Algorithm for testing Reconstruction Prediction Intervals

1. Load chronology rwi and target data
2. Bootstrap chronology rwi values, building 1000 replicate chronologies
3. Build mean-value chronologies from the replicate chronologies
4. Measure confidence interval of chronology by sorting mean value chronology data at each year and selecting corresponding 5th and 95th percentile values (90% chronology confidence intervals)
5. Find interval of proxy-target overlap
6. Set aside 10 years of proxy-target overlap for independent testing of the prediction intervals
7. Perform reconstruction calibration by split calibration-verification
   1. Calibrate reconstruction
      1. Capture regression coefficients in calibration interval
      2. Capture regression coefficients for upper and lower chronology confidence intervals to capture “regression error”
   2. Use coefficients to build reconstruction into verification interval
      1. Measure the difference between target and reconstruction values in the verification interval
8. Repeat step 7 for all possible continuous calibration-verification intervals
9. Build prediction intervals in independent set-aside interval
   1. Build prediction intervals based on empirical 90th percentile error
   2. Build prediction intervals based on median error + (standard deviation of error x z-score corresponding to 90th percentile)
   3. Build prediction intervals based on 90th percentile regression error + empirical reconstruction error (7.c.i. above)
   4. Build prediction intervals based on 90th percentile regression error + theoretical reconstruction error (7.c.ii. above)
10. Test prediction intervals in independent set-aside interval
    1. Measure the number of climate target values captured by each set of prediction intervals
    2. Save the captured total divided by the length of the set aside interval (e.g. 9/10 is the expected capture for 90% prediction intervals)
11. Repeat steps 6-10 for all possible set-aside intervals
12. Repeat steps 2-11 with MEboot method
13. Repeat steps 2-12 with 50% chronology confidence intervals and reconstruction predition intervals
14. Build 100 synthetic chronologies and repeat steps 1-13 for all
    1. Build 1,000,000 Ebisuzaki surrogates of the climate target in the interval of hronology-target overlap
       1. Select the surrogate with the correlation most similar to the correlation between the chronology and target
       2. This time series serves as a synthetic mean-value chronology – a basis for building synthetic ring-width indices
    2. Build 50 random length Ebisuzaki surrogates as ring-width indices
       1. A ring-width index is first modelled by 1000 Ebisuzaki surrogates
       2. The surrogates are rank-ordered by correlation to the synthetic mean-value chronology
       3. A synthetic ring-width index time series is randomly selected from the subset of 95th- to 99th-percentile surrogates

\*Note that prediction intervals produced in step 9a and b are identical regardless of bootstrapping methods.