Interpretation of Mt. Wrangell ice core, Alaska with monthly time scale

Syosaku Kanamori[1]; Takayuki Shiraiwa[2]; Sumito Matoba[3]

[1] ILTS, Hokkaido Univ.; [2] RIHN; [3] PORC, ILTS, Hokkaido Univ

To understand human impact to climate and atmospheric circulation or regional climate system which affect human activity, it is important to understand effect of episodic event like Kosa event, which happen within monthly time scale. Hence past climate proxy record which can reconstruct such events with monthly time scale is expected. Alpine ice cores are valuable past climate proxy or record of past atmospheric circulation at the places close to free troposphere. However, there is difficulty in its dating. The best time resolution among ice core studies was seasonal scale dated by annual layer counting of multi parameters.

To obtain past climate proxy data with monthly time scale, we drilled ice cores at the Summit Caldera of Mt. Wrangell, Alaska (62 ^{o}N, 144^{o}W; 4100 m a. s. l.) and have tried detailed dating for the core. First, we measured detailed density with 1 mm resolution for the ice cores. We also made in situ accumulation and temperature measurement at the drill site for one year. From the comparison of both data, we found that stepwise changes in density profile is formed at accumulation free period and rectangular shape of density profile is formed at surface erosion event. In addition, depths of melt events in the ice cores were defined by density spikes and melt features in visual stratigraphy. Second, accumulation and temperature data at the Summit Caldera of Mt. Wrangell was compared with precipitation and temperature data at regional meteorological stations. As the result, we found that timing of accumulation free period and high temperature event at the Summit Caldera of Mt. Wrangell can be estimated from the meteorological station data. Using these findings, we dated the Mt. Wrangell ice core with monthly time scale from 1991 to 2005. Averaged number of dated depths in an annual layer is 18.

As the result of dating with monthly time scale, we found following four things about Mt. Wrangell; 1)A few snow storm events largely affect hydrogen isotope ratio of the ice core. Hydrogen isotope ratio seems to reflect temperature in fall, which has the highest accumulation in four seasons but the relationship is unclear for other seasons. 2)The main accumulation season is fall, but inter annual variation of seasonal accumulation distribution is large. 3)Tritium, which seems to originate at stratosphere has annual peak in spring, March to June. 4)Mt. Wrangell and regional meteorological stations have almost same mechanism in precipitation. The correlation is also high in temperature.

Such dating method is possible for past 100 years in the Mt. Wrangell ice cores. Longer record is provided in future study.