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Carbon dioxide sequestration due to chemical weathering from the Indian river catchments – a review

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Chemical weathering of silicate rocks is known to sequester atmospheric carbon dioxide as a consequence of which a global cooling is initiated on a million year time scale. In the recent years, however, studies have reported that the CO_2 sequestration during the chemical weathering can influence the climate on a decadal to century time scale [1]. This is possibly because of human-induced landuse/ landcover changes (eg. deforestation) in the past decades and increase in the precipitation in the tropics that has led to enhanced weathering of rocks. However, limited studies exist on the amount of CO_2 drawdown from tropical rivers.

In India, as on date, 16 reported studies are available on chemical weathering and associated CO_2 drawdown in various river catchments. These studies are reviewed and an attempt is made to give a consolidated CO_2 drawdown due to chemical weathering from Indian sub-continent. The rivers originating from the Deccan Traps, which are west flowing (draining to Arabian Sea), did the highest CO_2 sequestration [2], [3] amongst all the studied rivers in India. This could be because of a combination of high run off, temperature and vulnerability of basalts to chemical weathering. Two other west flowing rivers flowing in the granite-gneiss basement of Western Ghats had lesser CO_2 drawdown compared to the rivers draining basalts. On the other hand, Himalayan and east flowing rivers (draining to Bay of Bengal) had a relatively lesser CO_2 drawdown compared to the west flowing rivers. The reasons could be due to the rock type available for weathering, relatively lesser runoff compared to the west flowing rivers and the flat topography. When the average CO_2 drawdown for Indian subcontinent rivers were compared with the other tropical rivers of the World, the CO_2 drawdown from the Indian sub-continent rivers were greater than 5 times the average of other tropical rivers. Therefore, there is a need for more detailed studies of the chemical weathering happening in the river catchments of India to arrive at a better estimate of silicate weathering and total CO_2 drawdown. This would also address the question of possible impact of chemical weathering in offsetting the increasing atmospheric CO_2 on a decadal to century time-scale.

References:

[1] Beaulieu et al (2012) Nature Climate Change, 2: 346-349

[2] Das et al (2005) Geochim et Cosmochim Acta, 69: 2067-2084

[3] Gaillardet et al (1999) Chem Geol 159:3-30