of solar radiation quantity change with change of solar height.

In the future work, we will analyze the temperature change on Antarctic ice sheet surface while considering this temperature difference.

Keywords: Antarctic climate, surface inversion, AWS, MODIS