MASTER PROJECT PROPOSAL:

Gas Diffusivity Inversion in Polar Firn Models

Responsables :

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Keywords: Distributed systems, PDE modeling, inverse problems, climate change, atmospheric chemistry and physics.

Framework:

Polar ice cores provide a unique archive of atmospheric composition at time scales covering glacial-interglacial cycles (the last 800 000 years) to the rise of anthropogenic pollution (since about 1850 A.D.), as described in IPCC (2013), WMO (2014) and references therein. The measurements obtained in firn (upper part of the ice cap ~50-100 m, where air circulation occurs) provide information about the gas evolution during the anthropocene period (since about 1850 A.D.) while measurements from deeper ice allow us to look further in the past (e.g. natural and anthropogenic variations of methane sources over the last millennia and chaotic climate transitions since 60 000 years from isotopic ratios).

A 1-D inverse model, initially developed by Rommelaere et al., 1997, was recently extended to multi-gas (including isotopologues) and multi-sites analysis. The full procedure involves a suite of three models of gas transport in firn, generically referred to as the LGGE-GIPSA model (Witrant et al., 2012 and 2013). It provides a unique tool for reconstructing atmospheric scenarios and was used to interpret the data from several laboratories in the world.

Expected results:

The aim of this project is:

1) To study the uniqueness and stability of the 1-D inverse problem of recovering the diffusion coefficient of gases.
2) to improve the computation time of the diffusivity inversion part of the model by using alternative optimization methods/parameterized diffusivity models using data from multiple sites;

Internship organization: LJK (5 months) with regular visits/interations with IGE and GIPSA.

REFERENCES

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