Groundwater Depletion and Associated CO_2 Emissions in India

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India is one of the largest user of groundwater with an annual abstraction rate of 230 billion-m^3 for irrigation. The excessive abstraction of groundwater releases CO_2 due to the burning of fossil fuels for pumping and the presence of bicarbonate ion in the pumped water. With the help of different data sources, we estimated the CO_2 emission in India from groundwater pumping and bicarbonate ion concentration. We estimated groundwater depletion from well level observations and Gravity Recovery and Climate Experiment (GRACE) groundwater storage observations. The estimated CO_2 emission from groundwater pumping is (31.29–131.02 million tons/year) is much higher than the emission from bicarbonate concentration (∼0.72 million tons/year). The estimated total CO_2 emission (pumping + bicarbonate) from groundwater is 32.01 – 131.74 million tons/year which is less than 2-7 % of the annual CO_2 emission from India. Based on the experimental data collected from 500 farmers in Punjab suggests innovative intervention in irrigation based on soil moisture information can significantly reduce the pumping water requirement and thus CO_2 emission. Our study proposes the urgent need for sustainable groundwater management in India since the environmental problems due to groundwater depletion are much severe than the associated CO_2 emission.