Dating of coastal ice cores drilled by Japanese Antarctic Research Expedition and environmental change study

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1. Introduction

It is possible to reveal the past climate and environmental change from the ice core drilled in polar ice sheet and glaciers. The 54th and 57th Japanese Antarctic Research Expedition conducted two shallow core in the coastal area of the East Antarctic ice sheet. Ice core sample was cut out at a thickness of about 5 cm in the cold room of the National Institute of Polar Research, and analyzed ion, water isotope, dust and so one. We also conducted dielectric profile measurement (DEP measurement).

2. Ice core

An ice core of 31m deep was collected at coastal H15 site (69º04'10"S, 40º44'51"E, 1030 m.a.s.l.) by JARE54. Another ice core of 261m deep was collected at coastal H128 site (69º24'02"S, 41º32'49"E, 1374 m.a.s.l.) by JARE57. Dating of ice core was done as follows. Calculate water equivalent from ice core density. Accumulate water equivalent from the surface. Approximate the relation of depth - cumulative water equivalent by a quartic equation. Basically we decided to summer (December) and winter (June) due to the seasonal change of the water isotope (δD or $\delta^{18}O$). In addition to the seasonal change of isotope, confirm the following. Maximum of SO_4^{2-} / Na^+, which is earlier in time than the maximum of water isotope. Maximum of MSA at about the same time as the maximum of the water isotope. Na^+ is maximal immediately after the local maximum of the water isotope. Tritium measurement will be conducted for certainty of dating.

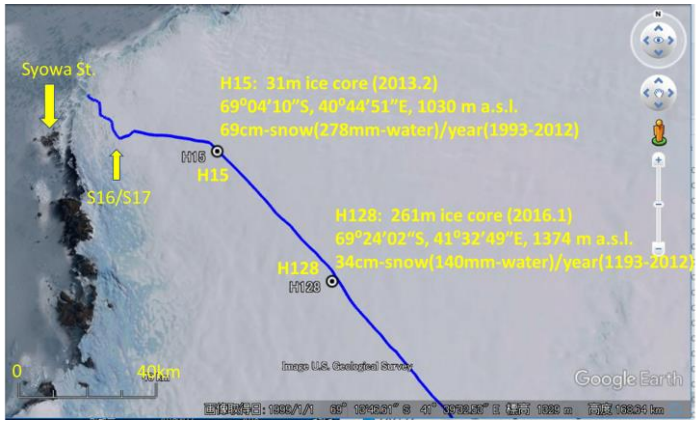

Figure 1. Ice coring sites in the coastal area.

4. Example of results

Snow densification was progressing faster than H128 at H15 where accumulation rate was large but the snow temperature was high. Dating of the H128 ice core is difficult. So we will report a few results of H15 ice core. The deepest age of H15 ice core was estimated to be around 1940 AD. The annual mass balance of coastal H15 is consistent with the result of snow stake measurement.

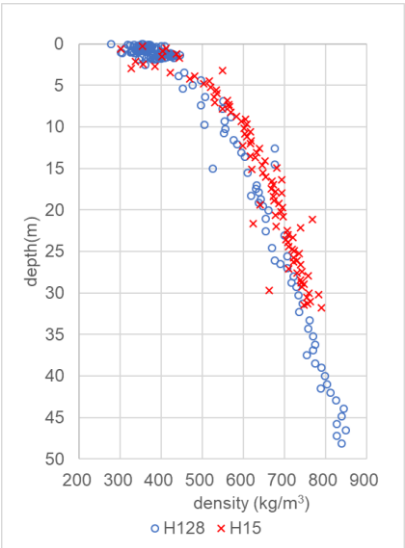

Figure 2. Depth-density profiles at H15 and H128.

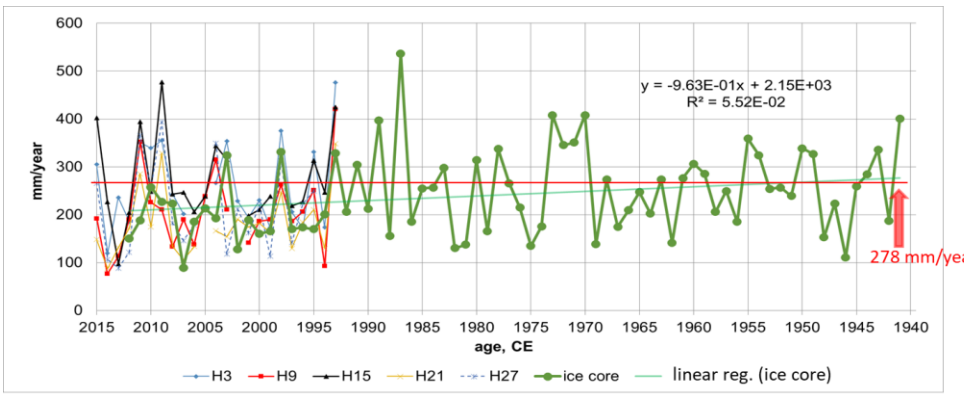

Figure 3. Yearly variation of surface mass balance.