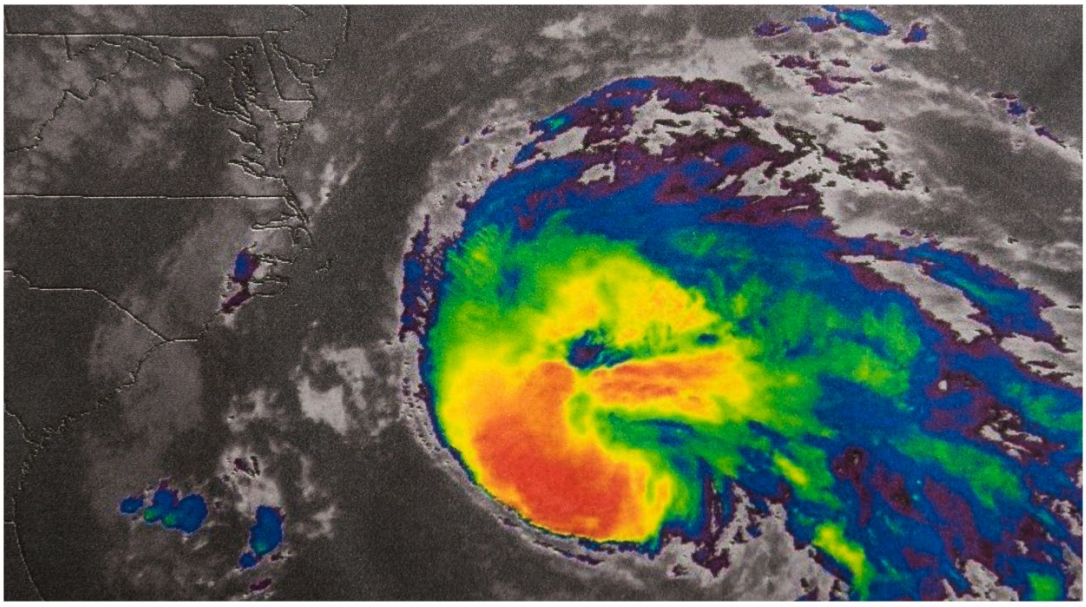
THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE
Hydrology &
Atmospheric Sciences



Doctor of Philosophy in Atmospheric Sciences Graduate Student Handbook

www.has.arizona.edu

Draft 8/18/2026

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1. Introduction

The purpose of this handbook is to guide students, after the completion of the admission and matriculation process, as you complete a degree in the Department of Hydrology and Atmospheric Sciences (HAS) housed in the College of Science. It features the department's and Graduate College's requirements that must be met to complete your degree program and answer questions you may have during your academic career.

1.1. Department of Hydrology & Atmospheric Sciences (HAS)

The HAS department was established in 2016, when the former Hydrology and Water Resources department and Atmospheric Sciences department officially merged. Through this merger, the University of Arizona established a unique department that integrates the study of water-related mass and energy movement, storage, and transformation across Earth's systems. This integration positions the department to play a leading role in addressing the challenges of water, weather, and climate in both their physical and chemical dimensions in the 21st century. We also strive to maintain our global leadership in hydrologic and atmospheric sciences research.

HAS is at the forefront of the field and is recognized as one of the top programs nationally and globally. In 2024, the Water Resources Program at the University of Arizona ranked #1 in the nation and #4 globally, reflecting the caliber of our faculty and students and the commitment of our researchers and staff. Excellence is our guiding principle, and we recognize that true excellence cannot exist without celebration of diversity and creating a sense of belonging for all.

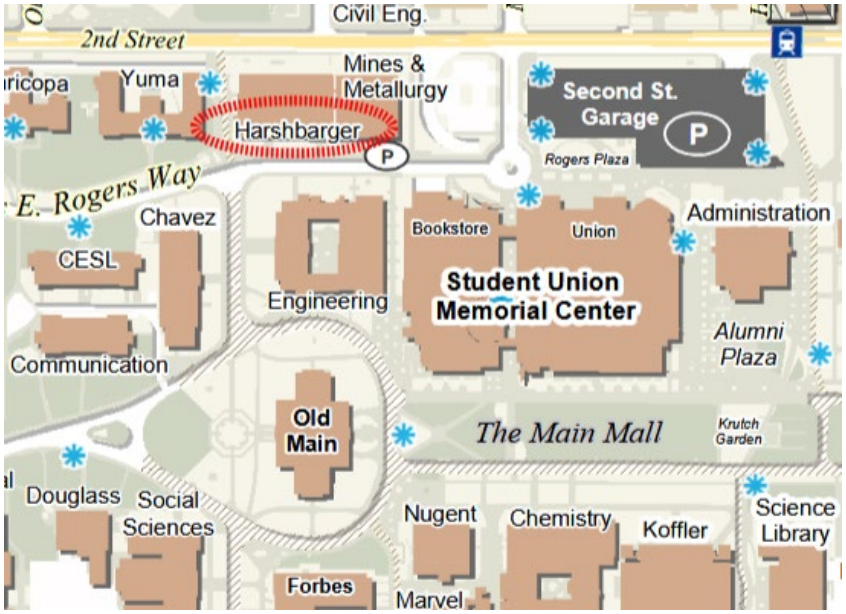
Our **vision** is to lead the world in integrated and quantitative hydrologic and atmospheric sciences and to develop and disseminate the knowledge needed to solve the water, weather, and climate related problems in the world.

Our **mission** is to build an integrated program that considers the fate and transport of water, energy, and chemical constituents throughout the land-atmosphere system.

Our **scope of work** is to maintain our world leading role in hydrologic and atmospheric sciences research and to offer unique, rigorous, and relevant educational programs at the BS, MS, and PhD levels.

Location Department of Hydrology & Atmospheric Sciences (HAS)
1133 E. James E. Rogers Way
Tucson, AZ 85721

UA Building #11-John W. Harshbarger Building (HARSH)



The John W. Harshbarger Building (JWH/HARSH) is conjoined with a stairwell with the Mines & Metallurgy Building (1235 E. James E. Rogers Way, Building 12). Both buildings are home to Hydrology &Atmospheric Sciences (HAS), Chemical & Environmental Engineering, School of Mining Engineering & Mineral Resources, and Material Science & Engineering.

1.2. HAS Departmental Contact Information

Academic Advising		
Eyad Atallah	Director of Graduate Studies (ATMO)	eyadatallah@arizona.edu
Lupe Romero	HAS Graduate Program Coordinator (GPC)	romerog@arizona.edu
Cindy Nguyen	Graduate College Degree Services	cnguyen@arizona.edu

HAS Administration		
Peter Troch	Professor & Department Head	patroch@arizona.edu
Jennifer McIntosh	Professor & Associate Head	jenmc@arizona.edu
Laura Duran	Executive Assistant	laura13@arizona.edu

Earth Sciences Business Team (incl. HAS)		
Pat Waters	Manager, Business-Finance	HAS-busops@arizona.edu
Cindy Barnett	Accountant I	
Angie Boylan	Accounting Assistant	
Heather Alvarez	Grant & Contract Administrator III	
Olivia Bernal	Human Resources Generalist III	
Lili Schwartz	Human Resources Generalist II	
Nelly McDowell	Human Resources Generalist I	

IT Help		
Mike Eklund	Systems Administrator, Principal	HAS-IT@arizona.edu
Matthew Jones	Systems Administrator, Senior	
UITS	UA Tech Support	https://it.arizona.edu/student-resources

Support Staff		
Terrie Thompson	Website Development (part-time)	tht@arizona.edu
Tim Corley	Lab. Coord. & Office Space (retired)	tcorley@arizona.edu

HASSA	HAS Student Association	uahassa@gmail.com

1.3. HAS Faculty

UA Faculty (tenure/tenure eligible) can serve on student's committees as the primary faculty advisor or a committee member. Faculty in non-tenure positions such as Professor of Practice, Research, or Lecturer, can serve as a co-chair (co-faculty advisor) or as a committee member.

Avelino Arellano	Professor	afarellano@arizona.edu
Eyad Atallah	Associate Professor of Practice	eyadatallah@arizona.edu
Victor Baker	Regents' Professor	baker@arizona.edu
Ali Behrangi	Professor	behrangi@arizona.edu
Andrew Bennett	Assistant Professor	andrbenn@arizona.edu
Hsin-I Chang	Assistant Research Professor	hchang05@arizona.edu
Xiaomin Chen	Associate Professor	chenx26@arizona.edu
Laura Condon (Lotter)	Professor	lecondon@arizona.edu
Xiquan Dong	Professor	xdong@arizona.edu
P.A. "Ty" Ferre	Professor	tyferre@arizona.edu
Bo Guo	Associate Professor	boguo@arizona.edu
Hoshin Gupta	Regents' Professor	hoshin@arizona.edu
Jennifer McIntosh	Professor, Assoc. Dept. Head	jenmc@arizona.edu
Laura Meredith	Associate Professor	laurameredith@arizona.edu
Guo-Yue Niu	Professor	niug@arizona.edu
Yang Song	Associate Professor	chopinsong@arizona.edu
Bryn Stewart	Assistant Professor	brynstewart@arizona.edu
Peter Troch	Professor, Department Head	patroch@arizona.edu
Dale Ward	Lecturer	dward@arizona.edu
Martha P.L. Whitaker	Professor of Practice	marthaw@arizona.edu
C.L. Larry Winter	Professor	winter@arizona.edu
Kim Wood	Associate Professor	kimwood@arizona.edu
Baike Xi	Research Professor	baikex@arizona.edu
Tian-Chyi Jim Yeh	Professor	yeh@arizona.edu
Xubin Zeng	Professor	xubin@arizona.edu
Marek Zreda	Professor	marek@arizona.edu

HAS faculty members are active in the following areas in Hydrology and Atmospheric Sciences:

- Atmospheric dynamics
- Atmospheric chemistry
- Atmospheric physics
- Atmospheric remote sensing
- Climate science
- Hydrometeorology
- Environmental hydrology
- Human-water interactions

- Planetary hydrology
- Subsurface hydrology
- Surface hydrology
- Catchment hydrology
- Hydrogeochemistry and water quality
- Machine learning and Artificial intelligence applications in Hydrology and Atmospheric Sciences

Highlights of HAS faculty research and scholarly contributions are provided below. The activities described are representative of the faculty's contributions to research and science.

Ave Arellano has received funding from NASA and NOAA to tackle the complex interplay of Air Quality and Greenhouse Gases across scales. By integrating Earth system models with ground-based, aircraft, and satellite data, his research group advances our understanding of how AQ/GHG influences weather, climate, and our environment. They collaborate with UA/Public Health to assess pesticide drift impacts on vulnerable communities and support the Arizona Department of Environmental Quality (ADEQ) and ASU in addressing ozone non-attainment in Phoenix and Yuma.

Victor Baker's expertise in paleohydrology reaches beyond Earth. He applies hydrological principles to understanding (1) the most extreme flooding phenomena on Earth and (2) the ancient hydrological conditions for the planet Mars. Though the greatest freshwater flooding on Earth involved ice-age conditions, understanding these phenomena led to paleoflood hydrology, a nature-based approach to understanding the flooding that can impact humankind in the current era of exacerbated extremes. This methodology is being applied to risk analyses for dams and nuclear power plants. His Mars research has documented massive megaflood phenomena that generated episodic formation of ocean-like water bodies that were associated with periods of Earth-like hydrological cycling.

Ali Behrangi and his group are leading the development of the next generation Global Precipitation Climatology Project (GPCP) product under NASA support (2017-2028). GPCP precipitation products have been used in over 5000 scientific journal articles and have become a science community standard for the global precipitation observation record. The GPCP products are used in many major climate reports, such as the Intergovernmental Panel on Climate Change (IPCC) and the annual "State of the Climate", published by the Bulletin of the American Meteorological Society. Behrangi is also a member of the proposing team for the recently selected $30 M NASA mission "Snow4flow" to study glaciers and precipitation impact on them.

Andrew Bennett is researching cutting edge methods for hydrological modeling, with a focus on developing deep learning methods. His work seamlessly integrates powerful deep learning methods into physically based models of the land surface. He has improved prediction of land-atmosphere interactions and the ability to model long-term water balance by coupling neural networks to process-based hydrologic models. He also developed novel architectures for the emulation of integrated hydrologic models which run a thousand times faster than the original simulators, and is currently developing advanced hybrid modeling techniques that will leverage a wide range of large-scale datasets to improve our understanding and predictions of the

hydrologic cycle.

Xiaomin Chen is a hurricane scientist focused on advancing the understanding and modeling of boundary-layer processes governing hurricane intensity, structure, and landfall wind hazards. He integrates large-eddy simulations, airborne and ground-based Doppler radars, numerical weather prediction, and artificial intelligence to address these challenges. Chen led the development of a tropical cyclone boundary-layer parameterization scheme now implemented in NOAA's next-generation operational Hurricane Analysis and Forecast System (HAFS), improving forecasts of hurricane intensity and structure. Chen collaborates closely with NOAA and NCAR scientists to translate fundamental research into operational forecasting capabilities that enhance hurricane preparedness and strengthen community resilience**.**

Laura Condon (Laura Lotter) leads a $6M NSF convergence accelerator project called HydroGEN. Her multi-institutional team of hydrologists, computer scientists and machine learning experts are developing a unique national hydrologic forecasting platform that combines advanced physical hydrology models with national observation networks and machine learning to provide unprecedented views into hydrologic behaviors from the bedrock to the treetops.

Xiquan Dong is the UA-PI for NASA EVC-1 (Earth Venture Continuty-1) project with a total of $150M during 2021-2031 with UA portion of $3.5M. In this project, Dr. Dong's group will provide the global solar fluxes from the Top-of-Atmosphere and the land surface to study the global radiation budgets and their associated global climate changes. This project partially supports two faculty and fully supports two PhD students.

Ty Ferre My research interests focus on improving the selection of measurements to support hydrologic decision-making. This involves the development of methods that use decision science to formulate hydrologic models and then use of hydrologic models to select and interpret measurements. I am particularly interested in the coupling relatively simple physical models, instrument response models, and advanced inverse methods to support decision making. Much of my work focuses on the incorporation of geophysical data into hydrologic analysis in this framework.

Bo Guo published one of the first papers (Guo et al., 2020, WRR) that provided the foundational understanding of the fate and transport of PFAS in the vadose zone. Building upon this pioneering work, Bo's group has developed a suite of practical modeling tools (packaged as "PFAS-LEACH", supported by a $1.35M DoD project) spanning a wide range of complexities for supporting risk assessment and remediation efforts at PFAS-contaminated sites. These PFAS-LEACH simulators have been widely used by practitioners in the US and internationally (30+ consulting firms and regulatory agencies to date) for assessing contamination risks at many PFAS-impacted sites.

Hoshin Gupta's long-term focus has been the theory and practice of Learning with Models and Data, with a particular interest in facilitating scientific discovery. He currently works on bridging "Information Theory" and "Machine Learning" with hydrological science. Rather than an emphasis on predictive accuracy, he focuses on interpretability, generalizability, and support for scientific hypothesis testing. With recent student Yuan Heng Wang, he developed the "Mass

Conserving Perceptron" as a foundational unit for interpretable machine-learning of geo-scientific systems from data. With current students, he is further exploring the hydrologically interpretable HydroLSTM machine-learning architecture that facilitates improved understanding and predictions in ungauged basins.

Jennifer McIntosh's research contributes to our understanding of sources of water, solutes, and gasses in the Earth's shallow crust, from the near surface to over several kilometers depth. She leads an NSF FRES project ($3M) on how fluids and co-existing microbial communities have evolved in response to changes in geologic and hydrologic forcings across the Colorado Plateau. Her work informs production of subsurface resources (e.g., Li, H_2, He), storage of energy waste-products (e.g., anthropogenic CO_2), and human health (e.g., geogenic contaminants) and has led to several invited talks and advisory groups for the US National Academy of Sciences, UK Royal Society, International Atomic Energy Agency, and US Nuclear Waste Technical Review Board. Results from this work are included in the Earth Science Discovery Program that brings over 600 schoolchildren to UA Flandrau's Science Center from local title I schools and trains 11 undergraduate students each year to deliver hands-on activities.

Laura Meredith integrates atmospheric and soil trace gas and volatile measurements with genomics and stable isotope labeling to unearth the intricate feedbacks between soil microbes, plants, and atmospheric chemistry. Her research group explores the "microbial volatilome," investigating how environmental stressors like drought alter the exchange of volatile organic compounds (VOCs) and trace gases—such as atmospheric hydrogen, nitrous oxide, and carbonyl sulfide—along the soil-plant-atmosphere continuum. She co-led the major international Water, Atmosphere, and Life Dynamics (WALD) campaign in the Biosphere 2 Tropical Rainforest, leading a multidisciplinary team to track ecosystem-scale responses to extreme climate conditions. Backed by funding from the National Science Foundation, including a CAREER Award, and the Department of Energy, her group's pioneering work with novel soil gas probes helps decode subsurface metabolic pathways to advance our understanding of biosphere-atmosphere interactions and soil carbon stabilization.

Guo-Yue Niu is addressing the question: Why have global drylands been drying? **He** tested the hypothesis of "dry gets drier, wet gets wetter" globally using the GRACE terrestrial water storage change data and found that global drylands have been drying with the hyperarid and arid regions showing the most significant decreasing trend. However, the wet regions did not show an apparent wetting trend. These results further suggest that Earth System Models (ESMs) for use in future climate projections and S2S predictions should further include plant adaptation mechanisms. Soil carbon-climate feedback has been considered one of the big uncertainties in 9rojectting future climate.

Yang Song's BIO-ESM lab group is addressing this challenge using gene-to-ecosystem scale data, artificial intelligence, and process-based Earth system models. As the lead PI, she is leading a DOE-sponsored project that collaborates with scientists from DOE Sandia National Lab and Oak Ridge National Lab to investigate the role of microbial functional diversity on soil carbon-climate feedback at the global scale and advance the prediction power of DOE E3SM, which is one of Earth system model participating in the Climate Model Intercomparison Project Phase 6 (CMIP6).

Bryn Stewart's research focuses on understanding hydrological and biogeochemical processes that govern water quantity and quality across different landscapes using process-based reactive transport modeling, data-driven modeling, and field observations. They are interested in studies spanning different temporal and spatial scales that improve our understanding of catchment processes and how they respond to climate change and other human-driven disturbances.

Peter Troch is leading multiple efforts to use the $40M LEO (Landscape Evolution Observation Laboratory; http://leo.b2science.org/) to conduct controlled rainfall-runoff experiments at a unique scale. Each of the three hillslopes of LEO contains a spatially dense sensor and sampler network capable of resolving meter-scale lateral heterogeneity and sub-meter scale vertical heterogeneity in moisture, energy and carbon states. These bare soil landscapes have been studied for the past 12 years (2013-2024) through hydrologic, geochemical and microbiological foci, resulting in 25 of 43 peer-reviewed papers led by faculty, postdocs and students from HAS. We are now preparing for the next phase of the experiment, when vascular biota in the form of heat- and drought-tolerant plant communities will be introduced to the landscapes.

Martha Whitaker brings authentic research experiences to undergraduates. She is the PI and co-PI for two undergraduate research teams known as vertically-integrated projects (VIPs): 1) Arizona Streamgage Catalog (AZStreamCat); and 2) Integrated Climate Research: Ecology, Water, Weather (ICREWW). She has also developed a course-based undergraduate research experience (CURE) in HWRS 350 Principles of Hydrology. These programs help undergraduates develop research and communication skills, and the CURE class democratizes students' access to a research experience.

Kim Wood's research group applies open-source tools such as Python to the study of tropical cyclone (TC; e.g., hurricane) behavior from the individual storm to the basin scale, with an emphasis on interpretable data visualizations that support their efforts in teaching and outreach. Their work interrogates TC structure in a storm-centered framework via large datasets, including satellite and aircraft observations, in addition to the atmospheric and oceanic conditions that affect TC evolution. Their investigation of TCs that rapidly weaken over the ocean is funded by an NSF CAREER award. For more information, visit their website at https://kouya.has.arizona.edu/.

Baike Xi is the co-investigator for the NASA Libera project (2021-2031): $3.5 million research funding at UA with PI, Dr. Xiquan Dong), providing shortwave, visible, and near-infrared (NIR, 0.7–5 μm) irradiances at the Top-Of-the-Atmosphere and the land surface via radiative transfer models and associated atmospheric profiles, surface, aerosol and cloud properties. The primary goal is to perform the NASA's Earth Radiation Budget climate data record continuity proposed by NASA Libera team. The software can be also used to clean energy (especially solar energy) forecasting. The other research focus is funded by NSF to study the aerosol-cloud-precipitation interaction.

Jim Yeh has been simulating spring discharge using deep learning, considering the spatiotemporal variability of precipitation. This work uses a generative variational autoencoder and is applied to augment precipitation data and improve a long-term memory network for spring

discharge prediction. Augmenting precipitation data improves various deep learning models' learning generalization and predictive capability. The generative variation autoencoder offers a novel solution to address data scarcity issues across diverse research domains.

Xubin Zeng is the deputy PI (with PI Armin Sorooshian, chemical engineering professor with a joint appointment in HAS) of the $30M/6 year NASA Earth Venture suborbital Mission (ACTIVATE) on the aerosol-cloud -meteorology interactions over the northeast Atlantic. This project includes multiple universities, a NASA center (LaRC), and an international partner. For instance, a recent paper led by Zeng's graduate student (Xu et al. 2024) under this project, on the retrieval of both mixed-layer height and planetary boundary height from airborne high spectral resolution lidar (HSRL-2), got a news release from our university. https://news.arizona.edu/news/peeking-invisible-world-atmosphere).

Marek Zreda has developed a way to measure stream discharge using sound. The derived sound-discharge rating function is linear over a wide range of discharges and has a remarkably high correlation coefficient. Measurements with a hand-held sound level meter take seconds to acquire, allowing for high-resolution, long-term monitoring of stream discharge, campaign surveys, and ad hoc measurements. The method is attractive because: the instrumentation is simple and inexpensive; field deployment requires no built infrastructure; the instrument is suitable for rapid or emergency deployment; the measurements are non-invasive and non-contact, made at a distance from the stream.

2. PhD Program in Atmospheric Sciences Overview

Our graduate program in Atmospheric Sciences (ATMO) is designed for students interested in radiation and remote sensing, weather analysis and predictability, data assimilation and modeling, global and regional climate change, atmospheric chemistry and aerosols, tropical meteorology and cyclones, and lightning and atmospheric electricity. The graduate course requirements and offerings cover the breadth and depth of topics under the National Center for Education Statistics (NCES) classification of Atmospheric Sciences and Meteorology (CIP Code 40.0401). The NCES classifies Atmospheric Sciences and Meteorology as, "a general program that focuses on the scientific study of the composition and behavior of the atmospheric envelopes surrounding the earth, the effect of earth's atmosphere on terrestrial weather, and related problems of environment and climate. Includes instruction in atmospheric chemistry and physics, atmospheric dynamics, climatology and climate change, weather simulation, weather forecasting, climate modeling and mathematical theory; and studies of specific phenomena such as clouds, weather systems, storms, and precipitation patterns."

2.1. Program Learning Outcomes:

Students will be able to:

1. Demonstrate fundamental knowledge of dynamic and physical meteorology, and of one or more sub-disciplinary focus areas within the atmospheric sciences and integrate this knowledge within their primary area of atmospheric research.
2. Demonstrate competence in synthesizing background information from peer-reviewed literature and apply tools used in the atmospheric and related sciences, to independently investigate multiple research questions and create new knowledge within the field.
3. Effectively communicate the results of their research, in the form of a dissertation document and final oral defense presentation.
4. Participate as a member of the scientific community, by public presentation of their research results in a professional venue and through the peer review process.

2.2. PhD in Atmospheric Sciences Program Prerequisites

To be successful in our PhD program in Atmospheric Sciences it is required that the student has completed undergraduate coursework in physics and mathematics.

Required

- Calculus I
- Calculus II
- Physics I: Introduction to Mechanics
- Physics II: Intro Optics & Thermodynamics OR Electricity and Magnetism

Recommended

- Vector Calculus

- Ordinary Differential Equations
- General Chemistry I (inorganic) for research in atmospheric chemistry and aerosols
- General Chemistry II (inorganic) for research in atmospheric chemistry and aerosols

3. Department Financial Support Policy

3.1. HAS Funding: TA, RA, Tuition and Fellowship Support

The HAS Department offers limited funding opportunities for graduate students. Students admitted into the PhD program in Hydrology & Water Resources must be supported financially by their faculty advisor through a paid research assistantship (RA) tied to a research grant/contract, the department through a paid teaching assistantship (TA), or have their own proven external source of funding. The department also has limited graduation tuition scholarships and fellowships, which are award competitively to recruit new students and support continuing students.

If you supported on an RA or TA position, you must complete the graduate assistant (GA) Career Conversation and submit to the GPC by the end of each semester. This serves as a two-way evaluation of your performance in the paid position and an opportunity to receive and provide feedback to your advisor/instructor. RA and TA Career Conversation forms can be found below; they are also emailed out by the GPC with the exact due date each semester.

- RA Career Conversation
- TA Career Conversation

If you are a current student looking for TA support and/or tuition scholarships and graduate fellowship support for an upcoming semester, look out for an email from the HAS Academic Committee. They put out a call for students to email the committee if they are in financial need for the upcoming semester. The HAS Academic Committee fills TA positions and distributes tuition and fellowship funds a few months before the next semester.

In cases of unforeseen financial emergencies, students should inform their advisors and may inquire about possible departmental support; however, such off-cycle funding is extremely limited and not guaranteed.

3.2. HAS Student Scholarships

There are also multiple graduate student scholarships available each year. In the spring, students will receive an email inviting them to apply for the department scholarships through Scholarship Universe for the next academic year. Please check the department website for the list of available scholarships and financial support.

3.3. In-state Tuition for Residents in Western US

If you are a resident of the western US, you may be eligible for Arizona IN-STATE TUITION for our graduate programs in Atmospheric Sciences (Master's and PhD). Look at the Western Regional Graduate Program (WRGP) | UArizona program guidelines to see if you qualify based

on the last state of permanent residency. The GPC will notify the Graduate College of your eligibility after the admissions process has been completed.

3.4. Other Sources of Funding

Given the limited availability of departmental funding, students are strongly encouraged to pursue additional teaching and research opportunities both on and off campus, as well as external scholarship funding. The University of Arizona also has internal fellowships and a list of external fellowships through the websites below:

- Graduate College
- Office of Fellowships
- Graduate & Professional Student Council

4. Work Space & Technology Logistics

4.1. Desk Space

All graduate students are assigned a desk space in the Harshbarger Building in a shared office. Please be considerate of your peers by keeping noise to a minimum, scheduling meetings/office hours in one of our conference rooms and maintaining a clean workspace.

4.2. Building Access & Keys

- Please provide a copy of your CatCard to the Graduate Program Coordinator (GPC) to request keys to your office, desk and Harshbarger building access.
- Students who need building access outside of regular business hours or on weekends must use their CatCard to enter, which requires prior approval and coordination with Facilities Management.
- You will receive an email from Facilities Management Key Desk to sign a document through AdobeSign and to book an appointment to pick up your key(s).
- Keys must be returned to the Key Desk upon degree completion.

4.3. Technology

- It is expected graduate students will have a personal laptop. In special circumstances or dependent on research, a faculty member may provide a desktop, equipment, or software.
- A printer (black/white) is available for students in Harsh 228. Violation to excess printing will get your printer access will be revoked. Students supply their own paper. Thumb drive, scan to email.
- University Libraries offers free technology loans to students through their Borrow technology program.
- University Information Technology Services (UITS)
    - offers free or low cost software licensing.
    - 24/7 Support Center

4.4. UA Email & HAS Listservs

Communication on campus is associated with your UA NETID. It is important to check your UA email at least daily to stay informed about funding opportunities, Hydrology & Atmospheric Sciences Student Association (HASSA) events, professional meetings, seminar speakers, job openings, and department announcements. The Graduate Program Coordinator (GPC) will add you to the HAS graduate student listserv. To post to the listserv, send a message to the GPC.

5. Degree Requirements & Pathway Through Program

5.1. Degree Requirements Atmospheric Sciences

HAS requires students to complete a minimum of 63 units of graduate-level courses to obtain a PhD degree in Atmospheric Sciences: 36 units of major coursework, 9 units of minor coursework and 18 dissertation units. Most students will take more than the minimum number of units for a given degree.

It is mandatory courses for all students to take 12 units of the ATMO core courses and 2 units of seminar. These seminar units are graded S, P, and K, and do not count toward the student's overall GPA. These credits DO NOT count toward the 63 total credits.

A Typical Doctoral Program:

Semester	Course and Exam	Units
Fall: Year 1	ATMO 541A Dynamic Meteorology I ATMO 551A Physical Meteorology I ATMO Elective	3 3 3
Spring: Year 1	ATMO 541B Dynamic Meteorology II ATMO 551B Physical Meteorology II ATMO Elective	3 3 3
Fall: Year 2	ATMO Elective ATMO Elective HWRS 595A* Qualifying Exam	3 3 1
Spring: Year 2	ATMO Elective ATMO Elective HWRS 595A*	3 3 1
Fall: Year 3	ATMO Elective ATMO Elective Minor Course	3 3 3
Spring: Year 3	Minor Course Minor Course Minor Course Comprehensive Exam	3 3 3
Fall: Year 4	ATMO 920 Dissertation	9
Spring: Year 4	ATMO 920 (Dissertation) Final Oral Defense	9
	Total Units	**68**

* Seminar units are not to be listed on the Plan of Study

All grades for Incompletes and current semester coursework must be received before the degree is considered completed. A student must have a cumulative GPA in all graduate coursework of at least a 3.000 to graduate.

All required units of credit counted toward the degree must be taken for graduate credit (typically 500 and 600 level courses), including any courses transferred from another institution. With program approval, up to 12 graduate units taken for graduate credit only as an undergraduate may be applied towards doctoral requirements.

5.2. Approved Major Coursework

The following list are courses that have been approved by HAS and can be used to fulfill the major course credit requirements for ATMO PHD. Any course not listed below must be preapproved by the faculty advisor and Director of Graduate Studies before enrolling.

Course #	Units	Title
ATMO 521	3	Physical Climatology
ATMO 524	3	Hydroclimatology
ATMO 529	3	Objective Analysis in the Atmospheric and Related Sciences
ATMO 536A	3	Weather Fundamentals (For Non-ATMO Backgrounds)
ATMO 545	3	Introduction to Data Assimilation
ATMO 555	3	Introduction to Atmospheric & Hydrology Remote Sensing
ATMO 558	3	Mesoscale Meteorological Modeling
ATMO 569A	3	Air Pollution I: Gases
ATMO 569B	3	Air Pollution II: Aerosols
ATMO 574A	3	Weather Analysis & Forecasting I
ATMO 574B	3	Weather Analysis & Forecasting II
ATMO 579	3	Boundary Layer Meteorology & Surfaces Processes
ATMO 580	3	Tropical Meteorology
ATMO 595B	3	Global Climate Change
ATMO 595C	3	General Circulation Observations & Modeling
ATMO 656A	3	Atmo Rad. & Remoting Sensing I
ATMO 656B	3	Atmo Rad. & Remoting Sensing II
CE 523	3	Hydrology
GC 572	3	Global Biogeochemical Cycles
GC 578	3	Global Change
GEOG 530	3	The Climate System
GEOS 539A	3	Intro to Dendrochronology
GEOS 578	3	Global Change
GEOS 579	3	Intro Climate Dynamics

GEOS 582	3	Paleoclimatology
HWRS 501	3	Tools for Data Handling and Analysis in Water, Weather, & Climate
HWRS 505	3	Vadose Zone Hydrology
HWRS 507	3	Numerical Methods and Deep Learning for Environmental Modeling (replacing HWRS 504)
HWRS 517A	3	Fundamentals of Water Quality
HWRS 518	3	Fundamentals of Subsurface Hydrology
HWRS 524	3	Hydroclimatology
HWRS 528	3	Fundamentals: Systems Approach to Hydrologic Modeling
HWRS 543A	3	Risk Assessment for Environmental Systems
HWRS 549	3	Statistical Hydrology
HWRS 551	4	Principles of Hydrology II (formerly HWRS 519)
HWRS 595A	1	Current Topics in Hydrology and Atmospheric Sciences (Seminar)
HWRS 601	3	Writing in Hydrology and Atmospheric Sciences
PTYS 517	3	Atmospheres & Remote Sensing
PTYS 544	3	Physics of High Atmospheres
REM 590	3	Remote Sensing for the Study of Planet Earth
WSM 552	3	Climate Change & Dryland Ecosystem Ecology
WSM 560A	3	Watershed Hydrology

5.3. Doctoral Minor Requirements

Ph.D. students are required to complete a doctoral minor. A doctoral minor gives students an opportunity to gain in-depth knowledge in a cognate field of interest and to expand interdisciplinary knowledge necessary for solving complex problems and addressing grand challenges.

Each doctoral minor program determines their own curriculum, academic requirements, and required credits, and comprehensive exam questions. A minor can range between credits 9-15 graduate units. The credit earned toward a doctoral minor can only be counted toward the doctoral minor and not also counted toward the major (no double-dipping). Specifically, students may not apply minor course credit to both the minor and major area of study.

The doctoral minor is a required part of the doctoral oral comprehensive exams. A written and oral comprehensive exam is required for the major degree portion of the exam; however, the minor department determines whether to require a written portion of the exam. The oral portion of the comprehensive examination must cover both the major and the minor disciplines during a single oral examination with the major and minor committee members participating.

A student considering multiple minors should talk to their faculty advisor in advance taking into consideration the additional cost, time to degree completion, and planning with regard to comprehensive exams.

Below are common minors ATMO PhD students have chosen. Search the Graduate Admission Guides to view available minor areas and their degree requirements.

- Applied Mathematics
- Arid Lands Resource Sciences
- Civil Engineering
- Computer Science
- Environmental Engineering
- Geosciences
- Global Change
- Hydrology
- Management Information Systems
- Law
- Natural Resources
- Remote Sensing
- Environmental Sciences
- Statistics
- Statistics & Data Science
- Water, Society & Policy

5.4. Transfer of Credit

Graduate credit earned at the University of Arizona or another approved institution may be counted toward the requirements of a PhD degree but will not be included in the calculation of the University of Arizona GPA. For transfer of credits from another university, *please send course syllabus, preferably translated to English to the Director of Graduate Studies and Major Advisor to approve course content and assess knowledge of key concepts.*

Transferred units are subject to the following restrictions:

- The credits must be approved by the major or minor department and the Graduate College.
- The minimum grade for transferred credits must be an A or B or the equivalent at the institution where course was taken.
- Transferred units may not count toward more than one doctorate degree.
- No more than 12 units taken in Medicine, Law or Pharmacy Practice may be used toward a doctoral degree.
- A maximum of 30 units of transfer coursework from UA MS degree may be used toward the PhD requirements.

Students who wish to transfer credit must submit a Transfer Credit form in GradPath before the end of their first year of study to have the courses evaluated for transfer eligibility.

Grades and the number of units for transfer credits may be adjusted so that they are consistent with the University of Arizona grading and credit system. Transfer credits used on a fully

approved Plan of Study appear with a grade of "T" on the University of Arizona transcript and are not calculated in the University of Arizona GPA. The name of the transfer institution appears on the University of Arizona transcript with the number of transfer units from that institution that were brought in towards the graduate degree.

5.5. Demonstrated Proficiency

All students must demonstrate, to the satisfaction of each student's Major Advisor, proficiency in both statistics and computer programming (e.g. R, MatLab, Python, FORTRAN, C++), numerical hydrologic modeling, and specialized instrumentation. Participation in laboratory or field work may be a component of the student's research or course work. This may be demonstrated by the successful completion of approved courses in these subjects, either as an undergraduate or graduate student, or as part of their dissertation research.

5.6. Required Presentation of Research

As described above, all students are required to present the results of their research at least twice during their PhD degree in a formal seminar or presentation at a scientific meeting in the form of an oral or poster presentation. Typically, students present at the annual department research symposium (El Día de Agua y la Atmósfera; (Spring), American Geophysical Union Meeting (December) or American Meteorological Society Meeting (January).

HAS is a key member of The University of Arizona's School of Earth and Environmental Sciences (SEES). SEES oversees the campus-wide, student-organized EarthWeek Symposium, held each spring semester. EarthWeek showcases the latest research conducted by undergraduate and graduate students across SEES units, including the El Día del Agua y la Atmósfera Symposium, which serves as one of the SEES featured event.

5.7. Graduate Non-Degree Coursework (including Certificates)

Students who have completed graduate non-degree* coursework at UA may count no more than 12 units of non-degree credit toward the degree requirements. A graduate certificate is considered distinct from a graduate **degree** (MS or PhD). Limits regarding the use of units applied towards a graduate certificate and a graduate degree are determined by the certificate program. Graduate certificates are exempt from the 12 unit non-degree policy above and are determined by the certificate and the degree program.

Below are common graduate certificates HAS students have completed. Search the Graduate Admission Guides to view available certificates.

- College Teaching
- Dendrochronology
- Ecosystem Genomics
- Geographic Information Science
- Hydraulics & Water Resources
- Mineral Resource Geology
- Science Communication

5.8. Second and Duplicate PhD Degrees

The Graduate College does not generally permit a person who holds a Ph.D. to pursue a second Ph.D. Persons holding a Ph.D. who wish to expand their training are encouraged to pursue post-doctoral training, a graduate certificate, or a professional degree (e.g. MD, JD, PharmD). In the rare case a graduate program wishes to admit a student for a 2nd Ph.D., the case must be justified by the department in a petition subject to approval by the Graduate College. The department must explain why the 2nd Ph.D. would be qualitatively different from the first. This rule applies to cases where the first degree is from the University of Arizona or from another domestic or international institution. Admission to a second Ph.D. will be allowed only with strong rationale from the program. If admitted for a second doctoral degree, students will be held to all the usual degree requirements and University regulations pertaining to fees, registrations, examinations, advancement to candidacy, residency, internships, etc. Not more than 9 credits from the prior degree may be applied toward the second degree. Applicants who already have a doctoral degree may not be given special preference for admission or for financial support.

Students sometimes want to pursue a UA master's along with a UA doctorate in a different major. This is allowed, subject to the following restrictions:

- No credit may be counted for more than two degrees. Thus UA credits could not be used for a master's in UA major 1, a doctorate in UA major 1, and a master's in UA major 2.

- A student may use no more than a total of 30 credits from all master's degrees toward a doctorate. Thus, if a student earned a non-UA master's, up to 30 credits could be used toward a UA doctorate. In that case, none of the transfer credit nor any additional coursework toward the UA doctorate could be used toward a UA master's in a major that differs from the doctorate because the student would have exhausted the 30 credit limit of master's coursework that can be shared with a doctorate.

6. Student Expectations

All graduate students are **expected to take initiative** regarding all aspects of their graduate studies. This includes meeting frequently with their advisor(s), individually or during research group meetings, and the Director of the PhD in Atmospheric Sciences program, to plan and discuss their research and academic progress. Students should also take the initiative to meet with the HAS Graduate Program Coordinator (GPC) at least once per semester to plan coursework and to verify that graduate program requirements are being met. Our GPC also has access to a wealth of information that will facilitate a student's success in the graduate program. Again, we stress the importance of the graduate student's individual responsibility to be "in charge" of their program. Frequent contact with research and program advisors minimizes the chance of unexpected and possibly expensive delays.

Your primary goal as a graduate student is to successfully complete the required courses in the PhD in atmospheric sciences program and conduct an independent, individual research project. Your research may be part of a larger group project, under the direction of your advisor, and may be tied to specific grant or contract objectives and timelines/deliverables.

The best way to keep informed is to read your email every day and respond to critical emails within 24 hours. Email is the official mode of communication at the UofA, so it is imperative that you check your email at least a couple times a day so that if there is an email that requires your response, you can do so before the end of the business day.

Graduate Students are expected to be knowledgeable of and comply with all policies and procedures for both the UA Graduate College and for the HAS Department. Policies are updated and announced frequently, and it is the student's responsibility to comply with current policies, even if these are changed after initial enrollment as a graduate student.

Familiarize yourself with UAccess Student Center, which is the university-wide online system for student information and accounting, including:

- Personal information
- Enrolling or dropping courses
- Advising: GradPath Forms
- Academic Record: academic summary, grades, transcript request
- Financial Aid
- Bursar's Account

7. Enrollment Policies & Procedures

Once admitted, use UAccess Student Center to enroll in courses. Before each semester be sure review notices and holds on your account, which may prevent you from registration. How to enroll in courses can be found the Office of the Registrar. Work with your research advisor, DGS, and/or GPC to choose courses that overlap your intended or future research and career directions.

All units of coursework for the doctoral degree must be taken for graduate credit at UA while the student is matriculated in a degree program. No course may be counted toward more than two degrees at UA or another institution.

Enrollment in independent studies and 900-level courses are restricted and need approval by the instructor of major advisor. The instructor/major advisor can send their approval to the GPC to complete student's enrollment in the course.

- Independent Studies (599/699/799) course is used for a semester long project to develop research skills set, literature review or special interest projects that will further the student's future final research project. Student's must complete the independent study proposal form to be submitted to the GPC to complete registration.
- Dissertation (ATMO 920) is research conducted to complete a dissertation.

7.1. Full-time Enrollment & Course Loads

Graduate students must enroll in a minimum of 9 units each semester to maintain full-time student status and keep on track to complete their degree in a timely manner. Maintaining full-time student status is also important to meet criteria to receive financial aid, scholarships, campus employment, or comply with immigration status. If the student is taking only two 3-credit courses in a semester, they can fill the remaining credits with research or thesis credit, or independent study credits.

Exceptions to 9 units minimum per semester may include:

- Continuous enrollment: After finishing all course requirements, students must continue to register each Fall and Spring semester for a minimum of 1 graduate research/thesis unit until all degree requirements are met.
- Students' decision to go part-time status
- Students who are funded in graduate assistantship position may enroll in a minimum of 6 units if they have completed all their coursework **AND** enrolled in dissertation units only.
- International students may request an exemption to full-time enrollment during last semester, medical conditions or academic difficulties.

7.2. Time Limitation

Students must meet all requirements for the degree of Doctor of Philosophy within 5 years of passing the Comprehensive Exam or risk being dismissed from the program. Programs may have more stringent time to degree requirements. Should a student not finish within that time, the

program may petition the Graduate College for an extension to time to degree. If the extension is approved, the student may be required to re-take the Comprehensive Exam before proceeding to complete requirements, e.g., the dissertation.

7.3. Leave of Absence

Graduate students may apply for a Leave of Absence (LOA) from a program for a semester or for the academic year using the Graduate Petition for a Leave of Absence. Coursework more than 10 years old is not accepted toward the PhD degree requirements.

It is not necessary for a student to apply for a LOA if he or she has a registration record for that semester. A "W" counts as a registration record. A LOA is inappropriate for a student who withdraws from all classes after the start of a semester and gets "W' grades since a Leave of Absence presupposes no registration at all for a term. Since, in such cases, the student has maintained continuous enrollment by having a registration record, he or she is eligible to register the following semester (or Summer or Winter term) and will suffer no adverse effects due to the fact that he or she was not eligible to apply formally for a Leave.

Only academic services or facilities available to the general public can be used during the LOA. Students who require significant faculty time (e.g. advising, reviewing, collaborating) must be enrolled rather than on LOA.

LOAs may affect the status of a graduate student's financial aid. Students are responsible for determining the requirements of their funding agency and/or academic unit prior to applying for a LOA.

Student insurance might not be available while on Graduate Student LOA, please contact Campus Health Services for more information.

International students must check with the International Students Programs and Services before filing for a LOA.

If a student fails to register and does not have a LOA on file, the student will be discontinued from their program. A new application will be necessary for the student to continue in the program. Re-admission is not guaranteed. See Continuous Enrollment and Re-admission Policies for more information.

- **Academic Leaves:** Academic LOAs (i.e., leaves to take course work at another university, for research, field work, internships, professional development, etc.) are handled on a case-by-case basis by the student's department and the Graduate College.
- **Medical Leaves:** Graduate students in degree or certificate programs may be granted a Medical Leave of Absence by the Dean of the Graduate College.
- **Personal Leaves:** Graduate students in degree or certificate programs are typically granted a Leave of Absence for only one year throughout the course of their degree program. When circumstances warrant, this may be extended beyond one year with approval from the Dean of the Graduate College. LOAs are granted on a case-by-case

basis for compelling reasons including birth or adoption of a child, personal or family reasons, medical reasons, military duty, or financial hardship. Students will maintain their status without reapplying to the department and the Graduate College at the expiration of the LOA.

- **Retroactive Leave of Absence:** A retroactive leave request is any request made after the last day of finals in the semester. If a student does not request the leave by the last day of finals, he or she would need to apply for re-admission to the program. Under extraordinary circumstances, LOAs may be granted retroactively. In such cases, students will be readmitted without reapplying to the department and the Graduate College.

7.4. Grades

After the course work is completed, the instructor will assign the appropriate grade on the UAccess grade roster. Incomplete grades should be completed in a timely manner and are submitted at the discretion of the course instructor. All grades for Incompletes and current semester coursework must be received before the degree is considered completed.

At least one half of the required units/credits must receive a grade of A, B, or C (rather than S or P). Courses in which a D or E grade is earned cannot be counted toward a graduate degree. While a grade of D or E does not earn units for a graduate student, they still figure into the grade-point-average (GPA).

Students enrolled in the graduate program must maintain a cumulative graduate GPA of 3.000 and meet their department's academic progress criteria toward degree completion. The minimum 3.000 GPA is based on all coursework taken for graduate credit, regardless of whether or not the courses are recommended or required for a specific graduate degree. Additionally, each program has its own criteria by which a student is evaluated on satisfactory academic progress. Falling below a cumulative graduate GPA of 3.000 or failure to meet other academic progress requirements will result in the student being placed on academic probation by the Dean of the Graduate College. Students on probation are required to meet with their Faculty Advisor, discuss the steps to be taken to remediate the problems that led to the probationary status, and develop a mentoring plan with specific actions to get back into satisfactory status. If, upon completion of a semester, the student's cumulative graduate GPA is below 3.0, or if the student failed to make satisfactory progress during that semester, the student will be allowed to register for one additional semester. An academic probation hold will prevent students from enrolling beyond that additional semester. Students who fail to make satisfactory process, and those whose cumulative graduate GPA is below 3.0, for two consecutive semesters will be disqualified from their program. Departments may petition for a one semester extension to academic probation for students who are making good progress towards satisfactory academic standing. If a grade changes or completion of an Incomplete causes a prior semester's cumulative GPA to drop below 3.0, the student will retroactively be placed on probation and that semester will count as the student's first semester below 3.0.

7.5. Incomplete

When an Incomplete (I) grade is assigned, the instructor will include details of the work needed to resolve the grade directly on the Incomplete (I) grade "write-in" section of the UAccess grade roster. These details must be included for the final grade roster to be submitted. This will contain the following details:

- Date the student last attended class
- Grade the student earned as of the last date of their attendance
- Remaining coursework
    - Listing of all remaining assignments, classwork, and any other tasks needed to finish the course, so the student understands specifically what they need to do to earn their final grade.

The student will receive an email confirming this information for their Incomplete grade. After the student completes the remaining coursework, the instructor will assign the appropriate grade.

In rare cases, students may receive approval for completing incomplete coursework beyond a semester:

- The one-year extension must be approved by the instructor and Graduate College dean. This extension requires the instructor and dean's signature on a Extension of Incomplete Coursework form. Notification of the dean's approval or denial is to be provided to the student by the dean's office. A copy of the approved or denied Petition must then be forwarded from the dean's office to the Office of the Registrar, Administration 210, for appropriate processing.

- For courses taken for graduate credit, an extension beyond 2 academic years may be considered only by the Graduate College.

See link for more information.

8. Forms Necessary for Degree Progression

8.1. GradPath Forms

The Graduate College requires all graduate students to complete official forms in GradPath forms through UAccess Student. The department may require internal forms to be completed in addition to GradPath forms. Please see the Graduate Program Coordinator for more information. https://grad.arizona.edu/degree-services/gradpath/gradpath-user-guides

- Responsible Conduct of Research
- Evaluation of Transfer Credit
- Doctoral Plan of Study (POS)
- Comprehensive Exam Committee Appointment (refer to 11.3, p. 32)
- Announcement of Doctoral Comprehensive Exam (refer to 11.8, p. 33)
- Results of Comprehensive Exam (refer to 11.8, p. 33)
- Prospectus/Proposal Confirmation (refer to 11.8, p. 33)
- Doctoral Dissertation Committee Appointment (refer to 12.4, p.35)
- Commencement Verification Form (refer to 14.1, p. 38)
- Announcement of Final Oral Defense (refer to 12.4, p.35)
- Results of Final Oral Exam/Defense (refer to 12.4, p.35)

8.2. Responsible Conduct of Research

"Fostering a culture and expectation of responsible and ethical conduct of research is a critical component in the advancement of knowledge through research and scholarship. It is a key element in the maintenance of public trust in the research enterprise." Source: UA Office of Research, Discovery, and Innovation. All students must complete the Responsible Conduct of Research (RCR) Statement form. Additionally, an RCR Workshop is required for any student who is financially supported by an NSF, NIH, or NIFA grant.

8.3. Plan of Study

In conjunction with your major advisor, each student is responsible for developing a Plan of Study as early as possible, to be submitted to the Graduate College no later than April 1 of their second semester in residence. The Plan of Study must have the approval of the student's major professor and department head (or Director of Graduate Studies) before it is submitted to the Graduate College.

The Plan of Study identifies

1. Courses already completed at the University of Arizona which the student intends to apply toward the graduate degree; and
2. On-going and future course work to be completed to fulfill degree requirements.
3. Expected Graduation Date

Your bursar's account will be billed candidacy fees of $35.00 at the time your Plan of Study is approved by the Graduate Student Academic Services office. These are one-time fees, and you will not be billed again if you change your anticipated graduation date.

9. Major Advisor and PhD Dissertation Committee

Most graduate students are recruited by specific faculty members to work in their research groups during the admissions process. Those faculty members will serve as the student's major advisor. Alternatively, students may be accepted into the PhD program in atmospheric sciences without a designated advisor. In this case, those students are assigned to the DGS as the preliminary advisor until the student can identify a permanent faculty research advisor. Sometimes, a student's area of research interest changes, funding ends, a faculty member leaves the university, or personal reasons, leading to the student to shift to another faculty advisor, as long as that faculty member is willing to work with the student. Once the permanent advisor is identified, the student and major advisor work together to select a research topic and choose other faculty members to invite to serve on the student's PhD dissertation committee.

9.1. Timeline

By the end of the 1st semester in the program – identify a PhD dissertation advisor if student hasn't already.
By beginning of 3rd year (5th semester) in the program – form PhD dissertation committee.
During 5th semester – student holds 1st PhD dissertation committee meeting.
Beginning of 4th year (7th semester) – student holds 2nd PhD dissertation committee meeting.
Ideally, by end of 4th year (8th semester) – student defends their dissertation after sending their dissertation to committee members at least 2 weeks in advance.

9.2. Detailed procedures

1) ***Dissertation Committee formation:*** PhD students are required to form their PhD Dissertation committees by the beginning of their 5th semester in the program (e.g., September 1st of 3rd year if started in August; February 1st of 3rd year if started in January). It is strongly recommended that the dissertation committee members are the same as the PhD comprehensive exam committee, except for the PhD minor advisor, which is required for the exam, but not the dissertation committee. PhD Dissertation Committees should comprise a minimum of 3 members: 2 tenured or tenure track core faculty from HAS, including the research advisor as chair, and one additional UA faculty or approved special member. Special members are people who possess the knowledge and expertise to evaluate a student's graduate work, but who do not meet the criteria to be added to the Graduate Faculty. *In some cases, students may need to change dissertation committee members, along the way, prior to their defense (e.g., faculty member moves, goes on sabbatical, may be replaced with someone with expertise more directly related to the dissertation topic). That is ok/understandable. The student will need to submit a form indicating their advisor approves the change.*

2) ***Annual Dissertation Committee meetings:*** PhD students are required to meet with their dissertation committees at least once a year, starting during their 5th semester (e.g., beginning of 3rd and 4th years in the program). At least one week prior to the committee meetings,

students should send the committee a 1-page (single spaced, 11 point font) report with updates on their research progress. At the beginning of the committee meetings students should give a 15-minute presentation on their research to-date and future plans. The dissertation committee meetings should last no more than 1 hour. Upon completion of the dissertation committee meeting, student will complete this short survey to document: **Annual Dissertation Committee Meeting.**

3) ***Dissertation Defense***: When PhD students are close to being ready to defend (i.e., the semester they plan to defend), they need to:

   a. Reach out to the PhD dissertation committee members to schedule a date and time (preferably at least 1-2 months in advance as faculty have busy schedules) for the defense.
   b. Complete GradPath Forms:
      i. Doctoral Dissertation Committee Appointment Form
      ii. Announcement of the Final Oral Defense Form
   c. Submit a complete, formatted draft of their dissertation to the PhD dissertation committee chair (their advisor) and members at least 2 weeks in advance of the defense.
   d. Schedule a room for the dissertation defense.
      i. Check room availability online for the Harshbarger Building (https://has.arizona.edu/events/has-room-reservations).
      ii. Email the Graduate Program Coordinator (Lupe Romero) with the preferred room, day, and time for the defense to schedule.
   e. Send dissertation title and abstract, defense date/time, and room location (including zoom meeting link if planning to use) to the Graduate Program Coordinator (Lupe Romero).

10. PhD Qualifying Exam Procedures

10.1. Purpose

The qualifying exam tests student's breadth of knowledge in atmospheric sciences, specifically in the core areas of dynamic and physical meteorology.

10.2. Eligibility

A. Students who received their MS in Atmospheric Sciences from the University of Arizona: may have the written component of the qualifying exam waived if they received a minimum of 3 As and one B in the four core courses (i.e., Dynamics Meteorology I&II and Physical Meteorology I&II). If not, they will be required to take the PhD qualifying exam.
B. Students who received their MS in Atmospheric Sciences from another university:
    a) may complete the four core courses within the first year of their PhD program. If they receive a minimum of 3 As and one B in the core courses, their PhD qualifying exam will be waived. If they do not earn the minimum grades, they will be required to take the PhD qualifying exam.
    b) If the student does not take the four core courses in our department (e.g., they took similar courses at their previous institution and can transfer credits), they will be required to take the qualifying exam to ensure they have the same basic foundational knowledge.
C. Students who received their MS in something other than Atmospheric Sciences, at the University of Arizona or another university: are required to take the four core courses in the first year of their PhD program. If they receive a minimum of 3 As and one B in the core courses, their PhD qualifying exam will be waived. If not, they will be required to take the PhD qualifying exam.

10.3. Timing

Students must take the PhD qualifying exam by or during the beginning of the **3rd semester (2nd year) of their program**. The Graduate Program Coordinator will schedule the PhD qualifying exam in **September** (for students who started in Fall of the previous year) or **January** (for students who started in Spring of the previous year). Students may opt to take the PhD qualifying exam earlier if they feel prepared.

10.4. Logistics

Students need to **reach out (via email) to the GPC at least one month in advance of the PhD qualifying examination date to schedule** (e.g., **by August 1st for September exam or December 1st for January exam, or an earlier date if ready to take the exam in their 1st year.**). They must choose their **'specialty area'** for the exam and communicate it in the email to the GPC. The Graduate Coordinator will forward the names of students needing to take the exam to the PhD qualifying exam committee co-chairs. The co-chairs will assign one other faculty member to serve on the committee (3 total faculty). **The student will then need to schedule the exam with the PhD qualifying exam committee co-chairs and member.**

10.5. Format

This is a written, in-person exam. Students will be provided with a set of 100 questions (the same for all students) to study in preparation for the exam, that encompass topics from the four core courses, as well as broader atmospheric sciences-related topics.

During the 4-hour exam period, the faculty examiner will provide each student with 10 questions to answer that are drawn or adapted from the pool of 100 possible questions. The exam questions will be divided as follows: 4 on Dynamic Meteorology, 4 on Physical Meteorology, and 2 on general ATMO-related topics. Each question will carry a value of 10 points for an exam total of 100 points.

10.6. Grading

The written exam will be graded as Pass/Fail. Students will receive pass if their total score is equal or greater than 60 or fail if the score is lower than 60. When receiving a grade of fail, the student will not be allowed to continue their pursuit of PhD study in HAS. Each question will be graded by two faculty members, and the final score will comprise an average of those grades. In situations where the discrepancy between scores for a given question is greater than 2 points, the director of graduate studies will review that response or request a third faculty member to review that response. The committee of ATMO faculty participating in the qualifying exam will make a final decision.

10.7. Retaking exam

Students who do not pass the first exam must schedule a re-examination no sooner than 3 months and no longer than 12 months from the date of the first exam. The re-examination will be administered by the same committee of faculty members. The same pool of questions will be available, but the focus will be to determine whether the student has demonstrated enough growth to indicate that they are likely to be successful in the PhD program. The advisor will take an active role in the discussions for a re-examination and they will have a vote with the expectation that they have the best sense of the student's qualifications.

10.8. Appeal

Students have the right to appeal the decision of the qualifying exam committee. They should lodge their appeal with the Department Head and Associate Department Head, including a statement of why they feel that the assessment was incorrect, whether they think that there was any element of bias included, and what they propose to rectify the outcome. The Department Head and Associate Department Head will confer with the co-chairs of the qualifying exam committee. If necessary, the members of the examining committee will be consulted. The Department Head and Associate Department Head will provide a written response, including further actions to be taken, to the student within one month of the appeal.

11. PhD Comprehensive Exams Procedures

11.1. Purpose

Evaluate the student's breadth of understanding across major and minor coursework. Evaluate the student's depth of understanding in their chosen field of research, writing and presentation ability, and ability to conduct original research. Enable the student's PhD Committee members provide feedback on research directions.

11.2. Timing

Should be completed as soon as all major and minor requirements have been completed (usually in the 3rd year). The written and oral portions of the comprehensive examination should take place at least three months prior to the Final Oral Examination (defense of dissertation)

11.3. Comprehensive Exam Committee members

Should be the same as the PhD Dissertation Committee and include 3 faculty from HAS, and 1 faculty from minor department. External committee members may be included on the dissertation committee and need not be included in the comprehensive exam.

11.4. Dissertation abstract/proposal

Students must submit a 1-page abstract of their dissertation to their PhD comprehensive examination committee AND the GPC to have on file with the Graduate College to initiate their PhD comprehensive exams.

11.5. Manuscript/Publication or Research Proposal

Student must submit either a first-authored research manuscript ("in prep", "in review" or "published"), or a research proposal at least 2 weeks prior to scheduling their oral PhD comprehensive exam (not to exceed 6 weeks per GC polices).

A) Research manuscript ("in preparation" or "in review") formatted to be submitted to a peer-reviewed scientific journal. If the student already has a paper published from their PhD research, they can submit the paper to their examination committee and automatically pass this portion of the exam.

B) Research proposal (at least 10 pages, including figures/tables, but not including references; formatted in typical NSF EAR directorate style).

11.6. Oral component

Presentation of student's research manuscript/paper or proposal (~30 minute presentation), followed by Q&A by committee members. 2 hours maximum.

11.7. Grading

The written and oral exam will be graded Pass/Fail. Students must receive a "passing" grade from at least 3 of the 4+ faculty members on both the written and oral components to pass the comprehensive exam. If students fail the written exam, they may submit a revised manuscript or proposal within two months of receiving notice that they failed the first exam. If students fail the oral exam, they may retake the oral exam within two months of receiving notice that they failed the first oral exam. The Graduate College allows no more than one re-take of the oral exam.

11.8. Required GradPath Forms and Fees

- Comprehensive Exam Committee Appointment Form
- Announcement of Doctoral Comprehensive Examination- is the oral examination date
- Results of the Oral Comprehensive Examination for Doctoral Candidacy - submitted by committee chair.
- Prospectus/Proposal Confirmation-student must send approved proposal to GPC to approve the form.
- When you advance to doctoral candidacy your bursar's account will be billed the candidacy fees of $35.00. These are one-time fees and you will not be billed again if you change your anticipated graduation date.

12. Final PhD Dissertation and Oral Defense Exam

12.1. Format of Dissertation & Defense

The dissertation represents the culmination of your graduate studies and should be presented in a professional manner. While this guide outlines a few specific requirements, you are otherwise expected to format and present your work according to the standards of your discipline and the expectations of your intended audience, with guidance from your committee.

A typical dissertation is the program consists of three publishable scholarly research papers. Each building upon the initial research topic. Publication of the dissertation is encouraged but not required prior to graduation.

Dissertation Guidelines
Sample Pages

12.2. Logistics for Scheduling Defense

The dissertation defense should be scheduled at least two weeks in advance; ideally at least a month in advance, as faculty's schedules are busy. It's the student's responsibility to schedule the day and time of their defense (exam) with their advisor and committee members. They should also reserve a room and complete their GradPath Forms. Please follow the Zoom Defense Protocol for HAS. No more than 6 weeks is allowed between submission of the dissertation and the oral defense. Please send the title of your dissertation, abstract, exam date/time, room location/Zoom number the GPC to send out the defense announcement to the listservs.

The student is expected to give a 30-40 minute presentation of their research (including study motivation, objectives/questions/hypotheses, methods, results and interpretations, and conclusions, mirroring their dissertation format). This portion of the defense is open to the public. The student can invite whomever they would like to attend in person or on Zoom. Following the presentation, the audience is invited to ask questions. After that, the audience is excused and only the student and committee members will meet for the closed portion of the defense. The student will be asked questions about their research and dissertation by the committee members, after which the committee will make a decision on if the student passed their defense (exam) or not, with the option to award a "superior pass" for exceptional performance. The dissertation committee will also provide feedback on dissertation deciding if it can be accepted as is, if it needs revisions, or is not adequate to meet the standards of a research project in our department.

12.3. Grading

Once the thesis or report has been accepted by the major advisor and other committee members, the dissertation approval page (signature page) can be initiated by the student or by the department's GPC through Adobe Sign and routed for signatures for the student and their committee members complete. Signature of the report approval page will initiate documentation of the final grade on the PhD dissertation.

12.4. GradPath Forms

- Doctoral Dissertation Committee Appointment
- Commencement Verification Form
- Announcement of Final Oral Defense
- Results of Final Oral Exam/Defense

Students must submit their final, approved dissertation electronically via the submission website maintained by ProQuest/UMI. This submission must be made by the submission deadline for the desired graduation term. The Graduate College will check the formatting of the submitted dissertation and may request changes before accepting the submission. When the dissertation has been accepted by the Graduate College, completion of requirements has been fulfilled, and all other final items are accounted for, the degree will be awarded provided the degree conferral date for the graduation term has been reached. Please refer to the Academic Calendar for the relevant semester for the conferral date.

ProQuest/UMI catalogs and stores the thesis and sends catalog information to the Library of Congress for distribution for depository catalogs and libraries. The thesis will also be archived in the University of Arizona Campus Repository, where it serves as the record of the student's research. Publication of the thesis by ProQuest and the Campus Repository does not preclude publication by other means, and successful candidates are urged to submit thesis material for publication in a scholarly or professional journals.

13. Compliance with UA Academic Policies

Student Code of Academic Integrity

Academic Integrity at the University of Arizona is the principle that stands for honesty and ethical behavior in all homework, tests and assignments. All students should act with personal integrity and help to create an environment in which all can succeed. Dishonesty will not be tolerated. This includes, but is not limited to, cheating, plagiarizing, fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Students who are found to be dishonest will be reported to the Associate Dean of the Graduate College and receive a sanction, such as a failing grade on the assignment, exam, and/or in the courses. Students should refer to the UA Code of Academic Integrity if they have questions. Available at: http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity

Absence & Class Participation

The UA's policies concerning Class Attendance and Participation is available at: https://catalog.arizona.edu/policy/courses-credit/courses/class-attendance-participation. The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, http://policy.arizona.edu/human-resources/religious-accommodation-policy. The calendar of religious holidays can be found at https://registrar.arizona.edu/calendar-religious-holidays. Absences for groups of more than three students that are pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: http://policy.arizona.edu/employmenthuman-resources/attendance

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility & Accommodations

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/) to establish reasonable accommodations. http://drc.arizona.edu/instructors/syllabus-statement.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code

of Academic Integrity as described in the UA General Catalog. https://deanofstudents.arizona.edu/policies/code-academic-integrity.

Nondiscrimination & Anti-Harassment

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex (including pregnancy), national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. For more information, including how to report a concern, please see https://policy.arizona.edu/employment-human-resources/nondiscrimination-and-anti-harassment-policy.

Safety on Campus & in the Classroom

For a list of emergency procedures for all types on incidents, please visit the website of the Critical Incident Response Team (CIRT): https://cirt.arizona.edu/case-emergency/overview. Also watch the video available at https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/app/me/ledetail/crtfy000000000003841.

University's Intellectual Property Policy

http://policy.arizona.edu/research/intellectual-property-policy

Confidentiality of Student Records

Family Educational Rights and Privacy Act of 1974 (FERPA) is the federal law that governs the rights of students and institutional responsibilities with respect to student records. FERPA is a federal law designed to protect the privacy of a student's educational record. More details on what FERPA is about and specifics of what constitutes an Education Record can be accessed at: http://www.registrar.arizona.edu/ferpa/default.htm

14. End of Program Housekeeping

14.1. Commencement

There are multiple ways to celebrate your graduation with friends and family. Depending on the time of year you complete requirements, you may join the campus-wide Commencement Ceremony in May and/or the College of Science Graduation Convocation (ceremonies held in May and December). Students graduating in August or December may attend the May commencement ceremony. You must RSVP to attend any ceremony or convocation. https://science.arizona.edu/academics/graduation-convocation

Students need to fill out the ***Commencement Verification Form*** to ensure that their name is listed in the commencement program and their address is up-to-date to receive their diploma and any other logistical contact information after graduation. Deadlines apply to ensure accuracy.

There is also a PhD Completion Confirmation Form. The student's major advisor and committee members will fill out the form when the dissertation has been approved and the oral exam was passed. The GPC will submit the form directly to the Graduate College to begin the conferral of the degree process.

14.2. Exit Survey

This survey is designed to gather critical information to assist our department in establishing a plan to improve the future of our programs and to provide evidence of student learning for our Annual Program Reviews. Please take a moment to complete the HAS Exit Survey for your degree program.

14.3. Technology

If you are using any ***technology*** belonging to the department, please contact HAS IT group at HAS-IT@arizona.edu and let them know you are returning equipment and where it is located.

14.4. Building Keys

If you are in possession of ***keys to any of room in Harshbarger*** or other university buildings, you are required to return keys to the UA Key Desk located at 1533 E. Helen St. Bldg. 155J. Please follow these instructions to return your building keys to the UA Key Desk.

- **If you need a return key receipt immediately**, you will need to schedule an appointment with the key desk. Go to **Key Desk Appointment Calendar**.

If you do not require an immediate receipt, you can deposit your keys into the Key Desk drop box, via the door slot, without the need for an appointment – keys are to be placed in one of the envelopes provided on the Key Desk door. Include your Cat Card and UA email address on the envelope. The return will be processed the next business day and a receipt will be emailed to you.

15. Additional UA Resources

Student success is often strengthened when students take an active role in exploring the services, resources, and people available on campus. Members of the campus community are committed to providing guidance and support along the way. Our goal is to help every student achieve their academic, personal, and professional aspirations.

Campus Pantry
https://campuspantry.arizona.edu/
The Campus Pantry is a student-run supplemental grocery program that serves students, faculty, and staff at the University of Arizona. Our program is designed to help fill in the gaps and prevent food insecurity.

Campus Health
http://www.health.arizona.edu/
Campus Health provides quality medical and mental health care services through virtual and in-person care. Phone: 520-621-9202

Counseling and Psych Services (CAPS)
https://health.arizona.edu/counseling-psych-services
CAPS provides mental health care, including short-term counseling services.
Phone: 520-621-3334

The Dean of Students Office's Student Assistance Program
https://deanofstudents.arizona.edu/support/student-assistance
Student Assistance helps students manage crises, life traumas, and other barriers that impede success. The staff addresses the needs of students who experience issues related to social adjustment, academic challenges, psychological health, physical health, victimization, and relationship issues, through a variety of interventions, referrals, and follow up services.
Email: DOS-deanofstudents@arizona.edu
Phone: 520-621-7057

Disability Resource Center
https://drc.arizona.edu/
The University of Arizona DRC leads campus in a progressive and proactive approach to accessibility. Our goal is to ensure disabled students, employees and visitors have a similar, if not identical, experience to their non-disabled counterparts. We work to reduce the need for individual accommodations through proactive collaboration with University partners to impact the systemic design of campus environments.

Survivor Advocacy Program
https://survivoradvocacy.arizona.edu/
The Survivor Advocacy Program provides confidential support and advocacy services to student survivors of sexual and gender-based violence. The Program can also advise students about relevant non-UA resources available within the local community for support.
Email: survivoradvocacy@arizona.edu

Phone: 520-621-5767

Preferred Name & Pronoun
If you wish to change your preferred name or pronoun in the UAccess system, please use the following guidelines:

> *Preferred name:* University of Arizona students may choose to identify themselves within the University community using a preferred first name that differs from their official/legal name. A student's preferred name will appear instead of the person's official/legal first name in select University-related systems and documents, provided that the name is not being used for the purpose of misrepresentation. Students are able to update their preferred names in UAccess.
>
> *Pronouns:* Students may designate pronouns they use to identify themselves. Instructors and staff are encouraged to use pronouns for people that they use for themselves as a sign of respect and inclusion. Students are able to update and edit their pronouns in UAccess.

More information on updating your preferred name and pronouns is available on the Office of the Registrar site at https://www.registrar.arizona.edu/records-enrollment/personal-information/updating-personal-information

500+ Clubs
https://www.arizona.edu/student-life/getting-involved

Amenities
https://www.arizona.edu/student-life/campus

Dog Days with the Dean	Campus Rec	Parking & SafeRide
Campus Closet	Bike Services	and many more
Rooftop Greenhouse	Campus Safety	

Student Success District
https://successdistrict.arizona.edu/
University Libraries
Bartlett Academic Success Center
Bear Down Building