12-9-2021

Climate Change Impacts on Atmospheric Ammonia and Implications for Human Health

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Climate Change Effects on Atmospheric Ammonia and Implications for Human Health

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Introduction

According to the National Deposition Program (NADP), Cache Valley has the **highest concentrations** of atmospheric ammonia in the entire nationwide network.

Our project aims to answer the questions of whether climate variables and events, such as precipitation, averaged winds, geopotential height, and teleconnections can be used to predict the behavior of these pollutants and how human biology will thus far be affected.

Methods

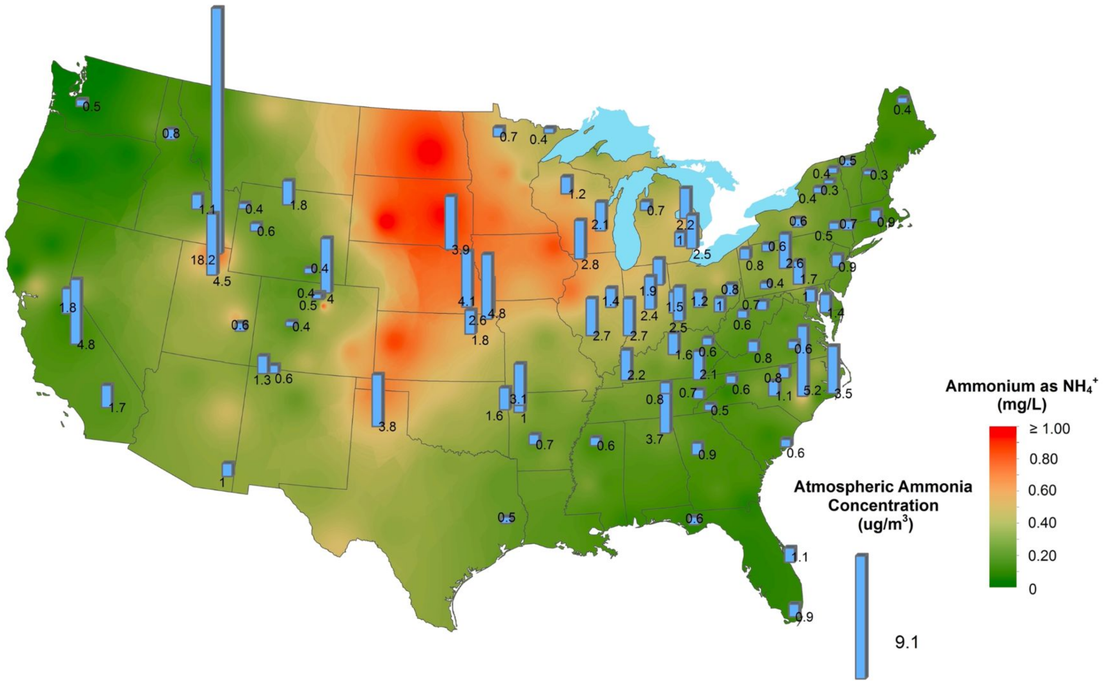
Climate Science Procedures

1. Collect atmospheric ammonia and ammonium ion deposition samples, sent to NADP lab
2. Identify patterns/periodicity of the pollutants
3. Cross-reference to climate variables using statistical analysis software such as GrADS

Health Procedures

1. Obtain hospitalization data related to asthma and other respiratory diseases
2. Run statistical analysis between climate and hospitalizations data

Precipitation is a Strong Predictor of Airborne Ammonia Levels



The background map represents the 2017 precipitation weighted mean ammonium ion concentration over the continental United States as measured by the NADP/National Trends Network (NADP/NTN). The blue bars represent the 2017 annual average atmospheric ammonia concentration as measured by AMoN.

Figure from NADP fact sheet

Airborne Ammonia Levels are Positively Correlated with Asthma Hospitalization

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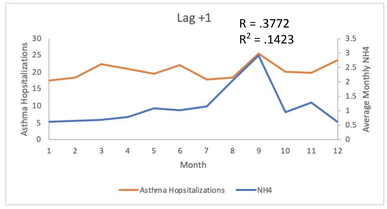
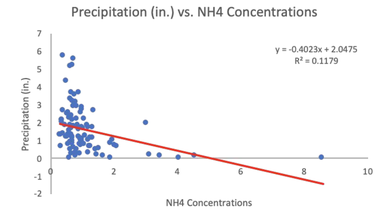
Research Questions

Climate Science Research
Question: What climate variables affect ambient ammonia concentrations?

Health Research Question:
What effects does change in atmospheric ammonia have on the health of Cache Valley residents?



Correlation of Ambient Ammonia and Asthma Hospitalizations Lagged by a Single Month



Precipitation negatively affects atmospheric Ammonia

Findings

Investigation of the connection between climate variables and atmospheric ammonia and ammonium reveals that precipitation appears to have the strongest (negative) correlation due to atmospheric scattering of particulates during precipitation events. This has implications for local air quality, as Cache Valley's dense agricultural sector combines with dryer years to exacerbate an already prevalent issue. Correlation of asthma hospitalizations and poor air quality showed that the two variables had a considerable effect on each other.

Definitions

- NH_3 - ammonia molecule
- NH_4 - ammonium ion
- Ambient ammonia - ammonia gas that is suspended in the air
- $PM_{2.5}$ - any particle that is 2.5 microns or smaller