graduate HANDBOOK

2021-2022

EARTH AND ATMOSPHERIC SCIENCES

2021-22 GRADUATE HANDBOOK AND APPENDICES

GRADUATE COMMITTEE

The Graduate Committee is responsible for administration of admissions, academics, and other advisory issues for graduate students in the department. The committee acts on applications for associate instructorships, fellowships, and summer research support and monitors academic progress of students. The committee consists of faculty members chosen to represent a range of disciplines and research fields in the department. The committee is assisted in its work by the Graduate Services Coordinator.

2020-21 GRADUATE COMMITTEE MEMBERS

Dr. Doug Edmonds, Director of Graduate Studies (edmondsd@indiana.edu)

Kaj Johnson (kajjohns@indiana.edu)

Ben Kravitz (bkravitz@indiana.edu)

Paul Staten (pwstaten@indiana.edu)

Graduate Services Coordinator Bryan Roberts (geolgrad@indiana.edu)

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Graduate Student Annual Review Forms: https://graduate.indiana.edu/forms/index.shtml

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GENERAL INFORMATION FOR ALL GRADUATE STUDENTS

Best practices for graduate students and their advisors

The advising relationship between students and their faculty advisor(s) is important for success and satisfaction in graduate school. The faculty and graduate students of EAS have created a series of guidelines that encode our collective values and best practices for creating a functioning and healthy student-advisor relationship. These guidelines pertain to both students and their advisors and should be reviewed regularly. See Appendix 7.

Degrees Offered

The following graduate degrees are offered In the Department of Earth and Atmospheric Sciences: M.S. Geological Sciences, M.S. Geological Sciences-Atmospheric Sciences, Ph.D. Geological Sciences, Ph.D. Geological Sciences-Atmospheric Sciences.

Admission Requirements (TOEFL)

If the graduate applicant's native language is not English, the College requires a score of at least 79 on the TOEFL iBT (delivered via the internet). Please note that the paper-based TOEFL ITP exam – sometimes called the institutional TOEFL – offered by the Intensive English Program on the Bloomington campus, cannot be used in place of the TOEFL iBT. Alternatively, an international applicant may submit the result of the International English Language Testing System (IELTS) examination in lieu of the TOEFL iBT. The College requires a score of at least 6.5 on the IELTS for graduate admission.

Residency

All graduate students must complete at least 30 hours of graduate credits in residence at the IU Bloomington campus. Ph.D. students must be in residence at the Bloomington campus for at least two consecutive semesters during the degree program.

IUB College Information

The websites for the College and the Graduate School (https://graduate.indiana.edu/index.shtml) provide links on the College Graduate Office page to submit requests (Extensions of Incomplete, Family and Medical Leave), to apply for funding (College Travel Awards, College of Arts and Sciences Dissertation Year Research Fellowships), and to appoint your Doctoral Advisory Committee.

Selection of Advisors and Research Committee

The Graduate Committee advises graduate students on course selection until a primary advisor is selected. Students should choose a primary advisor with graduate faculty status (Appendix 5) from the Department of Earth and Atmospheric Sciences or the Indiana Geological and Water Survey (IGWS https://igws.indiana.edu/). A co-advisor from the Department is required (Appendix 1) if the primary advisor is from the IGWS.

A Research Committee will oversee the student's academic and research progress toward the degree. For all degrees, a majority of members of the research committee must be selected from the Department of Earth and Atmospheric Sciences. The field of expertise of both the primary advisor and the research committee should reflect the topic of research chosen by the student.

Communication with Research Committee

Students must keep members of their Research Committee informed of progress with research and fulfillment of academic requirements on a regular basis, through both meetings and email. Meetings should occur at least once each semester of the academic year (Spring and Fall), although students are strongly encouraged to meet more frequently with their committee members on an informal basis.

Annual Review

An Annual Review of academic and research progress is required of all graduate students in the department. All students are to submit the completed Annual Review forms by March 15 following the announced procedures for submission. The Graduate Affairs Committee may require a student to submit forms earlier than the March 15 deadline under certain circumstances. Appendices 2 and 3 contain sample copies of M.S. and Ph.D. Annual Review forms. These are available on the departmental website as interactive PDF forms under the Student Portal, Graduate, Forms.

Completion of the Annual Review forms requires a meeting of the student with the research committee and signatures from committee members and the student. Students must scan all pages of the review, including the signed forms, and submit as one PDF to the Graduate Service Coordinator. Students who fail to complete their annual review are subject to loss of departmental support following a review by the Graduate Affairs Committee and the Chair.

Annual reviews will normally consist of three components:

An oral presentation by the student of research progress with a detailed plan for degree completion including coursework and research.

An in-depth discussion with the research committee to critically evaluate the student's progress and advise the student on future plans to advance his/her research.

Grading of student progress by the research committee. The grading scale, form and the submission process will be determined each year by the Graduate Affairs Committee.

The annual review process is the primary mechanism used by the Department to gauge student research performance and evaluate whether or not a student should continue to receive departmental support and continue in their degree program. It also assists the Graduate Affairs Committee in evaluating merit for student awards. Those students whose performance is judged unsatisfactory by their research committee will be subject to departmental summer probation, which behooves them to demonstrate improved performance in their research and/or coursework. Students in this category are required to undergo a second review by an extended committee (henceforth referred to as the evaluation committee) consisting of the student's research committee and one or more representative of the Graduate Affairs Committee. This review must take place in August prior to the start of the fall semester. If performance is still judged unsatisfactory the student will be placed on formal academic probation with the Graduate School for the fall semester. Students in probation are afforded a final opportunity to show progress in research based on a third review session administered by the evaluation committee before the end of the fall semester.

Sources of Funding

The Department of Earth and Atmospheric Sciences awards AI, RA, and Fellowship support, as well as summer research funds, on a competitive basis. AI support encompasses responsibilities in preparing and/or teaching laboratory courses, among other duties. RA support is dependent on the availability of specific research funds procured by individual faculty members through externally-funded grant proposals. Fellowships and summer research support are available from assets allocated to general or specific departmental accounts.

Diplomas

Degrees are granted every month of the year. The University Graduate School requires receipt of an electronic copy of the thesis/dissertation prior to the 15th day of the month for which the degree is to be granted; if received after the 15th the degree will be granted the next month. A degree diploma is mailed to a student's home address two to three months after the degree is conferred. Diplomas are sent by third-class mail (Printed Matter) through the US Postal Service. Please be aware that items sent third-class are not forwarded to a new address. Hence, students must verify that their correct permanent home address is on file with the Registrar to ensure that the degree is mailed to the desired location. Please see the Graduate Services Coordinator if you are an international student desiring special arrangements for receipt of the diploma. The Graduate Services Coordinator can instruct you in how to have the diploma sent from the University Graduate School to the EAS Graduate Office (IGWS 4022B). Our department will then send the diploma by airmail to your international address. Duplicate diplomas may be obtained through the Registrar for an additional fee.

MASTER OF SCIENCE THESIS OVERVIEW

This degree option is recommended for most students entering the program with an undergraduate degree. The degree requirements include:

- A total of 30 credit hours

At least 22 of the 30 hours must be graduate-level courses. 400-level courses from the Department of Earth and Atmospheric Sciences that can be taken for graduate credit are listed in Appendix 6. 500-700-level Geology courses and lower-level courses from other departments that count toward graduate credit can be found in the University Graduate School Academic Bulletin (https://bulletins.iu.edu/iu/gradschool/2020-2021/requirements/index.shtml; see the section entitled Graduate Credit - General in the Academic Regulations section of the University Graduate School Academic Bulletin).

- 12 of the 22 hours must be coursework taken in Earth and Atmospheric Sciences.
- A minimum of 3 credits of G810 (research credits) are required; a maximum of 8 credits of G810 can be applied toward the degree.
- All graduate students must take G590, preferably in their first year.
- At least three 3-credit hour courses of 500-level (not including G590) or above must be taken from the Department of Earth and Atmospheric Sciences.
- Selection of courses must be approved by the primary advisor in consultation with the student's research committee.

Transfer of credit

Up to 8 credit hours of graduate classes can be transferred from another institution, provided the classes meet the requirements of equivalency of graduate classes offered at IU and a grade of 'B' or higher was achieved. Pass/Fail or 'S' graded classes cannot be transferred. Requests for transfer of credit hours originate with the student and advisor. Students are required to highlight the specific courses they request for transfer on a copy of their transcripts and submit these documents to the Graduate Office GY 3040. Transfers require approval by the University Graduate School and courses must have been completed within 5 calendar years prior to awarding the Masters degree.

Minimum Grade Point Average

All Masters students must maintain a 3.0 (B) grade point average. Students with a GPA less than 3.0 can be placed on academic probation until the student's GPA increases to above 3.0. While on academic probation, the student cannot be supported as an AI, RA, or Fellow. If the GPA does not reach 3.0 after two semesters of probation, the student will be dismissed from the graduate program.

Primary Advisor

An advisor (and co-advisor if necessary; see page 4) should be chosen during the first semester and no later than March 1 of the first year in the degree program.

Research Committee

A three-person research committee must be formed for each Masters student, consisting of the primary advisor and two other members. Two of the members of this committee must be graduate faculty of the Department (see page 4). The composition of the research committee and signatures from each of the members must be filed with the Departmental Graduate Office by March 1 of the first year of the degree program. Any change in committee membership must be communicated immediately to the Graduate Office.

Completion of Written Thesis

The thesis should be prepared in a form that is essentially ready to submit for publication in an appropriate journal(s). Publication and public presentation of research results is strongly encouraged but not required. The format of the thesis must conform to the University's official policy on the production of theses (Appendix 4).

Timeframe

Master's degrees must be completed within five years of enrollment, or six years for Dual Masters degrees. Students who exceed this time frame must revalidate all coursework taken outside this timeframe.

M.S. Requirements

Students in the M.S. degree program who apply successfully for admission into the Ph.D. program in our Department must complete all formal requirements for the degree no later than one semester after entering the Ph.D. program.

Application for Advanced Degree Form

This form is on the Graduate School website (https://graduate.indiana.edu/forms/index.shtml), and must be completed and submitted a minimum of 60 days prior to the desired graduation date, regardless of whether you will attend the commencement ceremony.

Commencement ceremony

If you wish to attend the commencement ceremony, necessary forms must be filled out in advance. To attend the December commencement, the forms must be completed around mid-September; for the May commencement, they must be completed around mid-February. Further information can be found at the Indiana University Ceremonies website (https://universityevents.iu.edu/). Consult with the Department Graduate Office GY 3040 for further information.

M.S. Thesis Presentation

Students are encouraged to present their final M.S. research results at a regional or national meeting (e.g., AGU, GSA, AAPG, etc.). A departmental defense is not formally required but is strongly recommended and should be announced to the department with title, date, time and location.

MASTER OF SCIENCE 'REPORT OPTION' OVERVIEW

This degree option is not recommended for most students because it may limit future educational and professional goals. An exception is students who plan to continue in the Ph.D. program in our Department, building directly on research begun in the M.S. program. In such circumstances the report route can streamline that transition when appropriate but the formal decision to pursue this option should only be taken after admission to the Ph.D.

The degree requirements include:

- Total of 30 credit hours
- 27 of the 30 hours must be graduate-level courses; the remaining 3 can be G810. 400-level courses from the Department of Earth and Atmospheric Sciences that can be taken for graduate credit are listed in Appendix 6. 500- to 700-level Earth and Atmospheric Sciences courses, and lower-level courses from other departments that count toward graduate credit can be found in the https://bulletins.iu.edu/iu/gradschool/2020-2021/programs/bloomington/earth-and-atmospheric-sciences/courses.shtml
- 20 of the 27 hours must be in Earth and Atmospheric Sciences.
- At least three 3-credit hour courses of 500 level or above must be taken from the Department of Earth and Atmospheric Sciences.
- Selection of courses to be taken should be discussed with the primary advisor and research committee.
- Transfer of credit
- As above in M.S. overview.
- Minimum Grade Point Average
- As above in M.S. overview.
- Report

The precise format and content of the report are determined in collaboration with the student's advisor and research committee. The report must be signed by the entire research committee. It is recommended that the report be in a format suitable for publishing, but it is not required.

Primary Advisor

An advisor (and co-advisor if necessary; as above in M.S. overview) should be selected no later than March 1 of the first year in the degree.

Research Committee

As above in M.S. overview.

Timeframe

As above in M.S. overview.

Application for Advanced Degree Form

As above in M.S. overview.

Commencement Ceremony

As above in M.S. overview.

M.S. Report Option Presentation

Students are encouraged to present their final M.S. research results at a regional or national meeting (e.g., AGU, GSA, AAPG, etc.) or as a departmental defense with title, date, time and location announced to the department.

MASTER OF SCIENCE DEGREE: GEOLOGICAL SCIENCES-ATMOSPHERIC SCIENCES

Admission Requirements

Undergraduate major in Geological Science, Atmospheric Science, Mathematics, Physics, Chemistry, Biology, or equivalent. Applicants not meeting this requirement may be expected to complete additional coursework.

FIELD OF STUDY - ATMOSPHERIC SCIENCES

Course Requirements

Requirements are the same as the M.S. degree (thesis or report option) with one additional requirement. At least 12 credit hours must be from the list of courses specific to Atmospheric Sciences defined by the Department of Earth and Atmospheric Sciences.

M.S./M.S.E.S. MASTER OF SCIENCE IN GEOLOGICAL SCIENCES MASTER OF SCIENCE IN ENVIRONMENTAL SCIENCE

This degree program is appropriate for students from a wide range of undergraduate science programs interested in a career in environmental sciences. This dual masters' program is a 51-credit hour (two year) program that gives the student greater depth and breadth than is possible in a single degree.

Admission Requirements

A student must apply to and be accepted by both the Department of Earth and Atmospheric Sciences and SPEA.

Course Requirements

Course requirements are a minimum of 21 credits from each program distributed as follows:

- Earth and Atmospheric Sciences core (12 cr.)
- Environmental Science core (12 cr.)
- Courses in economics, policy, and law competencies (6 cr.)
- A tool skill (3 cr.)
- Other Earth and Atmospheric Sciences or SPEA courses recommended by advisory committee and
- 9 Credits of research divided between Earth and Atmospheric Sciences and SPEA.

The distribution of credits across these requirements can be modified with the approval of the research committee. This committee, with a minimum of three members, will supervise the student's research program. At least one member of the committee must have a primary affiliation with the Department of Earth and Atmospheric Sciences and at least one member must have a primary affiliation with SPEA. Two members of the advisory committee must be named as co-advisors with one advisor from each program.

Example credit hour distribution for an M.S. student

Classes:		Credit Hours
G583	Isotopic Systematics	3.0
G572	Basin Analysis and Hydrocarbons	3.0
G601	Clay Mineralogy	3.0
G571	Principles of Petroleum Geology	3.0
E451	Hydrogeology	3.0
G554	Fundamentals of Plate Tectonics	3.0
G590	The Art of Geological Sciences	1.0
G637	Seminar in Tectonics (taken twice)	2.0
A597	Introduction to Programming 1	3.0
Total		24.0
Research Hours:		
G810	Research Hours	6.0
Total		30.0

Courses that satisfy the 12 credit hour requirement:

G534 Dynamic Meteorology 2
G537 Synoptic Meteorology and Climatology
G538 Air Pollution Meteorology
G540 Physical Meteorology
G547 Atmospheric Instrumentation
G556 Wind Power Meteorology
G564 Dynamic Meteorology: Boundary-Layer Meteorology
G570 Micrometeorology
G574 Topics in Micro-and Boundary-layer Meteorology
G576 Climate Change Science

DOCTOR OF PHILOSOPHY DEGREE OVERVIEW

The requirements are:

Total of 90 credit hours

- 35 of the 90 hours must be graduate-level courses.
- 20 of the 35 hours of coursework must be in Earth and Atmospheric Sciences. The remaining credit hours may include electives and coursework required to fulfill the minor.
- All graduate students must take G590, preferably in their first year.
- 12 of these 35 hours must be graduate courses (not including G590) from the Indiana University Department of Earth and Atmospheric Sciences. In exceptional cases (e.g., when a student enters the Ph.D. program with a strong background in the Earth and Atmospheric Sciences from another university and finds few courses in the department that will support their doctoral research program), a candidate may petition the Graduate Studies Committee in writing to waive this requirement.
- Up to 30 credit hours of graduate classes can be transferred from another institution, providing a grade of 'B' or higher was earned. Pass/Fail or 'S' graded classes cannot be transferred without a letter of clarification from the instructor that a B or higher equivalent would have been awarded. Courses to be transferred must be approved by the University Graduate School and must have been completed within the 7 calendar years prior to passing the Qualifying Exam.

Minimum Grade Point Average

All Ph.D. students must maintain a 3.0 (B) grade point average.

G901 Advanced Research

Dissertation credits as G901 can be taken when the student has fulfilled all the course requirements detailed above, completed 90 credit hours of graduate-level coursework and passed the qualifying examination (see below). A maximum of 6 semesters of G901 is permitted. G901 is currently 6 credit hours per spring and fall semester. Summer enrollment is not required unless the student intends to receive the degree during summer, which necessitates enrollment in 1 credit of G810.

Primary Advisor

An advisor (and co-advisor if necessary; see page 4) should be selected and agree to fulfill this role no later than December 1 of the first year of the degree.

Advisory Committee

The advisory committee shall approve the student's program of study and counsel the student until the passing of the Qualifying Exam. The advisory committee must include at least two members from the major area and one from the minor. The name of the primary advisor and two other members of the committee must be confirmed in a signed letter to the Graduate Services Coordinator.

Example credit hour distribution for a Ph.D. student

Classes:		Credit Hours
G513	Seismology	3.0
G583	Isotopic Systematics	3.0
G514	Geophysical Signal Analysis	3.0
G612	Inverse Methods in Geophysics	3.0
G572	Basin Analysis and Hydrocarbons	3.0
G601	Clay Mineralogy	3.0
G571	Principles of Petroleum Geology	3.0
E451	Hydrogeology	3.0
G554	Fundamentals of Plate Tectonics	3.0
G589	Geomicrobiology	3.0
Total		30.0

Minor:		Credit Hours
A597	Introduction to Programming I	3.0
A598	Introduction to Programming II	3.0
P573	Scientific Computing	3.0
P673	Advanced Scientific Computing	3.0
Total		12.0
Total all Graduate Courses:		42.0
Research Hours:		
G810	Research Hours	48.0
Total Credit Hours for Ph.D.		90.0

Research Committee

Following the qualifying exam, a research committee must be selected, consisting of the primary advisor and 3-4 other members. The research committee can include all of the members of the Advisory Committee, supplemented by other IU faculty or individuals from other institutions connected to the research. Three of the members of this committee must be graduate faculty in the Department. The composition of the research committee and signatures from each of the members must be provided on the annual review form; any change must be communicated to the Graduate Office immediately.

Selection of a Minor

Selection of a Minor is also a requirement of the degree. Minors in allied science and mathematics are normally desired to broaden the student's background. The minor can also be in an area within the geosciences distinct from the chosen major. Formal external and internal minors are approved by the University Graduate School (https://bulletins.iu.edu/iu/gradschool/2020-2021/requirements/index.shtml).

An individualized minor option with a minimum of 12 credit hours from at least two different Departments is also possible through petition to the University Graduate School. An individualized internal minor, which also requires coursework from at least two Departments, must be approved by the Graduate Affairs Committee and by the Graduate School Dean's office prior to completing the proposed course work.

Minors typically require between 6 and 12 credit hours of coursework. The precise requirements and courses needed will be determined by the Minor Advisor, who must be a faculty member in the minor department. The minor advisor normally becomes a member of the student's research committee (see below).

Students electing an internal minor must complete a minimum of 6 credit hours of course work in an area of Earth and Atmospheric Sciences distinct from their major research area. Courses taken for the minor may count toward the requirement of 35 credit hours of graduate course work. The objective of the Ph.D. minor is to broaden the student's background. To assure that this objective is achieved, any students who are planning an internal minor must have their study plan approved by their advisory committee and the Director of Graduate Studies. Internal minors must be approved in advance by the University Graduate School as an individualized minor.

ADMISSION

Students are admitted to the Ph.D. program through one of three mechanisms:

- Direct admission to the Ph.D. program following completion of an undergraduate degree program. (Students who enter the Ph.D. program with a baccalaureate degree will be encouraged to complete an M.S. degree.)
- Admission after completion of an M.S. degree at another institution.
- Current Indiana University students enrolled in our M.S. program may apply for admission to the Ph.D. program early in their second year of graduate study. The early review process is used to evaluate a student's suitability for the Ph.D. program.
- The expectations of progress toward the Ph.D. degree and the timelines for review of student progress, as described in Figure 1 (page 17), are different for each of these groups.

EARLY REVIEW

Objectives

The early review is an extension of the department annual review process. The primary purpose of this requirement is to provide a departmental assessment of each student's level of preparation to complete the Ph.D. degree in an early stage. The aim is to (i) ensure that students are actively developing a viable research project, and (ii) identify aspects of students' academic background that need strengthening early in their course of study.

Administration and Timetable

The Graduate Affairs Committee administers this review procedure. Figure 1 (page 15) is a graphical representation of the timeline for this review for the three different groups outlined above. A key aspect of this process is that students entering the program with a baccalaureate degree are required to go through this process in the fall of their second year of residence, whereas students entering the program with an M.S. degree will be reviewed in the spring semester of their first year of residence.

Step 1: Study Plan

As illustrated by the timelines in Figure 1 (page 17), students are required to complete a preliminary Ph.D. research and study plan comprised of three parts:

Research Statement

A brief (less than one page) summary of a student's research plan. The format should be comparable to the "Intellectual Merit" section of the project summary for a standard proposal to the National Science Foundation written for a non-specialist in the research area.

Personal Statement

An assessment by the student of their perception of individual strengths and weaknesses pertinent to their research goals. This should address three areas:

- (i) academic background (e.g. coursework and field experiences)
- (ii) research skills (e.g. talents in writing, mathematics, computing, laboratory work, etc.) and
- (iii) personality characteristics important to professional success (e.g. tenacity, flexibility, commitment, ability to work in a team, etc.).

Students should view this task as an opportunity for objective professional self-assessment that can help the committee identify appropriate topics for discussion during the oral exam. An honest assessment will be most beneficial in this regard because it will facilitate recognition of areas of academic background that need strengthening and thereby aid ultimate success.

Intellectual Development

A bulleted list of specific targets in academic preparation and research skills that require strengthening in order to complete your Ph.D.

Step 2: Feedback and Review of Study Plan

The Graduate Affairs Committee and the student's advisor will provide written feedback to the student two weeks after the deadline for submission of the study plan. This response will be in the form of a review that the student should use as a guide in preparation for the oral exam. It will focus on topics that will constitute the principal points for discussion in the oral exam, especially areas that students identify as strengths, rather than weaknesses.

Step 3: Oral Exam

The Graduate Affairs Committee will schedule an oral exam for individual students. The examination committee will consist of two or members of the graduate committee, the student's advisor, and (optionally) one or more members of the student's research committee. Question topics will focus on areas of knowledge described in the individual review guide given to each student and centered on their strengths. Students should recognize, however, that the broad objective of the exam is to identify areas that need strengthening; hence, the Committee may ask questions regarding any aspect of geosciences.

Step 4: Results of Exam

There are three possible outcomes of this exam:

Unconditional Pass

This pass recognizes that a student has a background without deficiencies, a viable research plan, and is suitably prepared for success in the Ph.D. program, which includes completion of all requirements for the M.S. degree when applicable.

Deferred Decision

When the student's self evaluation or the exam reveals a need to augment their academic background there may be a requirement to complete one or more courses, or fulfill other specific conditions, as determined by the Graduate Affairs Committee and advisor. The result of the exam may be deferred pending the student's fulfillment of the conditions imposed by the Committee. Students in this category are required to demonstrate significant progress by their annual review or they may enter the probation process described above.

Fail

A student can fail this exam. The primary reason for failure will be a student's inability to convince the committee that he/she can successfully complete the Ph.D. program. For example:

- (i) an inability to provide coherent answers during the oral exam,
- (ii) the absence of a viable research plan,
- (iii) evidence of a lack of commitment to the profession or to the Ph.D. program.

There is no possibility for retaking the exam for students who fail. For students entering the program with an outside M.S. degree (group 2 above) the 'fail' result is reserved for those exceptional circumstances when a student is disengaged from their intended research program.

QUALIFYING EXAMINATION

This is a three-stage process and can be undertaken only after minimum course requirements have been fulfilled. It should be taken no later than the 6th semester in the program:

1) The candidate will prepare a research proposal of approximately 15 pages excluding figures and references. The proposal will be reviewed by the student's advisory committee and used as part of the exam assessment. The proposal must demonstrate that the proposed research consists of a suitable topic in terms of feasibility and importance. Preliminary results and familiarity with the field and literature are necessary before writing the proposal. Once revisions are made and the proposal is accepted by the advisory committee, the second stage can be initiated.

2) A written examination based on the research proposal is prepared by the advisory committee. This is a closed- book examination taken on a day chosen by the student, spanning approximately 3 hours in the morning and 3 hours in the afternoon. The examination is meant to evaluate familiarity with the chosen research area, to assess the relation of this field of research to others in the Earth and Atmospheric Sciences, and to alert the student to potential weaknesses in the research proposal. The advisory committee will evaluate responses to the examination. If responses are deemed sufficient and satisfactory, the third part of the process occurs. Students who fail the examination will be asked to leave the graduate program at the end of the semester, retake the examination, or complete specified remedial classes within 6 months of the examination date.

3) The oral portion of the exam takes place within a 2 week window after the written exam. The format normally consists of an oral presentation of the research proposal to the advisory committee, and responses to committee members' questions regarding both the proposal and the examination answers. This examination takes approximately 3 hours. A room within the department must be booked for this purpose and presentation equipment reserved (see the Office Assistant in GY129). Possible outcomes of this exam are: pass (admission to formal Ph.D. Candidate status), fail with permission to retake the exam, fail without permission to retake the exam, or a conditional pass (the candidate may need to satisfy some requirements set by the committee, which may involve further classes or research).

4) If a candidate passes, the Committee should forward a signed and dated form, on the day of completion, to the Graduate Coordinator for the student's records.

Nomination to Candidacy

After the Qualifying Exam the Nomination to Candidacy form must be completed online at https://graduate.indiana.edu/forms/index.shtml prior to the Qualifying Examination.

Appointment of Research Committee

After approval of the Nomination to Candidacy form, the candidate must complete the form for Nomination to Research Committee, which is on the University Graduate School's website (https://graduate.indiana.edu/index.shtml). It is important that the candidate file this paperwork promptly as nine months must elapse between the time of submission of this form and defense of the dissertation. In the past students have had their graduation delayed by failure to act on this requirement.

Completion of Written Dissertation

The dissertation should be prepared in a form that is essentially ready to submit for publication in appropriate journals. Publication of results is strongly encouraged. The format of the dissertation must conform to the University's official policy on the production of Ph.D. dissertations (Appendix 4).

Dissertation Defense

The dissertation defense can be scheduled no sooner than eight months from the date of completion of the Qualifying Examination and appointment of the Research Committee The Research Committee and student must come to an agreement that the dissertation is at a stage that is suitable for defense, based on drafts of the dissertation submitted to the committee.

An Announcement of the Dissertation Defense must be submitted to the University Graduate School a minimum of 30 days prior to the defense date, but they recommend you start the process 6 weeks before the planned defense date. An example of the format required is included in Appendix 4. Two weeks prior to the defense a copy of the dissertation must be placed in the front office of the department for public perusal. The defense itself consists of a public presentation of the dissertation research that any interested faculty and students may attend, followed by an open session of questions and discussion, after which the student's

Research Committee conducts a rigorous closed-session, oral examination of the student.

The result of the defense is determined as a pass, conditional pass, a deferred decision, or a failure without the option to retake. The conditional pass usually requires revisions of the dissertation as recommended by the research committee, and a deferred decision indicates that the opinion of the research committee was not unanimous, a circumstance that requires reports from the research committee detailing the differing opinions to the Dean of the Graduate School.

After a successful defense, the Graduate Office needs to receive (i) one signed copy of the dissertation abstract, and (ii) one signed dissertation. Students should plan to submit the final version of their dissertation electronically to the University Graduate School as soon as possible.

Timeframe

The Ph.D. dissertation must be accepted by the student's research committee and a copy must be submitted to the University Graduate School within seven years of passing the Qualifying Examination. Failure to do so will result in termination of Ph.D. candidacy. Reinstatement of candidacy is possible and involves obtaining permission of the department chairperson, fulfilling any reinstatement requirements from the Department, passing the Qualifying Examination again, and then requesting reinstatement from the Dean. Once reinstated, the degree must be completed within three years.

Ph.D. Commencement Participation Application

Paperwork must be completed in advance to attend the commencement ceremony. To attend the December commencement, forms must be completed in mid-September; for the May commencement, forms must be completed in mid-February. Further information can be found at the Indiana University Ceremonies website https://universityevents.iu.edu/ or the Grad Services office.

DOCTOR OF PHILOSOPHY DEGREE: GEOLOGICAL SCIENCE-ATMOSPHERIC SCIENCES

Course Requirements

Requirements are the same as the regular Ph.D. degree with one additional requirement. At least 12 credit hours from a list of courses specific to Atmospheric Sciences defined by the Department of Earth and Atmospheric Sciences.

DOCTOR OF PHILOSOPHY DEGREE WITHOUT PRIOR M.SC. DEGREE IN GEOLOGICAL SCIENCES

The requirements below presume that the student begins the program having completed a Bachelor's degree. The requirements include:

- Total of 90 credit hours
- 35 of the 90 hours must be graduate-level courses.
- 20 of these 35 hours must be graduate courses related to the student's major research area.
- 12 credits must be taken in the Indiana University Department of Earth and Atmospheric Sciences.
- Credits for the minor count toward the 35 total hours of coursework.
- Transfer of credit - as specified for Ph.D.
- The following items have the same requirements as those specified in the Ph.D. Overview:
- A 3.0 (B) grade point average
- G901 Advanced Research
- Primary Advisor
- Research Committee
- Selection of a Minor
- Ph.D. students are subject to annual and early review procedures described above
- Qualifying Examination
- Completion of Written Dissertation
- Dissertation Defense

Courses that satisfy the 12 credit hour requirement:

G534 Dynamic Meteorology: Synoptic to Global Scale
G537 Advanced Synoptic Meteorology and Climatology
G540 Physical Meteorology and Climatology
G556 Wind Power Meteorology
G564 Dynamic Meteorology: Boundary-Layer Meteorology
G570 Micrometeorology
G576 Climate Change Science

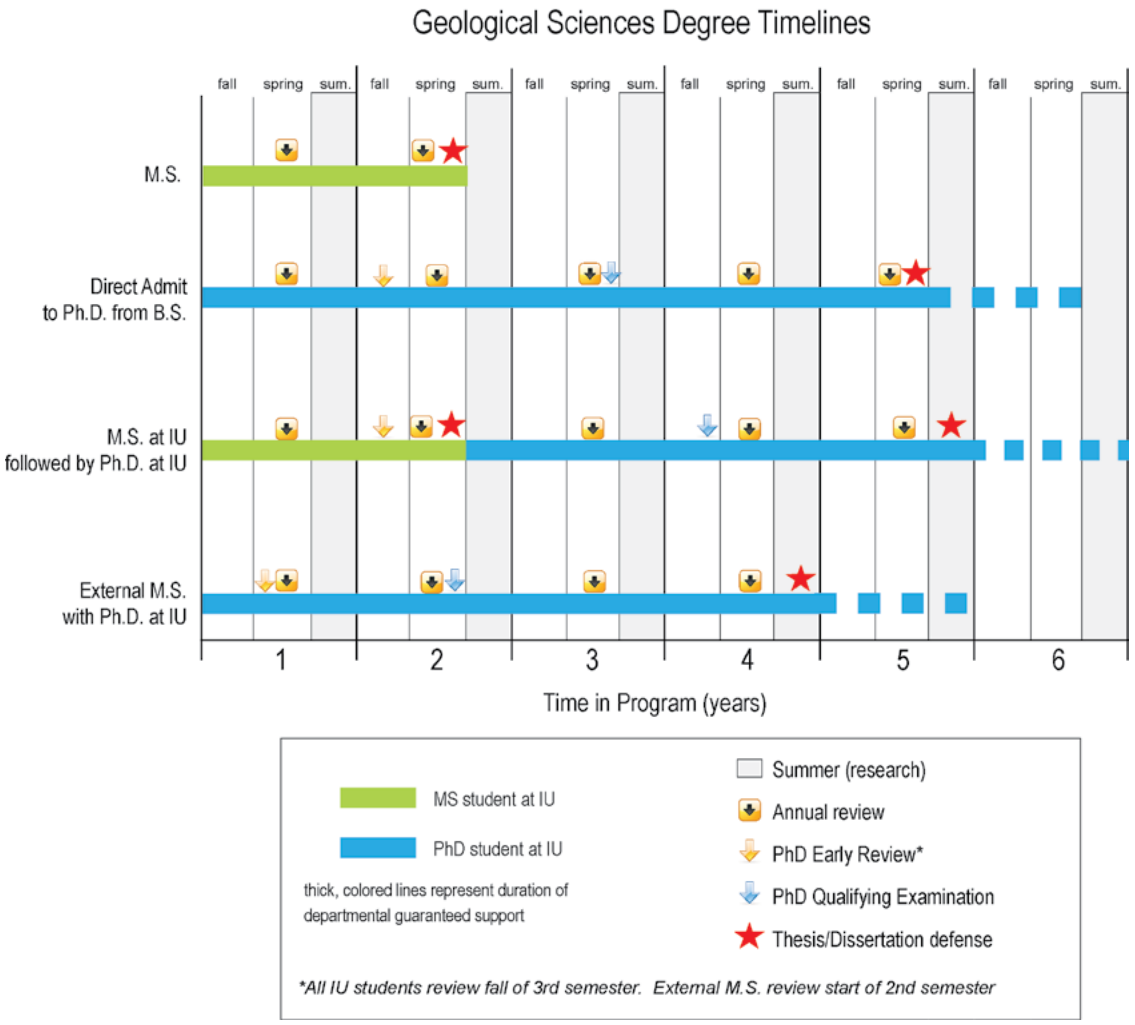

Figure 1: Illustrates a timeline for completing Ph.D. and M.S. degrees in Geological Sciences at IU.

graduate handbook **APPENDICES** 2021-2022

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APPENDIX 1
FACULTY DIRECTORY 2021-2022

APPENDIX 1: FACULTY, EMERITUS, AND ADJUNCT FACULTY

Teaching Faculty: (The following people can supervise Ph.D./Masters students and serve on research committees)						
Title	Name	Specialty	Phone	Room	Email	Department
Professor	Simon Brassell	Biogeochemistry, Organic Geochemistry	5-3786	MSBII 404	simon	EAS
Assoc. Professor	Douglas Edmonds	Sedimentary Geology	5-4512	GY 4054	edmondsd	EAS
Professor	Michael Hamburger	Geophysics, Seismology and Tectonics	5-2934	GY 4044	hamburg	EAS
Prof. of Practice	Jim Handschy	IU Field Station, Executive Director	406-600-1821	GY 4052	jwhandsc@iu.edu	EAS
Professor	Claudia Johnson	Geobiology	5-0646	GY 5048	claudia	EAS
Professor	Kaj Johnson	Geophysics	5-3612	GY 4042	kajjohns	EAS
Assoc. Professor	Chanh Kieu	Atmospheric Science	6-5704	GY 4057A	ckieu	EAS
Asst. Professor	Ben Kravitz	Atmospheric Science	5-4334	GY 4055A	bkravitz@iu.edu	EAS
Assoc. Professor	Jackson Njau	Geoanthropology	6-3170	GY 5052	jknjau	EAS
Asst. Professor	Travis O'Brien	Atmospheric Science	812-269-2051	GY 4037A	obrienta@iu.edu	EAS
Professor	David Polly	Paleontology, Geobiology	5-7994	GY 5053A	pdpolly	EAS
Professor	Juergen Schieber	Geology of Shales and Mudstones	5-5322	GY 5069	jschiebe	EAS
Asst. Professor	Paul Staten	Atmospheric Science	6-5135	GY 4053A	pwstaten	EAS
Asst. Professor	Andrea Stevens Goddard	Thermochrology and Geochronology	6-2319	GY 4043	alsg@iu.edu	EAS
Assoc. Professor	Brian Yanites	Geomorphology, Surface Processes, Geophysics	5-6109	GY 4056	byanites	EAS
Professor	Chen Zhu	Hydrogeology, Mass Transport, Water-Rock-Gas-Microbe Interactions	6-1884	MSBII 424	czhu	EAS
Research Faculty: (The following people can serve on research committees, and the Senior Scientists can supervise Ph.D./Masters students)						
Senior Lecturer	Erika Elswick	Geochemistry, Sedimentology, Sedimentary Ore Deposits	5-2493	MSBII 428	eelswick	EAS
Research Scientist	Ed Herrmann	Geoarchaeology	6-0587	GY 5042	edherrma	EAS
Lecturer	Elizabeth Kenderes	Igneous petrology, radiogenic isosopte		GY 2036	emkender@iu.edu	EAS
Senior Lecturer	Cody Kirkpatrick	Atmospheric Science	5-3481	GY 4046	codykirk	EAS
Senior Scientist	Chusi Li	Petrology, Geochemistry, Mineral Deposits	5-1558	GY 2042	cli	EAS
Assistant Research Scientist	Jess Miller-Camp	Paleontology Collections Manager, CBRC Digital Projects Manager		GY 5050	jessmc@iu.edu	EAS
Assistant Research Scientist	Shelby Rader	Non-traditional stable isotope systems	5-7508	MSBII 402	shtrader@iu.edu	EAS
Research Scientist	Peter Sauer	Biogeochemistry, Paleoclimatology	5-6591	MSBII 410	pesauer	EAS
Senior Scientist	Arndt Schimmelmann	Organic Geochemistry, Chemical Oceanography	5-7645	GY 2038	aschimme	EAS

APPENDIX 1: FACULTY, EMERITUS, AND ADJUNCT FACULTY

Emeritus Faculty						
Abhijit Basu	Sedimentary and Planetary Petrology		5-6654	GY 2046	basu	EAS
David Bish	Clay Mineralogy; X-ray Diffraction				bish	EAS
Robert Blakely	Geophysics				blakely	EAS
James Brophy	Igneous Petrology, Geochemistry				brophy	EAS
David L. Dilcher	Geobiology		6-0618	IGWS	dilcher	EAS
Bruce Douglas	Sedimentology, Stratigraphy				douglasb	EAS
Jeremy Dunning	Structural Geology				dunning	
Brian Keith	Sedimentology, Stratigraphy				keithb	IGS
Enrique Merino	Geochemistry and Petrology		5-5088	GY 2046	merino	EAS
Greg Olyphant	Hydrogeology, Quaternary Geology and Geomorphology				olyphant	EAS
Gary Pavlis	Geophysics, Seismology and Tectonics		5-5141	GY 2052	pavlis	EAS
Lisa Pratt	Biogeochemistry, Sedimentology/Stratigraphy				prattl	EAS
Ed Ripley	Isotope Geochemistry, Economic Geology				ripley	EAS
Lee J. Suttner	Sedimentology and Stratigraphy		5-4957	GY 2052	suttner	EAS
Robert Wintsch	Metamorphic, Structural, Sedimentary Petrology, Tectonics and Geochronology				wintsch	EAS
Adjunct Faculty: (The following people can supervise a Ph.D./Masters student, but require a co-advisor from the Faculty or Research Faculty. They can also serve on research committees)						
Adjunct Faculty	Matt Churchfield	Earth and Environmental Science	720-355-6001	GY 4050	matt.churchfield@nrel.gov	
Professor	Chris Craft	Wetland Ecology	5-5971	MSBII 408	ccraft	SPEA
Research Scientist	Lee Florea	Hydrogeology, carbonate geology	5-1376	IGWS		
Research Geologist	Jose Luis Antinao-Rojas	Surficial geology	5-1366	IGWS	jantinao	IGWS
Assoc. Professor	Adam Maltese	Science Education/Adjunct Faculty Geological Sciences	6-8059	Wright Ed Bldg 3054	amaltese	School of Education
Research Scientist	Maria Mastalerz	Coal Petrology, Coal Geochemistry, Coalbed Gas	5-9416	IGWS	mmastale	IGWS
Senior Researcher	Pat McLaughlin	Chemostratigraphy, sequence stratigraphy, regional Paleozoic geology, geologic mapping, and sedimentary diagenesis.	5-1350	IGWS	pimclaug@iu.edu	IGWS
Adjunct Faculty	Page Quinton	Paleontology, Paleoclimate	315-267-2815	SUNY Potsdam	quintopc@potsdam.edu	EAS/IUGFS
Adjunct Faculty	Michael Rygel	Stratigraphjy, sedimentology, petroleum geology	315-267-3401	SUNY Potsdam	rygelmc@potsdam.edu	EAS/IUGFS
Director, IGWS	Todd Thompson	Clastic and carbonate sedimentology, lake level, shoreline behavior, Indiana Dunes	5-7428	IGS	tthomps	IGS
Asst. Professor	Adam Ward	Watershed Hydrology and Engineering	6-4820	MSBII 430	adamward	SPEA

Only the listed phone number is needed when calling from on-campus; add 85 to the front to reach them from off-campus locations.

Add @indiana.edu to each of these emails to contact the person.

Please note that this list changes every year – please consult the updated directory information.

APPENDIX 2

EAS ANNUAL REPORT FORMS FOR THE MASTERS DEGREE

NOTE: The following forms are examples only. The actual forms you will use are online here:

https://earth.indiana.edu/student-portal/forms.html

APPENDIX 2: EXAMPLE ANNUAL REPORT FORM FOR THE M.S. DEGREE (page 1)

INSTRUCTIONS: Download this form from https://earth.indiana.edu/student-portal/forms.html

It should be completed and sent to the Graduate Services Coordinator no later than March 15th.

NAME:_____

ANNUAL REVIEW OF M.S. DEGREE PROGRESS

Students are required to organize a brief meeting with their Advisory Committee at least once a year (before March 15) to ensure that they share a common understanding of course selections, and research activities, plans and goals.

To assist in this process, students should provide copies of the form, duly completed, to all committee members at least 24 hours prior to this progress meeting. After the meeting, a PDF of the completed and signed form should be submitted to the Graduate Services Coordinator (room GY 3040). Information on this form and in the summary statement of research progress will be used by the Committee on Graduate Studies to help rank students for academic awards and financial support.

COURSEWORK CHECKLIST

Graduate requirements:	Completed ?	Comments
1. ≥ 9 credit hours ≥ 500 level	☐	_____
2. ≥ 12 of the 22 hours of graduate course credits in Geological Sciences	☐	_____
3. ≤ 8 credit hours graduate transfer credit	☐	_____
4. ≥ 30 credit hours total graduate credit	☐	_____

Annual course load is 30 credit hours: 12 in Fall & Spring Semesters, 6 in Summer Session

RESEARCH PLANS

Program Options:

M.S. students must complete:

- ☐ Either a thesis (strongly recommended),
- ☐ Or a research report

Provisional Thesis (or Report) Title:

Brief Outline (max, 1 page) of Research Objective & Strategies:

Aims, field work, sampling, analytical methods, etc.

Summary of Immediate (3-6 months) Research Plans:

Future activities, especially during the summer months

APPENDIX 2: EXAMPLE ANNUAL REPORT FORM FOR THE M.S. DEGREE (page 2)

PROPOSED LONG-TERM RESEARCH PLANS AND TIMETABLE:

ANTICIPATED PHASES OF RESEARCH ACTIVITIES AND CONTINGENCIES

Timetable and Dates:

1. Annual Review: Date, time, and venue

2. Thesis Completion: Target dates for draft and final version. Provisional date for thesis defense.

Summary of Financial Support:

Indicate sources of support, e.g. AI (provide course #), RA (note funding agency & PI), Fellowship (give source, self, other grants (e.g. GSA, Sigma XI, etc.)

	Semester 1	Semester II	Summer
Year 1			
Year 2			

RESEARCH PROGRESS

Summary of Progress

A summary statement, preferably a one-page synopsis, which documents the following items, should be appended to this form. Several of these details would typically be compiled for inclusion in a full curriculum vitae, which may also be appended to this report.

1. Research Activities: Summarize achievement during the past year in field work, in laboratory analyses, in data collection, and written reports.

2. Proposals and Contributions to Proposals: Document grant applications submitted for research or fellowship support, including title, funding agency, date of submission, duration, purpose, and amount of funding sought/awarded, and the current status (whether pending, accepted, or declined). A copy of the proposal should be provided. Comparable information should also be given for grant applications submitted by others, for example an advisor or collaborator, to which you contributed. In such cases a copy of the proposal summary should be provided.

3. Conferences and Short Courses: Give details of meetings, short courses or workshops attended, including their title(s), sponsoring organizations (e.g. GSA, AAPG), dates, location, and the source of any financial support enabling attendance.

4. Presentations: Provide a summary of any contributions to oral presentations or posters with information on the title, authorship, venue, date, and speaker (if applicable). Include a copy of the abstract, if available.

5. Publications: List all abstracts and papers, giving title, authorship, journal or book (e.g. conference proceedings or symposia), volume, pagination, and date of publication. Separately list comparable information for other manuscripts in preparation, submitted, under revision, accepted, or in press. Denote whether publications are peer-reviewed and provide copies of abstracts

6. Other Academic or Career Activities: Comment on any other relevant activities (e.g. internships) and on any awards received.

APPENDIX 2: EXAMPLE ANNUAL REPORT FORM FOR THE M.S. DEGREE (page 3)

COMMITTEE REVIEW AND REMARKS

Coursework Status

Based on details documented in Coursework Summary.

1. Required Course. As determined by Advisory Committee:

2. General Requirements. Enter accumulated credit hours within each category.
   ≥ 500 level Earth and Atmospheric Sciences (≥ 9h) ☐ Total Geol Sci. (≥ 20 h) ☐
   Transferred grad. Credit (≤8 h) ☐ Total graduate credit (≥ 30 h) ☐

3. Options. Specify credit hours accumulated within chosen option.
   Option A: Research (≤ 8 h) ☐
   Option B: Research (≥ 3h) ☐

COMMITTEE COMMENTS

1. Assessment of Degree Progress and a numerical ranking of research progress on a scale of 1-5 (1 = unsatisfactory; 2 = minimal; 3 = satisfactory; 4 = good; 5 = outstanding).
   Contents based on coursework & research activities:

2. Recommendations. Specific suggestions or requirements regarding degree progress.

3. Approval. Signatures designate agreement on course selection and research programs.

	Signature	Date
Research Advisor	_____	_____
Advisory Committee member:	_____	_____
Advisory Committee member:	_____	_____

INSTRUCTIONS: Download this form from https://earth.indiana.edu/student-portal/forms.html
It should be completed and sent to the Graduate Services Coordinator no later than March 15th.

APPENDIX 3

EAS ANNUAL REPORT FORMS FOR THE PH.D. DEGREE

NOTE: The following forms are examples only. The actual forms you will use are online here:

https://earth.indiana.edu/student-portal/forms.html

APPENDIX 3: EXAMPLE ANNUAL REPORT FORM FOR THE PH.D. DEGREE (page 1)

INSTRUCTIONS: Download this form from https://earth.indiana.edu/student-portal/forms.html
It should be completed and sent to the Graduate Services Coordinator no later than March 15th.

NAME:_____

ANNUAL REVIEW OF Ph.D. DEGREE PROGRESS

Students are required to organize a meeting with their Advisory Committee at least once a year (by March 15) – more frequent meetings are encouraged - to ensure that they share a common understanding of course selections, and research activities, plans, and goals.

To assist in the annual review process, students should provide copies of the form, duly completed, to all committee members at least 24 hours prior to this progress meeting. After the meeting, a PDF of the completed and signed form should be submitted to the Graduate Services Coordinator in the Graduate Services Office (room GY 3040). Information on this form and in the summary statement of research progress will be used by the Committee on Graduate Studies to help rank students for academic awards and financial support.

COURSEWORK CHECKLIST

Graduate Requirements:	Completed?
1. ≥ 12 credit hours formal graduate credits in Earth and Atmospheric Sciences	☐
2. ≥35 credit hours total formal graduate coursework	☐
3. ≤30 credits of transferred graduate credit	☐
4. ≥90 credit hours total graduate credit	☐
5. Specified credit hours in minor (determined by minor advisor)	☐

Annual course load is 30 credit hours: 12 in Fall and Spring Semesters, 6 in Summer Session

RESEARCH PLANS

Provisional Thesis (or report) Title:

Brief Outline of Research Objectives and Strategies:
Aims, field work, sampling, analytical methods, etc.

Summary of Immediate (3-6 months) Research Plans:
Future activities, especially during the summer months

Proposed Long-term Research Plans and Timetable:
Anticipated phases of research activities and contingencies

APPENDIX 3: EXAMPLE ANNUAL REPORT FORM FOR THE PH.D. DEGREE (page 2)

Timetable and Dates:

1. Annual Review: Date, time, and venue

2. Qualifying Examination. Proposed date and time

3. Thesis Completion: Target dates for draft and final version. Provisional date for thesis defense.

Summary of Financial Support:

Indicate sources of support, e.g. AI (provide course #), RA (note funding agency & PI), Fellowship (give source, self, other grants (e.g. GSA, Sigma XI, etc.)

	Semester 1	Semester II	Summer
Year 1			
Year 2			
Year 3			
Year 4			

RESEARCH PROGRESS

Summary of Progress

A summary statement, preferably a one-page synopsis, which documents the following items, should be appended to this form. Several of these details would typically be compiled for inclusion in a full curriculum vitae.

1. Research Activities: Summarize achievement during the past year in field work, in laboratory analyses, in data collection, and written reports.
2. Proposals and Contributions to Proposals: Document grant applications submitted for research or fellowship support, including title, funding agency, date of submission, duration, purpose, and amount of funding sought/awarded, and the current status (whether pending, accepted, or declined). A copy of the proposal should be provided. Comparable information should also be given for grant applications submitted by others, for example an advisor or collaborator, to which you contributed. In such cases a copy of the proposal summary should be provided.
3. Conferences and Short Courses: Give details of meetings, short course or workshops attended, including their title(s), sponsoring organizations (e.g. GSA, AAPG), dates, location, and the source of any financial support enabling attendance.
4. Presentations: Provide a summary of any contributions to oral presentations or posters with information on the title, authorship, venue, date, and speaker (if applicable). Include a copy of the abstract, if available.
5. Publications: List all abstracts and papers, giving title, authorship, journal or book (e.g. conference proceedings or symposia), volume, pagination, and date of publication. Separately list comparable information for other manuscripts in preparation, submitted, under revision, accepted, or in press. Denote whether publications are peer-reviewed and provide copies of abstracts
6. Other Academic or Career Activities: Comment on any other relevant activities (e.g. internships) and on any awards received.

APPENDIX 3: EXAMPLE ANNUAL REPORT FORM FOR THE PH.D. DEGREE (page 3)

COMMITTEE REVIEW AND REMARKS

Coursework Status

Based on details documented in Coursework Summary

1. Required Courses. As determined by Advisory Committee

2. General Requirements. Enter accumulated credit hours within each category.

☐ Total Earth and Atmospheric Sciences (≥ 12 h) ☐ Total Graduate Credit (≥ 90 h)
☐ Minor ☐ Graduate Course Credit (≥ 35 h)
☐ Transferred Grad Credit (≤ 30 h) ☐ Research

COMMITTEE COMMENTS

1. Assessment of Degree Progress and a numerical ranking of research progress on a scale of 1-5 (1 = unsatisfactory; 2 = minimal; 3 = satisfactory; 4 = good; 5 = outstanding). Comments based on coursework and research activities.

2. Recommendations. Specific suggestions or requirements regarding degree program.

3. Approval. Signatures designate agreement on course selection and research progress.

	Signature	Date
Research Advisor:	_____	_____
Advisory Committee member:	_____	_____
Advisory Committee member:	_____	_____
Advisory Committee member:	_____	_____
Minor Advisor:	_____	_____
Student:	_____	_____

INSTRUCTIONS: Download this form from https://earth.indiana.edu/student-portal/forms.html

It should be completed and sent to the Graduate Services Coordinator no later than March 15th.

APPENDIX 4

FORMS REQUIRED BY THE UNIVERSITY GRADUATE SCHOOL

The University Graduate School has a comprehensive website informing students on the requirements for preparing theses and dissertations.

These forms are available on OneIU:

M.S. APPLICATION FOR ADVANCED DEGREE (on OneIU)

Ph.D. NOMINATION OF RESEARCH COMMITTEE (on OneIU)

Ph.D. NOMINATION TO CANDIDACY (on OneIU)

Ph.D. SCHEDULE AND ANNOUNCEMENT OF FINAL EXAMINATION (on OneIU)

Ph.D. COMMENCEMENT PARTICIPATION APPLICATION (on OneIU)

A GUIDE TO THE PREPARATION OF THESES AND DISSERTATIONS (on Graduate School website)

INSTRUCTIONS: Go to the Graduate School website to complete and submit the required forms.

https://graduate.indiana.edu/forms/index.shtml

To check on deadlines, go to:

https://graduate.indiana.edu/theses-dissertations/deadlines.shtml

APPENDIX 5
OUTSIDE COURSES APPLICABLE TO THE DEGREES

APPENDIX 5: OUTSIDE COURSES

Outside Courses

(Note: This is not an exhaustive list, other subjects may be taken with permission of the Graduate Committee and the Graduate School.

All students are advised to consult the Director of Graduate Studies if you want a course at the 400 level or below to count for graduate credit.)

Mathematics		
Applied Mathematics		Cr hr
M301	Linear Algebra and Applications	3.0
M303	Linear Algebra for Undergraduates	3.0
M311	Calculus III	3.0-5.0
M312	Calculus IV	3.0
M343	Introduction to Differential Equations w. Applications I	3.0
M344	Introduction to Differential Equations w. Applications II	3.0
M415	Elementary Complex Variables w. Applications	3.0
M441	Introduction to Partial Differential Equations w. Applications I	3.0
M442	Introduction to Partial Differential Equations w. Applications II	3.0
Statistics and Probability		Cr hr
K310	Statistical Techniques	3.0
M360	Elements of Probability	3.0
M365	Introduction to Probability and statistics	3.0
M366	Elements of Statistical Inference	3.0
M463	Introduction to Probability Theory I	3.0
M464	Introduction to Probability Theory II	3.0
M466	Introduction to Mathematical Statistics	3.0
M467	Advanced Statistical Techniques I	3.0
M468	Advanced Statistical Techniques II	3.0
E538	Statistics for Environmental Science	3.0

APPENDIX 5: OUTSIDE COURSES

Computer Science		
A304	Introductory C++ Programming	2.0
A306	Object oriented programming in C++	2.0
A346	User Interface Programming	3.0
C201	Introduction to Computer Science	4.0
C202	Introduction to Software Systems	4.0
C311	Programming Languages	4.0
C335	Computer Structures	4.0
C343	Data Structures	4.0
M371	Elementary Computational Methods	3.0
M471	Numerical Analysis I	3.0
M472	Numerical Analysis II	3.0
Physics		
P302	Elementary Electronics	2.0
P421	Digital Electronics and Microprocessors	3.0
P422	Analog Electronics and Semiconductor devices	3.0
P431	Electronic Laboratory I	2.0
P432	Electronic Laboratory II	2.0
Chemistry		
C315	Chemical Measurements Laboratory I	3.0
C317	Equilibria and Electrochemistry	2.0
C318	Spectrochemistry and Separations	2.0
C364	Introduction to Basic Measurements	3.0
C501	Chemical Instrumentation	3.0
SPEA		
E515	Vector-based Geographical Information Systems	3.0
E526	Applied Math for Environmental Science	3.0
E536	Environmental Chemistry	3.0
E538	Statistics for Environmental Science	3.0

APPENDIX 6

400-LEVEL COURSES THAT CAN BE APPLIED TOWARD GRADUATE CREDIT

EAS 400 Level Courses that Count for Graduate Credit
Within the Department of Earth and Atmospheric Sciences

E406, Introduction to Geochemistry

E411, Invertebrate Paleontology

E416, Economic Geology

X420, Regional Geology Field Trip

E423, Methods in Applied Geophysics

E427, Introduction to X-Ray Mineralogy

X429, Field Geology in the Rocky Mountains

APPENDIX 7

GUIDELINES FOR ADVISOR-GRADUATE STUDENT INTERACTIONS IN THE DEPARTMENT OF EARTH AND ATMOSPHERIC SCIENCES

GRADUATE AFFAIRS COMMITTEE

Doug Edmonds (DGS, Chair)

Kaj Johnson, Member

Ben Kravitz, Member

Paul Staten, Member

Purpose of the guidelines: The graduate committee adopted a set of guidelines/best practices around student/advisor interactions. Advising graduate students is a critical part of our job as faculty, and it can be a transformative experience for both students and advisors. After all, graduate education is research-focused and consists of one-on-one experiences between mentor and mentee. These experiences strongly affect both the advisor and student and often define the experience. Despite this importance, advising is something we rarely talk about and evaluate as a department.

A 2019 report from the National Academies of Science, Engineering, and Medicine identified that strong advising/mentorship is a set of skills that can be learned and practiced. The study by NASEM reports the following outcomes of a positive advising/mentoring experience:

1. graduate students are more likely to persist in their academic decisions;
2. graduate students are more likely to complete their degree;
3. women and underrepresented students report feeling more integrated into their academic community;
4. increased recruitment of underrepresented groups;
5. graduate students see themselves as more competent researchers by focusing on their psychosocial needs.

The document provides a list of best practices that codifies the expectations we have for EAS faculty and graduate students. These guidelines are meant to move the EAS department toward an open culture of advising with the intention of maintaining a high standard of interactions between advisors and students. The advisor/student relationship is unique, and some of these practices will be more relevant than others.

These best practices are published in the graduate handbook and on the departmental website. We expect that this will be a living document that is updated regularly with new ideas and practices. The graduate affairs committee will review these best practices at the beginning of each school year. All changes to the best practices must be done in consultation with Earth and Atmospheric Graduate Student Association (EAGSA) board members and be passed by majority vote of the graduate affairs committee.

Guidelines for Advisor-Graduate Student Interactions in the Department of Earth and Atmospheric Sciences

Adapted from guidelines provided by the College of Arts and Sciences, Indiana University

The success of every graduate student in EAS depends on the individual effort of the student, and the effectiveness of the student-advisor partnership. To ensure that student-advisor interactions are as productive as possible, EAS provides general guidelines below.

These guidelines embody many of the best mentoring practices used by other institutions and professional societies. They are intended to provide principles for establishing an effective and productive student-advisor relationship that relies on trust, courtesy, clear communications, and shared expectations. These guidelines supplement the IU Student Code, which addresses primarily formal academic matters, by attending to the faculty's role in the student's research process.

Guidelines for Faculty Advisors:

1 Promote an environment that is intellectually stimulating and free of harassment by being supportive, equitable, accessible, encouraging, and respectful.

2 Recognize and respect the cultural backgrounds of students, and when appropriate connect them with different campus or professional organizations, such as (but not limited to)

Asian Culture Center
Neal Marshall Black Culture Center
LGBTQ+ Center
First Nations Educational & Cultural Center
La Casa
SACNAS
Geolatinas

3 Be sensitive to the power imbalance in the student–advisor relationship while in the office, lab or the field, especially if there are different social, cultural, economic, or geographic differences involved.

RECOMMENDATION: Fieldwork raises many sensitive issues. For more information, please review the following paper:

Safe fieldwork strategies for at-risk individuals, their supervisors and institutions

SCAN ME

4 Set clear expectations and goals for students regarding their academic performance, research activities and progress.

RECOMMENDATION: Create a mentor-mentee compact with your advisee. See page 40 for links to some examples.

5 Discuss policies and expectations for work, either as teaching assistants or research assistants, including work hours, vacation time, and health contingencies.

6 Should be aware of the isolating and severe burden fieldwork can have on students, especially minoritized ones, and should take care to responsibly educate themselves and students of any anticipated risks.

RECOMMENDATION: review the following paper:

Safe fieldwork strategies for at-risk individuals, their supervisors and institutions

SCAN ME

7 Establish mutually agreed upon expectations for frequency and format of communication that will provide students with regular, clear feedback on research activities, performance, and progress.

8 Promote and manage productive and collaborative relationships for students working in research groups as well as helping students establish networking and collaboration skills.

RECOMMENDATION: research groups should schedule regular meetings

9 Provide students with training and oversight in all relevant aspects of research, including the design of research projects, the development of necessary skills, the use of rigorous research techniques or procedures.

10 Provide and discuss clear criteria for authorship at the onset of collaborative projects and revisit authorship as the project develops and contributions change.

SCAN ME

RECOMMENDATION: Journals frequently require formal descriptions of contributions, so documentable practices are encouraged. An example is the **CRediT model**.

11 Foster a safe work environment by discussing and mitigating potential hazards associated with a student's research activities, including field data collection.

12 Encourage student participation in professional meetings and try to secure funding for such activities.

RECOMMENDATION: advisors should be aware of travel funds from:

a) EAS conference travel

b) College of Arts + Sciences conference travel awards

c) IU Graduate and Professional Student Government travel award.

Contact EAS Director of Graduate Services for more information.

13 Attempt to secure funding to support the research goals of graduate students and provide training to students in grant writing where appropriate.

RECOMMENDATION: involve graduate students in this pursuit by encouraging them to submit student grants to partially fund their research.

14 Ensure students receive training in the skills needed for a successful career in their discipline, including oral and written communication.

RECOMMENDATION: encourage all graduate students in EAS to present at professional conferences, in group meetings, and departmental brown-bag seminars.

15 Recognize that there are a variety of careers and disciplines your students can pursue; assist them in determining and achieving their career goals from the start of your relationship; recognize the limits of your own experiences and consult or introduce additional role models as necessary; keep up to date with career options, particularly given the hyper-competitive nature of the academic job market.

16 Be a role model by encouraging participation in departmental events (e.g., colloquium, Crossroads, etc), and acting in an ethical, professional, and courteous manner toward other students, staff, and faculty.

17 Be aware of on-campus resources and be able to provide students with help and suggestions; be aware of College and university policies on academic and personnel matters and be prepared to guide students through grievance, mediation, or academic/personal support processes.

Guidelines for Graduate Students:

1 Always act in an ethical, professional, and courteous manner toward other students, staff, and faculty, respecting the value of their time and responsibilities.

2 Recognize that you bear the primary responsibility for the successful completion of your degree.

> **RECOMMENDATION:** proactively ask for meetings with your advisor and committee when needed. Be familiar with requirements in the EAS graduate handbook. Follow milestone guidelines set by the University Graduate School and those in the EAS handbook.

3 Complete all tasks assigned by the department, including teaching, grading, and other assistantship responsibilities.

4 Know the policies governing graduate studies in the department and the graduate school and take responsibility for meeting departmental and graduate school deadlines.

> **RECOMMENDATION**: consult the IU EAS graduate handbook often.

5 Be proactive in communicating with the advisor and research committee about progress and challenges associated with research and program trajectory, paying particular attention to any apprehension about fieldwork.

6 Be proactive in responsibly educating yourself of any anticipated risks involving fieldwork including clear communication about limitations.

> **RECOMMENDATION:** review the following paper:
>
> ***Safe fieldwork strategies for at-risk individuals, their supervisors and institutions***

7 Recognize that in addition to your role as a student, you have rights and responsibilities as employees of the university, and expect that these are clearly conveyed to you.

> **RECOMMENDATION:** keep track of the hours spent on AI/RA duties to ensure that you do not exceed, on average, ~20 hr/wk.

8 Clearly communicate with your advisor(s) regarding your career preferences and any changes to those preferences during the course of your program.

9 Be proactive about improving research skills, including written and oral presentation.

10 Be proactive about teaching professionalization and preparation through exploring workshops and training opportunities.

> **RECOMMENDATION:** The IU Center for Innovative Learning (CITL) frequently runs workshops.

11 Seek out appropriate professional service opportunities and take advantage of career planning support in the Walter Center for Career Achievement.

> **RECOMMENDATION:** Schedule a one-on-one meeting with the graduate career counselor at the Walter Center in your first year.

12 Participate actively in departmental activities such as Earth and Atmospheric Graduate Student Association, colloquia, brown-bags, reading groups, etc.

> **RECOMMENDATION:** Attend the weekly departmental colloquium and become involved in Earth and Atmospheric Graduate Student Association.

EAGSA Officers:

- President of Graduate Life – Kirsten Hawley
- President of Activities – Allison Nelson
- President of Faculty Relations – Danny Peltier
- President of Finance – CJ Salcido
- President of Communications – **Sam Smith**

13 Seek mentoring and support resources beyond your faculty advisor(s), including other faculty members and peers as well as individuals external to the university.

14 Obtain outside help from ombudspersons, graduate chairs, or other faculty if conflicts arise with your advisor.

15 Be aware that if you feel compelled to change advisors or research direction, you have options and should consult with your advisor, other mentors, or department officers, recognizing that such options may include changing programs.

USEFUL LINKS FOR INFORMATION ON MENTORING

An amazingly detailed guide from National Academy Press with LOTS of information

https://www.nap.edu/resource/25568/interactive/index.html

University of Michigan Guide to mentoring

Mentoring guide for faculty:

https://rackham.umich.edu/downloads/how-to-mentor-graduate-students.pdf

Mentee guide for students:

https://rackham.umich.edu/downloads/student-mentoring-handbook.pdf

Harvard Graduate Women in Science and Engineering Mentoring guide, also includes an example of a mentoring compacts

https://projects.iq.harvard.edu/hgwise/tips-mentors

Best practices for mentors/mentees from University of Alabama at Birmingham

https://www.uab.edu/graduate/images/documents/resources/faculty-program-directors/Best-Practices-for-the-Mentor-Mentee-Relationship-1.pdf

Examples of compacts (mentor-mentee agreements):

University of Georgia: https://grad.uga.edu/index.php/current-students/mentor-mentee-compacts/

University of Wisconsin: https://ictr.wisc.edu/mentoring/mentoring-compactscontracts-examples/

Arizona State University: https://graduate.asu.edu/sites/default/files/creating_a_mentoring_agreement_0.pdf

University of Michigan: https://www.rackham.umich.edu/downloads/more-mentoring-plan-example-1.pdf