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Revisiting China's methane emissions from coal sector

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Methane emissions associated with human activities contributes significantly to global climate change. China is the world largest methane emitter and the coal mining sector is the largest contributor. Recent atmospheric inversion by Miller et al. using spaceborne column CH_4 concentration measurements inferred that emissions in China rose by more than $1.0 \text{ Tg CH}_4 \text{ yr}^{-1}$ from 2010 to 2017 due to the contribution of fossil fuel, especially from coal sector. Here we revisit methane emissions from the coal sector in China by comparing a sectorial bottom up emission inventory (2005-2019) with the results from another ensemble of CH_4 inversions using GOSAT satellite data during 2011-2017. During that period, the bottom up inventory gives an average emission of $17.9 \text{ Tg CH}_4 \text{ yr}^{-1}$ and the median of all inversions of $18.6 \text{ Tg CH}_4 \text{ yr}^{-1}$, with a range of [10.8, 25.6] corresponding to the min-max of all inversions and the use of two gridded maps of emissions to separate the coal sector from total emissions in each inversion grid cell. We confirm the upward trend in methane emissions from the coal sector from 2005 to 2019 observed by Miller et al. In addition, we show that trend accelerated after 2016 as consistently found in the bottom-up inventory and top-down inversions approaches. However, during the period of 2010-2017, the bottom-up inventory and top-down inversions showed opposite trends in emissions. Especially during the period of 2014-2016, emissions from coal sector decreased at a rate of $0.8 \text{ Tg CH}_4 \text{ yr}^{-1}$ using bottom up inventory, while emissions from top-down inversions maintained a relatively high growth rate at $0.4 \text{ Tg CH}_4 \text{ yr}^{-1}$. Suggesting possible underestimation of the emission by bottom up inventories. In addition, we estimates the contribution of abandoned mines to the growth of methane emissions from coal sector was around 20%, we also show a COVID-19 pandemic related sharp dip in methane emission from the coal sector in Feb 2020 and rebound since in April 2020 based on the estimation of monthly bottom-up inventory.