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Variability of polar snow densification during climatic transitions

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The transformation of snow into ice is a complex natural phenomenon and difficult to model. Depending on temperature and precipitation conditions, it may take several decades to millennia. This process is the cause of the age difference between the ice and the gases it contains. The prediction of gas trapping depth is a major challenge of paleoclimatology. The wide discrepancies observed in central Antarctica between densification model outputs and isotopic measurements of inert gases trapped in ice generate important uncertainty in past climate reconstructions.

The LGGE thermo-mechanical model of firn densification includes the formulation of mechanical processes, thermal properties, and gas trapping criteria. The model performances have been tested against measurements of present-day density and temperature profiles, and trace gas data in ice cores (^{15}N, ^{40}Ar, CH_4). Several ice cores are simulated with consistent model parameters. The model has been improved based on sensitivity tests and new experimental constraints (e.g. thermal properties such as activation energies, mechanical parameters: critical density, coordination number etc.). We will present the impact of model improvements on the variations of delta-depth/delta-age during climatic transitions.