Modelling nitrous oxide dynamics in grazed grassland systems

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Overview

- Background
- Livestock grazed and grassland management
- Grazing, geochemistry and UK_DNDC
- Two sites: Rowden and Cae Banadl
- Results
- Conclusion remarks

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Background

- The UK gross domestic product (GDP) 5% from agriculture in 2007
- Grassland over 50 % of the entire UK landmass.
- The UK agricultural GHG emissions in 2007
  - 74.3% of the total UK emissions of N_2O
  - 37.6% of the total UK emissions of methane

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Livestock grazing and grassland management

- Two basic methods: set stocking for uplands and paddock grazing for lowlands.
- Paddock grazing.
    - Livestock grazed on a rotational basis.
    - Grazing intensity and GHG emissions.
    - Grazing intensity and sustainability.
- More production and less GHG emissions →

Integrating grassland management .

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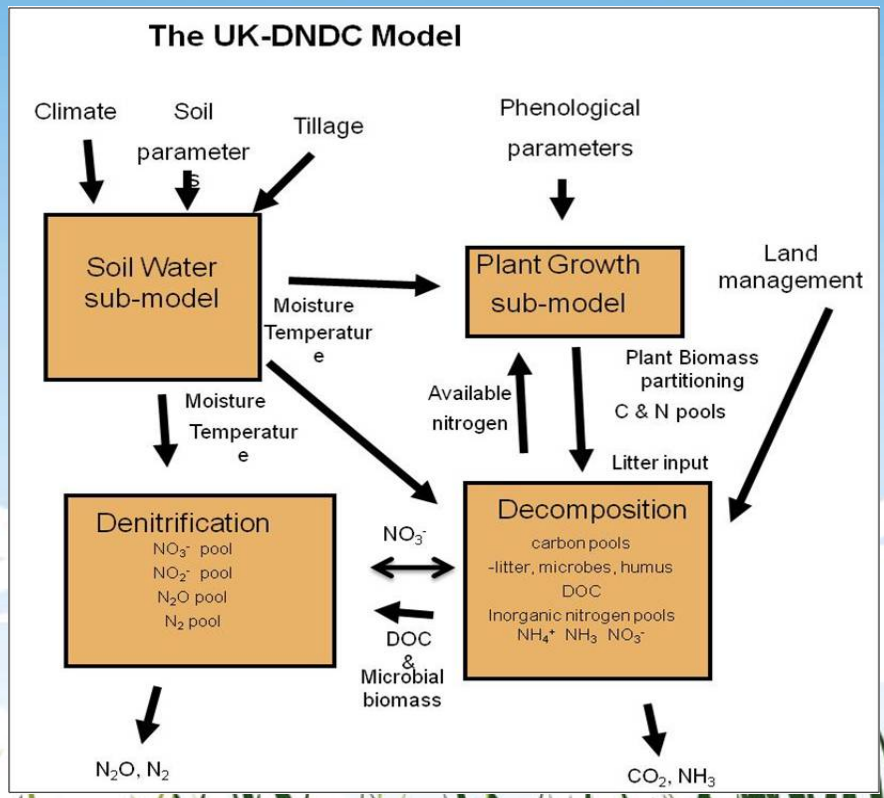
Grazing, Biogeochemistry, and UK_DNDC

- Grazing systems
- The UK soil and crop types and climate conditions
- Soil biogeochemical framework
- Modelling and validation using data of two sites



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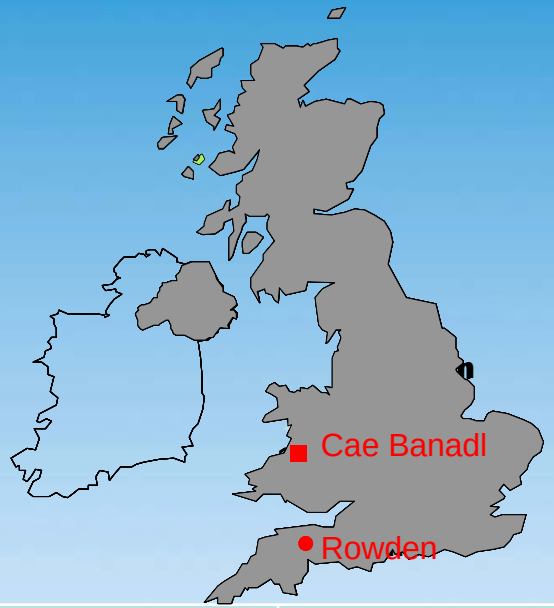
Two sites: Rowden and Cae Banadl

- **Modelling against two sites: Rowden and Cae Banadl**
- **Four plots for each site and each plot with 0-6 times fertiliser and 5-6 times grazing**



	Plot1		Plot2		Plot3		Plot4	
	Ferts kg/ha	Grazing hd.days/ha	Ferts kg/ha	Grazing hd.days/ha	Ferts kg/ha	Grazing hd.days/ha	Ferts kg/ha	Grazing hd.days/ha
Rowden	0	248.6	75	355.7	175	486.9	350	516.3
Cae Banadl	0	314	75	406	175	529	350	595

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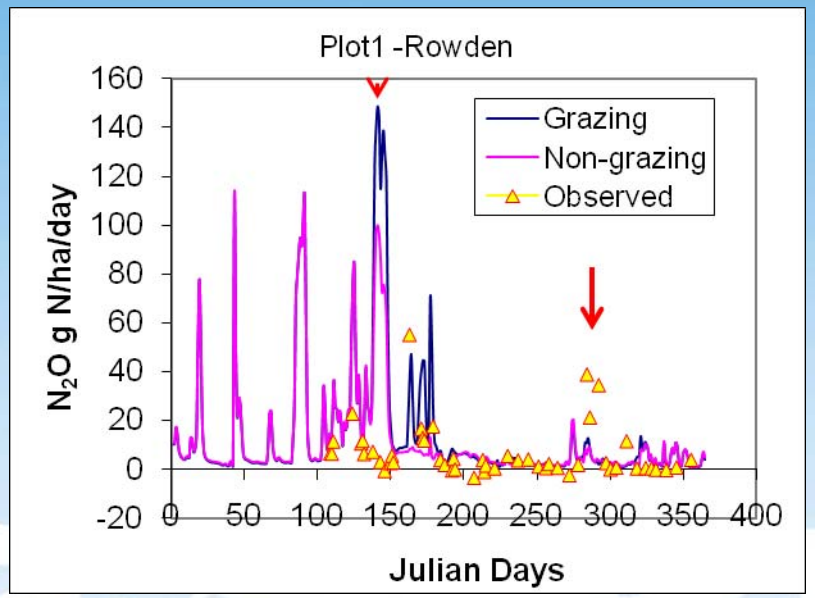
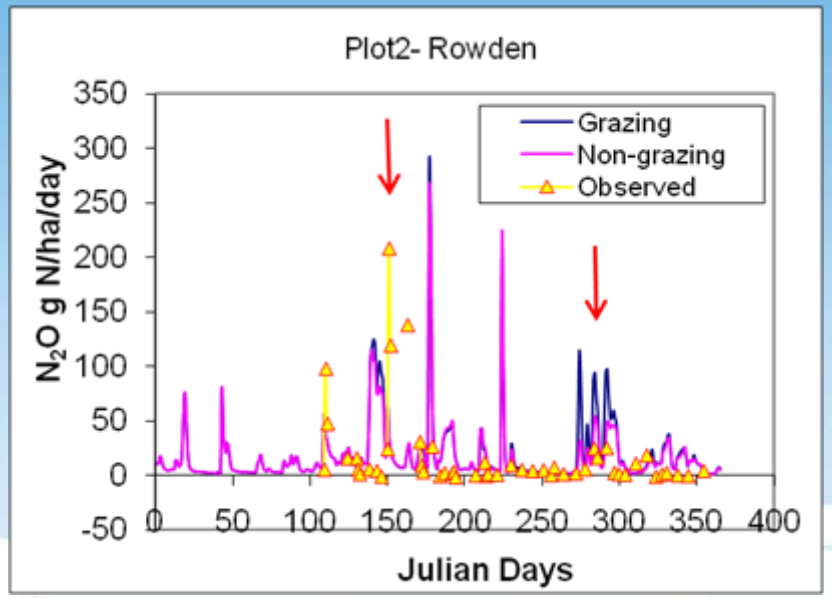
A comparison between observed and predicted values at Rowden





- **The model captures effect of grazing but not the peaks of emissions.**

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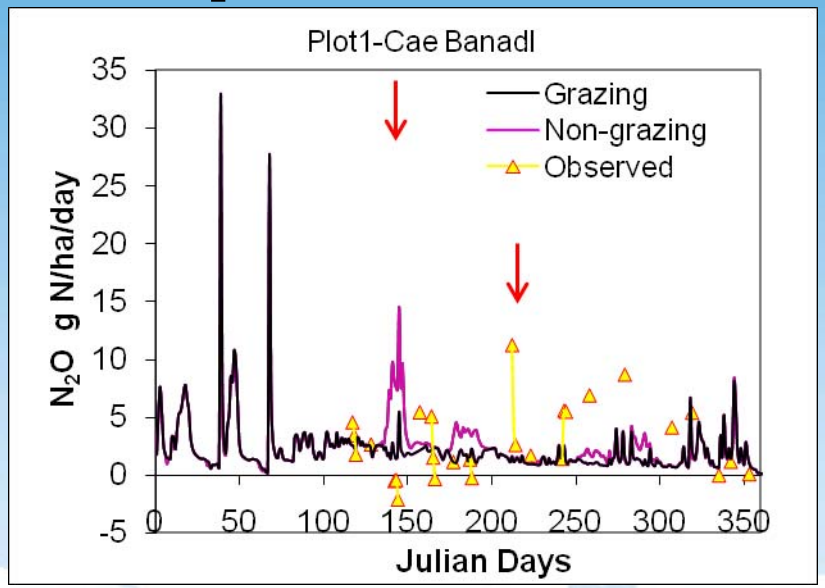
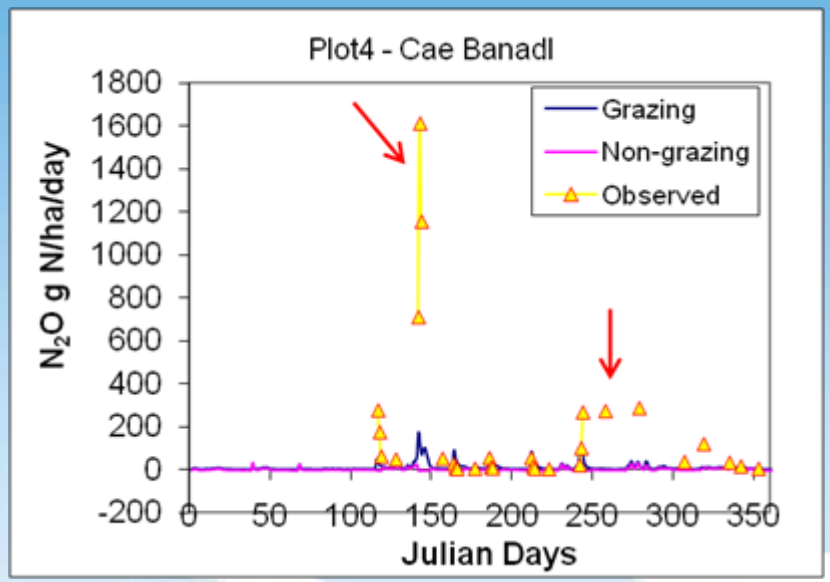
A comparison between observed and predicted values at Cae Banadl





- **The model captures effect of grazing but does not match the peaks of emissions. Particularly, the model underestimated peaks for the plot 4.**

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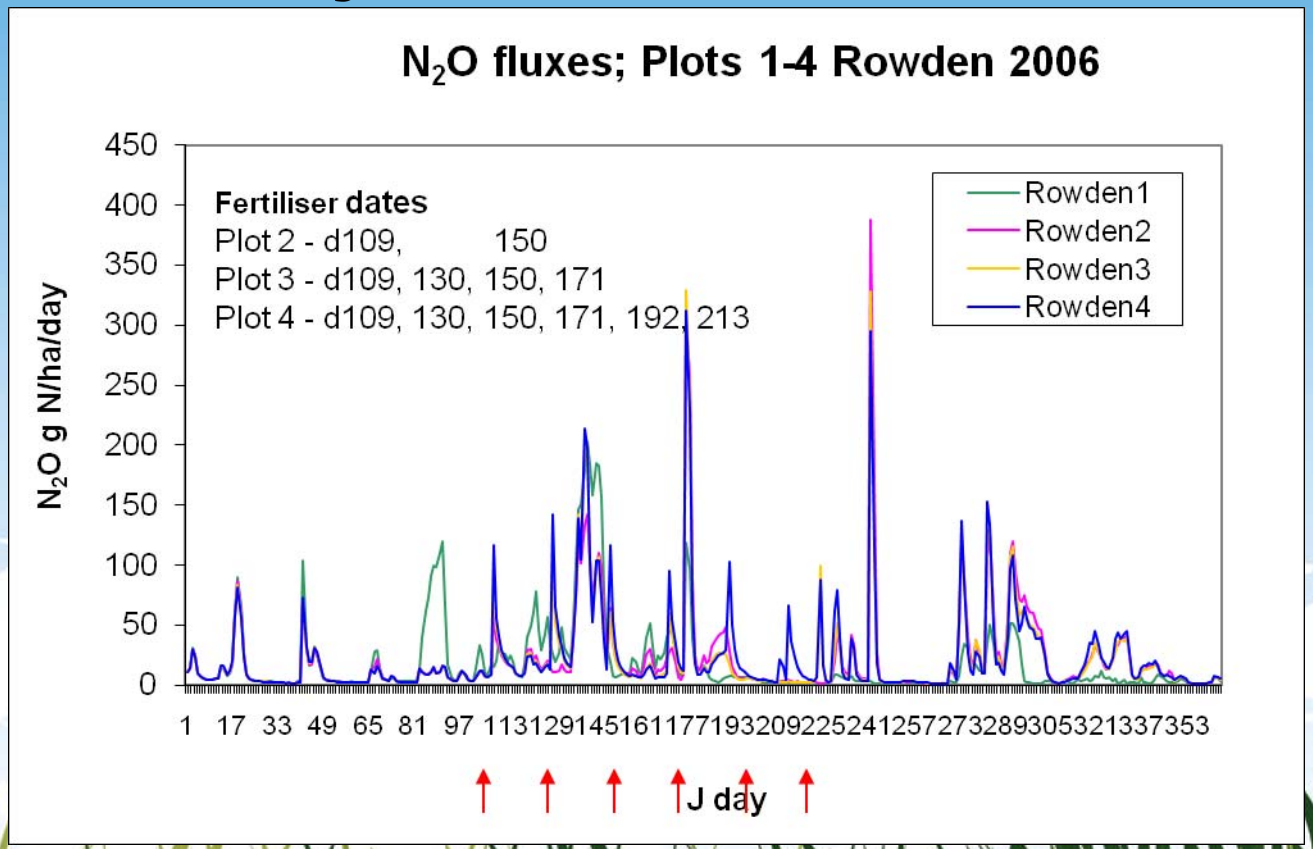
Effect of grazing and fertiliser intensity at Rowden

- Plots 2 and 3 seems there is no big differences quantitatively.
- This may imply that there is a region which is not sensitive to the grazing and fertiliser intensity



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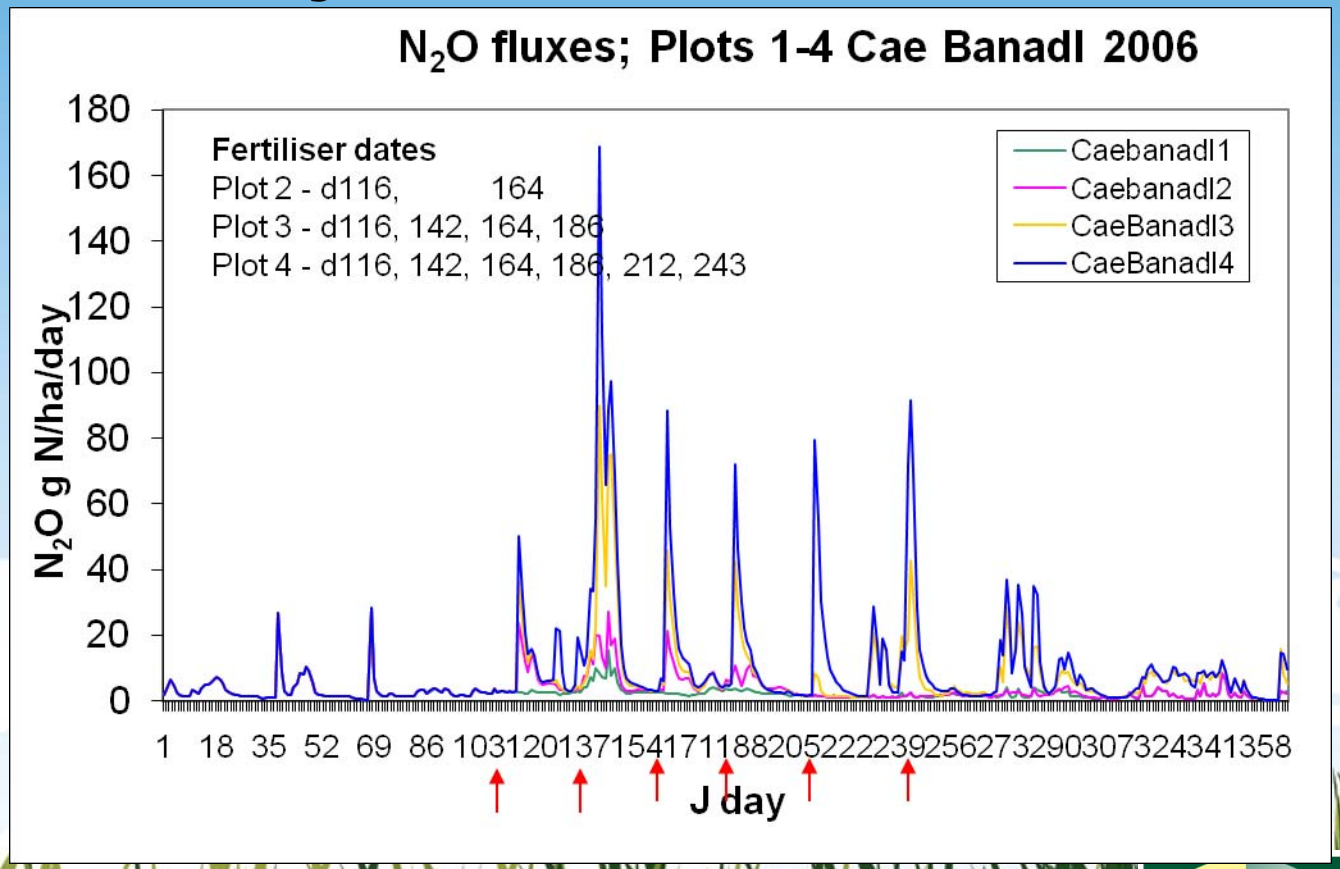
Effect of grazing and fertiliser intensity at Cae Banadl

- Plots 3 does produce more N_2O emissions than Plot2 quantitatively.
- Plot 4 leads an obvious increase of N_2O emissions.
- Proper management?



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Conclusion remarks

- UK_DNDC can model effects of grazing intensity
- UK_DNDC underestimates the peaks of N_2O emissions for the plot4 (intensive grazing and fertiliser)
- An optimal region appears to be less change of N_2O emissions as the grazing and fertiliser intensity increases.
- This region should be an indicator for grassland management and sustainability.
- However, more studies are still necessary for this optimal region in the future

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Thank you very much for your attention!!

- Questions?

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