

Experience on using inversions for UNFCCC reporting requirements

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Observational data provision from outside DECC UK network:
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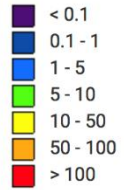
Introduction

- UK GHG inventory programme
- UK GHG emission verification programme
- Challenges in using Atmospheric data
- The way ahead

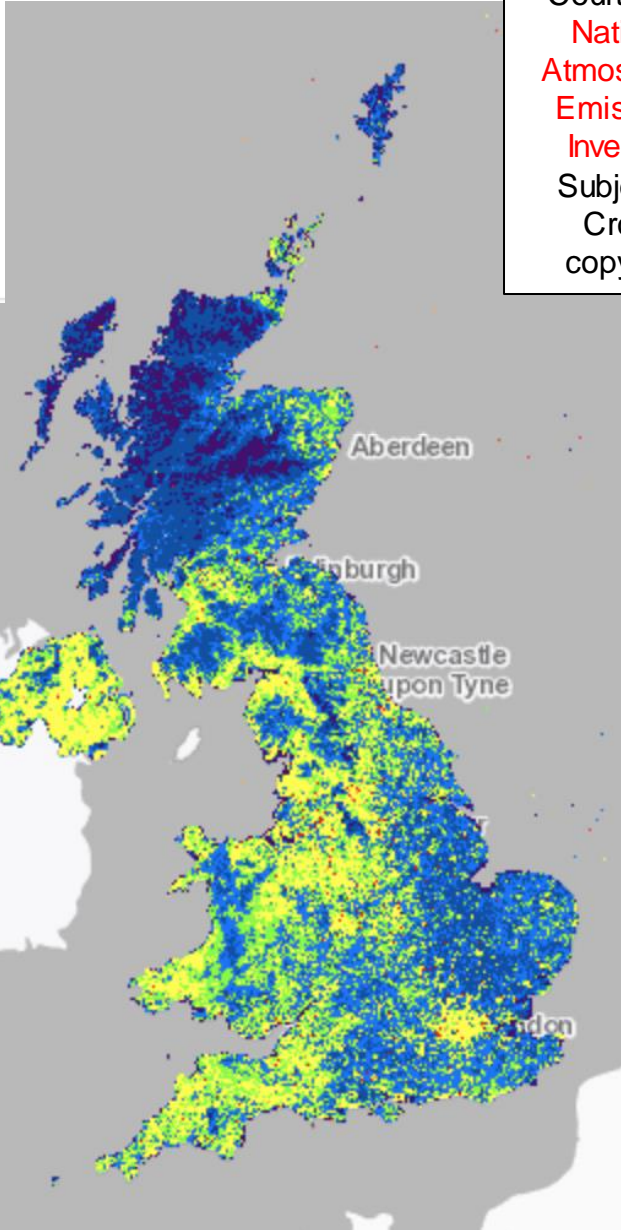
Legend

Methane

Units t/1x1km



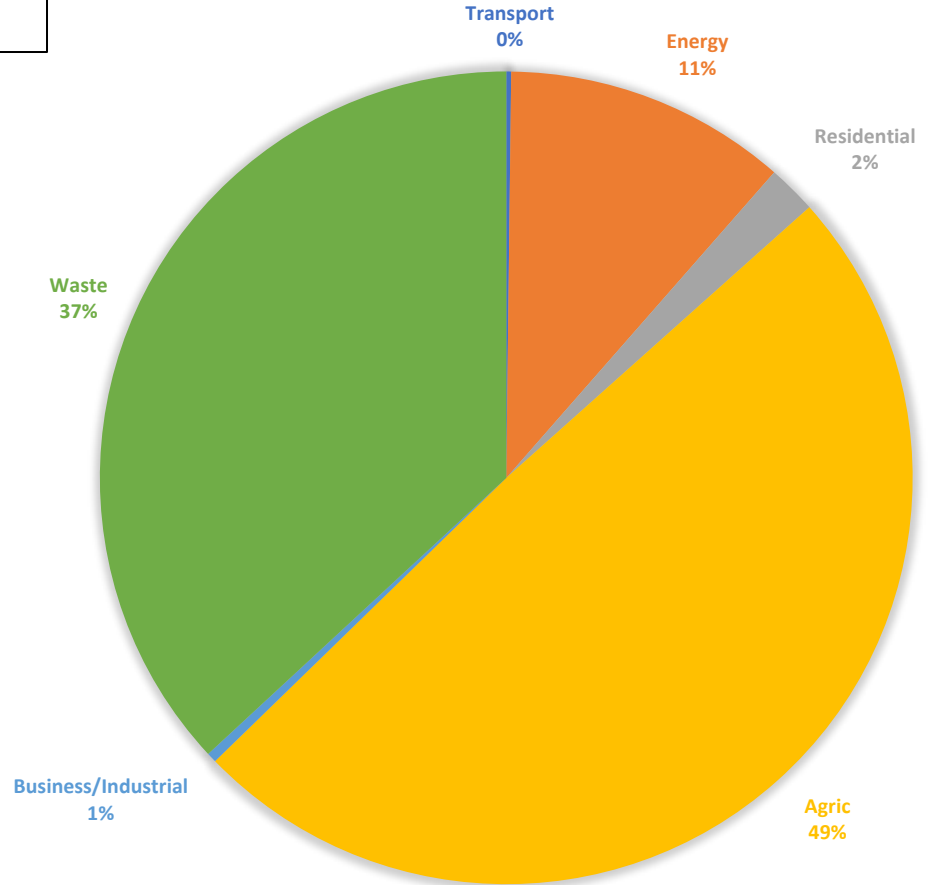
Courtesy of
National
Atmospheric
Emissions
Inventory
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UK GHG Inventory

UK CH₄ emissions 2018

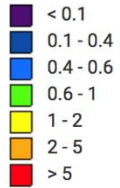
UK CH₄ EMISSIONS 2018 BY SECTOR



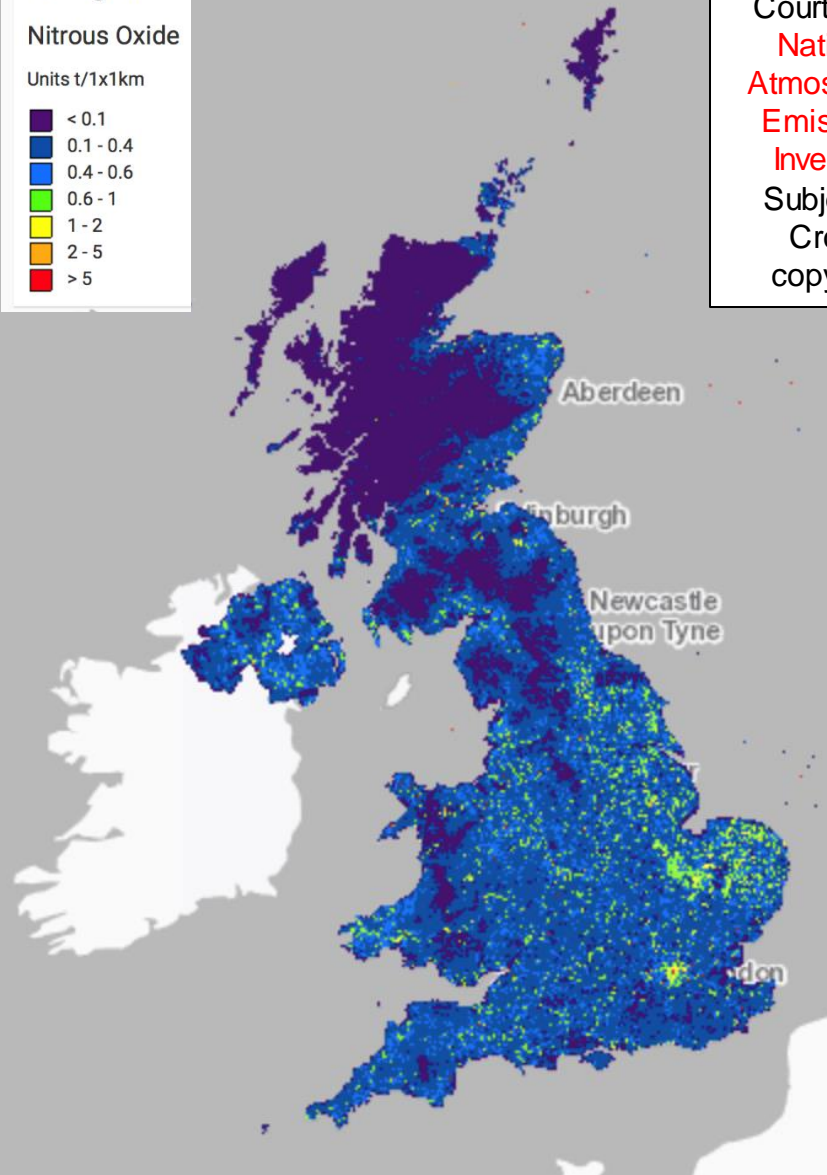
Legend

Nitrous Oxide

Units t/1x1km



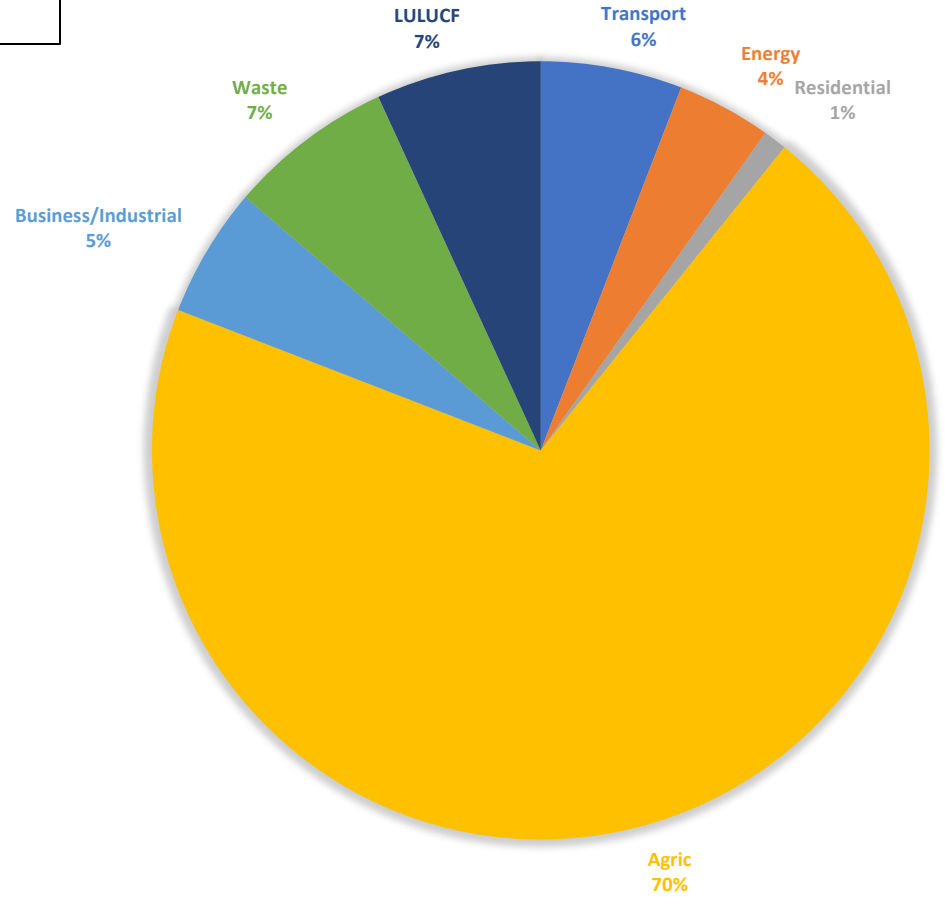
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UK GHG Inventory

UK N₂O emissions 2018

UK N₂O EMISSIONS 2018 BY SECTOR

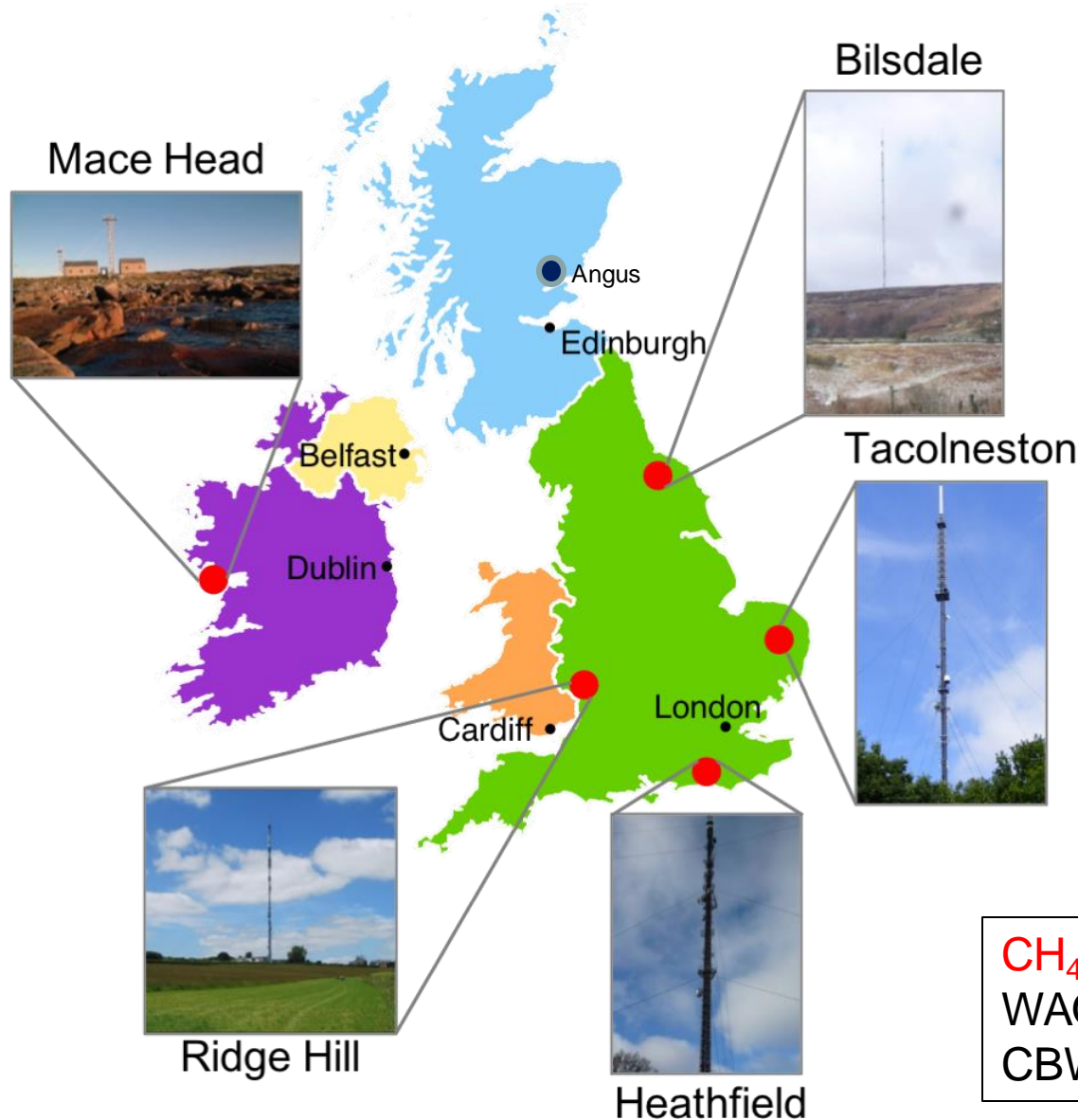


UK government National GHG Verification Programme

Using Atmospheric Observations to:

- Estimate Northern Hemisphere trends
- Estimate UK emissions of GHGs
- Compare to UK UNFCCC reported inventory

UK DECC (Deriving Emissions related to Climate Change) Network of observations



MHD from 1987
TAC & RGL from 2012
HFD & BSD from 2014

CH_4
Angus until Sep 2015

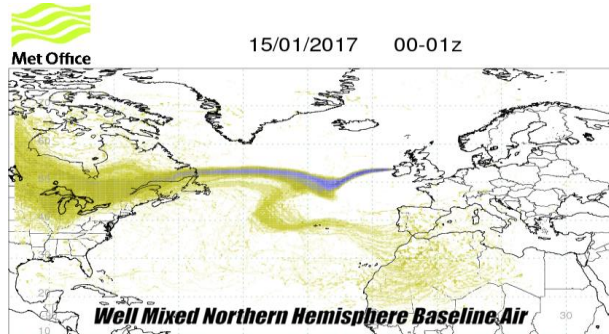
CH_4 (Additional Sites)
WAO (Weybourne, UK)
CBW (Cabauw, The Netherlands)

InTEM

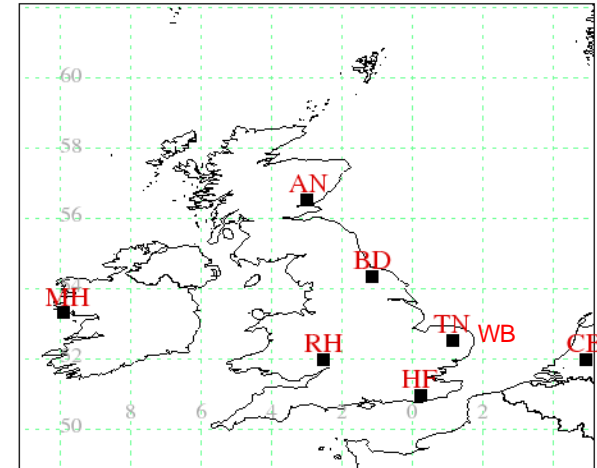
Inversion Technique for
Emission Modelling

To understand the recent history of the air arriving at measurement stations

Atmospheric Transport Model



Atmospheric Observations of GHG



Prior Knowledge
NAEI nested in
EDGAR

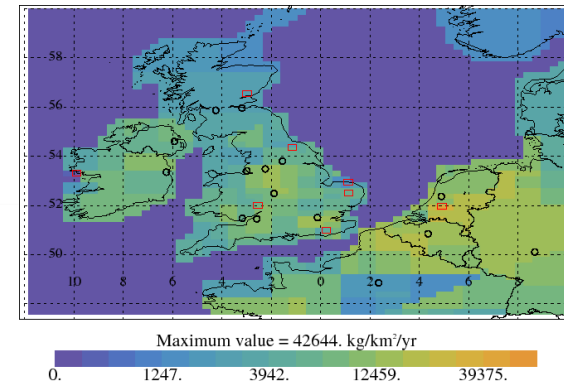
With Estimated
Uncertainties

To estimate the surface emissions that best describe the observations

Inverse Modelling System

Estimate of surface emissions

Uncertainties
Estimated

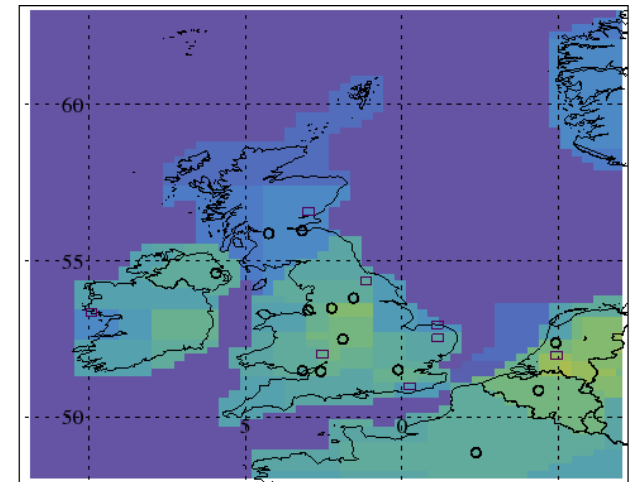
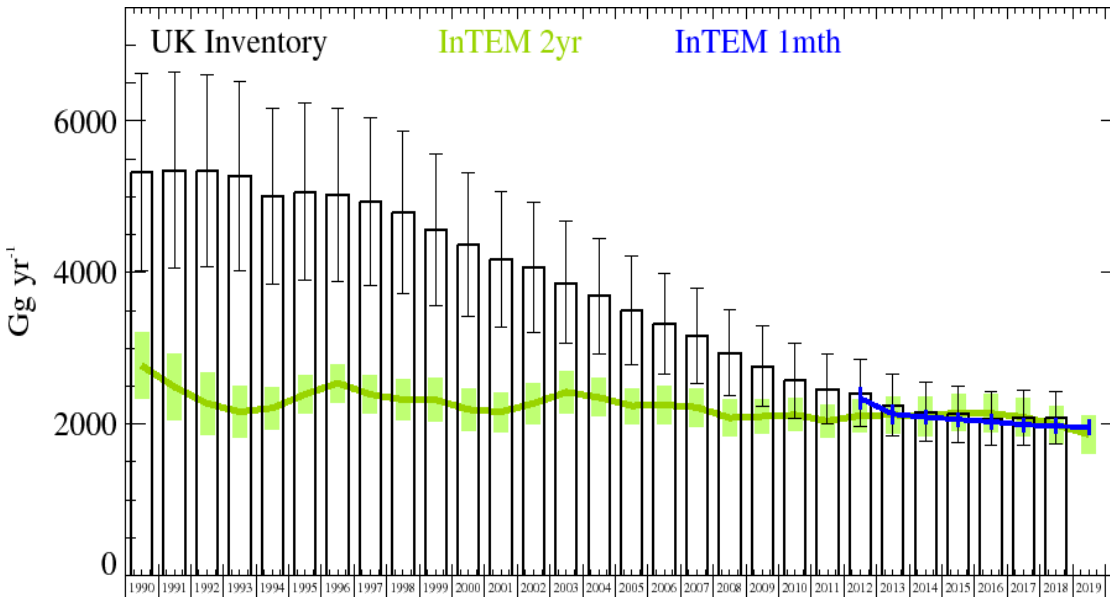
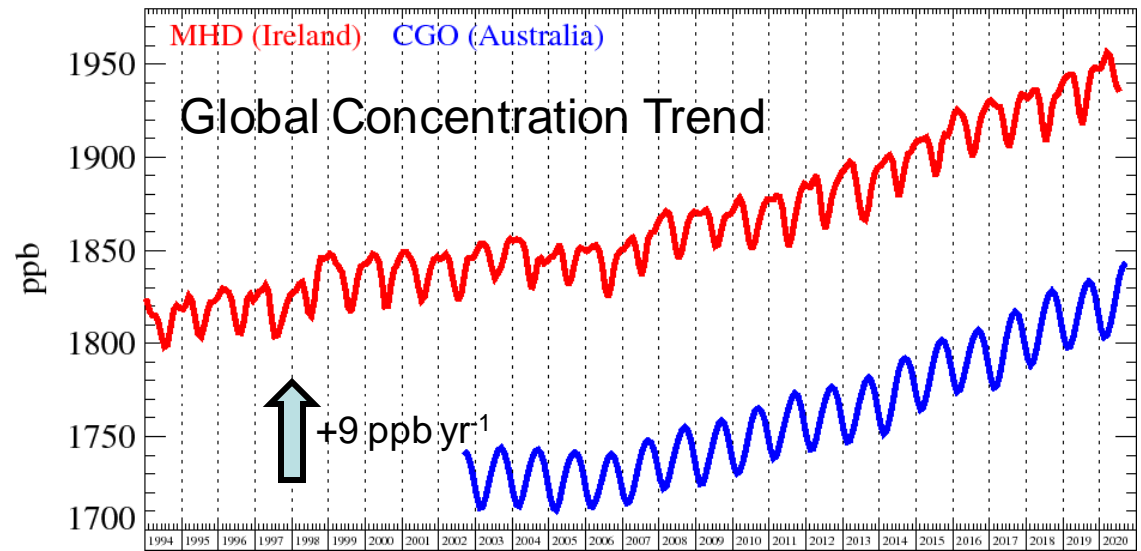


Use
Agriculture, Waste,
Energy, Wetlands

Methane

Growth: 9.0 ppb/yr
GWP₁₀₀: 28

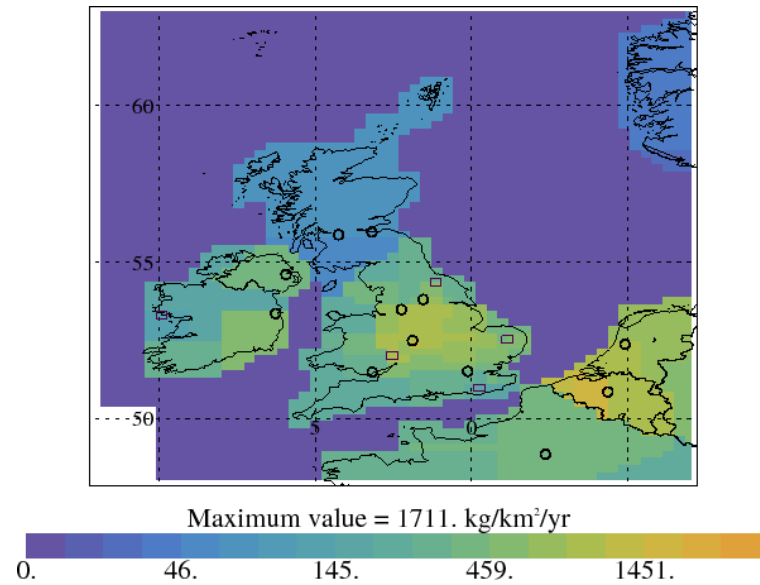
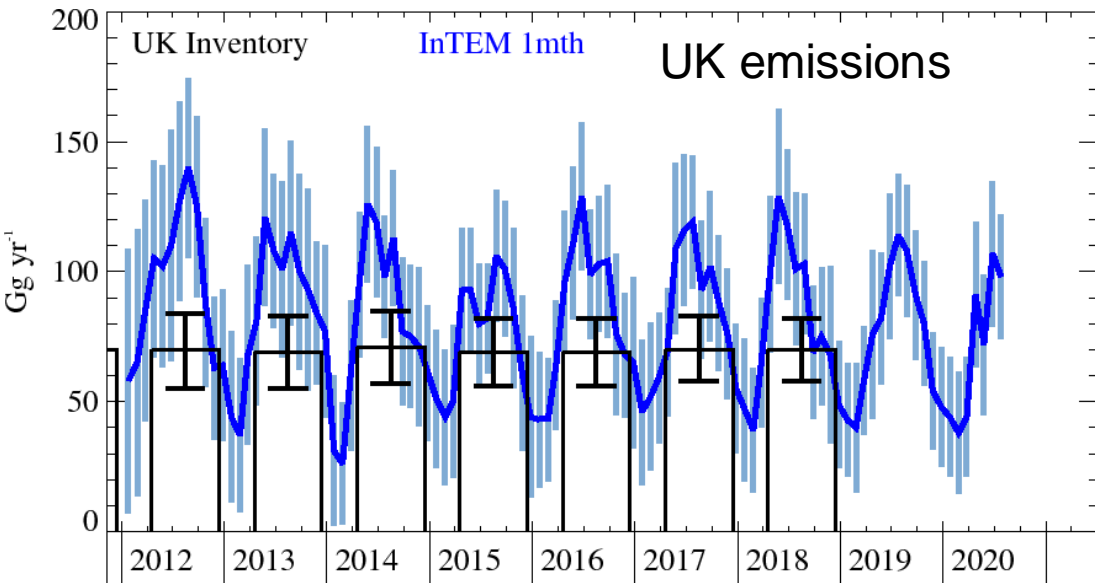
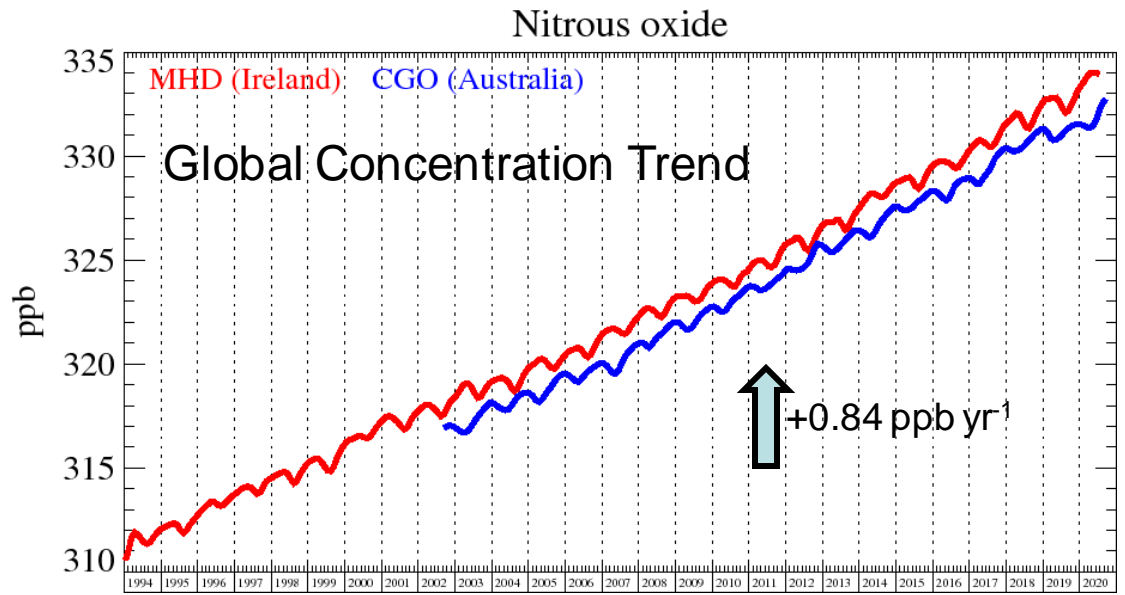
Methane



Use
Agriculture, Nylon
manufacture

Nitrous Oxide

Growth: 0.84 ppb/yr
GWP₁₀₀: 265



Using Atmospheric Observations

- 3 Key Uncertainties
 - 1) Model 2) Baseline 3) Observation
- Modelling more uncertain than observations
- Chose observations when model most certain
 - Atmosphere well mixed
 - Each model time has a different uncertainty
- Inter-comparability between stations vital

Future Improvements

- Observation precision
 - New laser systems for N₂O significantly more precise
- Complimentary observations
 - Different sources have different signatures
 - Isotopes
 - Co-emitted gases
- Provide insight and estimates for **SECTOR** specific emissions
- Better Transport models ➡ via Better meteorology
- Human CO₂ emission estimates

Concluding Remarks

- Each year UK submits a UK National Inventory Report to UNFCCC
 - UK first country (2003) to compare reported emissions to estimates derived from atmospheric observations
- Reported Annual Emissions estimated from Activity Data by Sector/Gas
 - But how accurate are these estimates – can they be Verified? Confirmed?
- CH₄
 - UK reported estimates \approx recent atmospheric estimates
 - Year to year variability but no strong seasonal cycle
- N₂O
 - UK reported estimates $<$ Atmospheric estimates (by 10-15%)
 - Very strong seasonal cycle
- Assigning uncertainty to each model time is key challenge
- Sector specific emission estimates most valuable