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mberly A. Hill, Paul B. Shepson, Sonia Lasher-Trapp
rdue University, West Lafayette, Indiana

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Processing of Atmospheric Nitrogen by Clouds in a Forest Environment

1. Overview

orest growth is usually limited by nitrogen availability, o an enhancement in nitrogen input to trees can ertilize and boost a forest's ability to take up CO_2, otentially influencing global climate change. Wet eposition by precipitation and fog accounts for 80-95% f total nitrogen deposition. Clouds over forest nvironments may provide reaction surfaces and act as hotochemical reactors for water-soluble nitrogen ompounds, altering the amounts and species of itrogen deposited to the forest. This study will nvestigate the role of clouds and cloud chemistry in the itrogen cycle in a forest environment through the use f aircraft-based cloud water sampling and cloud water nalysis. The quantification and speciation of nitrogen cloud water and in the air within a cloud will expand ur understanding of the ways clouds process nitrogen nd remove it from the atmosphere.

4. Methods of Analysis

1. Collect cloud water using a slotted rod cloud water collector mounted vertically on the roof of an aircraft *(Figures 2 and 3)*
2. Measure gas-phase concentrations of NO, NO_2, and reactive nitrogen inside and outside of clouds, using a chemiluminescence detector
3. Analyze cloud water for Organic Nitrogen, Nitric acid, and Ammonia content

2. Cloud Chemistry

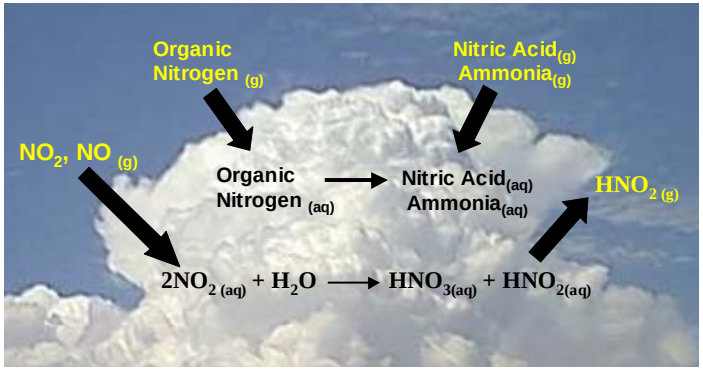

Figure 1: Nitrogen Chemistry in Clouds

Figure 2: The cloud water collector

5. Impacts

Before understanding the influence of nitrogen on the carbon cycle, we must identify and quantify all available sources of nitrogen to a forest.

The goals of this study are:

1. To quantify the amount and types of nitrogen in clouds
2. To quantify processing of atmospheric nitrogen in clouds to determine its contribution to the nitrogen cycle

3. Research Objectives

- Studies of gas and liquid cloud nitrogen composition will be conducted over a forest environment using an aircraft.
- Cloud water analysis will reveal the relative importance of various nitrogen species in a forest environment (organic nitrogen or nitric acid and ammonia) *(Figure 1).*
- Measurements of gas phase nitrogen concentrations inside and outside clouds will allow us to observe changes in concentration, such changes being indicative of nitrogen processing in clouds *(Figure 1).*
- Studies will be conducted at the University of Michigan Biological Station (UMBS) in Pellston, MI as part of the BEACON (Biosphere Exchange of Atmospheric Carbon and Odd Nitrogen) project.

http://aoss.engin.umich.edu/PROPHET/Vision/BEACON%20Vision.htm

Figure 3: The research aircraft, a Beechcraft Duchess

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