

Tutorial for the use of the software

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1 Introduction

This tutorial serves as a supplementary to René-Bazin et al.(in prep). It contains the description of the codes of the software and of the notebooks used to make this paper. The described codes can be found on GitHub : <https://github.com/Elierb/Snow—Ice-Bayesian-Inversion.git>

2 Installation of the software

The original software is TransTessellate2D (Hawkins et al.(2018)) and can be found on :

<https://github.com/rhyshawkins/TransTessellate2D.git>

The software requires the installation of the following packages :

- GNU g++ Version 6.x or greater
- GNU fortran Version 6.x or greater
- GNU Make version 4.x or greater
- GNU Scientific Library (GSL) version 1 or 2
- OpenMPI version 1.10

Once you’ve installed these packages, you need to do *make* in the root of the directory.

Then, you should do *make* again in the model you want to study (ex : snow_ice/CS-IS_2p_LARM).

To run the inversion, you need to do *python InversionBinnedParallel.py* in the same directory than previously (ex : snow_ice/CS-IS_2p_LARM).

3 Description of the different codes

3.1 C++ codes to perform the inversion

The software we used to perform the inversion is written in C++ and is contained in the base/ directory.

3.2 Codes to launch the software

In each model directory you can launch the inversion using either **InversionBinnedParallel.py** or **temporel.py**. The first python code is used to perform a single inversion (ex : one month) whereas **temporel.py** is used to perform several inversions over specified dates (for example if you want to invert for each month of an entire Winter in one step, without having to re-launch the inversion for each month separately).

3.3 Notebooks to plot figures

Several notebooks are used to plot resulting maps from the inversion and also to make the figures used in René-Bazin et al.(in prep). These notebooks can be found in each model directory in snow_ice/

- **mapping.ipynb** : This notebook serves to plot the resulting map of the inversion, the associated standard deviation and the acceptance rates. The notebook uses the results contain in the images/ directory.
- **figures.ipynb** : This notebook serves to plot the figures for the paper.
- **validation_comparison.ipynb** : This notebook serves to plot validation and comparison of our inversion for ice and snow to other ice and snow products.

- **input_error.ipynb** : This notebook is used to compute the error map from the freeboards

3.4 Other useful files

- **observations.txt** : this file contains the input for the inversion
- **results/log.txt-000** : this file is useful to track the inversion. There are as many log files as the number of chains you use (the last 0 will change to 1, 2,...)
- **finalmodel.txt.A-000** : this file contains the last model computed for each variable. It could be used to make continuing markov chain.