Ice Core Early Career Researchers Workshop

Organizers in 2025: Bess Koffman (Colby), T. J. Fudge (U. Washington), **Ursula Jongebloed (U. Washington),** Julia Andreasen (U. Minnesota), Jacob Chalif (Dartmouth), Laurel Bayless (CU Boulder), Kara Lamantia (Ohio State)

Supported by NSF

ICECReW's Mission

Provide **early career researchers** (ECRs) who study **ice cores and related topics** with opportunities to meet each other and form **relationships**, learn **skills** relevant to academic work and beyond, and feel **included** in the ice core community.

We strive for:

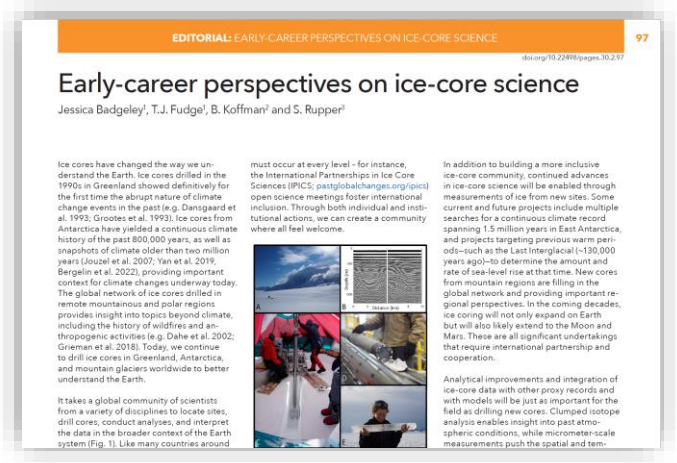
- Inclusive participation
- Broad research representation
- Diversity, equity, and inclusion
- ECR leadership
- Produce a workshop product
- Adaptive focus on different topics

What does ICECReW look like?

- Usually the weekend before IceCOMM
- 30-40 participants (+/- 3 years of PhD)
- ~1.5 days
- US researchers; 50% women, 55% self-identified as member of underrepresented group (2022)
- 4-6 panelists from various career stages and career types

What does ICECReW do?

- **History and future of ice core science:**
  - Review major scientific discoveries made possible by ice cores
  - Assess current and burgeoning areas of ice core-related research
- **Science collaboration and proposal writing:**
  - Brainstorm new projects related to ice core science
  - Learn about the process of applying for funding
- **Career opportunities for ECRs studying ice cores**:
  - Discuss opportunities and job-search strategies for careers in academia, industry, and government
- **Scientific paper writing (in collaboration with COLDEX!)**:
  - Share best practices for communicating scientific research in academic papers



EDITORIAL: EARLY-CAREER PERSPECTIVES ON ICE-CORE SCIENCE 97

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Early-career perspectives on ice-core science

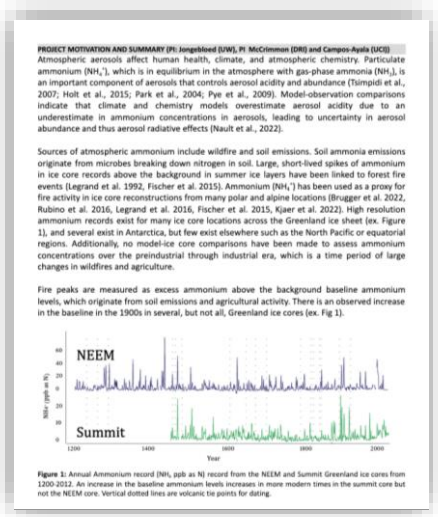
Jessica Badgeley[1], T.J. Fudge[1], B. Koffman[2] and S. Rupper[3]

Ice cores have changed the way we understand the Earth. Ice cores drilled in the 1990s in Greenland showed definitively for the first time the abrupt nature of climate change events in the past (e.g. Dansgaard et al. 1993; Grootes et al. 1993). Ice cores from Antarctica have yielded a continuous climate history of the past 800,000 years, as well as snapshots of climate older than two million years (Jouzel et al. 2007; Yan et al. 2019; Bergelin et al. 2022), providing important context for climate changes underway today. The global network of ice cores drilled in remote mountainous and polar regions provides insight into topics beyond climate, including the history of wildfires and anthropogenic activities (e.g. Dahe et al. 2002; Grieman et al. 2018). Today, we continue to drill ice cores in Greenland, Antarctica, and mountain glaciers worldwide to better understand the Earth.

It takes a global community of scientists from a variety of disciplines to locate sites, drill cores, conduct analyses, and interpret the data in the broader context of the Earth system (Fig. 1). Like many countries around the world, the International Partnerships in Ice Core Sciences (IPICS; pastglobalchanges.org/ipics) open science meetings foster international inclusion. Through both individual and institutional actions, we can create a community where all feel welcome.

In addition to building a more inclusive ice-core community, continued advances in ice-core science will be enabled through measurements of ice from new sites. Some current and future projects include multiple searches for a continuous climate record spanning 1.5 million years in East Antarctica, and projects targeting previous warm periods–such as the Last Interglacial (~130,000 years ago)–to determine the amount and rate of sea-level rise at that time. New cores from mountain regions are filling in the global network and providing important regional perspectives. In the coming decades, ice coring will not only expand on Earth but will also likely extend to the Moon and Mars. These are all significant undertakings that require international partnership and cooperation.

Analytical improvements and integration of ice-core data with other proxy records and with models will be just as important for the field as drilling new cores. Clumped isotope analysis enables insight into past atmospheric conditions, while micrometer-scale measurements push the spatial and tem-



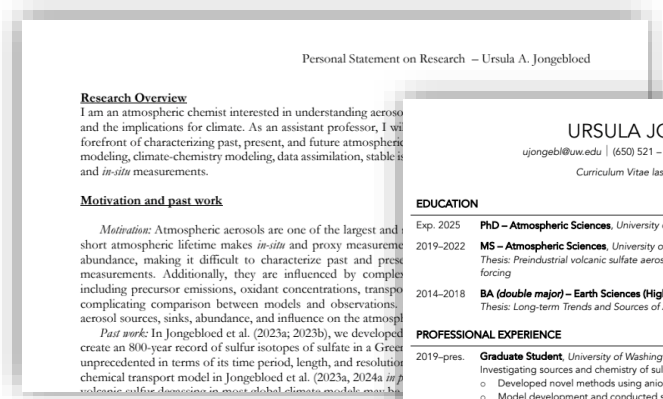
PROJECT MOTIVATION AND SUMMARY (PI: Jongebloed [UW], PI McCrimmon [DRI] and Campos-Ayala [UCI])

Atmospheric aerosols affect human health, climate, and atmospheric chemistry. Particulate ammonium (NH_4^+), which is in equilibrium in the atmosphere with gas-phase ammonia (NH_3), is an important component of aerosols that controls aerosol acidity and abundance (Tsimpidi et al., 2007; Holt et al., 2015; Park et al., 2004; Pye et al., 2009). Model-observation comparisons indicate that climate and chemistry models overestimate aerosol acidity due to an underestimate in ammonium concentrations in aerosols, leading to uncertainty in aerosol abundance and thus aerosol radiative effects (Nault et al., 2022).

Sources of atmospheric ammonium include wildfire and soil emissions. Soil ammonia emissions originate from microbes breaking down nitrogen in soil. Large, short-lived spikes of ammonium in ice core records above the background in summer ice layers have been linked to forest fire events (Legrand et al. 1992, Fischer et al. 2015). Ammonium (NH_4^+) has been used as a proxy for fire activity in ice core reconstructions from many polar and alpine locations (Brugger et al. 2022, Rubino et al. 2016, Legrand et al. 2016, Fischer et al. 2015, Kjaer et al. 2022). High resolution ammonium records exist for many ice core locations across the Greenland ice sheet (ex. Figure 1), and several exist in Antarctica, but few exist elsewhere such as the North Pacific or equatorial regions. Additionally, no model-ice core comparisons have been made to assess ammonium concentrations over the preindustrial through industrial era, which is a time period of large changes in wildfires and agriculture.

Fire peaks are measured as excess ammonium above the background baseline ammonium levels, which originate from soil emissions and agricultural activity. There is an observed increase in the baseline in the 1900s in several, but not all, Greenland ice cores (ex. Fig 1).

Figure 1: Annual Ammonium record (NH_4 ppb as N) record from the NEEM and Summit Greenland ice cores from 1200-2012. An increase in the baseline ammonium levels increases in more modern times in the summit core but not the NEEM core. Vertical dotted lines are volcanic tie points for dating.



Personal Statement on Research – Ursula A. Jongebloed

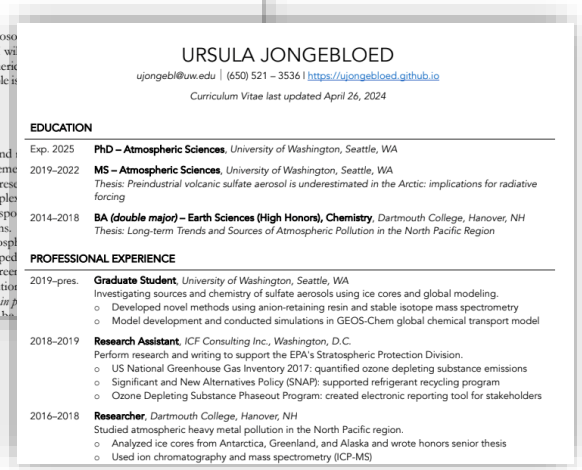
Research Overview

I am an atmospheric chemist interested in understanding aeroso
and the implications for climate. As an assistant professor, I wi
forefront of characterizing past, present, and future atmospheri
modeling, climate-chemistry modeling, data assimilation, stable i
and *in-situ* measurements.

Motivation and past work

Motivation: Atmospheric aerosols are one of the largest and
short atmospheric lifetime makes *in-situ* and proxy measureme
abundance, making it difficult to characterize past and prese
measurements. Additionally, they are influenced by comple
including precursor emissions, oxidant concentrations, transpo
complicating comparison between models and observations,
aerosol sources, sinks, abundance, and influence on the atmosp

Past work: In Jongebloed et al. (2023a; 2023b), we developed
create an 800-year record of sulfur isotopes of sulfate in a Gree
unprecedented in terms of its time period, length, and resolutio
chemical transport model in Jongebloed et al. (2023a, 2024a *in p*



URSULA JONGEBLOED

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Curriculum Vitae last updated April 26, 2024

EDUCATION

Exp. 2025 **PhD – Atmospheric Sciences**, *University of Washington, Seattle, WA*

2019–2022 **MS – Atmospheric Sciences**, *University of Washington, Seattle, WA*
Thesis: Preindustrial volcanic sulfate aerosol is underestimated in the Arctic: implications for radiative forcing

2014–2018 **BA *(double major)* – Earth Sciences (High Honors), Chemistry**, *Dartmouth College, Hanover, NH*
Thesis: Long-term Trends and Sources of Atmospheric Pollution in the North Pacific Region

PROFESSIONAL EXPERIENCE

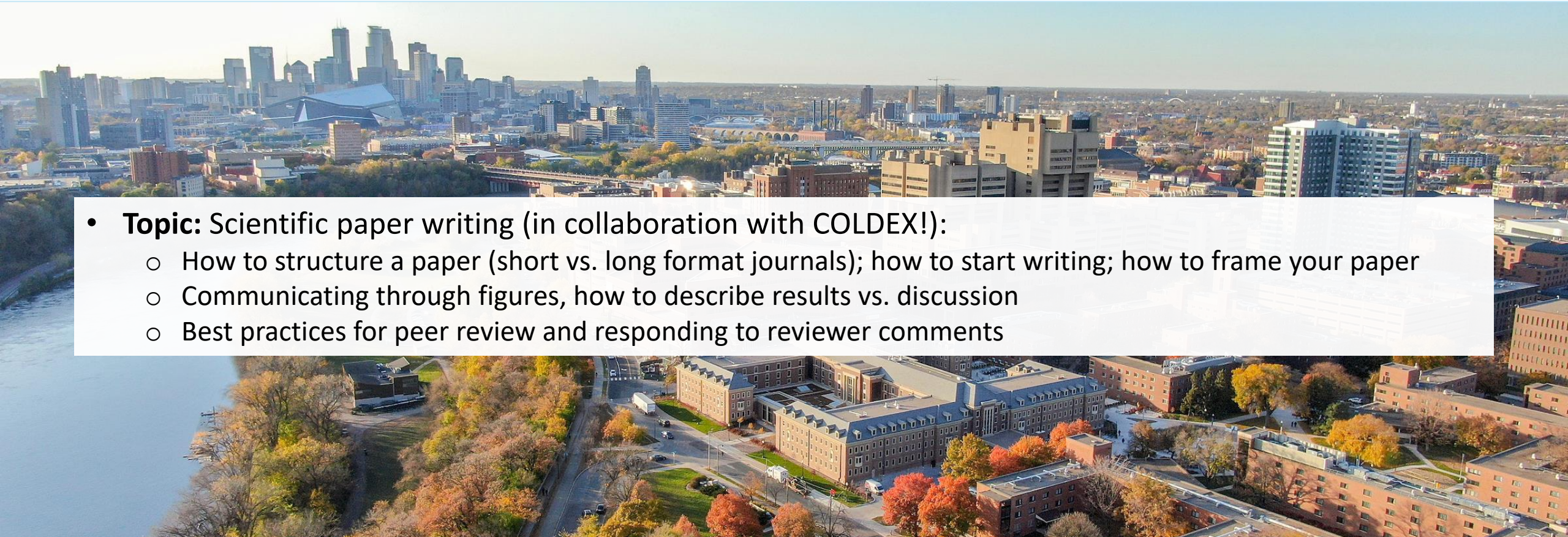
2019–pres. **Graduate Student**, *University of Washington, Seattle, WA*
Investigating sources and chemistry of sulfate aerosols using ice cores and global modeling.
- Developed novel methods using anion-retaining resin and stable isotope mass spectrometry
- Model development and conducted simulations in GEOS-Chem global chemical transport model

2018–2019 **Research Assistant**, *ICF Consulting Inc., Washington, D.C.*
Perform research and writing to support the EPA's Stratospheric Protection Division.
- US National Greenhouse Gas Inventory 2017: quantified ozone depleting substance emissions
- Significant and New Alternatives Policy (SNAP): supported refrigerant recycling program
- Ozone Depleting Substance Phaseout Program: created electronic reporting tool for stakeholders

2016–2018 **Researcher**, *Dartmouth College, Hanover, NH*
Studied atmospheric heavy metal pollution in the North Pacific region.
- Analyzed ice cores from Antarctica, Greenland, and Alaska and wrote honors senior thesis
- Used ion chromatography and mass spectrometry (ICP-MS)

What is the plan for ICECReW 2025?

- **Location**: Minneapolis (or nearby St. Paul), Minnesota
- **Dates**: May 15-17, 2025
- **Who:**
  - ECRs in fields related to ice core science
  - YOU!



- **Topic:** Scientific paper writing (in collaboration with COLDEX!):
  - How to structure a paper (short vs. long format journals); how to start writing; how to frame your paper
  - Communicating through figures, how to describe results vs. discussion
  - Best practices for peer review and responding to reviewer comments

How do I get involved?

- If you are an ECR, you should apply to participate in ICECReW!
- If you are a researcher (e.g., professor) reach out to an organizer!
- If you are a researcher in another field and want to bring this to your community, email us!
- **To get involved, apply for ICECReW 2025 or email an organizer:**

https://herculesdome.org/icecrew-2025

My email: ujongebl@uw.edu

"This was one of the most **well-organized and open/welcoming** workshops I have ever been a part of."

"For the first time since starting my program, **I feel like part of the ice core community.**"

"It provided a great way for me to interact with many people in my field that I haven't met before. I felt **really excited and hopeful about the future of ice core science!** I'm specifically looking forward to contributing to the synthesis publication."

Questions?

Get involved: **https://herculesdome.org/icecrew-2025**

Feel free to email me at ujongebl@uw.edu!

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