# Hydrogeochemical modelling of water-sediment interactions during infiltration of monovalent-partial desalinated water into different dune sediments

Mareike Schloo[1], Laura Braeunig[1], Victoria Burke[1], Janek Greskowiak[1] and Gudrun Massmann[1]

[1] Institute of Biology and Environmental Sciences (IBU), Carl von Ossietzky University of Oldenburg, Germany

## Introduction

Salinization of groundwater due to saltwater intrusion in coastal regions requires efficient mitigation strategies, e.g., the infiltration of monovalent-partial desalinated water (mPDW) via Managed Aquifer Recharge, which is the approach of the cooperative project *innovatION* [1]. The infiltration of a water type into an aquifer of a different water quality leads to a series of geochemical reactions [2, 3]. Based column experiments, potential water-sediment interactions during Managed Aquifer Recharge were identified in a reactive transport modelling approach.

## Materials & Methods

- The model is based on column experiments, in which mPDW were injected into different aquifer material from the Island of Langeoog, North-West Germany [4].
- A “step-by-step” modelling approach [2, 5] was used to analyse the effect of individual reaction processes (Tab. 1) and to assess the plausibility of the simulations with respect to the experimental results.
- Software: PHREEQC version 3 [6]

Tab. 1: Model scenarios chosen based on observed experimental reactions.

| Model | | Scenario |
|---|---|---|
| 1 | Flow + Transport | Model of flow and transport |
| 2 | Exchange | Model 1 including cation-exchange |
| 3 | Calcite | Model 1 including calcite dissolution |
| 4 | Calcite + fixed $CO_2$ | Model 3 including a fixed $CO_2$-partial pressure |
| 5 | Exchange + Calcite + fixed $CO_2$ | Model 1 including all reaction networks |

## Results & Discussion

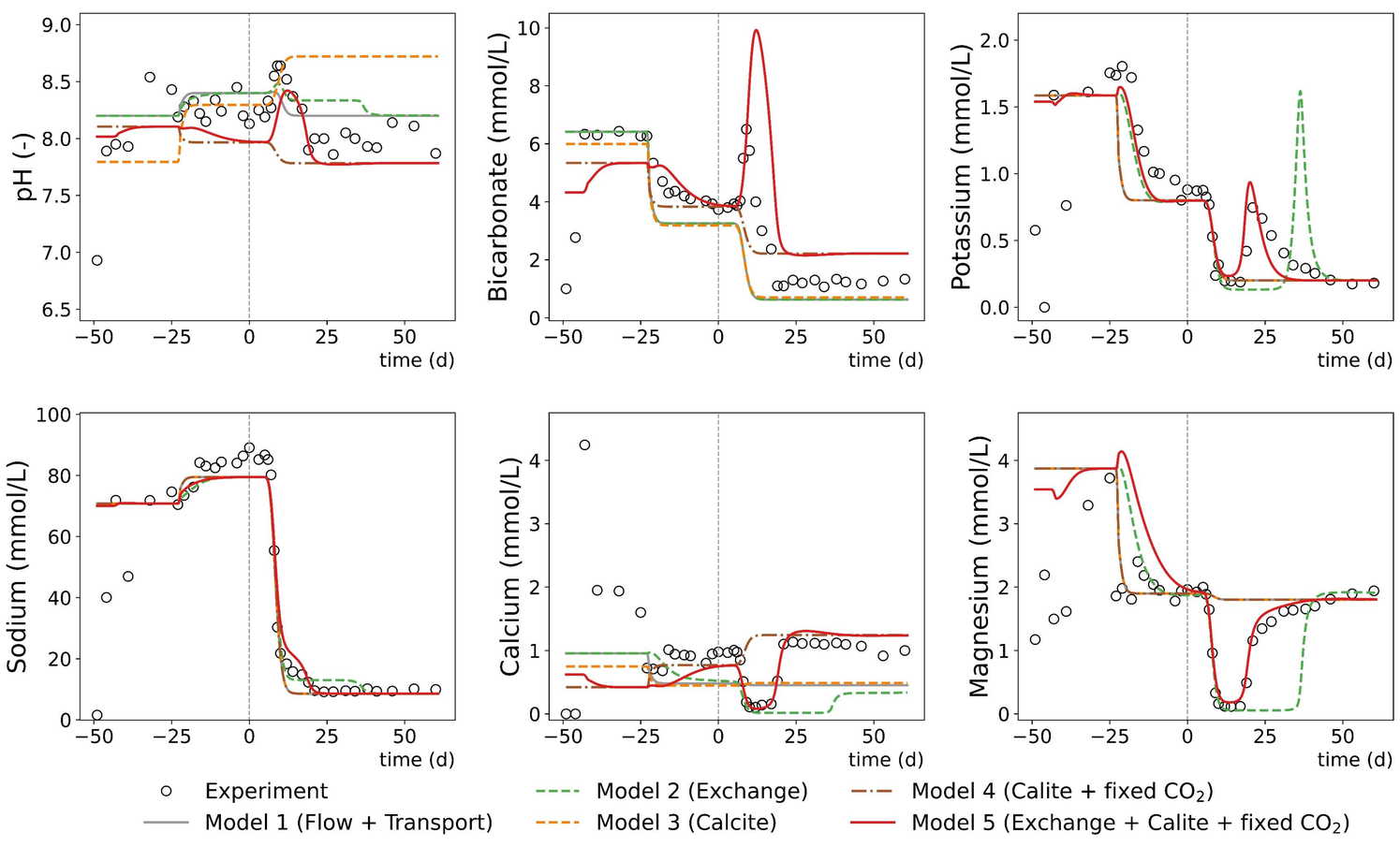


Fig. 1: Comparison of the reactive transport models and experimental results of a beach sand aquifer in which mPDW was infiltrated from day zero on.

- Fig. 1 shows the comparison of the different model scenarios and experimental results for salinated beach sand aquifer [4].
- After a conditioning phase using saline water (SW), the infiltration water type was changed to mPDW on day zero.
- The water exchange to mPDW leads to a series of geochemical reactions.
- The best fit was achieved with model 5 (solid red line) including cation exchange, calcite dissolution and a fixed $CO_2$-partial pressure.
- Cation exchange and calcite dissolution were identified as ongoing processes.

## Conclusion & Outlook

- Hydrogeochemical modelling with PHREEQC allows the quantification of potential water-sediment interactions during Managed Aquifer Recharge with monovalent-partial desalinated water.
- Furthermore, the model can be applied to other field locations and different geochemical conditions.

Contact
mareike.schloo@uni-oldenburg.de

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