

Geophysical Research Abstracts
Vol. 18, EGU2016-3276, 2016
EGU General Assembly 2016
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Source attribution of methane emissions from global oil and gas production: results of bottom-up simulations over three decades

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Existing bottom-up emission inventories of historical methane and ethane emissions from global oil and gas systems do not well explain year-on-year variations estimated by top-down models from atmospheric measurements. This paper develops a bottom-up methodology which allows for country- and year specific source attribution of methane and ethane emissions from global oil and natural gas production for the period 1980 to 2012. The analysis rests on country-specific simulations of associated gas flows which are converted into methane and ethane emissions. The associated gas flows are constructed from country-specific information on oil and gas production and associated gas generation and recovery, and coupled with generic assumptions to bridge regional information gaps on the fractions of unrecovered associated gas that is vented instead of flared. Summing up emissions from associated gas flows with global estimates of emissions from unintended leakage and natural gas transmission and distribution, the resulting global emissions of methane and ethane from oil and gas systems are reasonably consistent with corresponding estimates from top-down models. Also revealed is that the fall of the Soviet Union in 1990 had a significant impact on methane and ethane emissions from global oil and gas systems.