Extended Data

Coastal Aquifers as Major Players in Shaping Ocean Chemistry through Solute Fluxes

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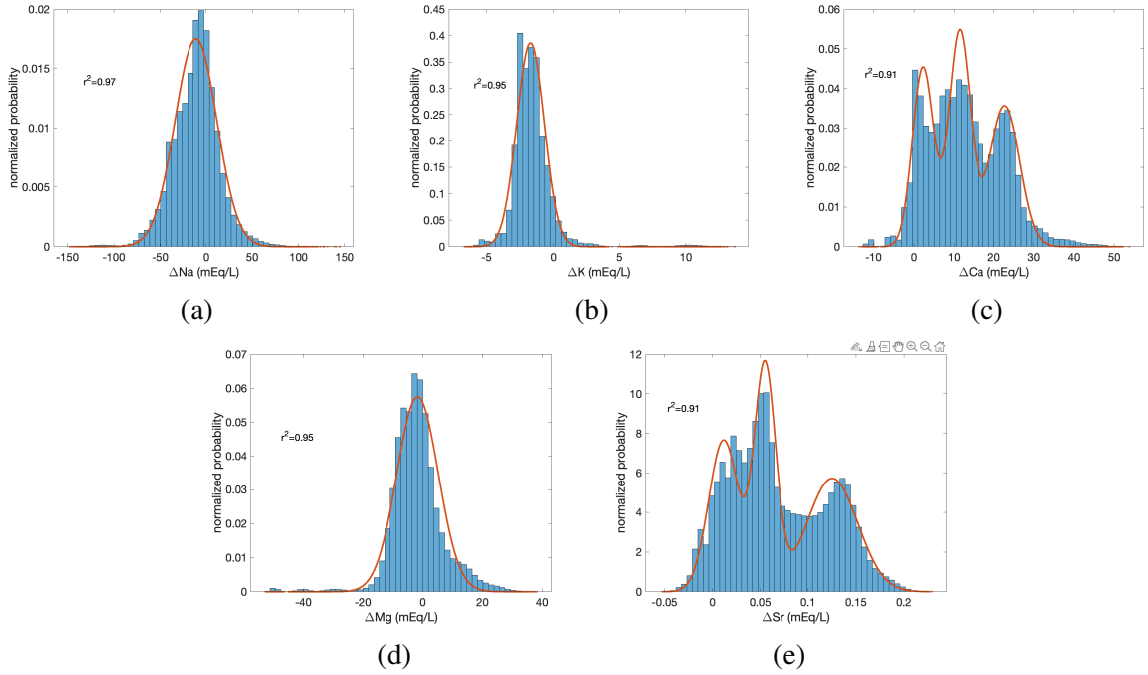

Fig. 1: Distribution of the long-term SGD end-members and fitted normal distributions. (a) ΔNa^{+}, (b) ΔK^{+}, (c) ΔCa^{2+}, (d) ΔMg^{2+}, (e) ΔSr^{2+}. The dataset was filtered based on chloride concentrations (Cl^{-}) greater than 54 mEq/L.

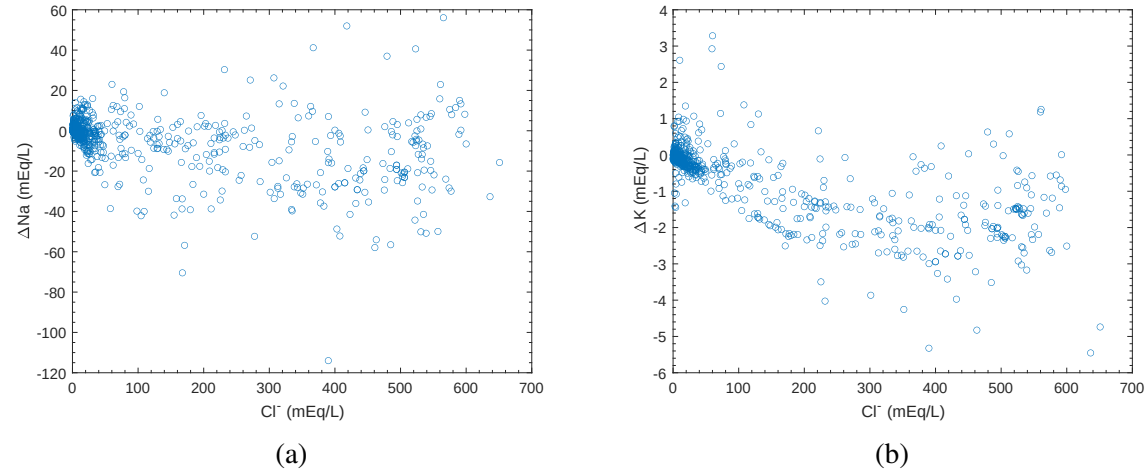

Fig. 2: Relationships between chloride concentration and the depletion in (a) $Na^{+}$and (b) K^{+}. For potassium, groundwater with Cl^{-}<200 mEq/L follows a mixing line with freshwater. Therefore, for these samples, the depletion was calculated after correcting it to the fraction of groundwater with 200 mEq/L Cl^{-}(i.e., multiplying the depletion by the dilution factor).

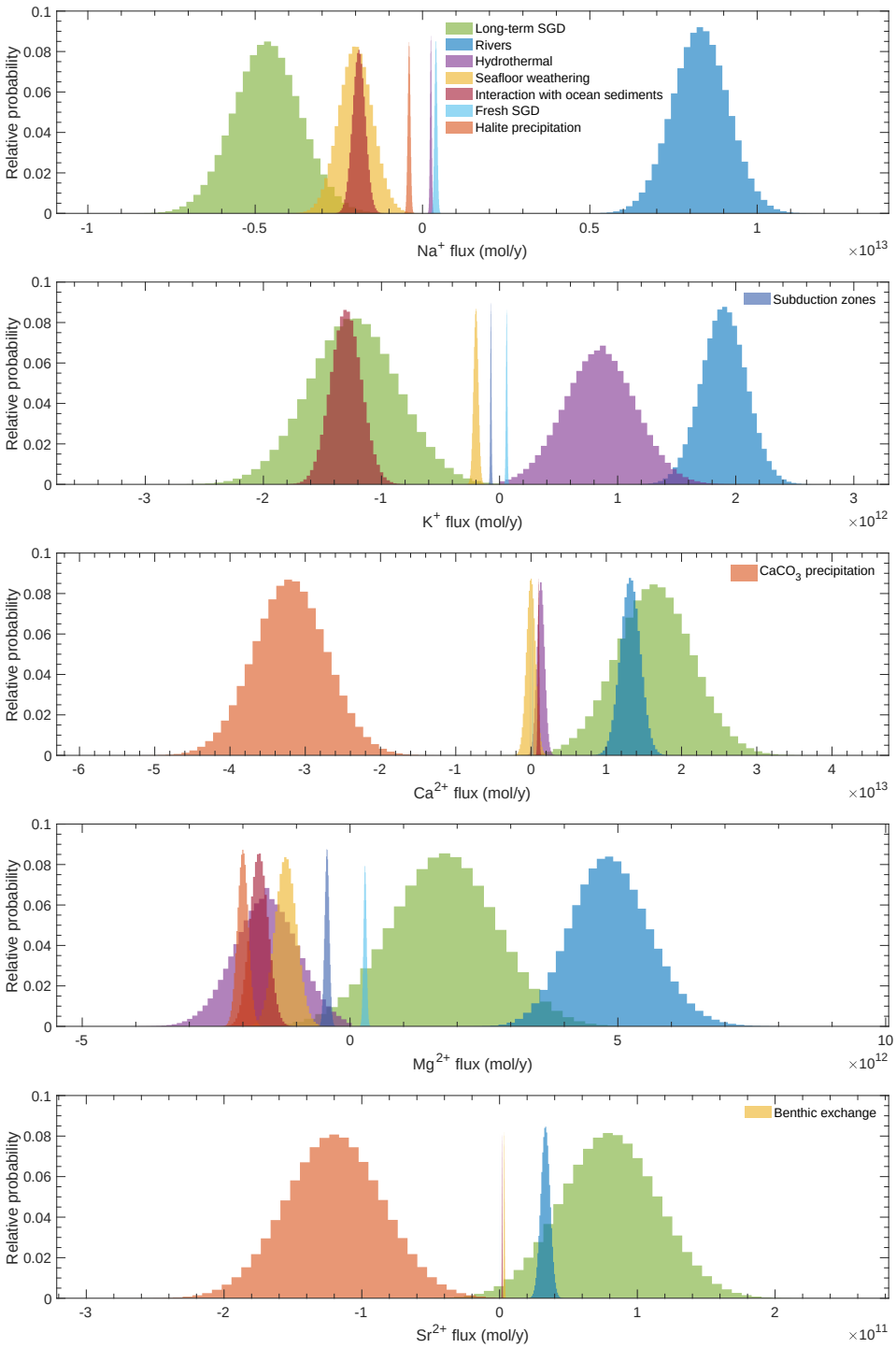

Fig. 3: Sources and sinks used as the model input for each one of the elements and calculated missing source/sink reflected as long-term SGD.

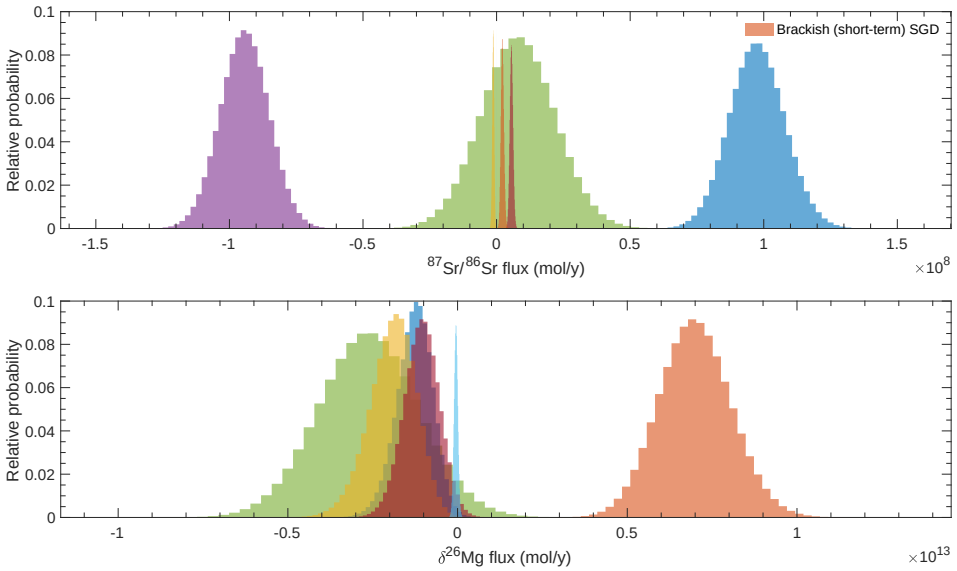

Fig. 4: Sources and sinks used as the model input for $^{87}Sr/^{86}Sr$ and $\delta^{26}Mg$. The flux of the isotopes is the ratio in the source/sink multiplied by the element's flux. The missing source/sink is considered to be the long-term SGD.

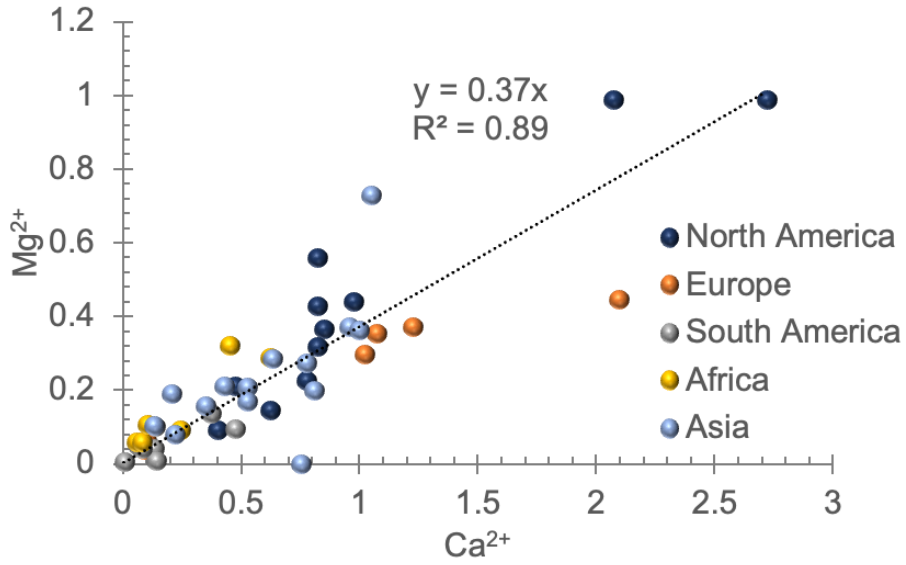

Fig. 5: Relationship between Ca^{2+} and Mg^{2+} concentrations (mg/L) in rivers.

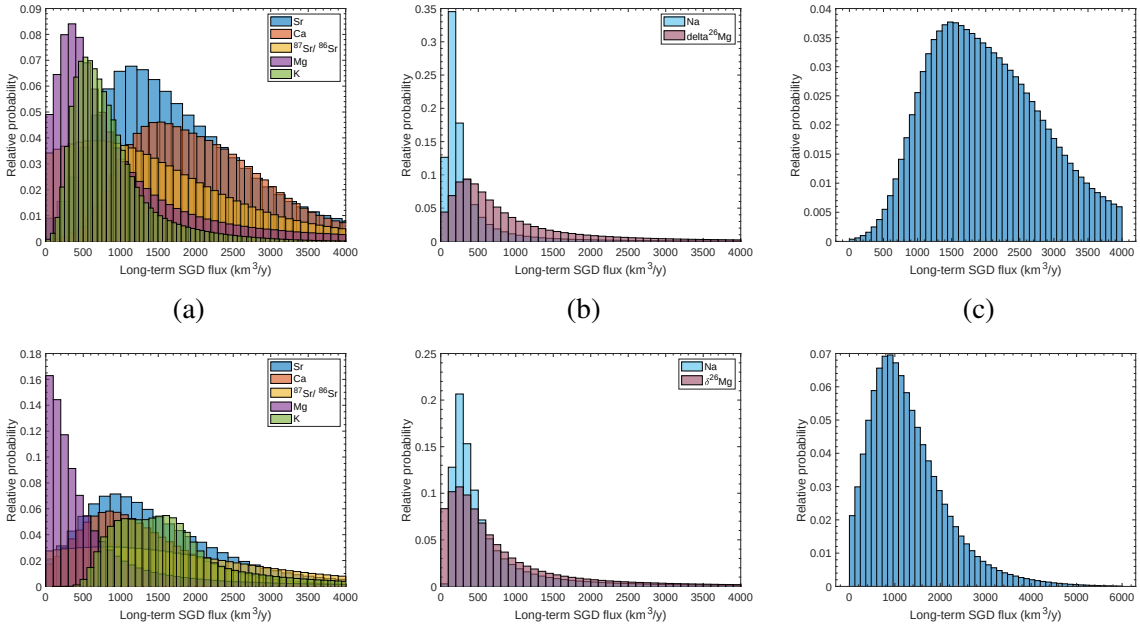

Fig. 6: Histograms of model output results showing the calculated long-term SGD. (a) and (b): Fluxes of individual elements according to each budget component. (c): The flux that is consistent with all different element and isotope budgets. (d) and (e): Fluxes for the scenario with a 1.5-fold increase in river and hydrothermal fluxes according to each budget component. (f): The flux that is consistent with all different element and isotope budgets for the 1.5 scenario.

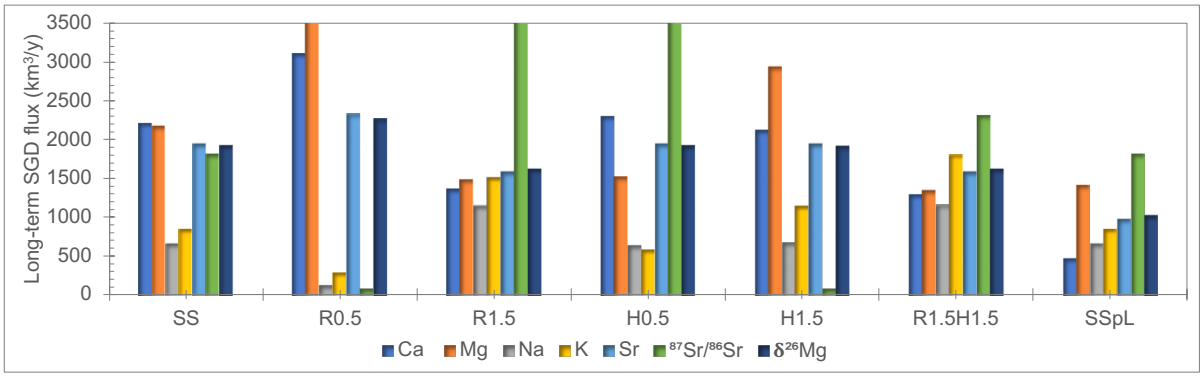

Fig. 7: Summary of the mean fluxes calculated according to the different elements in the different scenarios. The scenarios are as follows: SS - steady state, R0.5 - rivers at half of today's fluxes, R1.5 - rivers at 1.5 times today's fluxes, H0.5 and H1.5 - hydrothermal circulation in mid-ocean ridges at 0.5 and 1.5 times today's fluxes, respectively, R1.5H1.5 - rivers and hydrothermal circulation at 1.5 times today's fluxes, and SSpL - precipitation rate at 0.565 of the original run affecting Ca^{2+}, Mg^{2+}, and Sr^{2+} removal. For the flux obtained by the $^{87}Sr/^{86}Sr$ budget, we present the most abundant flux rather than the mean due to the long tail in its solution distribution.