Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

ACC029-12 Room:102 Time:May 26 16:00-16:15

Dependence to Glacial Ice Sheets in Amplifying the Polar Climate

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Larger climate change in the high latitude known as polar amplification is anticipated to occur and ice core cites and paleoiclimate model experiments are used to evaluate the climate sensitivity of the Climate models used for future climate projection. For the boundary condition of the Last Glacial Maximum (LGM) experiment of PMIP (Paleoclimate Modelling Intercomparison Project) phase 3, a new ice sheet is applied, which is the average of three ice models derived from different method. Here we compare the ice sheet boundary condition to the previous boundary conditions of PMIP phase 1 and PMIP phase 2 and also examine the dependence of the result of polar amplification to the choice of ice models. The PMIP3 LGM ice sheet in NH is now thinner and flatter than in PMIP2, which decreases the topography effect of ice sheet and influences the stationary wave and storm tracks. On the other hand, PMIP3 LGM ice sheet in SH is now thicker in West Antarctica (WAIS), broader in the east (EAIS), which cools down the zonal mean in the high southern latitude. The EPICA and DomeF cores are reproduced even if the altitude is corrected in the East Antarctica. We find that the extent of EAIS and the WAIS change influence the zonal mean and even in the Domes of EAIS. We also find from our GCM sensitivity experiments that both the ice sheets and Greenhouse gas amount contribute to the temperature at the ice core cites. This implies that the ratio of polar amplification throughout the ice age cycle could depend on the ice sheet history especially in the WAIS as well as the history of Greenhouse Gas. The long term temperature change that could not be explained by the change of radiative forcing of Greenhouse gas, orbital change and abrupt climate change can be largely attributed to the size of WAIS/EAIS for the ice cores in the Southern Hemisphere and to the size of Northern Hemisphere ice sheets for the ice cores in the Northern Hemisphere.