

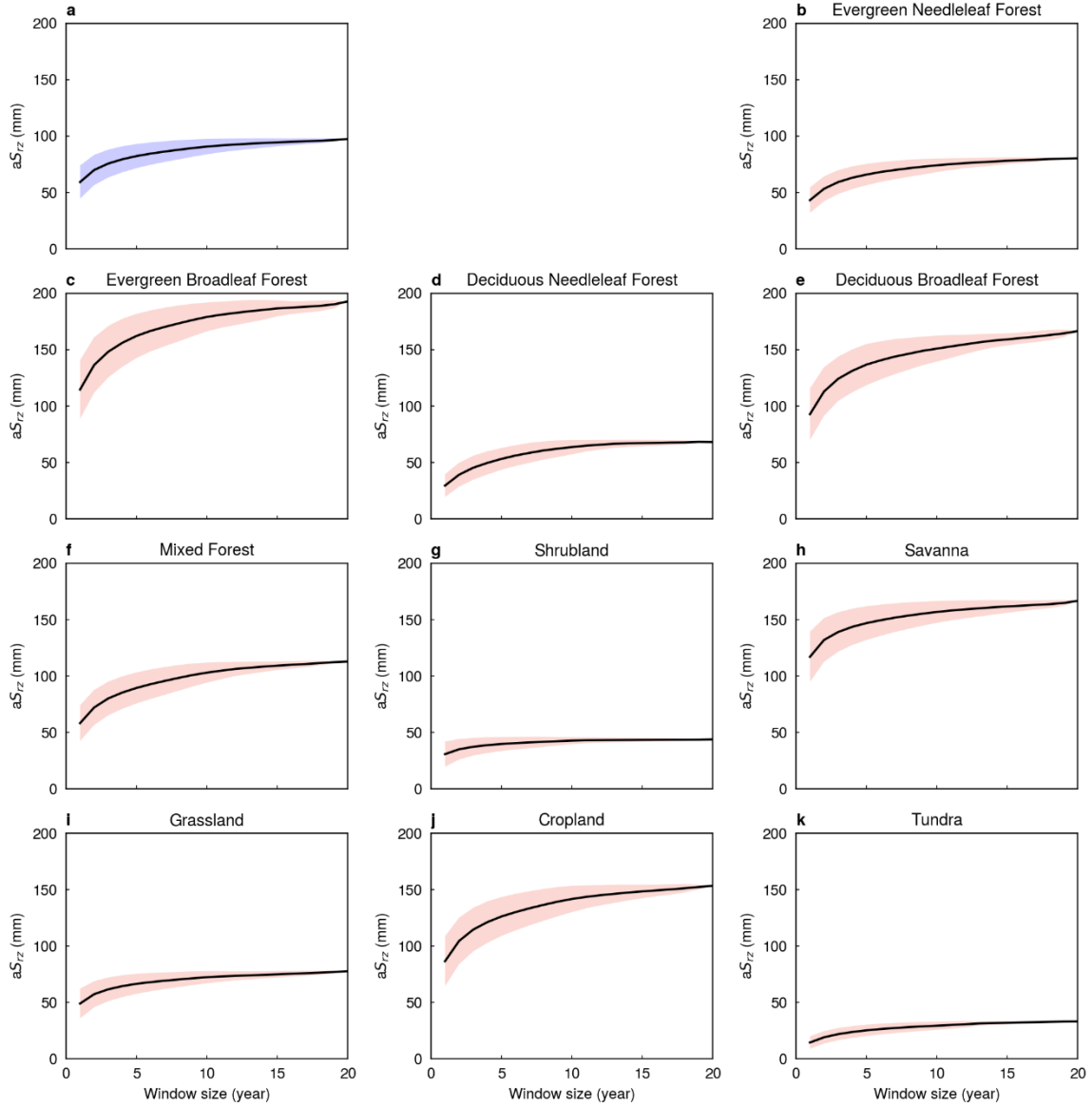


Figure S1. Sensitivity of climatological mean aS_{rz} to the length of the reference window used to define the local storage minimum. For each window length from 1 to 20 years, aS_{rz} was recalculated using all possible moving windows within 2001 to 2020. For example, a 10-year window yields 11 estimates, corresponding to 2001 to 2010, 2002 to 2011, ..., and 2011 to 2020. For each window length, the black line shows the mean climatological aS_{rz} across all possible windows, and shading shows the 25th to 75th percentile range across these window choices. Panel a shows the global mean, and panels b to k show means for individual vegetation classes.

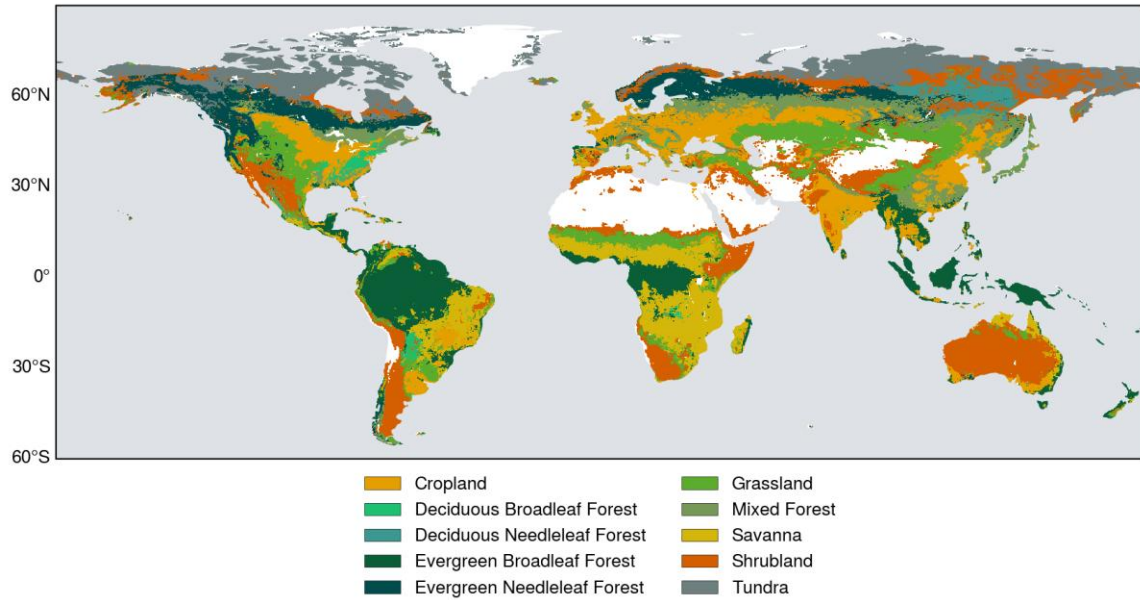


Figure S2. Dominant vegetation classes used in the analysis. Vegetation classes are based on the MODIS modified IGBP land cover classification. The original 30 arc-second product was aggregated to the 0.25° analysis grid by assigning each grid cell the dominant vegetation class. Greenland and Antarctica are excluded from the analysis domain.

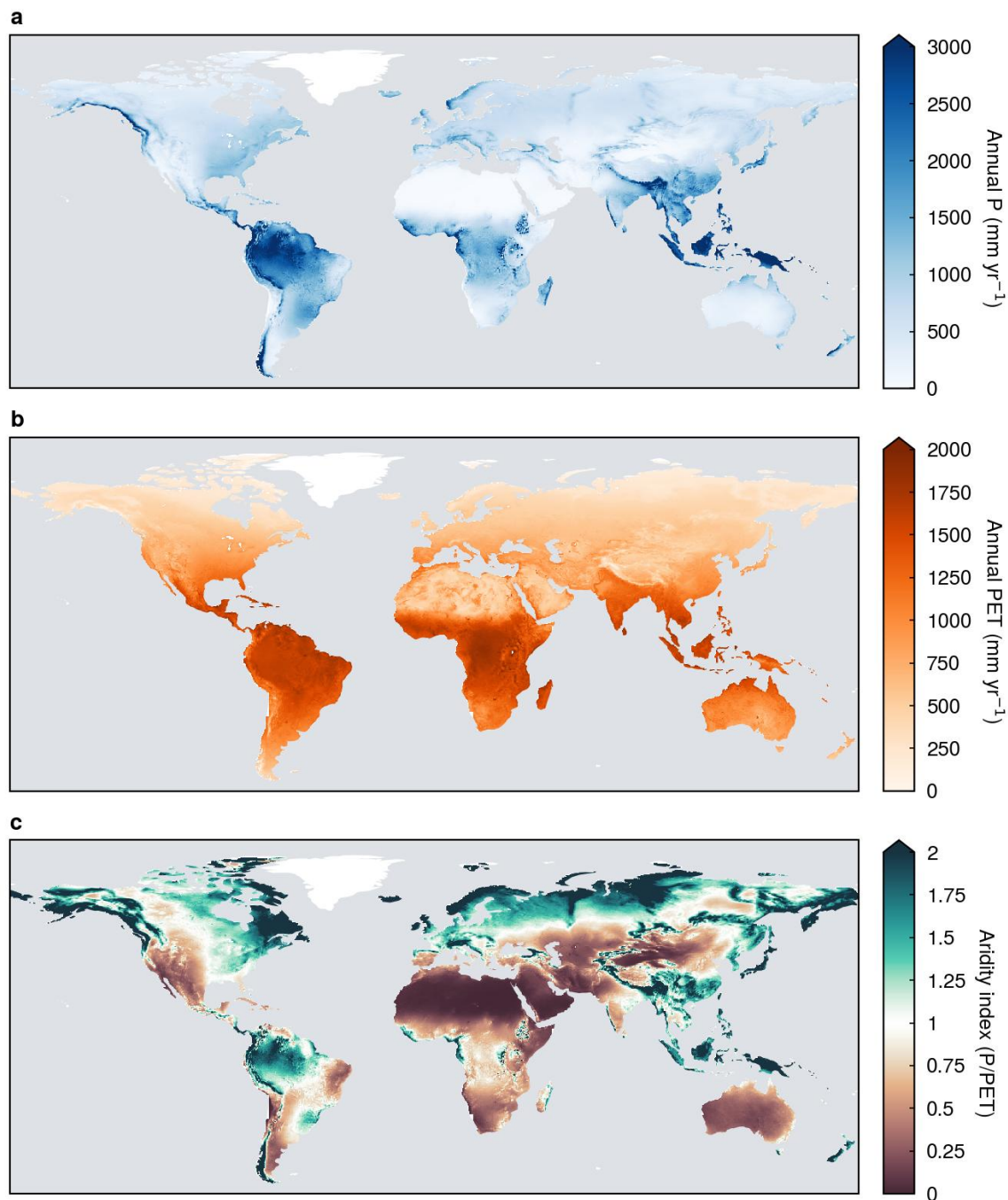


Figure S3. Climatological hydroclimatic fields used to define aridity and climatic water balance. (a) Mean annual precipitation P , (b) mean annual potential evapotranspiration (PET), and (c) aridity index, defined as P/PET , over 2001 to 2020.

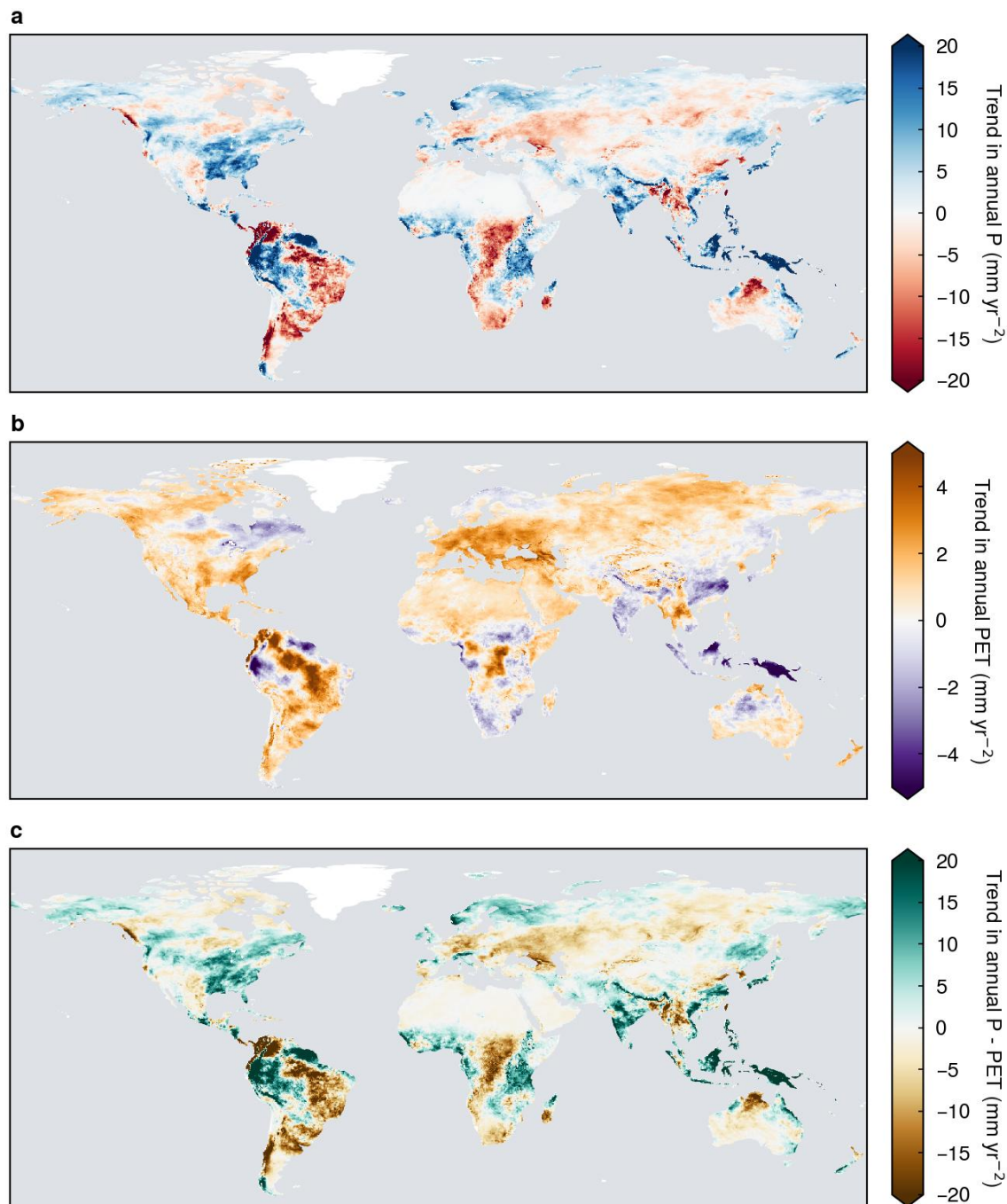


Figure S4. Trends in hydroclimatic drivers and climatic water balance over 2001 to 2020. (a) Trend in annual precipitation P, (b) trend in annual potential evapotranspiration (PET), and (c) trend in annual climatic water balance, defined as P-PET. Trends are estimated at each grid cell using the Theil-Sen slope on annual values. Positive values indicate increasing P, PET, or P-PET, respectively, and negative values indicate decreasing values.

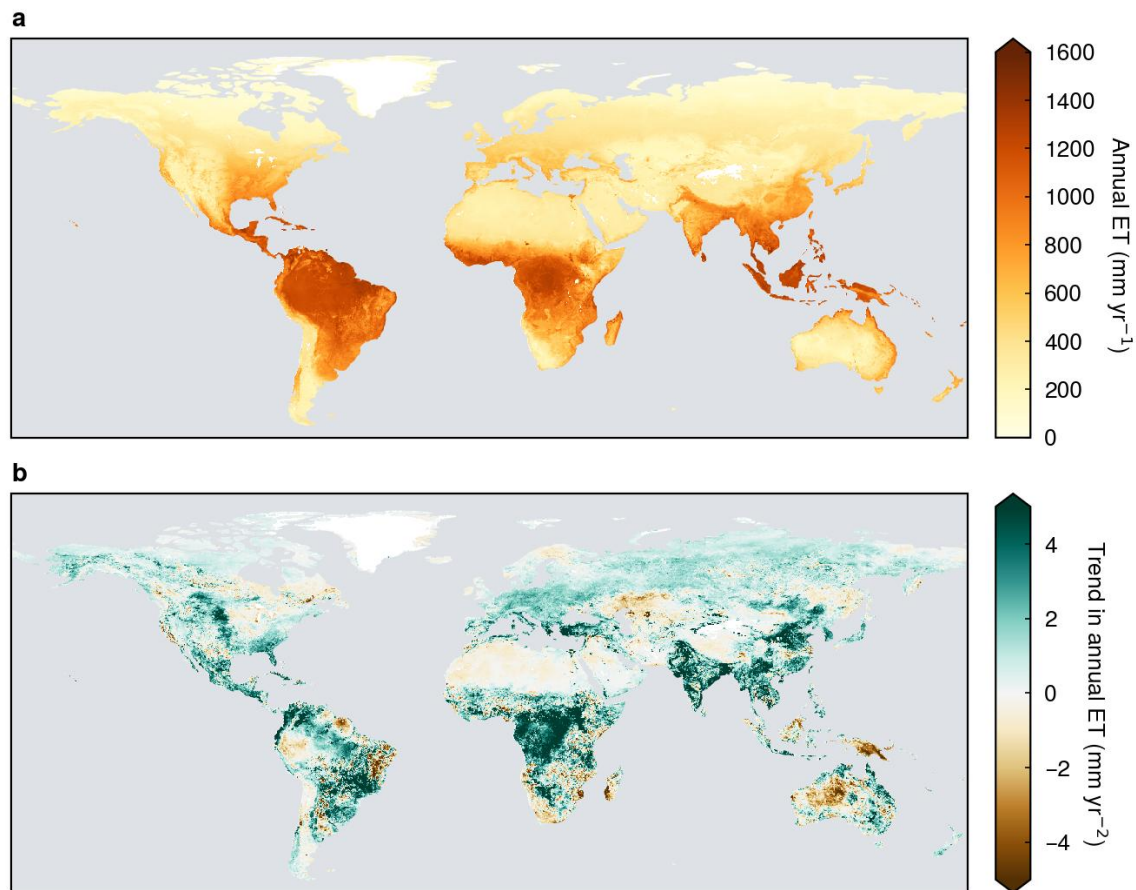


Figure S5. Mean evapotranspiration and trends in evapotranspiration over 2001 to 2020. (a) Climatological mean annual evapotranspiration (ET) over 2001 to 2020. (b) Theil-Sen trend in annual ET over the same period. ET is taken from FLUXCOM X-BASE and aggregated to the 0.25° analysis grid. Positive values in panel b indicate increasing annual ET, and negative values indicate decreasing annual ET.

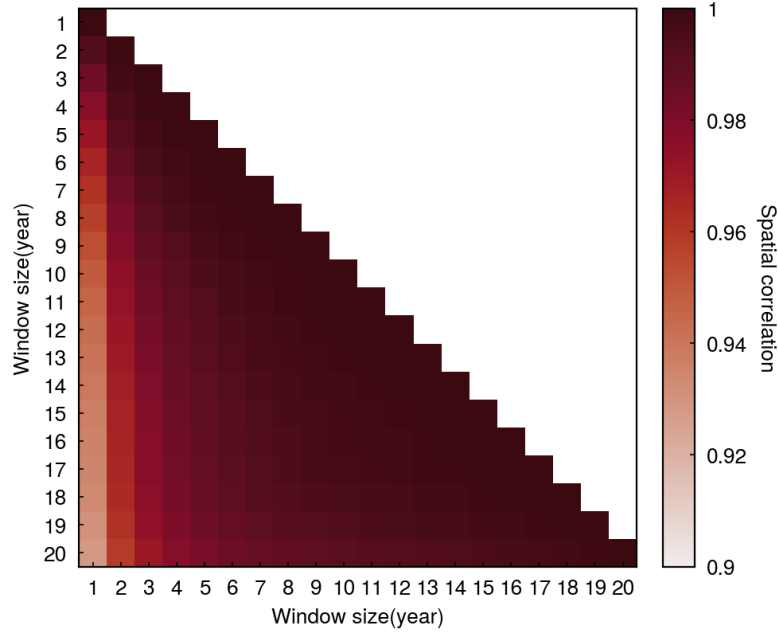


Figure S6. Spatial consistency of climatological mean aS_{rz} maps across reference window lengths. For each reference window size w , aS_{rz} was recalculated for all possible moving windows of size w within 2001 to 2020, and the resulting climatological mean aS_{rz} maps were averaged across window choices. Each cell shows the spatial Pearson correlation between the averaged climatological aS_{rz} maps obtained from the row and column window sizes.