



**Figure 3. Hydraulic connectivity, impulse-response dynamics, and statistical dependencies among groundwater and surface water sites at Waycross and Jones Island. (A)** Daily mean water levels from July 2017 to July 2020 for groundwater wells (Waycross 27G003, Jones Island 27E004) and Jones Island swamp surface water. Groundwater sites show highly synchronous fluctuations. Surface water displays distinct temporal dynamics, suggesting differing hydrologic processes. Inset map (upper right) shows locations of USGS groundwater wells 27G003 (Waycross) and 27E004 (Jones Island) within the Okefenokee region along the Georgia–Florida border. **(B)** Summary statistics highlighting linear correlation (Pearson’s  $r$ ) and similarity in temporal dynamics (Dynamic Time Warping; DTW). Granger causality analysis reveals that groundwater fluctuations at Waycross significantly predict groundwater levels at Jones Island (Waycross→Jones GW, lag = 1 day;  $F = 103.1$ ,  $p < 0.001$ ), supporting a directional hydraulic gradient. Mutual information (MI) quantifies nonlinear dependence, with higher values indicating stronger shared information between groundwater wells (Waycross–Jones GW MI = 2.33) and comparatively lower shared information with surface water (Waycross–Jones SW MI = 1.15; Jones GW–Jones SW MI = 1.16). **(C)** Groundwater impulse-response function determined via deconvolution (open circles), fitted with a one-dimensional vertical diffusivity type curve (blue line). The optimal diffusivity match (red circle) yields a diffusivity of approximately 291 m<sup>2</sup>/d, indicative of rapid hydraulic responses and strong aquifer connectivity.

### 3.2 Hydraulic connectivity and response analysis