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Ice air content, local insolation and dating the EDC record

B. Lemieux-Dudon (1), P. Duval (1), D. Raynaud (1), V. Y. Lipenkov (2), F. Parrenin (1)

(1) Laboratoire de Glaciologie et Géophysique de l'Environnement, CNRS and University Joseph Fourier, Saint-Martin-d'Hères, (2) Arctic and Antarctic Research Institute, Saint Petersburg, (lemieux@lgge.obs.ujf-grenoble.fr)

An air content record covering the last 440 kyr has been obtained along the EPICA DC ice core. The record displays the fundamental Milankovitch orbital frequencies with a dominant obliquity periodicity (41 kyr). We show that a large part of the changes in the porosity at close-off should be related to the obliquity and possibly also to the precession (23 kyr) found in the air content power spectrum. We then discuss different processes, which could explain the link between orbital forcing and porosity at close-off. According to Kawamura et al. (AGU abstract, San Francisco, 2004), wind produces high-density surface snow crusts which prevent vertical gas mixing and gases are trapped at a relatively low bulk density. High local insolation would homogenize the snow structure through recrystallization and would contribute to increase the close-off density. Alternatively, we propose that insolation, by leaving its imprint on the snow structure, would affect the transition between snow and firn and would be a controlling parameter for the closure of pores. Wind crusts or high density layers would not be needed to explain the relationship between air content and insolation in low accumulation sites like Concordia, Vostok and Dome Fuji. We then use the observed link between the spectrally integrated albedo and the sun angle (Warren, S.G., Rev. Geophys. Space Phys., 20, 67-89., 1982) to estimate the variation of the annual mean absorbed solar radiation by the snow cover which could account for the unexplained part of the close-off porosity changes. Finally we explore the potential of using this new proxy of local insolation for contributing to the EDC3 time scale (Parrenin et al., this session) with "absolute" and evenly spaced age markers.