DEDUCING EMISSION RATES FROM GAS CONCENTRATIONS IN A LIVESTOCK FARM THROUGH A BACKWARD LAGRANGIAN STOCHASTIC METHOD-BASED MODEL

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This work suggests a practical methodology for calculating greenhouse gases (GHG) emissions and other types of gas in dairy cattle farms. Climate change is one of the Sustainable Development Goals (2015) and European Union wants to reach climatic neutrality by 2050. In agriculture, ruminant livestock farming is the most impactful sector, in terms of methane and nitrous oxide emissions, according to ISPRA computations (2021). We need valid measuring protocols for assessing emissions in every production phase to reduce emissions in livestock and cropland systems. The equipment required to build a system capable of measuring GHG emissions from livestock farms is composed of Multi-Sensor Platforms (MSP), an anemometer, and various types of software for data analysis. Once a valid measurement protocol is established, emission rates from surface area sources in a livestock farm, such as a slurry storage tank, can be calculated. An MSP contains sensors to quantify gas concentrations and sensors to characterize turbulent transport on the micro-meteorological scale, like temperature and pressure sensors. An anemometer is also needed to obtain wind speed and wind direction. Surveys can measure on the ground and, if necessary, in the low troposphere using a drone. WindTrax is a free software tool for simulating short-range atmospheric dispersion, that uses Lagrangian stochastic particle models. The results provided by the model are numerical and graphical. WindTrax supplies datasets containing calculated emission rates and concentrations. Georeferenced atmospheric dispersion maps can be realized, using calculated concentrations in a GIS environment. We validated model concentrations with CO_2 measurements at 2, 3, and 4 meters from the ground at two different points of a dairy cattle farm. Finally, by identifying the surface area sources most impactful we will apply appropriate mitigation solutions at exactly the right time to reduce emissions in the air from livestock systems.