**Porewater exchange drives the dissolved silicate export across the wetland‐estuarine continuum**

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**Introduction**

This file includes one text (Text S1), three Figures (Fig. S1, Fig. S2, Fig. S3 and Fig. S4) and two Tables (Table S1 and Table S2).

**Text S1** The methods of nutrient measurements

Water samples for nutrient measurements were filtrated immediately in the field with a GF/F membrane (0.7 μm) and stored at 4°C until analysis. Nitrate (NO3-N), nitrite (NO2-N), ammonium (NH4-N), dissolved reactive phosphorus (DRP) and dissolved silicate (DSi) were measured using segmented flow colorimetry (San++ analyzer, Germany). NH4-N, NO3-N and NO2-N were analyzed using indophenol blue photometric spectrophotometry, N-(1-naphthyl)-ethylenediamine(C12H14N2) spectrophotometry and reduction (cadmium)-N-(1-naphthyl)-C12H14N2) spectrophotometry. DRP was analyzed using phosphorus molybdenum blue spectrophotometry. DSi was analyzed using the molybdenum blue colorimetric method. Dissolved inorganic nitrogen (DIN) was the sum of NO3-N, NO2-N and NH4-N. The precision was determined by repeated determination of 10% of the samples and the relative error was 3-5%.

**Text S2** Methods of porewater exchange rate (PEX) calculation

Here is a companion research with our previous study, and more detailed information was shown in Wang et al (2022). The method of PEX calculation was presented briefly with the equation (1)-(3):

$J=-φ×(\frac{(h\_{up}-h\_{low})}{△L}$+$\frac{ε(c\_{up}-c\_{low})}{2}$*)* (1)

Where *J* is the hydraulic gradient [-]; *hup* and *hlow*, and *cup* and *clow* represent the freshwater-equivalent hydraulic head [L] and pore water salinity [M L-1] at the upper and lower wells; *ΔL* is the distance between the upper and lower wells [L]; *φ* is the ratio of the dynamic viscosity of freshwater to seawater [L]; *ε* is a constant used to describe the linear relationship between density and salinity. The vertical PEX rate was calculated with:

*qn=KV*×*J* (2)

Where *KV* is the vertical hydraulic conductivity [L T-1] obtained from the in-situ falling head method. *qn* is the PEX rate [L T-1]. If *qn*>0, the groundwater flows vertically upward through the sediments; if *qn*<0, then seawater infiltrates into the sediments. The vertical fluxes (*F*) of nutrients were estimated with:

$F=\sum\_{i=0}^{n}Ci×q\_{ni}$ (3)

Where *Ci* is the hourly nutrient concentration of surface water (*qn*<0) or groundwater (*qn*>0) at the *i*th sampling campaign. Positive and negative values represent groundwater discharge (efflux) and surface water infiltration (influx), respectively.



**Fig. S1** Water depth and hourly porewater exchange rates in the mangroves (orange circles) and salt marshes (green circles) during neap tides (11th-12th October 2020) and spring tides (20th-21st October 2020).



**Fig. S2**. Schematic diagram of pair-wells device for monitoring surface water-groundwater exchange. The upper and lower wells were buried in the sediment depths of 0-10 cm and 60-70 cm, respectively.



Note: The data of DRP were from Wang et al. (2022).

**Fig. S3** Tidal variations of water depth, DO, and concentrations of nitrogen and phosphorus in surface water (black circles) and groundwater (red circles) in the mangrove and salt marsh during neap (11th-12th, October) and spring (20th-21st, October) tides. Most of DOP in groundwater were under the detectable level.



**Fig. S4** The relationship between DSi concentrations and pH values in surface water (a) and groundwater (b) in the mangroves and salt marshes during neap tides (11th-12th October 2020) and spring tides (20th-21st October 2020).



**Fig. S5** The relationship between DSi concentrations and temperature in surface water (a) and groundwater (b) in the mangroves and salt marshes during neap tides (11th-12th October 2020) and spring tides (20th-21st October 2020).

**Table S1** The statistical DSi concentrations (Mean±SD) at high and low tides in surface water and groundwater in the mangroves (M) and salt marshes (S) during neap tides (11th-12th October 2020) and spring tides (20th-21st October 2020).

|  |  |
| --- | --- |
| Water types | DSi (μmol L-1) |
| Neap tides | Spring tides |
| M | S | M | S |
| Low tide 1 | 163±11 | 162±17 | 150±21 | 132±12 |
| High tide 1  | 141±6 | 149±14 | 118±8 | 119±8 |
| Low tide 2  | 152±11 | 138±19 | 143±9 | 128±11 |
| High tide 2  | 143±9 | 145±7 | 119±8 | 122±3 |
| Groundwater | 277±132 | 221±48 | 458±22 | 147±8 |

**Table S2** The concentrations of DSi in front of dam and behind dam in Zhangjiang river in 2020 and 2022.

|  |  |  |
| --- | --- | --- |
| Date | In front of the dam | Behind the dam |
| 2020.05.27 | 295±12 | 269±31 |
| 2020.12.25 | 310±1 | 204±77 |
| 2022.01.05 | 328±3 | 247±28 |