26 May 2022

Vienna, Austria

Land use change and meteorology effect on atmospheric ammonia (NH_3) as seen by IASI

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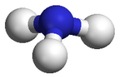
Does ammonia matter?

Agricultural practices

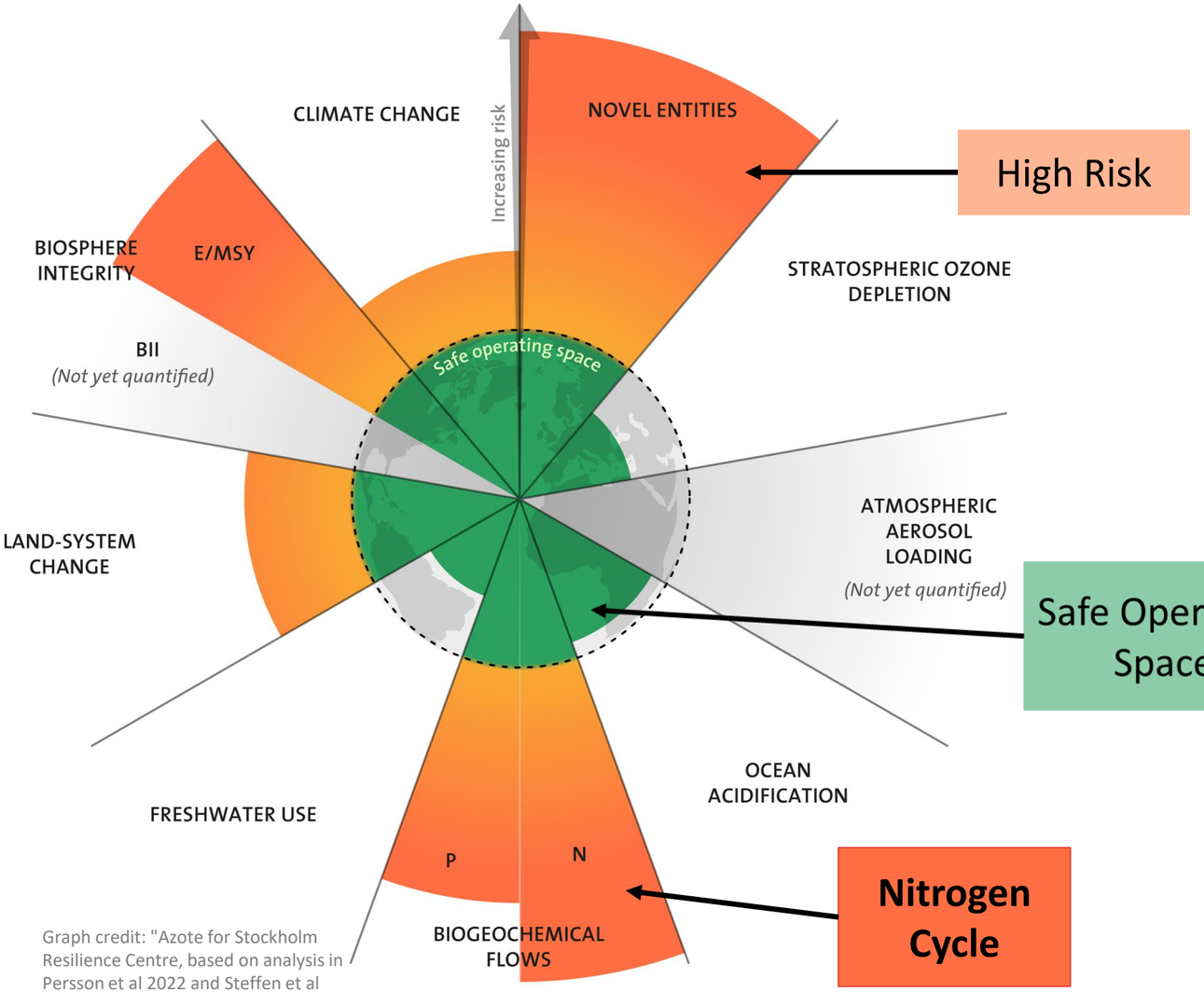
Fertilizers
Livestock

Ammonia



NH_3

Planetary Boundaries

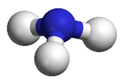


Graph credit: "Azote for Stockholm Resilience Centre, based on analysis in Persson et al 2022 and Steffen et al 2015". Download here.

Does ammonia matter?

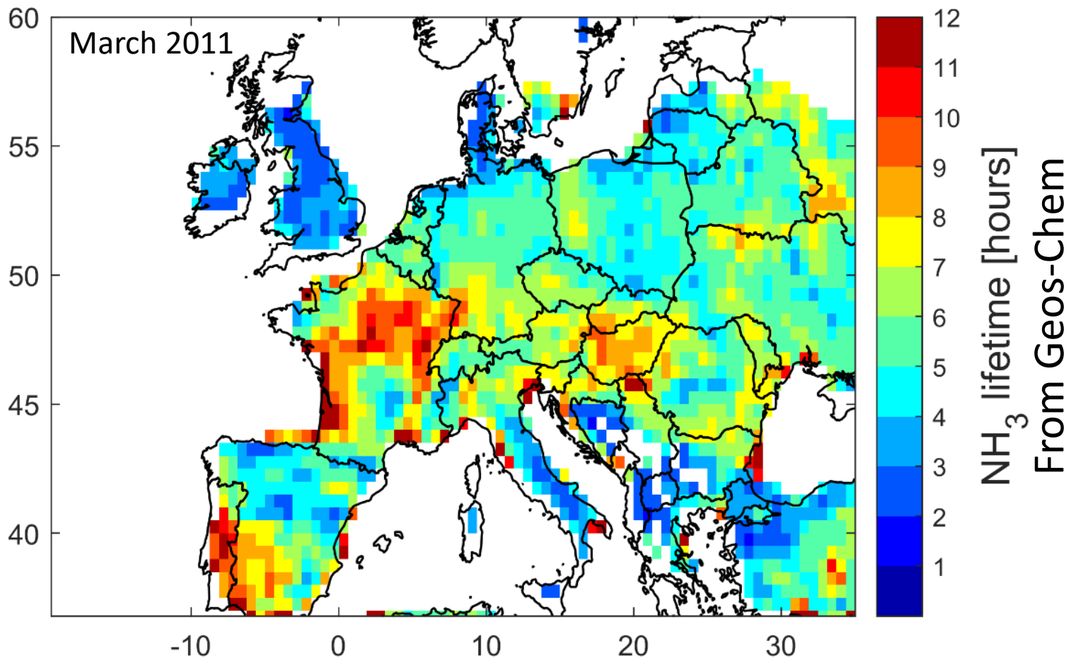
Meteorology and land-use change effect??

Data	Agricultural practices	Impact
2008 – Present		
Infrared Atmospheric Sounding Interferometer Metop	Fertilizers Livestock	Air Quality degradation
Satellite	**Ammonia**	**Lifetime**



NH_3

Ammonia has a short residence time

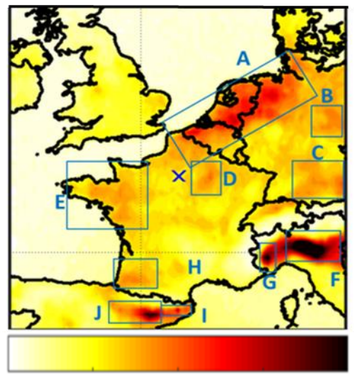


NH_3 ⋯⋯▶ PM2.5

How does temperature affect ammonia concentrations?

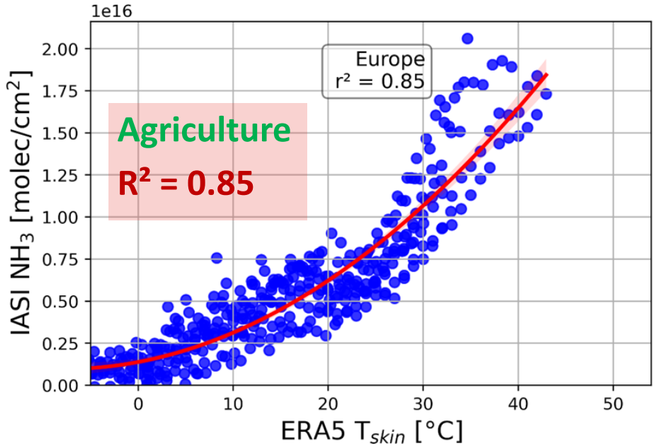
Viatte, Abeed et al. (submitted to AMT)

Europe



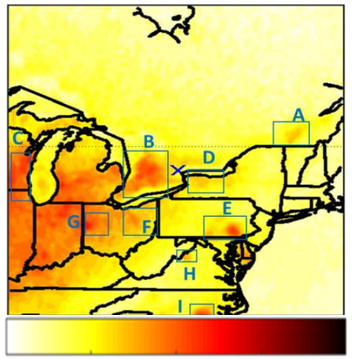
0 0.5 1 1.5 2

NH_3 total column [10^{16} molecules/cm^2]



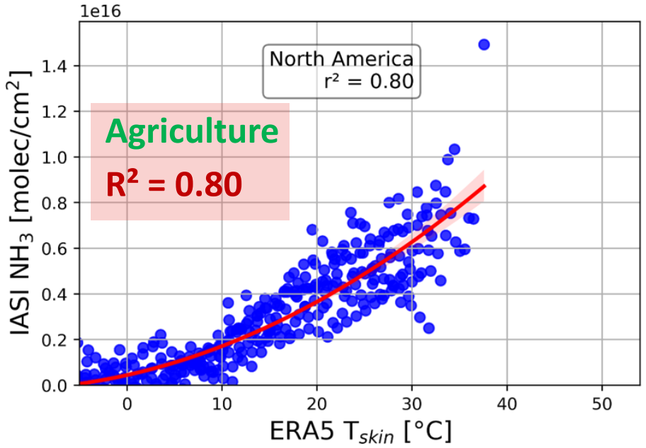
North America

2008 – 2018 IASI NH_3 concentrations

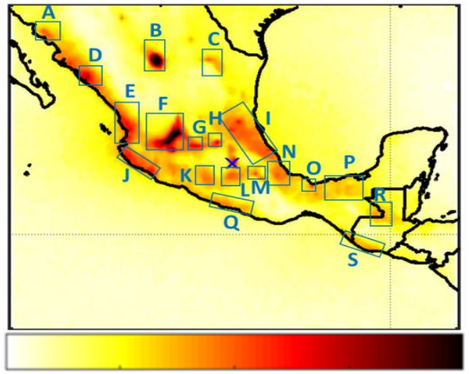


0 0.5 1 1.5

NH_3 total column [10^{16} molecules/cm^2]

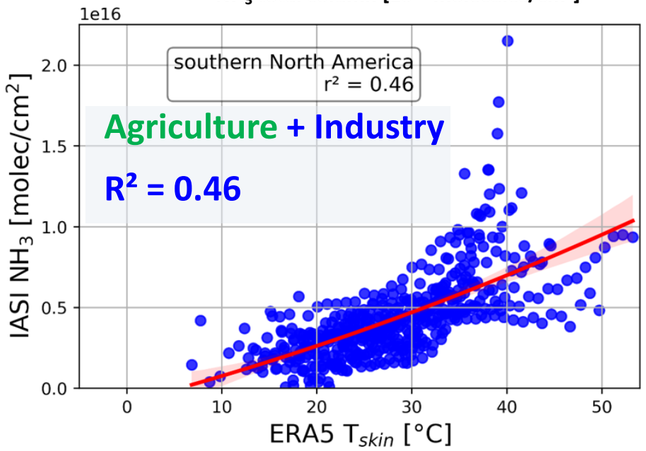


southern North America



0 0.5 1 1.5 2

NH_3 total column [10^{16} molecules/cm^2]



Agriculture Temperature increase causes NH_3 to be less soluble in water → **Temperature favors volatilization of NH_3**

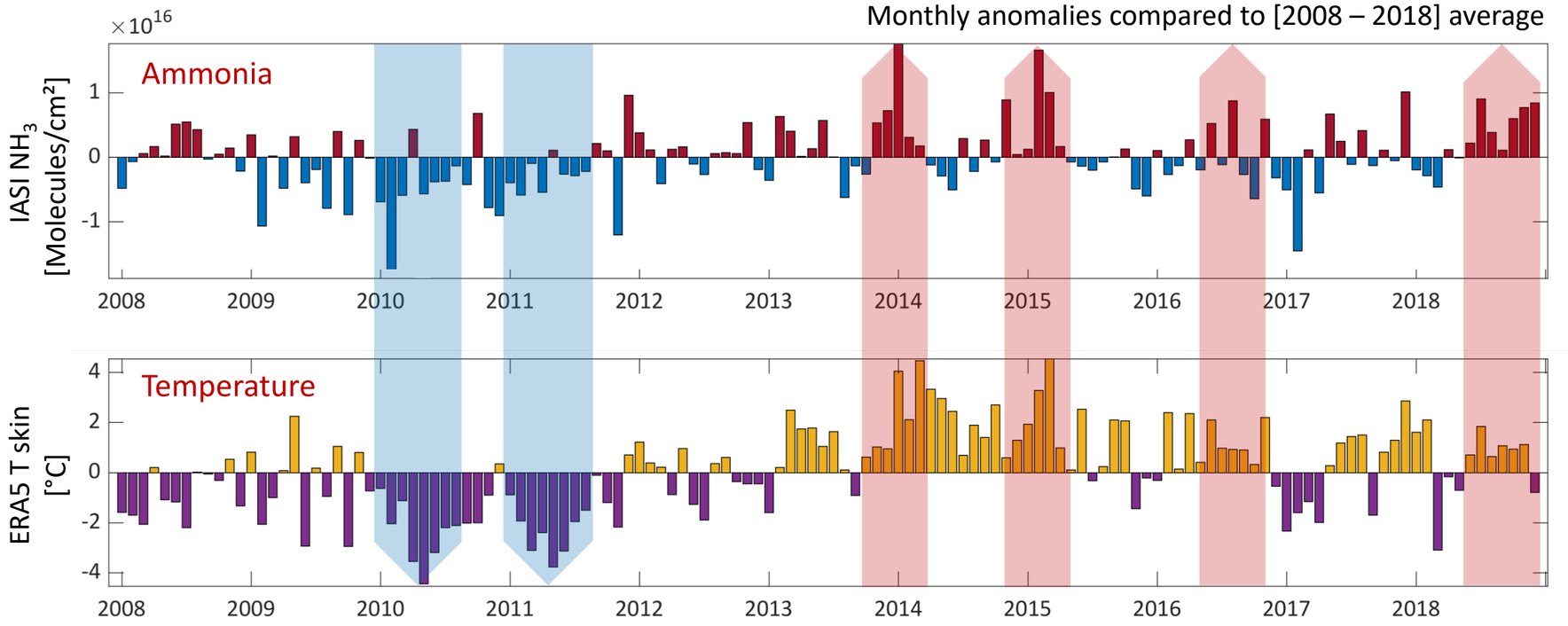
Industry NH_3 is emitted from industrial processes → **Industrial activity is what mostly governs [NH_3]**

How does temperature affect ammonia concentrations?

Political stability

United States

San Joaquin Valley, Agriculture



Correlation between temperature and ammonia

How does temperature affect ammonia concentrations?

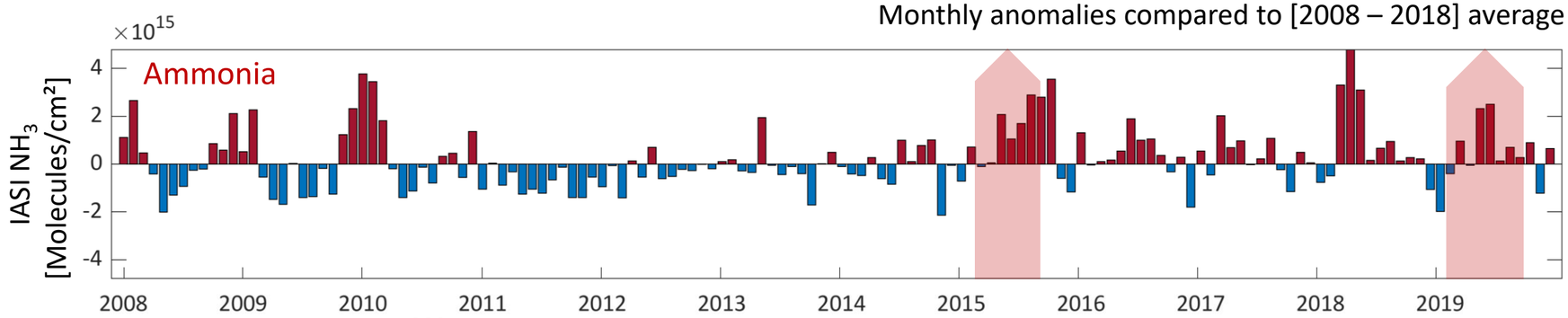
Abeed et al., 2021
https://doi.org/10.1525/elementa.2021.000041

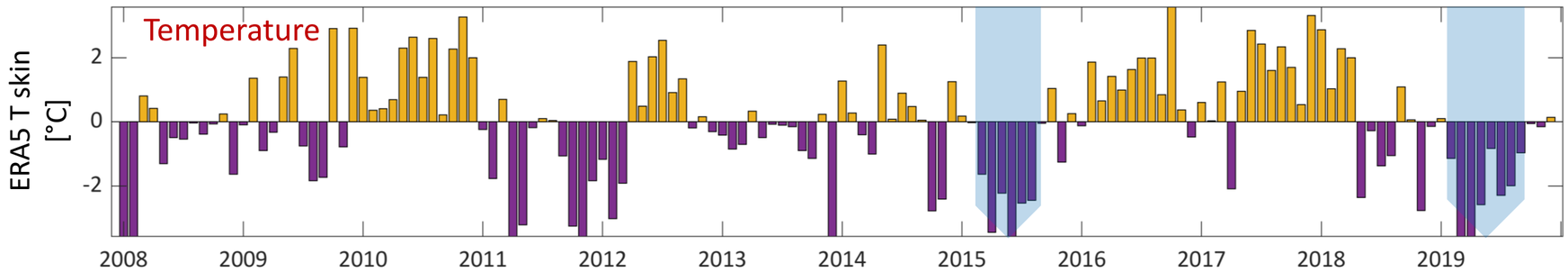
War zone

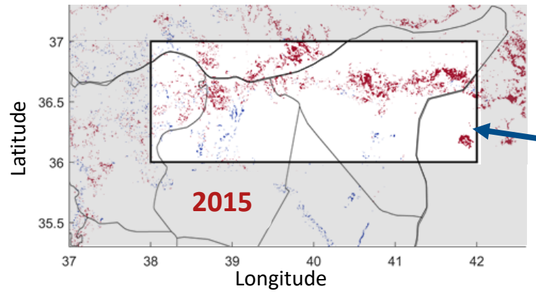
Syria

North-East Syria, Agriculture

Monthly anomalies compared to [2008 – 2018] average

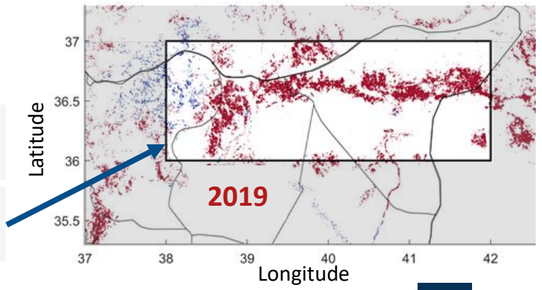






Cropland expansion

2015 +10%	Islamic State (Daesh)
2019 +35%	Kurdish Forces



ELEMENTA
Science of the Anthropocene

Abeed, R, et al. 2021. A space view of agricultural and industrial changes during the Syrian civil war. *Elem Sci Anth*, 9: 1. DOI: https://doi.org/10.1525/elementa.2021.000041

RESEARCH ARTICLE

A space view of agricultural and industrial changes during the Syrian civil war

Rimal Abeed[1,*], Cathy Clerbaux[1,2], Lieven Clarisse[2], Martin Van Damme[2], Pierre-François Coheur[2], and Sarah Safieddine[1]

The agricultural sector in Syria was heavily affected by the civil war that started in 2011. We investigate the war's impact on the country's atmospheric ammonia (NH_3) from 2008 to 2019, using measurements from the infrared atmospheric sounding interferometer instrument on board the Metop satellites. We examine the changes in NH_3 close to a fertilizer industry, whose activities were suspended due to conflict-related events. We also explore the effect of war-induced land use/land cover changes on agriculture-emitted ammonia in north-east Syria that has witnessed battles between different groups. The interpretation of the changes in NH_3 is supported by different datasets: visible satellite imagery to assess the effect on industrial activity, reanalysis data from the European center for medium-range weather forecasts to look at the effect of meteorology (temperature, wind speed, and precipitation), and land cover and burned area products from the moderate resolution imaging spectroradiometer (MODIS) to examine land use/land cover changes and fire events during the study period. We show that the NH_3 columns are directly affected by the war. Periods of intense conflict are reflected in lower values over the industry reaching –17%, –47%, and –32% in 2013, 2014, and 2016, respectively, compared to the [2008–2012] average, and a decrease reaching

Paper:

OSPP:

EGU European Geosciences Union

A space view of agricultural and industrial changes during the Syrian civil war

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