



Understanding the Sources and Sinks of Volatile Organic Compounds

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Overview

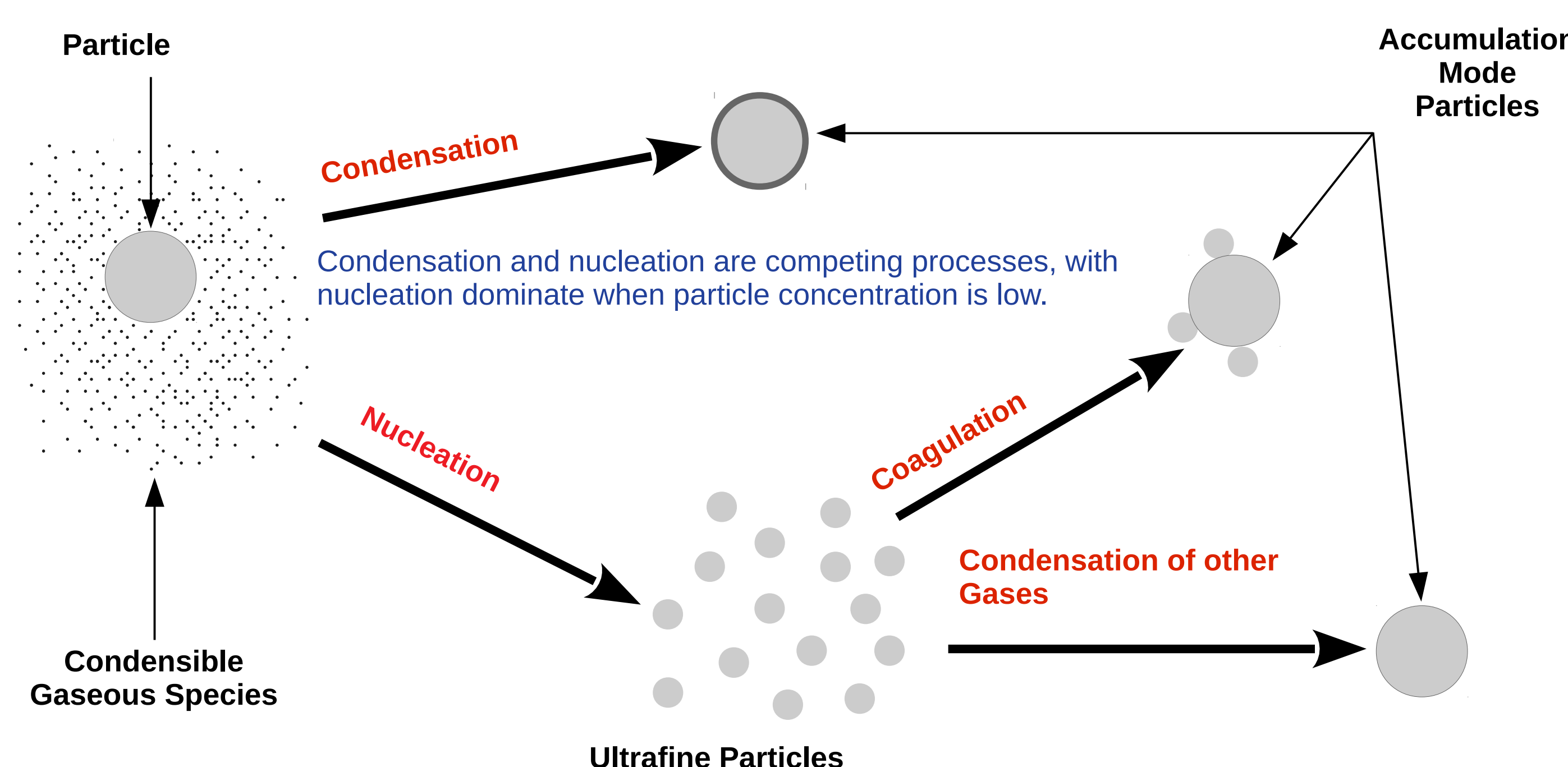
The topics of energy and the environment really interface in the atmosphere of the earth. Energy production invariably involves the atmosphere, either through emissions to the atmosphere or as an important component, such as in the harnessing of renewable (wind and solar) energy. Similarly, the land surface (environment) interacts with the atmosphere through several biogeochemical systems. This paper focuses on the sources and sinks of gases involved with energy production and the environment where people live. Specifically, the focus is on a group of gases known as volatile organic compounds (VOCs), which are emitted during energy production using fossil fuels and from natural processes. Plants, animals, and soil microorganisms that make up the land surface are a major source of VOCs in the atmosphere. VOCs are removed from the atmosphere by condensation onto existing particles and nucleation of new particles. The particles are eventually removed from the atmosphere and deposited to the land surface. There are many important questions that need to be addressed to understand the sources and sinks of VOCs; however, by restricting research questions to important regional issues and considering the current personnel, there are a few suggested questions to focus on:

1. What are the major emission sources of VOCs in North Dakota, and how do they change?
2. How can the efficiency of detection of VOC point sources be improved?
3. What is the contribution of VOCs to aerosols in a rural location such as North Dakota?



Sources and Sinks of VOCs

- Hydraulic fracturing of shale formations is an methane important source.
- Methane, and VOCs in general, are also emitted by biogenic sources such as farm animals, plant crops, and wetland soil.
- Solvents, household cleaners, and air fresheners are indoor sources of VOCs.

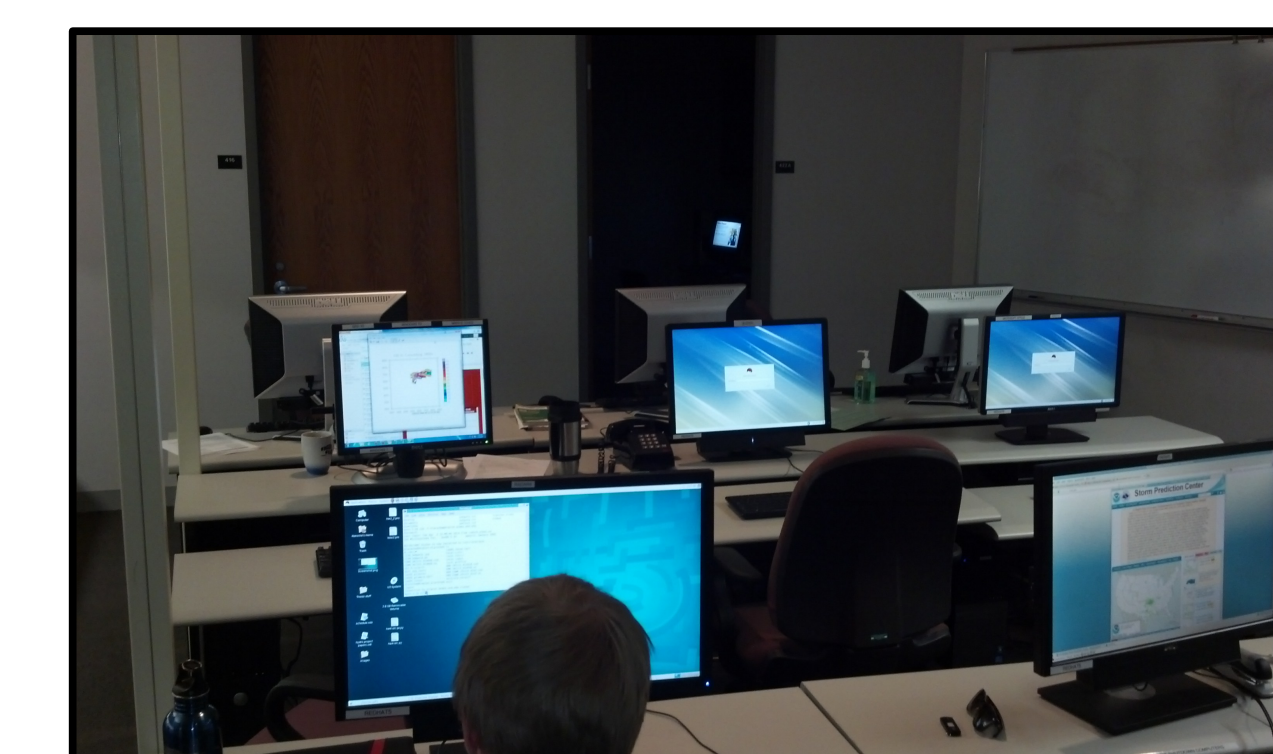


Importance of VOCs

- Understanding pollution since VOCs, along with oxides of nitrogen (NO_x), are the two major precursors to photochemical production of ozone.
- Solvents, household cleaners, and air fresheners are indoor sources of VOCs that can contribute to poor air quality.
- VOC gases condense to form suspended particles in the atmosphere (aerosols). Therefore, VOCs contribute to increases in the two major air quality issues in the United States, high surface ozone and particulate matter concentrations.
- Methane can adversely affect human health and is the second most important anthropogenic greenhouse gas. Hydraulic fracturing of shale formations is an methane important source.

Proposals Submission Topics

- **North Dakota Petroleum Council and American Petroleum Institute**
 - Emissions of volatile organic compounds (VOCs) and Aerosols in Western North Dakota
 - EERC, Continental Resources, and School of Aerospace Sciences
- **Department of Energy (DOE) Small Business Innovation Research (SBIR)**
 - Unmanned Airborne System for Autonomous Wellhead and Pipeline Monitoring
 - Department of Atmospheric Sciences
- **National Science Foundation (NSF)**
 - Volatile organic compounds (VOCs) contributions to Rural, Continental Cloud Condensation Nuclei Concentrations
 - College of Engineering and Mines and School of Aerospace Sciences
- **National Institutes of Health (NIH)**
 - Mortality of Seniors related to Exposure to Indoor Volatile Organic Compounds (VOCs) in Rural American



Collaboration and Teams

- Work together on goal to provide exceptional learning experience and student opportunities.
- Teams are required for solving today's most important problems.

