

# Improved High-Resolution Global and Regionalized Isoscapes of $\delta^{18}\text{O}$ , $\delta^2\text{H}$ , and $d$ -Excess in Precipitation

Stefan Terzer-Wassmuth<sup>1</sup>, Leonard Wassenaar<sup>1</sup>, Jeff Welker<sup>2</sup>, and Luis Araguás<sup>1</sup>

<sup>1</sup>International Atomic Energy Agency Department of Nuclear Sciences and Applications

<sup>2</sup>University of Alaska Anchorage

October 31, 2020

## Abstract

Patterns of  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  in Earth's precipitation provide essential scientific data for use in hydrological, climatological, ecological and forensic research. Insufficient global spatial data coverage promulgated the use of gridded datasets employing geostatistical techniques (isoscapes) for spatiotemporally coherent isotope predictions. Cluster-based isoscape regionalization combines the advantages of local or regional prediction calibrations into a global framework. Here we present a revision of a Regionalized Cluster-Based Water Isotope Prediction model (RCWIP2) incorporating new isotope data having extensive spatial coverage and a wider array of predictor variables combined with high-resolution gridded climatic data. We introduced coupling of  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  (e.g.  $d$ -excess constrained) in the model predictions to prevent runaway isoscapes when each isotope is modelled separately. We validated RCWIP2 isoscape performance by cross-checking observed versus modelled  $d$ -excess values. We improved model error quantification by adopting full uncertainty propagation in all calculations. RCWIP2 improved the RMSE over previous isoscape models by ca. 0.6 for  $\delta^2\text{H}$  with an uncertainty  $<1.0$  for  $\delta^{18}\text{O}$  and  $<8$   $\delta^2\text{H}$  for most regions of the world. The improved RCWIP2 isoscape grids and maps (season, monthly, annual, regional) are available for download at <https://isotopehydrologyneetwork.iaea.org>.

## Hosted file

RCWIP2 paper 2020-10-30\_upload.pdf available at <https://authorea.com/users/287069/articles/490033-improved-high-resolution-global-and-regionalized-isoscapes-of-%CE%B418o-%CE%B42h-and-d-excess-in-precipitation>

## Hosted file

rcwip2 paper table1.pdf available at <https://authorea.com/users/287069/articles/490033-improved-high-resolution-global-and-regionalized-isoscapes-of-%CE%B418o-%CE%B42h-and-d-excess-in-precipitation>









