Methane emissions from groundwater pumping in the USA

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Methane emissions from groundwater pumping in the Los Angeles Basin, north-eastern Pennsylvania, and the principal aquifers of the USA were estimated using the average concentrations of methane in groundwater samples and annual groundwater pumping volumes. High average methane concentrations, 44.1 mg/L, and extensive groundwater pumping, ~3.1 x 10^{11} L/a in the Los Angeles Basin, result in the annual emission of ~2,882 metric tons (MT/a) of microbial methane [1], ~0.7% of methane released annually in the South Coast Air Basin, and ~3% of the methane released from the Aliso Canyon storage facility leak in 2015-2016. Ethane emissions in the Los Angeles Basin were 3.5 MT/a [1].

Lower methane emissions estimated for NE Pennsylvania, ~0.03 MT/a, reflect lower methane concentrations and groundwater pumping, 0.7 mg/L and 4.67 x 10^{7} L/a, respectively. Methane concentrations and groundwater withdrawals, 1.06 x 10^{14} L/a, across the USA enabled the estimation of the total emissions of methane from principal aquifers (92% of total pumping) of 43,576 MT/a in the year 2000, which represents a small percentage of the total annual US methane emissions, but a previously unquantified flux in the global methane budget. Total extracted global groundwater methane emissions were estimated to be 713,000 MT/a, by adopting a global estimates for groundwater extraction, and an average methane concentration in older groundwater of 0.6 mg/L.

[1] Kulongoski et al., (2018) *JGR-biogeosciences,* doi:10.1002/2017JG004026.