Coal Mine Methane Emission Estimates - An Evolving Understanding

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ABSTRACT

The estimation of greenhouse gas emissions from coal mines is increasingly becoming a priority for both operators and regulators. At the same time, involved scientific challenges in the methane measurements is generating significant interest from global research community. Various technology providers are also actively engaged in improving their sensors and platforms to address the measurement challenges and capitalise the market opportunities. This presentation highlights rapidly evolving multifaceted landscape of coal mine greenhouse gas emissions. It covers the advances in sensors for the detections, including ground-based, airborne, and satellite-based systems as well as models for the emission estimations, including attempts to reduce the involved uncertainties.

In the early days, sensors were bulky and stationary, with limited capabilities. However, the latter half of the 20th century brought significant improvements, introducing more sensitive and accurate laser-based and optical sensors. More recent developments of ground-based powerful laser systems (GreenLITE, LongPath, etc.) with a capacity to cover around 25 square kilometres area make them potentially suitable for a large surface coal mine monitoring albeit several challenges still need to be addressed. On the other hand, drone-based systems have achieved substantial advancements in the recent past with improved and light-weight methane detector sensors (ALMA, Falcon, LMF, etc.). Additionally, increasing number of satellites dedicated to observe greenhouse gas emissions are launched (GOSAT, TROPOMI, GHGSats) or planned to be launched soon (MethaneSAT, MERLIN, COOL, etc.). Most instruments can only give out methane concentration values of either a point or a column averages. These datapoints map the spatial distribution of methane but do not directly offer the total volume of the methane present. To transform these discrete measurements to an understanding of the total methane flux or flow rates, several efforts are currently dedicated towards improving the modelling methods.

In summary, there are rapid advancements towards improving the capabilities of the sensors as well as to reduce the involved uncertainties in modelling greenhouse gas emission estimates. This presentation is focused on highlighting global trends that is relevant to estimate surface coal mine methane emissions.