

Project 6 (TWP2-WP5): Water isotope database: present and past archives

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Objectives :

Water stable isotopes are a powerful tool to decipher the hydrological cycle at global and local scales. The objectives of this project are:

- 1/ to obtain a global vision of isotopic changes for well documented past periods (Last 200 years, Mid-Holocene, LGM, Last Interglacial) and to better interpret isotopic proxies in terms of climate change.
- 2/ to better understand the differences between data and models: are they related to the representation of processes? to different spatial (horizontal and/or vertical) scales between the data point and the model grid?
- 3/ to better understand the factors controlling past isotopic evolutions in ice, carbonate and sediment archives. A forward proxy modeling will be developed for better quantify the relative influence of different climate parameters.

This work is part of the Labex L-IPSL project which aims at improving our knowledge on climate change and to anticipate its impacts on nature and society. The main tool to be developed is a database on $\delta^{18}\text{O}$, $\delta^{13}\text{C}$ and δD grouping data (instrumental and paleoclimate archives) and model simulations at different time scales. The activities include:

- synthesis of precipitation and sea water observational data for the instrumental period prolonged for the period of historical simulations (1800-2010) by tree-rings, lacustrine and ice cores, speleothems and coral data;
- synthesis of paleo-data, beginning with continental data, for key periods of the past (6k, Last-Interglacial, ...) or transition period where simulations are (will be) available (6 – 2k, D/O, Late Glacial,...). A link with two other IPSL projects concerning LGM and water vapor must also be developed.
- making available simulated equivalents for each data point, at least for IPSL models.

Progress of the project :

The LABEX-IPSL post-doc aimed to establish the state of the art of existing data sources for oxygen and carbon stable isotopes ($\delta^{18}\text{O}$ and $\delta^{13}\text{C}$) as well as deuterium (δD) for different types of archives (lacustrine and marine sediment cores, speleothems, ice cores and tree rings cellulose) for the last two glacial/interglacial cycles. Afterwards, a database of the available datasets was built, with a particular focus on the PMIP key periods (last 200 years, Mid-Holocene, Last Glacial Maximum and the Last Interglacial).

The first 18 months of this work (beginning in May 2013) consisted in compiling all the available $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ records stored in the NOAA and PANGAEA websites, as well as in the internal database of the LSCE and by communication with authors. Raw data from published datasets were isolated, homogeneously formatted (fixed data disposition and samples age unit) and stored on individual files, while age model information were extracted and stored separately. After that, the evaluation of the quality of the available age models was performed on dated datasets, and age control quality flags were integrated in a single metafile also providing essential information on all compiled datasets (~3000 published and dated $\delta^{18}\text{O}$, $\delta^{13}\text{C}$ and δD records), as well as ~3400 additional unpublished records).

In association with Patrick Brockmann (data analyst at LSCE), an open-access online platform is being built, providing dynamic and interactive browsing, visualization and downloading facilities for compiled data, and a manuscript is being written for future publication. It is possible to access to a preliminary version of this open-access online platform on the following web site: <http://climateproxiesfinder.ipsl.fr>.

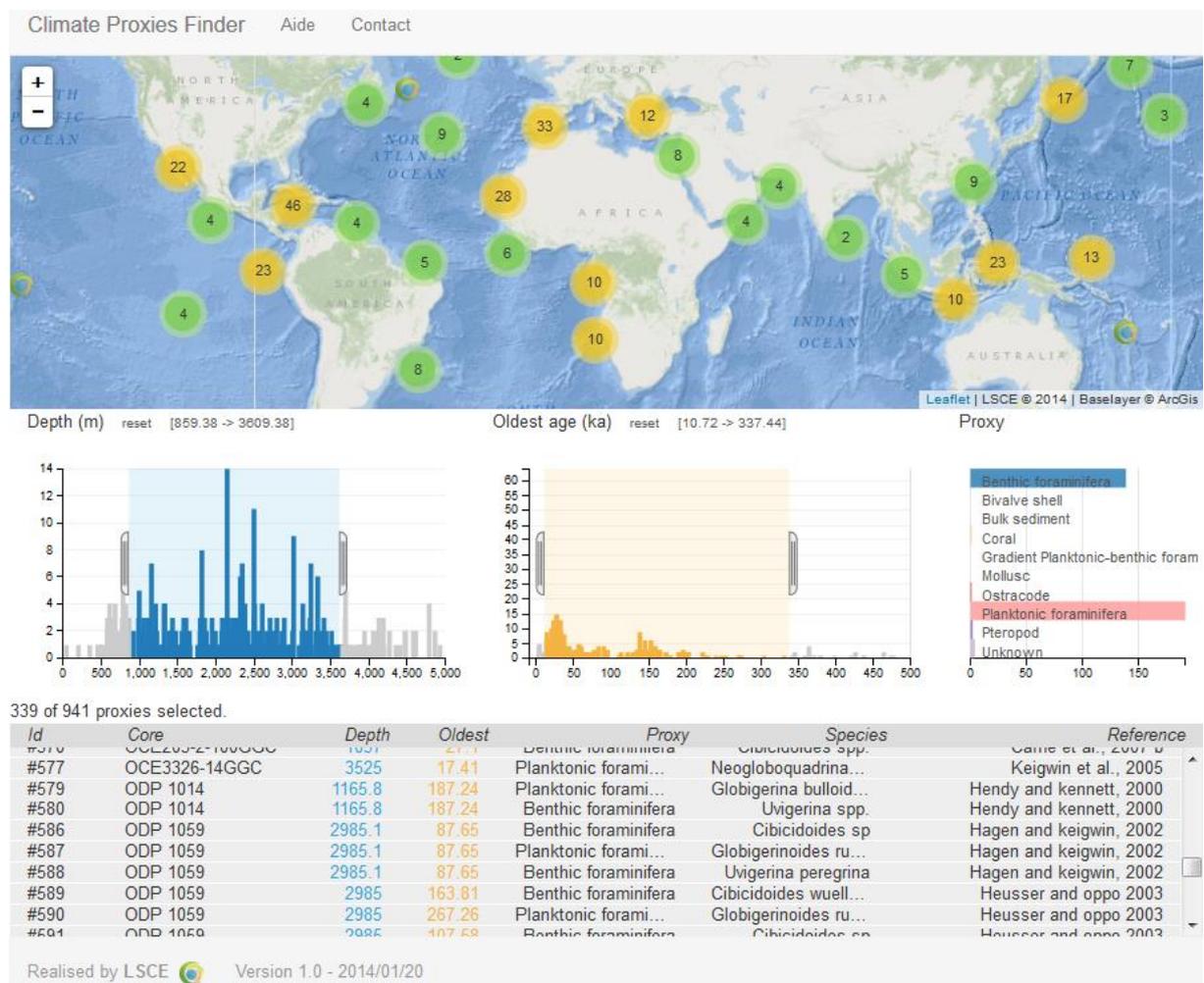


Figure 1 : Prototype of the data browsing feature of the online platform based on compiled marine $\delta^{18}\text{O}$ records. Numbers on the map correspond to clusters of records, with density-based colours. Note that the density of records displayed on the map is dynamically linked to parameters chosen by the user (water depth of the core site, time interval spanned by the record, group and/or species of foraminifera used for analysis).

The prolongation of this contract (6 months of post-doc until March 2015) allowed: (i) the finalization of the database with the integration of new records, including deuterium, deuterium-excess, ^{17}O and ^{17}O -excess records (ii) the control of data quality and adjustments for compatibility with the online portal; (ii) the finalization of manuscript submitted to *Climate of the Past*; (iii) the ongoing construction of the Web platform for data browsing, online visualization and downloading.

Presentation and publications associated to this project:

This work was presented at two international meetings:

- PMIP workshop on oceans, December 2013, Corvallis, OR, USA. *Water Isotope Database: Present and past archives in a new online open-access library.*
- EGU general assembly 2014, Vienna, Austria. EGU2014-7396, *Stable Isotope Database: present and past archives.* Session IG7/CL6.14/SSP1.3, with companion Poster.

Publication in progress: T. Bolliet, Patrick Brockmann, Valérie Masson-Delmotte, Franck Bassinot, Valérie Daux, Dominique Genty, Amaelle Landais, Marlène Lavrieux, Elisabeth Michel, Pablo Ortega, Camille Risi, Didier M. Roche, Françoise Vimeux, Claire Waelbroeck : *An interactive tool for navigation within a database of water and carbon stable isotope records from natural archives.* Submitted to *Climate of the Past*.

Ongoing work was additionally presented to the L-IPSL scientific committee (February 2014), and to the WP5 working group every three months, for review and feedbacks.