Spatiotemporal ammonia (NH_3) emission and source detection in Brandenburg Germany

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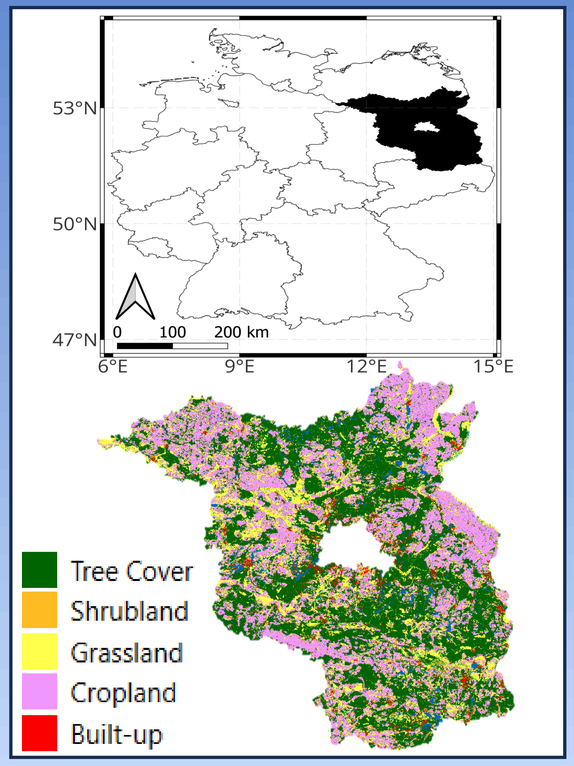
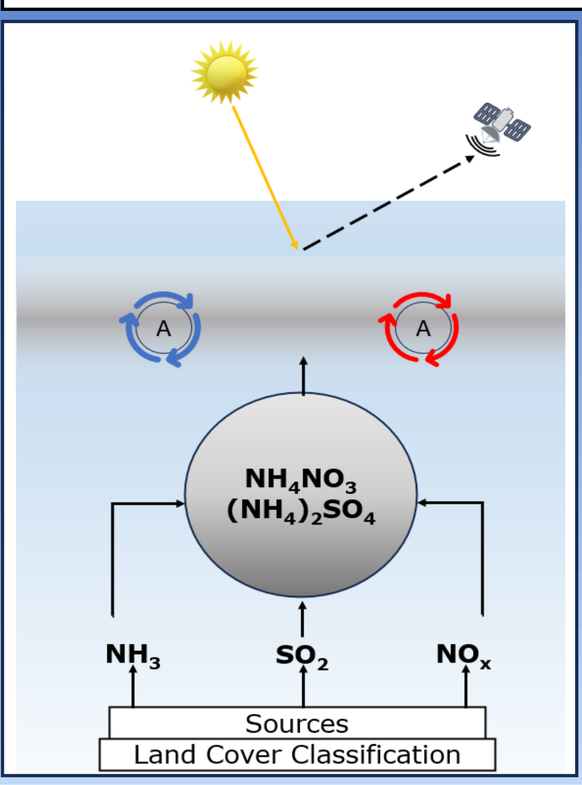
Introduction



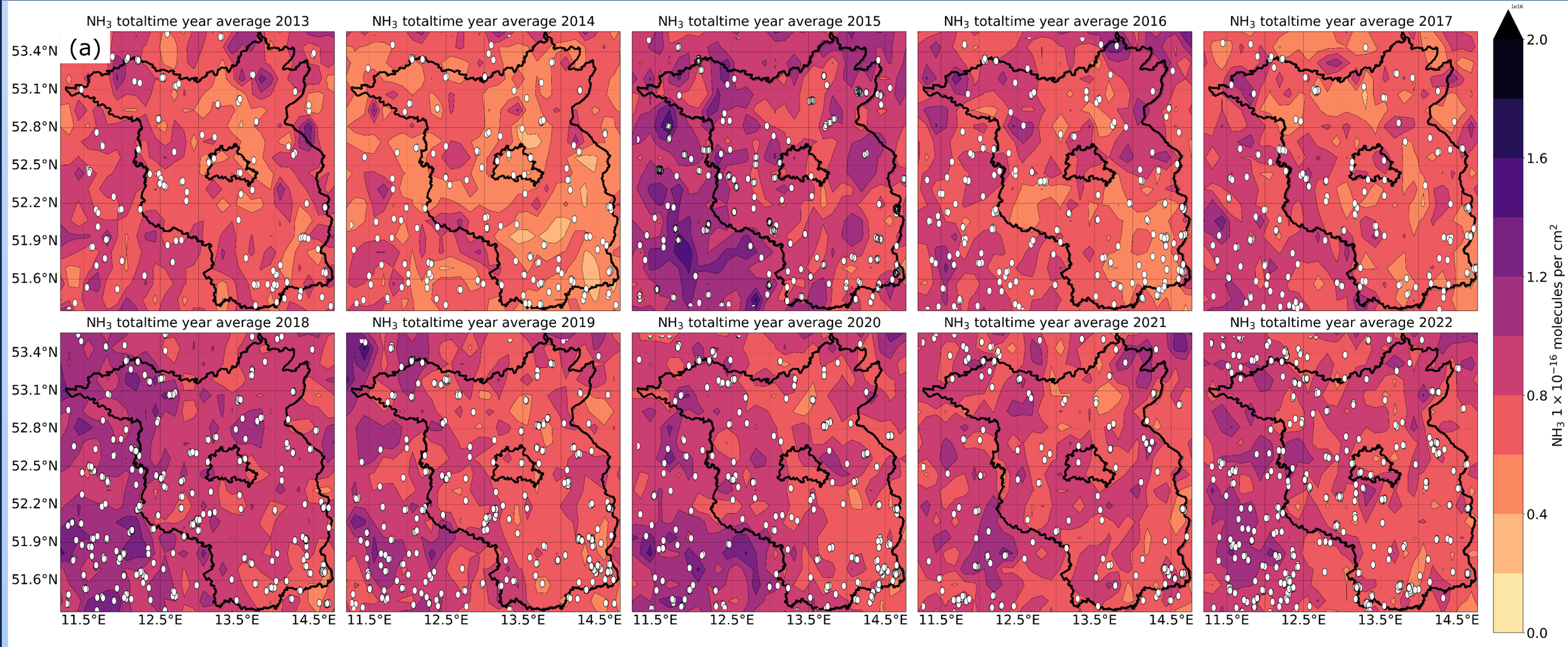
- Ammonia (NH_3) is a very reactive important gas, has a widespread impact related to air pollution, visibility, climate change, acid deposition and eutrophication. The primary source of global emission are agriculture, urban activities, and wildfires.
- NH_3 is a major precursor and contributor to the formation of aerosol particles transforming NH_3 into ammonium (NH_4^+) in the atmosphere.
- The study area shows the distribution of the land cover classification located in Brandenburg, Germany.

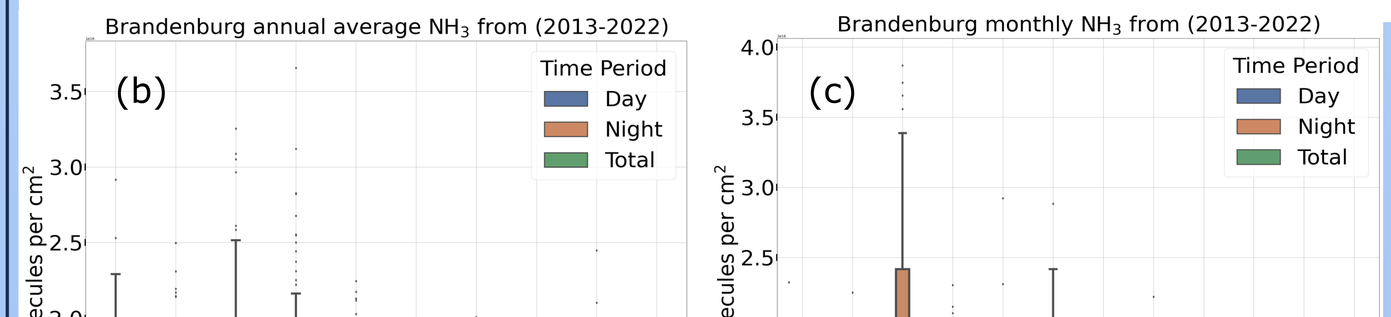
Methods



- Satellite-based data earth observation to capture spatial and temporal variations in ground surface sources and total column of NH_3 emission.
- Atmospheric detection of NH_3 emission from Meteorological Operation Satellite with platform (MetOp-B) with Infrared Atmospheric Sounding Interferometer instrument (IASI) and Land Cover Classification map at 10 m resolution with five classes at Brandenburg.
- MODIS Aqua/Terra collection for active fires products.

Results





a) Annual mean IASI NH_3 emissions of total columns from 2013-2022, the observations values over Brandenburg are typically in the range of <2 x 10^{-16} molecules per cm^2 with spatial resolution 0.125° × 0.125°. The maps reveal a noticeable increase levels of NH_3 during 2015, 2016, and 2018. MODIS Aqua/Terra collection level-2 version 6.1 for active fire products showing the annual distribution of fire spots in a white circles.

b) The boxplot time series for annual NH_3 levels clearly demonstrates that, in most cases, nighttime concentrations surpass the daytime, particularly during 2015, 2016, and 2021.

c) Climatology NH_3 time series, the months of March and August consistently display peaks, this pattern is likely influenced by seasonal factors such anthropogenic and weather conditions.

Conclusions

- The study area in Brandenburg, provides an in-depth look at land cover classification and NH_3 emissions trends.
- The annual mean NH_3 emissions from 2013-2022 unveils consistent values with a noticeable increase observed during specific years in the northern region of Brandenburg. The annual distribution of fire spots using MODIS Aqua/Terra, highlighting the possible relationship between fire incidents and ammonia emissions. Boxplot time series reveal an intriguing pattern where nighttime NH_3 concentrations generally exceed daytime levels.
- Future work: Multiplatform approach of satellite and ground-based observations, to investigate the relationships between secondary aerosol particle with aerosol optical depth (AOD) values in the atmosphere under the presence of NH_3 considering additional factors that contributing to their changes, dispersion methods and ML .

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