EGU2020-21873
https://doi.org/10.5194/egusphere-egu2020-21873
EGU General Assembly 2020

Assessing seasonal controls in silicon cycle and isotopic signatures of groundwater under anthropogenic stress in tropical watershed

Sarath Pullyottum Kavil[1,2], Damien Cardinal[2], Jean Riotte[3], Arnaud Dapoigny[4], Laurent Ruiz[3,5], Benjamin Baud[5], Sarma Vedula VSS[6], Busala Siva Kiran Kumar[6], Véronique Vaury[7], and Ramananda Chakrabarti[1]

[1]Centre for Earth Sciences, Indian Institute of Science, Bangalore, India
[2]LOCEAN-IPSL, Sorbonne Universite, Paris, France
[3]GET-OMP, IRD, Toulouse, France
[4]LSCE-IPSL, CEA-'CNRS-UVSQ, Gif-sur-Yvette, France
[5]Indo-French Cell for Water Sciences, IRD, Indian Institute of Science, Bangalore, India
[6]NIO-CSIR, Visakhapatnam , India
[7]IEES, Sorbonne Université, Paris, France

Intense irrigation along with extensive use of fertilizers significantly effects the hydrological and biogeochemical cycles in shallow aquifers. Land use changes associated with human activities are known to be a major controlling factor of the terrestrial silicon cycle, altering silicon fluxes to surface and groundwater. In the present study we determined dissolved silicon concentration (DSi) and δ^{30}Si of shallow groundwater samples collected from bore wells and piezometers of two watersheds in Southern India under contrasting land use: one intensely cultivated (Berambadi) and one forested (Mule Hole).

Intense groundwater irrigation in the Berambadi region leads to water table depletion, progressive salinization and occurrence of nitrate hotspots in groundwater. We collected groundwater samples during two periods, during the summer (dry) season in March and during the South-West monsoon season in August from both watersheds. DSi values ranged from 410 µM to 1487 µM, with a lower value during August sampling indicating dilution effects caused by monsoon precipitation. Mule Hole and Berambadi aquifer recharge mostly occurs through surface water percolation or from lateral flow. Groundwater composition thus exhibits seasonal variation depending on precipitation which can be traced using water isotopes (δ^{18}O and δ^{2}H). The depleted values in Berambadi groundwater (average δ^{18}O of -2.99 ‰ and δ^{2}H of -15.86 ‰) compared to forested watershed in Mule Hole indicate higher contribution from meteoric water likely due to quicker turnover resulting from continuous irrigation.

Silicon isotope fractionation in natural waters is majorly controlled by soil-water interaction consisting in dissolution of primary minerals and formation of secondary minerals and also from biogenic sources and uptake. Preliminary results show no significant differences in δ^{30}Si signatures in groundwater from the two watersheds (1.1 ± 0.3 ‰) in dry season despite higher and more variable DSi concentration in cultivated watershed (1100 ± 260 µM vs. 790 ± 120 µM for

the forest). Assuming similar discharge, higher DSi concentration in Berambadi during both seasons indicates increased export/mobilization of Si into aquifer when compared to forested landscape.

We will further refine our understanding of Si biogeochemistry in groundwater and the changes associated with land use by comparing the water and silicon isotopes with the germanium/silicon ratio and major element compositions in comparison with surface water data.