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Nitrosat: Nitrosat: Mapping reactive nitrogen at the landscape scale

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The nitrogen cycle has been heavily perturbed due to ever growing agriculture, industry, transport and domestic production. It is believed that we now have reached a point where the nitrogen biochemical flow has exceeded its planetary boundary for a safe operating zone. This goes together with a cascade of impacts on human health and ecosystems. To better understand and address these impacts, there is a critical need to quantify the global nitrogen cycle and monitor its perturbations on all scales, down to the urban or agricultural source. The Nitrosat concept, which was preselected recently in the framework of ESA's Earth Explorer 11 call and is entering Phase0 activities, has for overarching objective to simultaneously identify the emission contributions of NH3 and NO2 from farming activities, industrial complexes, transport, fires and urban areas. The specific Nitrosat science goals are to: Quantify the emissions of NH3 and NO2 on the landscape scales, to expose individual sources and characterize the temporal patterns of their emissions. Quantify the relative contribution of agriculture, in its diversity of sectors and practices, to the total emissions of reactive nitrogen. Quantify the contribution of reactive nitrogen to air pollution and its impact on human health. Constrain the atmospheric dispersion and surface deposition of reactive

nitrogen and its impacts on ecosystems and climate; and contribute to monitoring policy progress to reduce nitrogen deposition in Natura 2000 areas in Europe. Reduce uncertainties in the contribution of reactive nitrogen to climate forcing, atmospheric chemistry and interactions between biogeochemical cycles. To achieve these objectives, Nitrosat would consist of an infrared Imaging Fourier Transform Spectrometer and a Visible Imaging Pushbroom Spectrometer. These imaging spectrometers will measure NH3 and NO2 (respectively) at 500 m, which is the required spatial scale to differentiate, identify and quantify the main point and area sources in a single satellite overpass. Source regions would be probed from once a week to once a month to reveal the seasonal patterns. Combined with air quality models, assimilation and inverse modelling, these measurements would allow assessing the processes that are relevant for the human disruption of the nitrogen cycle and their resulting effects, in much more detail than what will be achieved with the satellite missions that are planned in the next decade. In this way, Nitrosat would enable informed evaluations of future policies on nitrogen emission control. This presentation will detail the mission concept, provide first results from the Phase 0 scientific studies and from supporting aircraft campaigns.

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