$$[X]_{evaporite-corrected} = [X]_{rain-corrected} - \frac{[X]}{[Cl]}_{highest-Cl} * [Cl]_{rain-corrected}$$

This ensures that all chloride in the corrected sample is removed. The correction uses ionic ratios from the most concentrated water source, which acts as a proxy for the sediment imparting its signature. In this way, the correction does not affect samples which do not have high Cl (and hence do not have a large evaporite contribution), but does decrease the concentration of ions for those that do.

4 Results

Need to propagate Monte Carlo Uncertainty

results/tables yo

5 Discussion

Andermann et al, 2012

They also talk about a modelLook at response time, being inveresely proportional to hydraulic diffusivity. THey assume length scales of 0.5-5km, and typical values of time to be about 45 days.

They are looking at very large discharges, order 5000 m3/s

Also want the Maher and Chamberlain rate constant explanation compared to normal data

We begin with the following equations:

$$C = \frac{C_0}{1+D} + C_{eq} \cdot \frac{D}{1+D}$$

$$D = \frac{\tau \cdot D_w}{q}$$

$$D_w = \frac{L \cdot \phi}{T_{eq}}$$

$$L = q \cdot t$$

$$T_{eq} = \frac{C_{eq}}{R \cdot f}$$

$$R = \rho \cdot k \cdot A \cdot X$$

$$k = 3.1 \cdot 10^{-13} \cdot t^{-0.61}$$

— Step-by-Step Derivation

Step 1: Substitute Relationships into D_w and D

From Equation (3):

$$D_w = \frac{(q \cdot t) \cdot \phi}{\frac{C_{eq}}{R \cdot f}}$$

$$D_w = \frac{q \cdot t \cdot \phi \cdot R \cdot f}{C_{eq}}$$

Substituting D_w into Equation (2):

$$D = \frac{\tau \cdot \frac{q \cdot t \cdot \phi \cdot R \cdot f}{C_{eq}}}{q}$$

$$D = \frac{\tau \cdot t \cdot \phi \cdot R \cdot f}{C_{eq}}$$

—

Step 2: Expand R and Substitute k

From Equation (6):

$$R = \rho \cdot (3.1 \cdot 10^{-13} \cdot t^{-0.61} * 10^6) \cdot A \cdot X$$

Need to convert k from mol/m^2/yr to umol/m^2/yr

Substitute Equation (6) into D:

$$D = \frac{\tau \cdot t \cdot \phi \cdot \rho \cdot (3.1 \cdot 10^{-7} \cdot t^{-0.61}) \cdot A \cdot X \cdot f}{C_{eq}}$$

$$D = \frac{\tau \cdot \phi \cdot \rho \cdot A \cdot X \cdot f \cdot 3.1 \cdot 10^{-7} \cdot t^{0.39}}{C_{eq}}$$

—

Step 3: Substitute D into C

Using Equation (1):

$$C = \frac{C_0}{1 + D} + C_{eq} \cdot \frac{D}{1 + D}$$

$$C = \frac{C_0 C_{eq}}{C_{eq} + D} + \frac{D \cdot C_{eq}}{C_{eq} + D}$$

$$C = \frac{C_0 C_{eq} + D \cdot C_{eq}}{C_{eq} + D}$$

Substitute D into C:

$$C = \frac{C_0 \cdot C_{eq} + \tau \cdot \phi \cdot \rho \cdot A \cdot X \cdot f \cdot 3.1 \cdot 10^{-7} \cdot t^{0.39}}{C_{eq} + \frac{\tau \cdot \phi \cdot \rho \cdot A \cdot X \cdot f \cdot 3.1 \cdot 10^{-7} \cdot t^{0.39}}{C_{eq}}}$$

—

Step 4: Solve for t

Define B:

$$B = \tau \cdot \rho \cdot A \cdot X \cdot f \cdot \phi \cdot (3.1 \cdot 10^{-7})$$

Substitute B into t:

$$t = \left(\frac{C_{eq}}{B} \cdot \frac{C - C_0}{C_{eq} - C} \right)^{\frac{1}{0.39}}$$

—

Conclusion

We have derived an expression for t:

$$t = \left(\frac{C_{eq}}{B} \cdot \frac{C - C_0}{C_{eq} - C} \right)^{\frac{1}{0.39}}, \quad \text{where } B = \tau \cdot \rho \cdot A \cdot X \cdot f \cdot \phi \cdot (3.1 \cdot 10^{-7})$$

References