Use of Sr isotopes as a tool to decipher the soil weathering processes in a tropical river catchment, Southwestern India

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The Nethravati-Gurupur River is a small tropical mountainous river fed by Indian southwest monsoon. The river basin lies on the metamorphic transition boundary separating Peninsular Gneiss from Southern Granulitic Province belonging to Archean and tertiary-quaternary period (Western Dharwar Craton) with granite gneisses, charnockites and meta-sediments as major lithology. The total dissolved solid (TDS) concentration is relatively low (46 mg L^{-1}) with silica being the dominant contributor. The concentrations of dissolved minor ions such as Al and Fe are higher compared to world river average. The major and minor elements in the basin are higher during base flow and lesser during peak flow season and the relationship can be explained by power law reduction function. The basin is characterized by lesser dissolved Sr concentration (avg. 150 μmol L^{-1}) and more radiogenic 87Sr/86Sr isotopic ratios (avg. 0.72041 at outlet) than the average world river ratios (0.7119), which can be explained by the weathering of silicate rock minerals in the basin. The Sr concentration and $^{87}Sr/^{86}Sr$ isotopic ratio correlates with silicate derived cations (corrected for atmospheric and carbonate contributions). The $^{87}Sr/^{86}Sr$ isotopic ratio shows strong seasonal variation in the basin, i.e., radiogenic isotopes during dry season whereas less radiogenic values during peak flow season, which corresponds to bedrock mineral weathering during non-monsoon and secondary soil mineral weathering during monsoon. There is a clear seasonal shift in the source of stream water chemical composition; during non-monsoon the stream water is sourced from ground water which is in contact with the bedrock (weathering front) whereas during monsoon, the stream water chemical composition is sourced from the secondary minerals weathered from the regolith layer. The secondary soil mineral weathering leads to limited silicate cation and enhanced silica fluxes in the Nethravati river basin.