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ML in the Dating of Greenland Ice Cores: A GRU Method for Automated Annual Layer Identification

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Our understanding of past climate and the mechanisms that drive climate change can be improved through analysis of the excellent palaeoclimatic data available in the Greenland ice cores, but such insights depend on having an established chronology of the ice core. Therefore, the dating of ice cores is an essential part of palaeoclimatic science. However, this dating is often carried out by manual identification, which is both time-consuming and somewhat subjective.

A GRU Encoder-Decoder model for automatic annual layer identification is developed. The GRU provides a sigmoid output, which is then used to find annual layer positions with a peak detection algorithm. The method is applied to the ice cores NGRIP, GRIP and DYE-3 using the manually identified layer positions from GICC05 and GICC21 as targets in training. These annual layer positions, together with reference horizons from stratigraphic markers, are used for evaluating predictions from the model. The model can be used for validation of existing counts, and with further development for predicting annual layer positions in shorter ice-core sections with uncertain annual layers.

Field of study

Earth & Climate Physics

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