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Facet_36Cl_CREp / README.md

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History



Getting Started

ModelFacet is a Matlab program allowing to model ^{36}Cl concentrations of rock samples belonging to the surface of a normal fault facet. The program allows to inverse the data using a Monte-Carlo Markov chain algorithm, to constrain two main parameters driving the ^{36}Cl concentrations within a sample: the fault slip-rate, and the duration of the post-glacial period. The forward model includes various factors that modulate the ^{36}Cl production rate within the rock, such as the site location, the shielding resulting from the geometry of the facet and associated colluvium, the chemical composition of the fault-plane rock, and the geomagnetic field temporal variations.

Prerequisites

Using **ModelFacet** requires Matlab (version ≥ 2016), and an .xls file editor.

How to start an inversion

Data and site parameters

The samples data (chemistry and geographical information) and the parameters describing the site, must be provided by the user in the excel sheet named "**DATA_IN.xlsx**", localized in the "*Input*" folder. The excel file is composed of two sheet. The sheet *Sample* allow the user to provide the chemistry analysis of each sample, including ^{36}Cl concentration, major and traces, and the localization information. The geometry of the facet has to be provided in the sheet *Parameters*.

Parameters for the modeling and the Inversion

The parameters used for the modeling of ^{36}Cl concentrations, and the inversion of the data are summarized in the sheet *Parameters* of the file "**DATA_IN.xlsx**".

Modeling parameters

- Lambda_f_e : effective fast neutron attenuation coefficient
- Lambda_f_t : true fast neutron attenuation coefficient
- Lambda_mu : slow muon attenuation length
- Psi_mu_0 : slow negative muon stopping rate at land surface
- P_Cl36_Ca : spallation production rate for Ca, SLHL
- P_Cl36_K : spallation production rate for K, SLHL
- P_Cl36_Ti : spallation production rate for Ti, SLHL
- P_Cl36_Fe : spallation production rate for Fe, SLHL
- P_Cl36_Ca error : uncertainty on spallation production rate for Ca, SLHL
- P_Cl36_K error : uncertainty on spallation production rate for K, SLHL
- P_Cl36_Ti error : uncertainty on spallation production rate for Ti, SLHL
- P_Cl36_Fe error : uncertainty on spallation production rate for Fe, SLHL
- Geomag : Choice of the geomagnetic database (1: Mush; 2: GLOPIS; 3: LSD)
- Scaling : Choice of the scaling scheme (1: Time-dependant LAL-STONE with cutoff rigidity, 2: Time-dependant LSD, 3: Time-independant LAL-STONE 2000 no cutoff)
- Atm : Choice of the Atmospheric model (0: ERA40 (Uppala et al. 2005), 1: standard atmosphere equation (NOAA 1976))

Inversion parameters

- Age_max : maximum age to compute ^{36}Cl concentrations produced in sample at depth
- PG_age_0 : initial guess for post-glacial age
- SR_0 : initial guess for the fault slip-rate
- SR_min : minimum slip-rate bound
- SR_max : maximum slip-rate bound
- SR_std : slip-rate standard deviation for proposal function (normal distribution)
- T_min : Inversion minimum post-glacial age bound
- T_max : Inversion maximum post-glacial age bound
- T_std : post-glacial age standard deviation for proposal function (normal distribution)
- n_walker : number of chain
- n_models_inversion : number of models generated during the inversion
- parallel_computing : use of parallel computing (1:true,0: false)
- N_burnin : proportion of the chain removed, must be ≥ 0 and < 1 .
- n_plot : number of samples randomly picked to draw ^{36}Cl concentrations pdf from the inversion

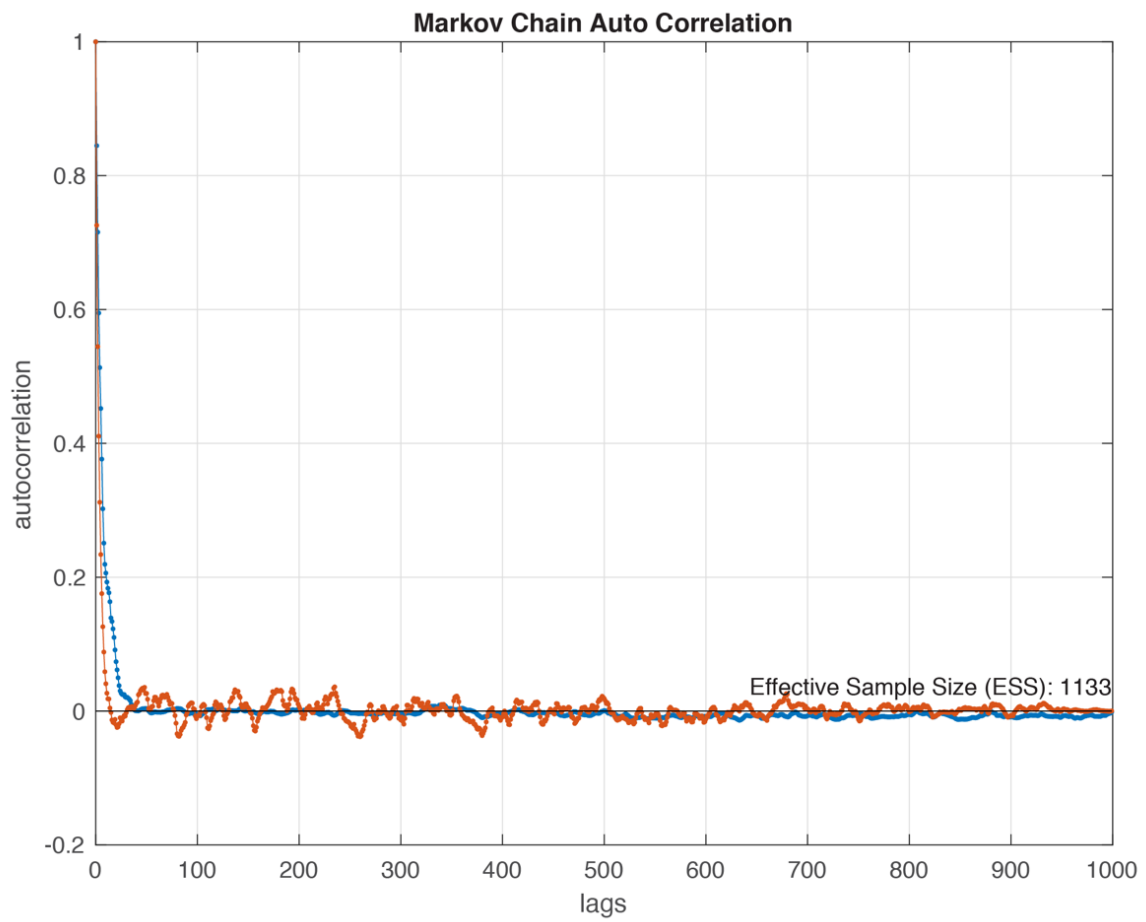
Running a data inversion

To run an inversion of ^{36}Cl concentrations, use the following command in the *Matlab* window:

```
Inversion_36Cl_Facet
```

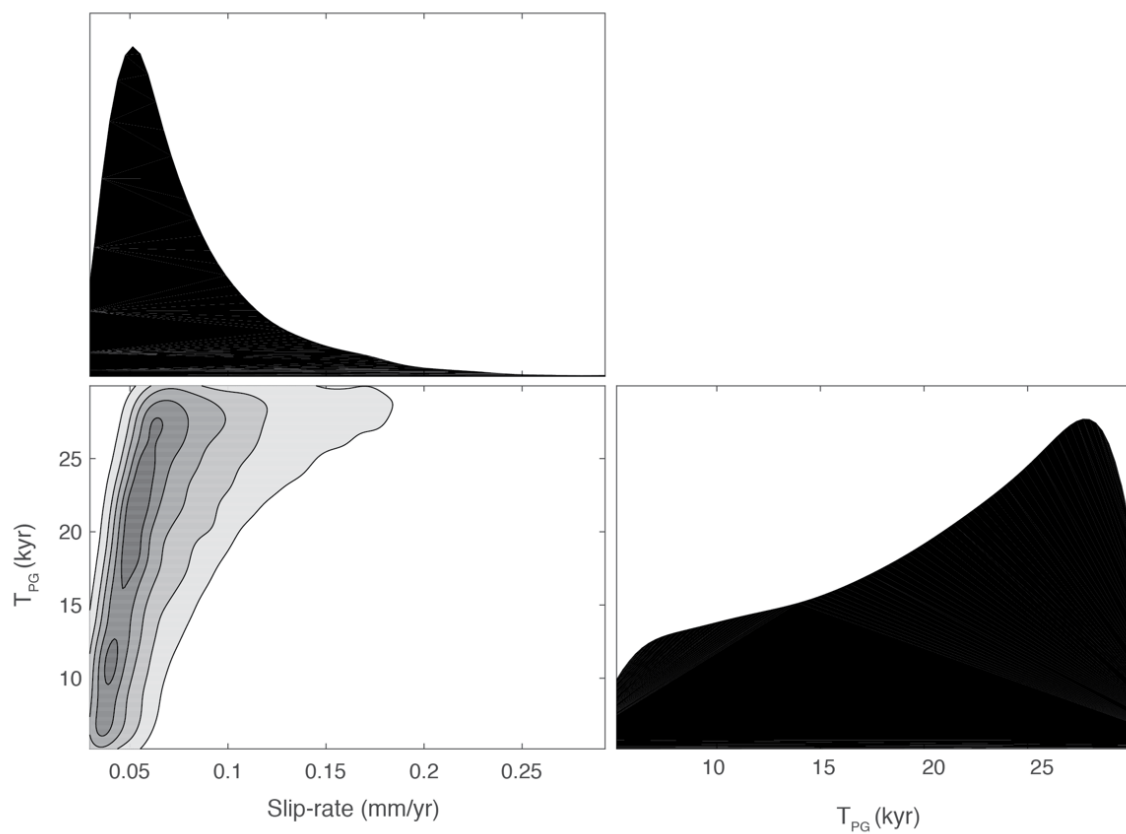
Autocorellation plot :

After the inversion, check the Markov chain autocorellation plot to be sure the algorithm has converged and produced uncorrelated models. Be sure the proportion of models removed from the chains is large enough to remove the whole burnin period.



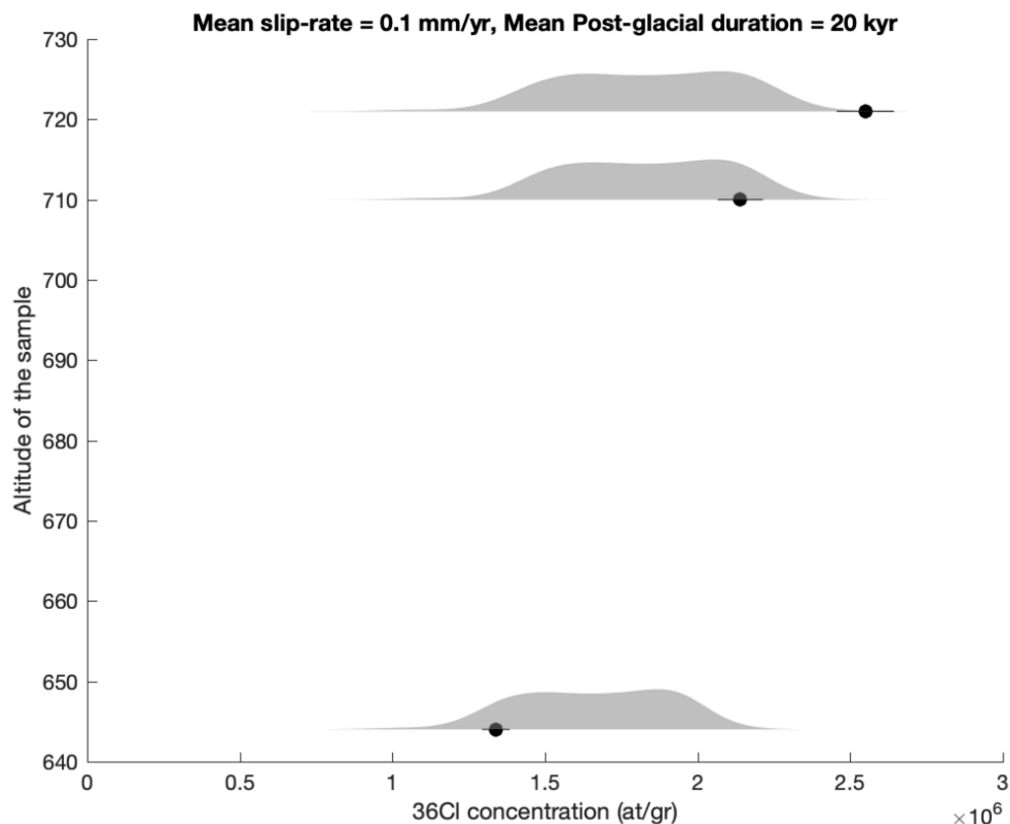
Posterior probability density plot :

The program will also produce the posterior pdf plot for each parameters:



Posterior probability density of modeled ^{36}Cl concentrations :

The program provide the plot of modeled ^{36}Cl concentrations of 1000 models randomly selected in the Markov chains.



How to test a forward model

To model the ^{36}Cl concentrations of a given model, indicates the input parameters (slip-rate and post-glacial duration) in the frame *Test a forward model* in the sheet *Parameters* of the xls setting file. Run the following command in the *Matlab* window:

```
Inversion_36Cl_Facet
```

