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Using emissions derived from atmospheric observations to inform the reported UK inventory

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Verification of the nationally reported greenhouse gas (GHG) inventories using inverse modelling and atmospheric observations is considered to be best practice by the United Nations Framework Convention on Climate Change (UNFCCC). It allows for an independent assessment of the nationally reported GHG emissions using a comprehensively different approach to the inventory methods. Significant differences in the emissions estimated using the two approaches are a means of identifying areas worthy of further investigation.

An inversion methodology called Inversion Technique for Emission Modelling (InTEM) has been developed that uses a non-negative least squares minimisation technique to determine the emission magnitude and distribution that most accurately reproduces the observations. By estimating the underlying *baseline* time series, atmospheric concentrations where the short-term impact of regional pollution has been removed, and by modelling where the air has passed over on route to the observation stations on a regional scale, estimates of UK emissions are made. In this study we use an extensive network of observations with six stations across the UK and six more in neighbouring countries. InTEM uses information from a Lagrangian dispersion model NAME (Numerical Atmospheric dispersion Modelling Environment), driven by three-dimensional, modelled meteorology, to understand how the air mixes during transport from the emission sources to observation points. The InTEM inversion results are submitted annually by the UK as part of their National Inventory Report to the UNFCCC. They are used within the UK inventory team to highlight areas for investigation and have led to significant improvements to the

submitted UK inventory. The latest UK comparisons will be shown along with examples of how the inversion results have informed the inventory.