

Workflow for creating virtual datasets and testing reconstruction approaches

1. Input

("True" SST and $\delta^{18}\text{O}_w$ values in time domain)

All virtual cases

Cases 30-33

Cases 1-29

Cases 30-33

Cases 1-29

artificial
growth rate

measured
SST

artificial
SST

measured
SSS

artificial
 $\delta^{18}\text{O}_w$

+ SST
noise

salinity
mass
balance

+ $\delta^{18}\text{O}_w$
noise

modelled
 $\delta^{18}\text{O}_w$

Subsampling based on artificial sampling resolutions

2. "True" SST and $\delta^{18}\text{O}_w$ values in sampling domain

Convert SST and $\delta^{18}\text{O}_w$ data to carbonate $\delta^{18}\text{O}_c$ and Δ_{47} values based on empirical relationships in *Kim and O'Neil (1997)* and *Bernasconi et al. (2018)* and add analytical noise to simulate measurement

3. Artificial $\delta^{18}\text{O}_c$ and Δ_{47} records in sampling domain

5. Accuracy and precision of reconstructions of MAT, SST seasonality, mean annual $\delta^{18}\text{O}_w$ and $\delta^{18}\text{O}_w$ seasonality

Compare reconstructed SST and $\delta^{18}\text{O}_w$ data with "true" values to calculate accuracy and precision for all cases and all reconstruction approaches

4. Reconstructed SST and $\delta^{18}\text{O}_w$ values in time domain

Apply reconstruction approaches on artificial datasets and group result in monthly time bins

$\delta^{18}\text{O}_c$ -based
reconstruction

$\delta^{18}\text{O}_c$

Δ_{47} -based
reconstruction

smoothing

binning

optimization