逐次データ同化手法を用いたドームふじ氷床コア年代決定モデルの開発

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A dating method for Dome Fuji Ice Core using Sequential 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. (2007). Trough Kalman filtering and smoothing method, we could gain a new tracking method for the age of ice. Figure 1 has new accumulation rates with new age axes for DF1. To gain the optimized parameters for the dating model, we tried two methods, the maximum likelihood method and the mean posterior distribution. The differences between these methods are in the interglacial periods. The accumulation rate simulated with parameters from the mean posterior distribution is liable to be larger than that with the maximum likelihood method. In this time, we treat the age of ice as an object for the data assimilation and we won't assimilate both of accumulation rates and thinning function individually. In the use of Kalman filtering, 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 introduce a new state space model be applied with a Particle filtering and MCMC sampling method to gain the distribution of likelihoods for the parameterization in the presentation.

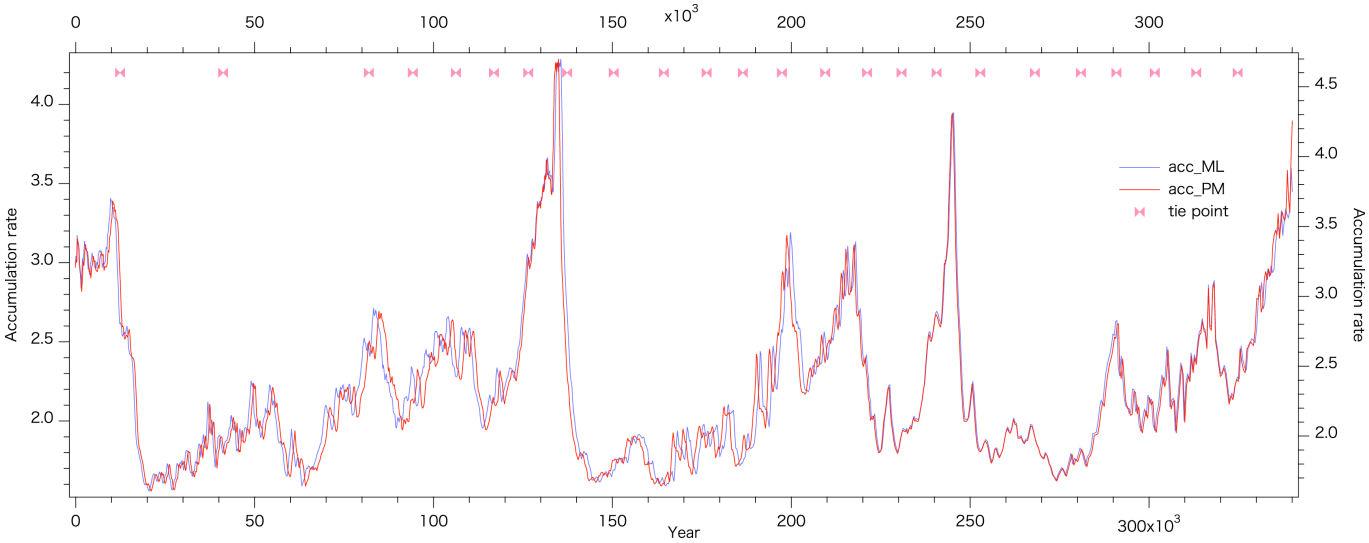

Figure 1. The reconstructed accumulation rates with new age axes by the maximum likelihood method (blue line) and mean posterior distributions (red line).

References

1) Parrenin, F. et al. (2007), 1-D-ice flow modelling at EPICA Dome C and Dome Fuji, East Antarctica, *Climate of the Past*, *3*, 243-259.