



Statistical approaches and tools for IntCal20

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The construction of the new IntCal20 calibration curve was undertaken using a number of new statistical approaches (Heaton et al. 2020), when compared to previous versions. This was partly due to the nature of some of the new datasets; partly to improve the robustness of the curve; and partly to address particular aspects of radiocarbon within the Earth System such as reservoir effects, incorporation of geological carbon in speleothems, and the uncertainties associated with different timescales. Here the main approaches taken are summarised with a perspective on their strengths and potential weaknesses.

In particular, the high-resolution extensions to the Hulu speleothem radiocarbon record (Cheng et al. 2018) allow it to be used to anchor the chronology for other key records (Suigetsu, Cariaco, and the Pakistan and Iberian Margins), providing a coherence in the timescale not possible before. Further, for the first time, we incorporate time varying marine reservoir ages, constrained by the Hamburg Large Scale Geostrophic Ocean General Circulation Model (LSG OGCM) (Butzin et al. 2020). In addition, work on the relationship to the Greenland ice core timescales (Adolphi et al. 2018) enables us to make direct comparison between radiocarbon dated records and the ice core timescale and here we report on tools to assist with this.

Along with the update to the calibration curve itself, the associated tools for calibration, age-depth modelling and Bayesian modelling have also been updated to make best use of the new resolution and characteristics of the curve. Here we summarise updates to Bacon, Calib and OxCal.

Heaton, T.J. et al (2020) The IntCal20 approach to radiocarbon calibration curve construction: A new methodology using Bayesian splines and errors-in-variables Radiocarbon: in review.

Cheng, H. et al. (2018) Atmospheric $^{14}\text{C}/^{12}\text{C}$ changes during the last glacial period from Hulu Cave. *Science*, 362(6420), pp.1293-1297. doi:10.1126/science.aau0747

Adolphi, F. et al. (2018) Connecting the Greenland ice-core and U/Th timescales via cosmogenic radionuclides: Testing the synchronicity of Dansgaard-Oeschger events. *Climate of the Past*, 14, pp.1755-1781. doi:10.5194/cp-2018-85

Butzin, M. et al. (2020) A short note on marine reservoir age simulations used in IntCal20. Radiocarbon: in press.