



Taste CREp: the Cosmic-Ray Exposure program

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We present here the CREp program and the ICE-D production rate database, an online system to compute Cosmic Ray Exposure (CRE) ages with cosmogenic ^3He and ^{10}Be (crep.crpg.cnrs-nancy.fr). The CREp calculator is designed to automatically reflect the current state of the global calibration database production rate stored in ICE-D (<http://calibration.ice-d.org>). ICE-D will be regularly updated in order to incorporate new calibration data and reflect the current state of the available literature.

The CREp program permits to calculate ages in a flexible way:

- 1) Two scaling models are available, i.e. i) the empirical Lal-Stone time-dependent model (Balco et al., 2008; Lal, 1991; Stone, 2000) with the muon parameters of Braucher et al. (2011), and ii) the Lifton-Sato-Dunai (LSD) theoretical model (Lifton et al., 2014).
- 2) Users may also test the impact of the atmosphere model, using either i) the ERA-40 database (Uppala et al., 2005), or ii) the standard atmosphere (N.O.A.A., 1976).
- 3) For the time-dependent correction, users or choose among the three proposed geomagnetic datasets (Lifton, 2016; Lifton et al., 2014; Muscheler et al., 2005) or import their own database.
- 4) For the important choice of the production rate, CREp is linked to a database of production rate calibration data, ICE-D. This database includes published empirical calibration rate studies that are publicly available at present, including those of the CRONUS-Earth and CRONUS-EU projects, as well as studies from other projects. Users may select the production rates either: i) using a worldwide mean value, ii) a regionally averaged value (not available in regions with no data), iii) a local unique value, which can be chosen among the existing dataset or imported by the user, or iv) any combination of single or multiple calibration data.

We tested the efficacy of the different scaling models by looking at the statistical dispersion of the computed Sea Level High Latitude (SLHL) calibrated production rates. Lal/Stone and LSD models have comparable efficacies, and the impact of the tested atmospheric model and the geomagnetic database is also limited. If a global mean is chosen, the 1σ uncertainty arising from the production rate is about 5% for ^{10}Be and 10% for ^3He . If a regional production rate is picked, these uncertainties are potentially lower.