Figure S1: Ensemble histogram of forcing metrics from LENS with explicit TWS (grey bars) and accumulating residuals of the water balance (white bars) with the satellite observations from GRACE/AIRS/GPCP/CERES (solid black line) and the alternate observations from GRACE and ERA-Interim (dashed black line), averaged across land regions within different latitude bands.
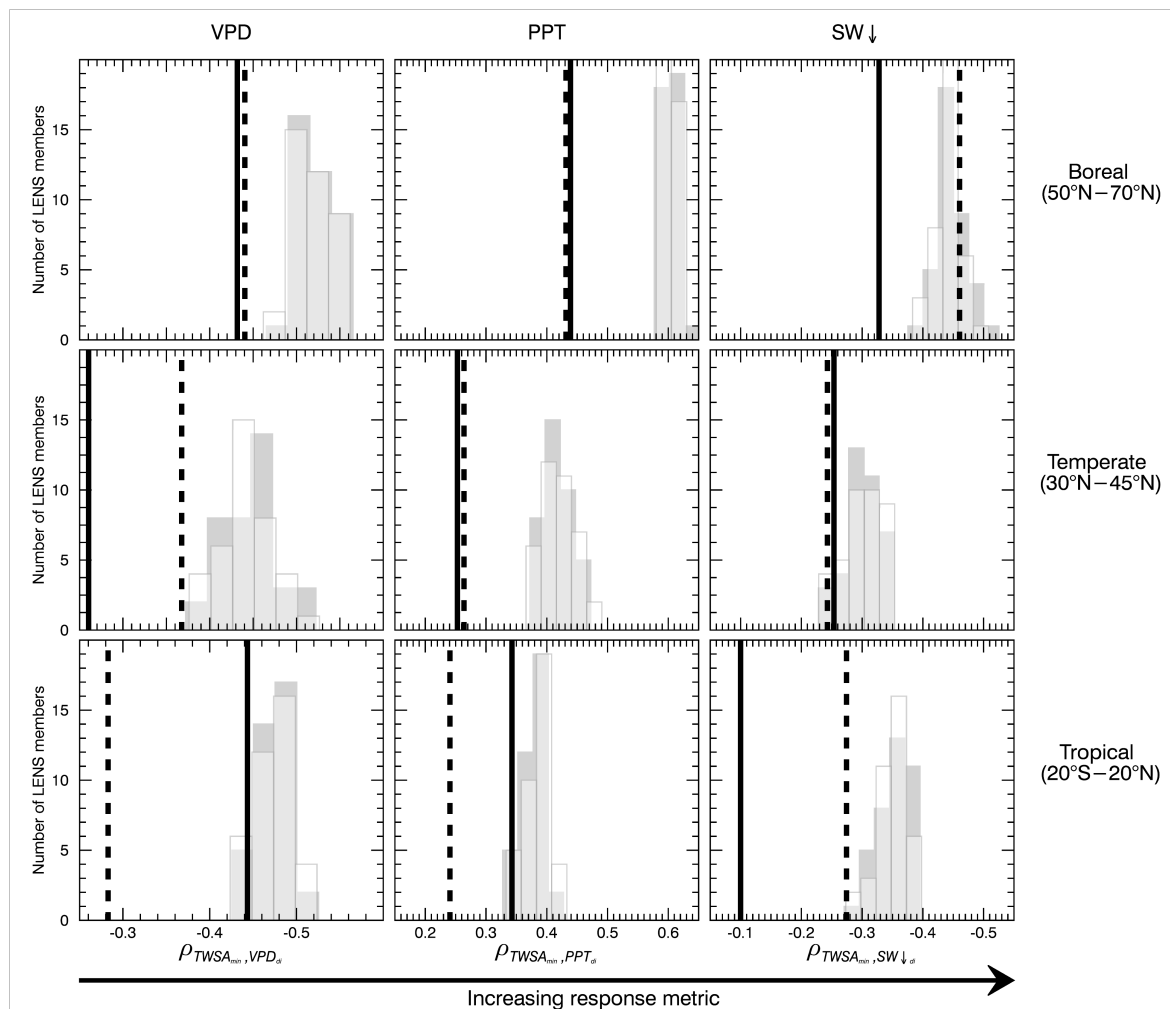
Figure S2: Ensemble histogram of response metrics from LENS with explicit TWS (grey bars) and accumulating residuals of the water balance (white bars) with the satellite observations from GRACE/AIRS/GPCP/CERES (solid black line) and the alternate observations from GRACE and ERA-Interim (dashed black line), averaged across land regions within different latitude bands.
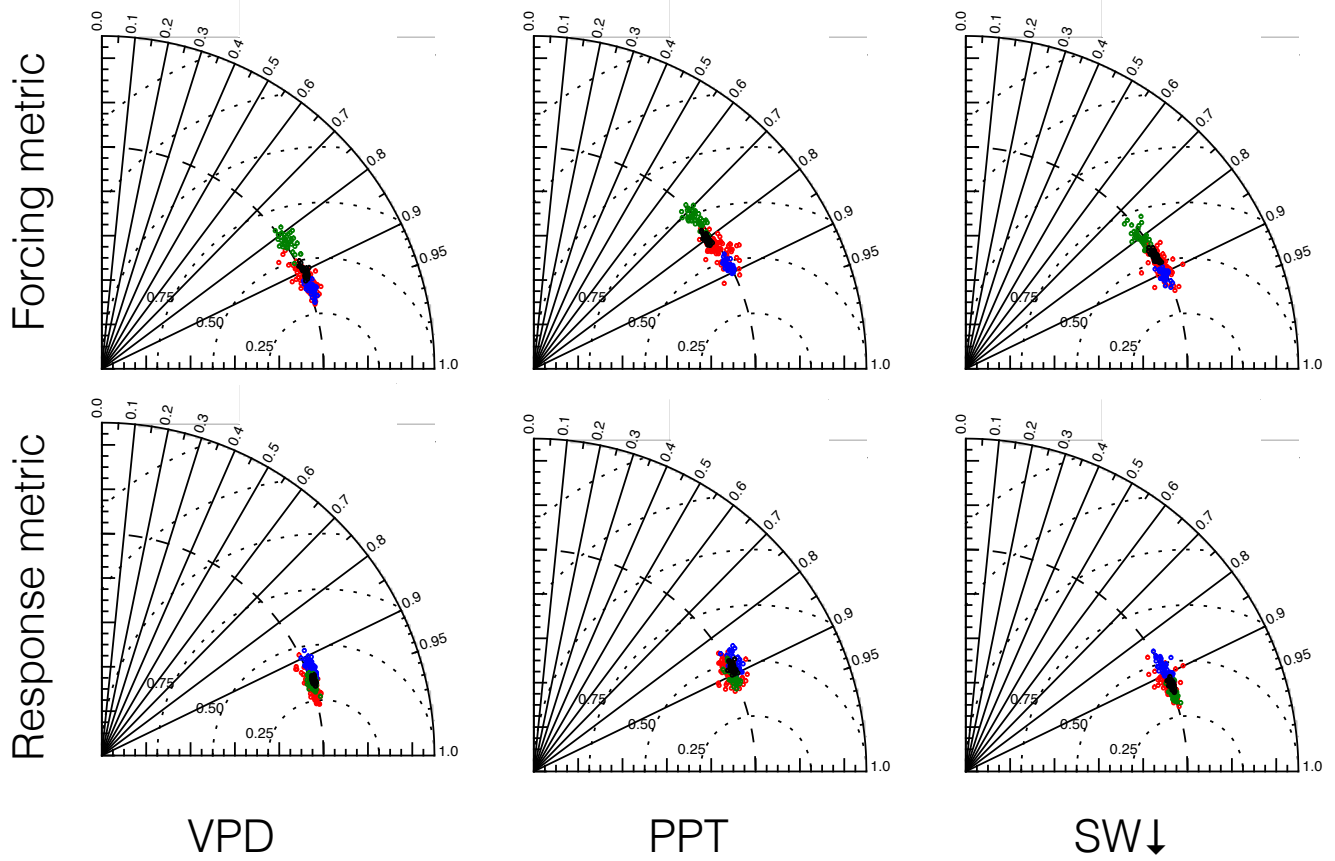
Figure S3: Comparison of explicit total water storage output with the accumulated residuals of precipitation, evapotranspiration, and total runoff (surface and subsurface) for LENS.