Geophysical Research Abstracts
Vol. 15, EGU2013-10000, 2013
EGU General Assembly 2013

A new dating method for Dome Fuji ice core using data assimilation

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Understanding of past climate changes is regarded as a key for predicting the future climate. In particular, ice cores have been providing excellent records of the past climatic and environmental changes. The second Dome Fuji deep ice core (DF2 core) was drilled to 3,035 m below surface, and the comparison of its isotopic record with that of EDC core suggests that the DF2 core reaches ∼700 kyr ago. In order to accurately date the core, one needs good estimation of accumulation rate and thinning function especially in the deep part (within ∼500 m from the bed corresponding to ∼340-700 kyr ago). The thinning function, which results from the horizontal stretching and vertical compression of an ice layer, is a function of several factors such as depth, temperature, basal sliding and geothermal heat flux.
Using Data Assimilation, we try to make a new dating method but based on the glaciological dynamics of Parrenin et al. (2004, 2007). Trough Kalman filter and smoothing method, we could gain a new tracking method for the age of ice. In this time, we treat the age of ice as an object for the data assimilation and we don't assimilate both of accumulation rates and thinning function individually. It is still in the experimental stage but we will introduce the method and indicate the results. The new method has an advantage in the speed for calculation of parameterizations over the other models. We will indicate the results of calculation times and the optimized parameters in comparison with the other models. From reductions of calculation times, we would be able to calculate sampling of larger members for parameterization using another data assimilation method like a particle filter which needs a huge cost of calculations. In the use of Kalman Filter, it is difficult to treat both of the accumulation rate and the thinning function as variable in the state space model because there is the exponential equation for the accumulation rate. We will design a new state space model be applied with the other data assimilation method in the next step.