Satellite monitoring of ammonia: from point sources to long-term trends

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IASI satellite ammonia (NH₃) measurements are used to identify, categorise and quantify world’s NH₃ emission hotspots. In particular, applying spatial oversampling and supersampling techniques on more than 10 years of IASI measurements, we are able to track-down more than 500 localized point sources of agricultural, industrial (fertilizer, coking, soda ash, geothermal and explosives industries), urban and natural origin. We present an on-line global NH₃ point sources catalogue, consisting of an interactive global map, visualizing the distribution, type and time evolution of the different point sources (http://www.ulb.ac.be/cpm/NH3-IASI.html). Calculated satellite-based emissions of NH₃ suggest a drastic underestimation of point sources in bottom-up inventories, especially those of industrial emitters. Temporal analysis revealed rapid shifts in anthropogenic activities, such as the opening or closure of industrial plants. These results demonstrate that using NH₃ satellite data will be hugely beneficial for improving bottom-up emission inventories.

A recently obtained homogeneous data record of NH₃ total columns from IASI (ANNI-NH₃-v3R) is also used to derive trends over the last decade. We apply a bootstrap resampling method to determine the trends and to assess whether the calculated values are significant or not. We obtain the first global distribution (0.5°×0.5°) of atmospheric NH₃ trends based on 11 years (2008-2018) of IASI/Metop-A observations. Distinct temporal patterns are extracted and are analysed in light of anthropogenic activities and biomass burning events. National absolute and relative trends are also calculated and discussed.