Geophysical Research Abstracts
Vol. 20, EGU2018-10520, 2018
EGU General Assembly 2018

Remotely Piloted Aircraft Systems (RPAS) application for mapping nitrogen deposition over intensively grazed grassland

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In grazing livestock systems, the deposition of reactive nitrogen via urination is a significant potential source of nitrogen loses (e.g: nitrous oxide, ammonia emissions, nitrate leaching) which can account for 50 % to 60 % of the nitrogen input. These events occur randomly, resulting in high spatial variability at the field scale which prevents accurate accounting of their contribution to various pathways of nitrogen losses. This study investigated an alternative technique for identifying the spatial coverage in grasslands using Remotely Piloted Aircraft Systems (RPAS) technology.

In this project, imagery from multi-rotor RPAS were used to identify urine patches in a 2 ha field (Johnstown Castle farm, Ireland) and in a 5 ha field (Easter Bush, Scotland), which had been grazed by dairy cows and sheep respectively. The field in Ireland was number of times surveyed over the grazing season of 2017, whilst the field in Scotland was surveyed once (in April 2016) to enable testing of the initial method.

The results were summarised to construct a urine patch coverage map highlighting the size and colour properties of each patch. For the sheep grazing, the imagery of four samples of approximately 50 m2 areas within the field were analysed using a custom pixel based model written in R (the R Foundation, USA), that utilised colour channel thresholding and Kmeans clustering. For a total of 210 m2 of grassland, 4.12 % of the total area was considered influenced by urine events, with 82 patch areas averaging 0.11 m2. The detection of urine patches using RPAS imagery combined with soil measurements (greenhouse gas emissions, pH, moisture, nitrogen and carbon content) show potential to aid automatic and fast determination of urine patch cover at the field scale. This detection is essential for a better spatial modelling of nitrogen inputs, allowing better targeting of nitrogen fertilisers and the estimation of greenhouse gas emissions.