APPROVED BY SENATE
03/08/2021

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: WEATHER AND CLIMATE RISK AND ANALYTICS, MS

In Workflow

1. U Program Review (dforgacs@illinois.edu; eastuby@illinois.edu; aledward@illinois.edu)
2. 1253 Head (jtrapp@illinois.edu)
3. SESE Head (tomkin@illinois.edu)
4. KV Dean (las-catalog@illinois.edu)
5. University Librarian (jpwilkin@illinois.edu)
6. Grad_College (agrindly@illinois.edu; jch@illinois.edu; lowry@illinois.edu)
7. Provost (kmartens@illinois.edu)
8. Senate EPC (bjlehman@illinois.edu; moorhouz@illinois.edu; kmartens@illinois.edu)
9. Senate (jtempel@illinois.edu)
10. U Senate Conf (none)
11. Board of Trustees (none)
12. IBHE (none)
13. DMI (eastuby@illinois.edu; aledward@illinois.edu; dforgacs@illinois.edu)

Approval Path

1. Thu, 05 Nov 2020 20:04:07 GMT
   Deb Forgacs (dforgacs): Approved for U Program Review
2. Thu, 05 Nov 2020 20:10:44 GMT
   Robert J. Trapp (jtrapp): Approved for 1253 Head
3. Thu, 05 Nov 2020 21:26:23 GMT
   Jonathan Tomkin (tomkin): Approved for SESE Head
4. Thu, 05 Nov 2020 23:10:39 GMT
   Kelly Ritter (ritterk): Approved for KV Dean
5. Thu, 05 Nov 2020 23:49:26 GMT
   John Wilkin (jpwilkin): Rollback to KV Dean for University Librarian
6. Fri, 06 Nov 2020 16:43:29 GMT
   Kelly Ritter (ritterk): Approved for KV Dean
7. Fri, 06 Nov 2020 17:13:42 GMT
   John Wilkin (jpwilkin): Approved for University Librarian
8. Thu, 10 Dec 2020 20:07:45 GMT
   Allison McKinney (agrindly): Approved for Grad_College
9. Wed, 20 Jan 2021 18:58:38 GMT
   Kathy Martensen (kmartens): Approved for Provost

New Proposal

Date Submitted:Wed, 04 Nov 2020 21:24:19 GMT

Viewing:: Weather and Climate Risk and Analytics, MS

Changes proposed by: Beth McKown

Proposal Type

Proposal Type:

Major (ex. Special Education)

Proposal Title:

If this proposal is one piece of a multi-element change please include the other impacted programs here.*example: A BS revision with multiple concentration revisions*

Establish an Master of Science in Weather and Climate Risk and Analytics- online

EP Control Number

EP.21.058

Official Program Name

Weather and Climate Risk and Analytics, MS

Effective Catalog Term

Fall 2021

Sponsor College

Liberal Arts & Sciences

Sponsor Department

Atmospheric Sciences

Sponsor Name

Robert J. Trapp

Sponsor Email

jtrapp@illinois.edu

College Contact

Kelly Ritter

College Contact Email

ritterk@illinois.edu

Program Description and Justification

Provide a*brief*description and justification of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

The Department of Atmospheric Sciences (ATMS) proposes to create an online-only Master of Science (M.S.) degree. Unlike our current M.S. degrees in Atmospheric Sciences (http://catalog.illinois.edu/graduate/las/atmospheric-sciences-ms/), this new online degree will be focused specifically on Weather and Climate Risk and Analytics. Such a focused degree program is motivated by rapidly growing opportunities in the private sector for atmospheric scientists with this specific skill set. Students who graduated with bachelor's degrees and joined the work force more than approximately five years ago would not likely have gained these skills as part of their college or university training; in many atmospheric sciences programs, students still do not gain these skills. Our M.S. program would therefore appeal to these working professionals, in domestic as well as international markets, who wish to advance their careers in the dynamic and lucrative area of Weather and Climate Risk and Analytics.

Because of its focus and online delivery, the proposed degree will require a new set of six online courses and course requirements. All of these courses have been approved and will be available to on-campus students. The Department proposes to make this degree program available starting in Fall 2021.

The proposed online M.S. degree in Atmospheric Sciences will be one of three connected, synergistic online M.S. programs that are being developed with funding from the Office of the Provost's "Investment for Growth" (IFG) Program (https://provost.illinois.edu/about/initiatives /investment-for-growth-program/). The other two programs will be offered by sister departments in the School of Earth, Society, and Environment (SESE): The Department of Geology (GEOL) and the Department of Geography and Geographic Information Science (GEOG). Those programs will enhance the Atmospheric Sciences program by providing shared, specialized courses in certain key areas (see below); the shared courses are currently under development by the contributing department. SESE has a strong history of online programs and several faculty with deep experience in online course offerings.

The new online M.S. degree is unique in that it will be focused specifically on Weather and Climate Risk and Analytics. At the current time, no other institution/university across the world has this type of degree program, implying that we could capture this market, both domestically and internationally. That said, we are aware of other efforts to develop online atmospheric sciences M.S. degrees, and so time is of the essence.

The new degree program is consistent with the ATMS Vision: "World-class learning and discovery in the atmospheric sciences", and the ATMS Mission: "To conduct research on the most challenging problems in the atmospheric sciences for the betterment of humankind, and to provide a modern, world-class education to students in the atmospheric sciences that will guide them to be leaders and exemplary citizens, and enable them to pursue life-long intellectual discovery and service."

Indeed, considering that weather and climate directly or indirectly impact every aspect of human existence, an underlying goal of this degree program is to reduce human vulnerability to the negative impacts of weather and climate, and enhance human prosperity given the beneficial impacts. This basic goal intersects with the following UIUC strategic initiatives:

• Explore food security: Agriculture is a recipient of negative and beneficial impacts, and advanced knowledge of these impacts helps inform the need for irrigation, a decision to use drought-resistant seeds, and perhaps a plan for longer-term grain storage. It also informs industries that work at the intersection of agricultural commodity production, transportation, and marketing. Graduates of our program will possess the tools and abilities to provide this knowledge.

• Explore energy and sustainability: Decisions on how best to implement solar or wind energy infrastructure, and natural gas supply and demand, must be driven by properly analyzed spatiotemporal data. Along similar lines, decisions on energy futures trading are most successful when informed by well-designed dynamical and statistical models. Graduates of our program will understand how to deploy these models, and also how to properly interpret their output.

• Explore data science: Weather and climate data are "big", and with sophisticated Earth and space-based sensors and higher-resolutions models, these data will continue to grow. Graduates of our program will be equipped with the skills needed to efficiently confront and add value to such data streams.

• Explore health sciences: Air quality, heat stress, and disease vectors are but a few of human health issues impacted by weather and climate, which can be extreme and highly variable. Graduates of our program will understand how to combine health-science data with atmospheric measurements and model predictions to help reduce human suffering and vulnerability.

Our proposed focus on Weather and Climate Risk and Analytics will address these and related broad initiatives. It will also address rapidly growing needs for atmospheric scientists who require post-graduate degrees with: (i) high-end skills in computational analysis/analytics of weather and climate data, (ii) expertise in predictive models for the weather-climate interface, and (iii) an ability to assess weather- and climate-related risk.

This particular skill set is different than that of traditional weather forecasting, and is particularly desirable in the private sector, which is the fastest-growing employment sector in the atmospheric sciences according to the U.S. Bureau of Labor Statistics (https://www.bls.gov/ooh/Life-Physical-and-Social-Science/Atmospheric-scientists-including-meteorologists.htm). Note that topics such as weather and climate data analytics have emerged only recently, meaning that students who graduated with bachelor's degrees and joined the work force more than approximately five years ago would not likely have gained these skills as part of their college or university training; in many atmospheric sciences programs, students still do not gain these skills. Our M.S. program would therefore appeal to these working professionals, in domestic as well as international markets, who wish to advance their careers.

An online-only program is essential for this target market, because it precludes the need for an extended absence from a current position and/or familial responsibilities, and otherwise maximizes learning flexibility. Indeed, students will pay tuition for a program that enhances their careers without forcing them to take time out from those careers.

The online courses developed for the new program will also be beneficial for on-campus students pursuing traditional, thesis-based M.S. degrees. Although these students have different course requirements (http://catalog.illinois.edu/graduate/las/atmospheric-sciences-ms/), the new online courses will serve as graduate-level electives that will broaden the knowledge and research skill set for on-campus students; current students in ATMS have already expressed interest in the online courses.

Complementing the set of core online courses (see below) is at least one non-thesis research project (ATMS 596). This is designed to help the online M.S. students apply their growing knowledge of Weather and Climate Risk and Analytics to a specific problem contributed either by ATMS faculty or by one of our industry partners (which will include Nutrien, AXIS Reinsurance, State Farm, and Ameren). Work on these problems could be conducted onsite at an industry partner facility, as appropriate and feasible. Additionally, such research-practicum problems could arise out of separate initiatives in Urban Resilience and Environmental Sustainability, and Climate Understanding and Preparedness, both led by ATMS Prof. Donald Wuebbles with support from the Discovery Partners Institute (DPI). Work on DPI-associated problems could also be conducted onsite in DPI facilities in Chicago, as appropriate and feasible. Solutions to these applied problems should contribute to prosperity in the State of Illinois, and otherwise help bring recognition to the program and students throughout the country and world. To help ensure this recognition, an advisory board of program alumni and professionals will be formed. This board will also provide continued guidance on the program curriculum.

In summary, the new online M.S. degree in Atmospheric Sciences will help prepare students for the most rapidly growing and lucrative opportunities in the atmospheric sciences. Additionally, it will provide a means for the Department of Atmospheric Sciences to assist in the achievement of the University's 2018-2023 strategic goal of making UIUC "the go-to place for professional and continuing education programs" through "the creation of workforce-development strategies and related partnerships across the public and private sectors…using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers."

Corresponding Degree

MS Master of Science

Is this program interdisciplinary?

No

Academic Level

Graduate

Will you admit to the concentration directly?

No

Is a concentration required for graduation?

No

CIP Code

400401 - Atmospheric Sciences and Meteorology, General.

Is This a Teacher Certification Program?

No

Will specialized accreditation be sought for this program?

No

Institutional Context

University of Illinois at Urbana-Champaign

Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built.

Explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

The development of this degree program was initiated in approximately 2015 with the recognition of the rapidly growing employment opportunities in the private sector, and the corresponding need for atmospheric scientists with post-graduate-level: (i) skills in computational analysis/analytics of weather and climate data, (ii) expertise in predictive models for the weather-climate interface, and (iii) abilities to assess weather- and climate-related risk. Our community's emphasis on weather and climate data analytics has emerged only recently, meaning that students who graduated with bachelor's degrees and joined the work force more than approximately five years ago would not likely have gained these skills as part of their college or university training; in many atmospheric sciences programs, students still do not gain these skills. It was therefore out motivation to create a new M.S. program that would appeal to these working professionals, in domestic as well as international markets, who wish to advance their careers. Such working professionals would not be permitted to take an extended absence from a current position and/or familial responsibilities, and thus comprise an inherently different pool of students than those pursuing traditional, on-campus, thesis-based M.S. degrees. Moreover, the students in our thesis-based, on-campus M.S. degrees have different course requirements (http://catalog.illinois.edu/graduate/las/atmospheric-sciences-ms/), and generally have a wider range of professional objectives, including pursuit of a Ph.D. degree and eventual employment in academia. It should be noted that an non-thesis, on-campus M.S. degree currently exists and has overlapping course requirements with the thesis M.S. degree. It is a rarely used option (on average, one student per every two years during the past six years), and primarily serves as an exit strategy for students who determine that their interests are incompatible with a research-based degree, but have already invested significant time in coursework and want to complete a degree for general professional purposes.

The proposed online degree requires completion of a set of six new online courses that have no overlap with existing, on-campus courses. However, the design of this program, and of the content of the courses, has been informed by our traditional M.S. (and Ph.D.) degree program and existing, on-campus courses.

There is no conflict with an existing program at UIUC. In fact, no other institution/university across the world has this type of degree program.

University of Illinois

Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

Weather and climate directly or indirectly impact every aspect of human existence. The degree program supports the University's mission through its underlying goal to reduce human vulnerability to the negative impacts of weather and climate, and enhance human prosperity given the beneficial impacts. As noted above, this basic goal intersects with the following UIUC strategic initiatives:

Explore food security, Explore energy and sustainability, Explore data science, and Explore health sciences

The new degree program is also consistent with the ATMS Vision: "World-class learning and discovery in the atmospheric sciences", and the ATMS Mission: "To conduct research on the most challenging problems in the atmospheric sciences for the betterment of humankind, and to provide a modern, world-class education to students in the atmospheric sciences that will guide them to be leaders and exemplary citizens, and enable them to pursue life-long intellectual discovery and service."

State of Illinois

Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)

High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.

Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

Describe how the proposed program supports these goals.

The proposed program It will address rapidly growing needs for atmospheric scientists who require post-graduate degrees with: (i) high-end skills in computational analysis/analytics of weather and climate data, (ii) expertise in predictive models for the weather-climate interface, and (iii) an ability to assess weather- and climate-related risk.

For example, the State of Illinois' agricultural sector is a recipient of negative and beneficial impacts of weather and climate. Advanced knowledge of these impacts helps inform the need for irrigation, a decision to use drought-resistant seeds, and perhaps a plan for longer-term grain storage. It also informs industries that work at the intersection of agricultural commodity production, transportation, and marketing. Graduates of our program will possess the tools and abilities to provide this knowledge.

One of the requirements of the proposed degree program is at least one non-thesis research project (ATMS 596). This is designed to help the online M.S. students apply their growing knowledge of Weather and Climate Risk and Analytics to a specific problem. We anticipate that some problems will be coordinated through the Discovery Partners Institute (DPI). Indeed, work on DPI-associated problems could be conducted onsite in DPI facilities in Chicago, as appropriate and feasible. Solutions to these applied problems should contribute to prosperity in the State of Illinois, and otherwise help bring recognition to the program and students throughout the country and world.

Admission Requirements

Desired Effective Admissions Term

Fall 2021

Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

Students applying to the online M.S. program will need to fulfill the same admission requirements as those applying to the current on-campus M.S. in Atmospheric Sciences, except completion of the Graduate Record Examination. As listed on our graduate admissions page, the current requirements include a minimum grade point average of 3.0 (on a 4.0 scale), and submission of three letters of reference. Applicants whose first language is not English are required to take the Test of English as a Foreign Language (TOEFL). Details regarding this requirement can be found at the Graduate College TOEFL web site.

Although not required, we anticipate that students with a bachelor's degree in atmospheric science and oceanography, or with degrees/backgrounds in physics, mathematics, computer science, geography, engineering, and related fields, will be most interested in this program.

Describe how critical academic functions such as admissions and student advising are managed.

As with on-campus ATMS graduate students, admission of students in the online program will be handled by the Departmental Graduate Admissions Committee. Unlike on-campus graduate students, the students in the online program will receive academic advising by new ATMS Teaching Assistant Professor Alicia Klees, whose position is fully dedicated to the online program. Because this is a non-thesis program, students will not require thesis advisors. However, Departmental faculty can serve as mentors for non-thesis research (ATMS 596) projects.

In addition, per the Departmental bylaws, all graduate students will be required to undergo an annual review, conducted by the online program academic advisor.

All Graduate Students who are continuing (not graduating) are also required to undergo an annual review. Graduate students provide their primary advisor with a statement summarizing their activities and achievements during the past academic year that summarizes their progress in research, courses, major exams, any special achievements, presentations, papers etc., and progress toward their degree. The advisor then meets with the student, and following the meeting, provides a formal written review of the student's performance. The review does not have to be long, but should summarize the key points that emerge from your discussion with the student, and give guidance to the student about expectations for the coming year. The review form is signed by the student and advisor. The Department Head will then examine the review, and if there are any concerns, follow up with the advisor, or possibly with the advisor and student. Graduate student reviews will be conducted after the Spring semester in May-June.

Enrollment

Number of Students in Program (estimate)

Year One Estimate

5

5th Year Estimate (or when fully implemented)

15

Estimated Annual Number of Degrees Awarded

Year One Estimate

0

5th Year Estimate (or when fully implemented)

15

What is the matriculation term for this program?

Fall

What is the typical time to completion of this program?

2 years

What are the minimum Total Credit Hours required for this program?

32

Delivery Method

This program is available:

Online Only

Describe the use of this delivery method:

Courses will be offered entirely online; this is a fully online degree program.

Budget

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

Yes

Please explain/describe:

The additional instructional, support, and administrative effort will be provided through the IFG grant, and include:

• One full-time, specialized faculty member in Atmospheric Sciences. This specialized faculty member will be dedicated to supporting online instruction. This person will also be responsible for general academic advising of new students. Teaching Assistant Professor Alicia Klees will occupy this position, beginning August 16, 2020.
• One School (SESE)-level program coordinator, covered 33% by Atmospheric Sciences, who will have responsibility to manage advertisement of this and the other new online programs in the School, as well as recruiting, applications and admission, course registration, grades, and related duties.
• Summer and/or overload salary for current faculty to develop and offer online courses.
• Additional TA support, if needed to expand courses.
• Additional IT support effort at the School level to help administer the online courses.
These activities are fully funded via the IFG grant for the first three years of the program, and are fully costed as part of the self-sustaining model, thereafter.

Additional Budget Information

Degree-program start-up costs are funded through the IFG grant, and the long-term additional costs related to the online option will be covered sustainably by tuition return after startup (with net positive revenue for the Department and revenue for the College of LAS). The Resources section below contains details regarding IFG funding and sustainability of finances.

Additional costs are budgeted to:
• Develop and deliver new online courses
• Advise M.S. students in the new program
• Handle administrative tasks related to admissions, advertising, and other general aspects
All ATMS courses for the online program will be taught either by the new IFG-supported Teaching Assistant Professor Alicia Klees or by existing faculty members including Profs. Ryan Sriver, Jeff Trapp, and Brian Jewett. The majority of the instruction will thus be on-load, although there will also be occasional service-in-excess instruction, primarily in the summer sessions.
All five required ATMS courses (see below) have been approved, and the more specific online content and presentation of each will be developed over the next two years, to be ready for Fall 2022, by ATMS faculty under IFG funding. One required GEOG course, GEOG 407 (Foundations of CyberGIS and Geospatial Data Science), is an online course being developed by GEOG under IFG funding. It is designed to be a shared course across the three departments in SESE, and will be taught by a GEOG faculty member. ATMS 517 (Data Science for the Geosciences) is also designed to be a shared course across SESE.
Additional IT support, advertising costs, and miscellaneous costs are also budgeted in the IFG grant, at $35,000 per year.

Although the program is initially supported by IFG grant funds, it is planned to be self-supporting, with AY 20/21 tuition rate proposed at the base + differential online rate, currently $712/credit hour. Under the IVCB budget model, the tuition flows back to the College. Based on our projections, if the enrollment goal of 15 student/year is met, then the program will be net revenue positive to the Department.

Resource Implications

Facilities

Will the program require new or additional facilities or significant improvements to already existing facilities?

No

Technology

Will the program need additional technology beyond what is currently available for the unit?

No

Non-Technical Resources

Will the program require additional supplies, services or equipment (non-technical)?

No

Resources

For each of these items, be sure to include in the response if the proposed new program or change will result in replacement of another program(s). If so, which program(s), what is the anticipated impact on faculty, students, and instructional resources? Please attach any letters of support/ acknowledgement from faculty, students, and/or other impacted units as appropriate.

Attach File(s)

MS WeatherClimate ATMSProposal.doc

Faculty Resources

Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

An additional specialized faculty member has been hired through IFG funding to support this program (see “Budget”, above); a program coordinator will be hired in 2020 or early 2021. As a consequence, we do not expect that existing faculty will be significantly impacted. Current and future UIUC students will benefit from the new online courses that will be developed for this program.

The new specialized faculty member in Atmospheric Sciences will be dedicated to supporting the online instruction required by this program. This person will also be responsible for general academic advising of students in the online program.

There is no expectation to increase regular semester teaching loads for current faculty. Some faculty will instruct online classes as part of their regular teaching commitment, and some overload or summer teaching may occur on an optional basis. Given the projected enrollment, any impact on student-faculty ratios will be minor (albeit positive). Our online courses will have course caps of no more than 30 students.

The School (SESE)-level program coordinator will have responsibility to manage advertisement of this and the other new online programs in the School, as well as recruiting, applications and admission, course registration, grades, and related duties.

Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

No impact. Existing library resources, collections, and services meet the needs of this program.

Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No

Does the program include other courses/subjects impacted by the creation/revision of this program?

Yes

Required courses

GEOG 407 - Course GEOG 407 not Found

Explain how the inclusion or removal of the courses/subjects listed above impacts the offering departments.

One of the required courses for the Atmospheric Sciences online M.S. is GEOG 407 (Foundations of CyberGIS and Geospatial Data Science), an online course under development by GEOG under IFG funding. It has been designed to be a shared course across the three departments in SESE, and will be taught by a GEOG faculty member.

Financial Resources

How does the unit intend to financially support this proposal?

The first three years of the program are supported by the IFG grant; it is planned to be self-supporting afterward, with AY 20/21 tuition proposed at the base + differential online rate, currently $712/credit hour. Under the IVCB budget model, the tuition flows back to the College. Based on our projections, if the enrollment goal of 15 students/year is met, then the program will be net revenue positive to the Department.

Will the unit need to seek campus or other external resources?

No

Attach letters of support

Program Tuition Waiver Policy Proposal- request self supporting-Weather MS am.pdf
self-funded-questions MS Weather and Climate Risk.pdf

Are you seeking a change in the tuition rate or differential for this program?

No

Is this program requesting self-supporting status?

Yes

Market Demand

What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students:

The specific skill set that we will emphasize in your proposed degree program is different than that of traditional weather forecasting, and is particularly desirable in the private sector, which is the fastest-growing employment sector in the atmospheric sciences according to the U.S. Bureau of Labor Statistics (https://www.bls.gov/ooh/Life-Physical-and-Social-Science/Atmospheric-scientists-including-meteorologists.htm).

2) What type of employment outlook should these graduate expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

As just noted, private industry is the fastest-growing employment sector in the atmospheric sciences, and therefore the graduates of this program would expect a particularly bright outlook. In more general terms, the USA Today published a study in 2019 citing that majors in meteorology and

atmospheric sciences had the lowest unemployment rate (https://www.usatoday.com/story/money/2019/06/26/college-majors-with-the-lowest-unemployment/39583811/). This is consistent with a survey of graduates from our existing programs. Generally speaking, the number of potential jobs in state agencies and research centers is relatively small. On the other hand, we anticipate that graduates of this program will be in high demand in private firms in Chicago and statewide, especially those engaged in commodities and energy trading, and/or focused on the agricultural and energy sectors, which are especially sensitive to the weather and climate.

What type of employment outlook should these graduates expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

As just noted, private industry is the fastest-growing employment sector in the atmospheric sciences, and therefore the graduates of this program would expect a particularly bright outlook. In more general terms, the USA Today published a study in 2019 citing that majors in meteorology and atmospheric sciences had the lowest unemployment rate (https://www.usatoday.com/story/money/2019/06/26/college-majors-with-the-lowest-unemployment/39583811/). This is consistent with a survey of graduates from our existing programs. Generally speaking, the number of potential jobs in state agencies and research centers is relatively small. On the other hand, we anticipate that graduates of this program will be in high demand in private firms in Chicago and statewide, especially those engaged in commodities and energy trading, and/or focused on the agricultural and energy sectors, which are especially sensitive to the weather and climate.

What resources will be provided to assist students with job placement?

The students in the online program will receive academic advising and mentoring by new ATMS Teaching Assistant Professor Alicia Klees, whose position is fully dedicated to the online program. More generally, the Department will continue to communicate all job announcements to all students.

Program Regulation and Assessment

Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).

The outcomes and assessment procedures will essentially follow those already in place within the Department. Specifically, the learning outcomes for the proposed online M.S. degree are:

1. All students will have a fundamental understanding of the core theoretical underpinnings of atmospheric sciences
2. All students will have the ability to formulate a research problem, and develop an approach towards solving that problem.
3. All students will have ethically responsible and effective communication skills, written and verbal, at a professional scientific level.
4. All students will have knowledge of the frontiers in atmospheric science research.

The Department performs formal annual evaluations of every graduate student to determine their progress in achieving the learning outcomes, as well as to identify any roadblocks that may be inhibiting the student from progress toward the degree. This evaluation includes a self-evaluation by the student, a written review of the self-evaluation and a separate evaluation by the student's advisor, and a final evaluation of the review process by the Department Head. In the case where deficiencies have been identified, the Department Head in consultation with the student advisor recommends approaches to address the deficiencies.

The Department does an annual anonymous survey of current graduate student outcomes. The survey was developed in response to the Graduate College's Assessment of the Illinois Doctoral Experience Report in 2015. The survey asks questions such as "Has the Department provided me with an excellent educational experience while in graduate school?", "Has the Department prepared me for a career in my chosen discipline (whether in Atmospheric Sciences or another field)?", "Does the Department have an adequate range of courses at the graduate level?". In total there are 28 questions. The survey also requests, but does not require, that the students self- identify gender and if they are domestic or international students. The survey does not ask if they are from an underrepresented minority since there are currently a sufficiently small number that their survey could be used to identify them. The results of the survey are presented by the Graduate Affairs committee to the faculty, and later by the Graduate Affairs Committee Chair to all the graduate students. The committee chair gathers all comments and suggestions made by the students and faculty about the survey outcome and take actions to improve the graduate program.

Finally, the Department continually gathers information about our alumni and their careers beyond our graduate program. This is done through direct contact, and/or searches through LinkedIn and professional directories such as the American Meteorological Society's directory. The Department updates the database every year to keep track of student outcomes.

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

Program of Study

"Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: https://www.ibhe.org/assets/files/PrivateAdminRules2017.pdf). For proposals for new bachelor's degrees, if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.

All proposals must attach the new or revised version of the Academic Catalog program of study entry. Contact your college office if you have questions.

Catalog Page Text

Catalog Page Text: Description of program for the catalog page. This is not official content, it is used to help build the catalog pages for the program. Can be edited in the catalog by the college or department.

Students in the Master of Science degree program will focus specifically on Weather and Climate Risk and Analytics. This program is intended as a terminal degree for students already engaged in preparing for professional work in atmospheric science and related fields. It is delivered online and is designed to be completed within two years.

Statement for Programs of Study Catalog

Weather and Climate Risk and Analytics, MS

Code	Title	Hours
ATMS 517	Data Science for the Geosciences	4
ATMS 520	Physical and Dynamical Meteorology	4
ATMS 521	Climate Analysis, Variability, and Prediction	4
ATMS 523	Weather and Climate Data Analytics	4
ATMS 526	Risk Analysis in the Geosciences	4
GEOG 407	Foundations of CyberGIS & Geospatial Data Science	4
ATMS 596	Non-Thesis Research (8 hours max applied toward degree)	8
Total Hours		32

Other Requirements [1]

Requirement	Description
Other requirements may overlap	
Minimum GPA	3.0

EP Documentation

DMI Documentation

Program Reviewer Comments

John Wilkin (jpwilkin) (Thu, 05 Nov 2020 23:49:26 GMT): Rollback: Beth, please adjust the statement regarding library resources to reflect the College's sense that the currently available resources (including collections and services) are adequate. An affirmative statement like this is necessary. "None expected" implies no need for library resources when there will be significant need for collections and subject expertise. I believe the library is adequate in these regards, but we need your assessment affirming this.

Key: 979

Proposal for new curricula (degree, major, concentration, minor)

Submit completed proposals via email to Associate Dean Kelly Ritter (ritterk@illinois.edu). Please obtain Executive Officer and School Director (if applicable) approval via email and forward with the proposal to LAS.

Proposal Title: A new online, non-thesis, Master of Science degree in Atmospheric Sciences ("Master of Science Degree in Weather and Climate Risk and Analytics - Online")

Proposed effective date: August 2022

Sponsor(s): Robert J. Trapp, Head of Atmospheric Sciences, jtrapp@illinois.edu

College contact: Kelly Ritter, Associate Dean for Curricula and Academic Policy, College of Liberal Arts and Sciences, ritterk@illinois.edu

Is this program interdisciplinary? Yes, to some extent, with the Departments of Geography and Geology.

PROGRAM DESCRIPTION and JUSTIFICATION

1) **Provide a brief description but concise description of your proposal.**

The Department of Atmospheric Sciences (ATMS) proposes to create an online-only Master of Science (M.S.) degree in Atmospheric Sciences. Unlike our current M.S. degrees in Atmospheric Sciences (http://catalog.illinois.edu/graduate/las/atmospheric-sciences-ms/), this new online degree will be focused specifically on *Weather and Climate Risk and Analytics*. Such a focused degree program is motivated by rapidly growing opportunities in the private sector for atmospheric scientists with this specific skill set. Students who graduated with bachelor's degrees and joined the work force more than approximately five years ago would not likely have gained these skills as part of their college or university training; in many atmospheric sciences programs, students still do not gain these skills. Our M.S. program would therefore appeal to these working professionals, in domestic as well as international markets, who wish to advance their careers in the dynamic and lucrative area of *Weather and Climate Risk and Analytics*.

Because of its focus and online delivery, the proposed degree will require a new set of six online courses and course requirements. All of these courses have been approved and will be available to on-campus students. The Department proposes to make this degree program available starting in Fall 2022.

2) **Provide a justification of the program**, including how your unit decided to create this program, highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

The proposed online M.S. degree in Atmospheric Sciences will be one of three connected, synergistic online M.S. programs that are being developed with funding from the Office of the Provost's "Investment for Growth" (IFG) Program (https://provost.illinois.edu/about/initiatives /investment-for-growth-program/). The other two programs will be offered by sister departments in the School of Earth, Society, and Environment (SESE): The Department of Geology (GEOL) and the Department of Geography and Geographic Information Science (GEOG). Those programs will enhance the Atmospheric Sciences program by providing shared, specialized courses in certain key areas (see below); the shared courses are currently under development by the contributing department. SESE has a strong history of online programs and several faculty with deep experience in online course offerings.

The new online M.S. degree is unique in that it will be focused specifically on *Weather and Climate Risk and Analytics*. At the current time, no other institution/university across the world has this type of degree program, implying that we could capture this market, both domestically and internationally. That said, we are aware of other efforts to develop online atmospheric sciences M.S. degrees, and so time is of the essence.

The new degree program is consistent with the ATMS Vision: "World-class learning and discovery in the atmospheric sciences", and the ATMS Mission: "To conduct research on the most challenging problems in the atmospheric sciences for the betterment of humankind, and to provide a modern, world-class education to students in the atmospheric sciences that will guide them to be leaders and exemplary citizens, and enable them to pursue life-long intellectual discovery and service."

Indeed, considering that weather and climate directly or indirectly impact every aspect of human existence, an underlying goal of this degree program is to reduce human vulnerability to the negative impacts of weather and climate, and enhance human prosperity given the beneficial impacts. This basic goal intersects with the following UIUC strategic initiatives:

- ***Explore food security***: Agriculture is a recipient of negative and beneficial impacts, and advanced knowledge of these impacts helps inform the need for irrigation, a decision to use drought-resistant seeds, and perhaps a plan for longer-term grain storage. It also informs industries that work at the intersection of agricultural commodity production, transportation, and marketing. Graduates of our program will possess the tools and abilities to provide this knowledge.
- ***Explore energy and sustainability***: Decisions on how best to implement solar or wind energy infrastructure, and natural gas supply and demand, must be driven by properly analyzed spatiotemporal data. Along similar lines, decisions on energy futures trading are most successful when informed by well-designed dynamical and statistical models. Graduates of our program will understand how to deploy these models, and also how to properly interpret their output.
- ***Explore data science***: Weather and climate data are "big", and with sophisticated Earth and space-based sensors and higher-resolutions models, these data will continue to grow.

Graduates of our program will be equipped with the skills needed to efficiently confront and add value to such data streams.

- ***Explore health sciences***: Air quality, heat stress, and disease vectors are but a few of human health issues impacted by weather and climate, which can be extreme and highly variable. Graduates of our program will understand how to combine health-science data with atmospheric measurements and model predictions to help reduce human suffering and vulnerability.

Our proposed focus on *Weather and Climate Risk and Analytics* will address these and related broad initiatives. It will also address rapidly growing needs for atmospheric scientists who require post-graduate degrees with: (i) high-end skills in computational analysis/analytics of weather and climate data, (ii) expertise in predictive models for the weather-climate interface, and (iii) an ability to assess weather- and climate-related risk.

This particular skill set is different than that of traditional weather forecasting, and is particularly desirable in the private sector, which is the fastest-growing employment sector in the atmospheric sciences according to the U.S. Bureau of Labor Statistics (https://www.bls.gov/ooh/Life-Physical-and-Social-Science/Atmospheric-scientists-including-meteorologists.htm). Note that topics such as weather and climate data analytics have emerged only recently, meaning that students who graduated with bachelor's degrees and joined the work force more than approximately five years ago would not likely have gained these skills as part of their college or university training; in many atmospheric sciences programs, students still do not gain these skills. Our M.S. program would therefore appeal to these working professionals, in domestic as well as international markets, who wish to advance their careers.

An online-only program is essential for this target market, because it precludes the need for an extended absence from a current position and/or familial responsibilities, and otherwise maximizes learning flexibility. Indeed, students will pay tuition for a program that enhances their careers without forcing them to take time out from those careers.

The online courses developed for the new program will also be beneficial for on-campus students pursuing traditional, thesis-based M.S. degrees. Although these students have different course requirements (http://catalog.illinois.edu/graduate/las/atmospheric-sciences-ms/), the new online courses will serve as graduate-level electives that will broaden the knowledge and research skill set for on-campus students; current students in ATMS have already expressed interest in the online courses.

Complementing the set of core online courses (see below) is at least one non-thesis research project (ATMS 596). This is designed to help the online M.S. students apply their growing knowledge of *Weather and Climate Risk and Analytics* to a specific problem contributed either by ATMS faculty or by one of our industry partners (which will include Nutrien, AXIS Reinsurance, State Farm, and Ameren). Work on these problems could be conducted onsite at an industry partner facility, as appropriate and feasible. Additionally, such research-practicum problems could arise out of separate initiatives in Urban Resilience and Environmental Sustainability, and Climate Understanding and Preparedness, both led by ATMS Prof. Donald Wuebbles with support from the Discovery Partners Institute (DPI). Work on DPI-associated problems could also be conducted onsite in DPI facilities in Chicago, as appropriate and feasible. Solutions to these applied problems should contribute to prosperity in the State of Illinois, and otherwise help bring recognition to the

program and students throughout the country and world. To help ensure this recognition, an advisory board of program alumni and professionals will be formed. This board will also provide continued guidance on the program curriculum.

In summary, the new online M.S. degree in Atmospheric Sciences will help prepare students for the most rapidly growing and lucrative opportunities in the atmospheric sciences. Additionally, it will provide a means for the Department of Atmospheric Sciences to assist in the achievement of the University's 2018-2023 strategic goal of making UIUC "the go-to place for professional and continuing education programs" through "the creation of workforce-development strategies and related partnerships across the public and private sectors…using Illinois expertise to create new jobs and enhance the skill sets of new and continuing workers."

3) In addition, please provide an answer as to how your degree (120 hours of coursework) will satisfy this requirement: IBHE requires that all degree programs contain at least 40 credit hours in upper division courses as part of their overall degree. Not all 40 hours need to be in your major. Simply state how many of those 40 hours are achieved in your major. Upper division courses have been described as 300- and 400- level coursework and some 200-level courses in which multiple prerequisites are required.

As detailed below, this M.S. degree will satisfy the requirement of 32 graduate-level credit hours.

INSTITUTIONAL CONTEXT (new majors and degrees ONLY)

University of Illinois at Urbana-Champaign
Mission: The University of Illinois at Urbana-Champaign is charged by our state to enhance the lives of the citizens in Illinois, across the nation and around the world through our leadership in learning, discovery, engagement and economic development.

1) Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built. Also, explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

The development of this degree program was initiated in approximately 2015 with the recognition of the rapidly growing employment opportunities in the private sector, and the corresponding need for atmospheric scientists with post-graduate-level: (i) skills in computational analysis/analytics of weather and climate data, (ii) expertise in predictive models for the weather-climate interface, and (iii) abilities to assess weather- and climate-related risk. Our community's emphasis on weather and climate data analytics has emerged only recently, meaning that students who graduated with bachelor's degrees and joined the work force more than approximately five years ago would not likely have gained these skills as part of their college or university training; in many atmospheric sciences programs, students still do not gain these skills. It was therefore out motivation to create a new M.S. program that would appeal to these working professionals, in domestic as well as international markets, who wish to advance their careers. Such working professionals would not be permitted to take an extended absence from a current position and/or familial responsibilities, and thus comprise an inherently different pool of students than those pursuing traditional, on-campus, thesis-based M.S.

degrees. Moreover, the students in our thesis-based, on-campus M.S. degrees have different course requirements (http://catalog.illinois.edu/graduate/las/atmospheric-sciences-ms/), and generally have a wider range of professional objectives, including pursuit of a Ph.D. degree and eventual employment in academia. It should be noted that an non-thesis, on-campus M.S. degree currently exists and has overlapping course requirements with the thesis M.S. degree. It is a rarely used option (on average, one student per every two years during the past six years), and primarily serves as an exit strategy for students who determine that their interests are incompatible with a research-based degree, but have already invested significant time in coursework and want to complete a degree for general professional purposes.

The proposed online degree requires completion of a set of six new online courses that have no overlap with existing, on-campus courses. However, the design of this program, and of the content of the courses, has been informed by our traditional M.S. (and Ph.D.) degree program and existing, on-campus courses.

There is no conflict with an existing program at UIUC, and in fact, no other institution/university across the world has this type of degree program.

University of Illinois

University of Illinois' mission: The University of Illinois will transform lives and serve society by education, creating knowledge and putting knowledge to work on a large scale and with excellence.

2) Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

Weather and climate directly or indirectly impact every aspect of human existence. The degree program supports the University's mission through its underlying goal to reduce human vulnerability to the negative impacts of weather and climate, and enhance human prosperity given the beneficial impacts. As noted above, this basic goal intersects with the following UIUC strategic initiatives:

Explore food security, ***Explore energy and sustainability***, ***Explore data science***, and ***Explore health sciences***

The new degree program is also consistent with the ATMS Vision: "World-class learning and discovery in the atmospheric sciences", and the ATMS Mission: "To conduct research on the most challenging problems in the atmospheric sciences for the betterment of humankind, and to provide a modern, world-class education to students in the atmospheric sciences that will guide them to be leaders and exemplary citizens, and enable them to pursue life-long intellectual discovery and service."

State of Illinois

The Public Agenda for Illinois Higher Education is a planning blueprint for the State of Illinois to direct state policies and resources to the higher education and career needs of Illinois residents and to address the current and future economic needs of the state.

3) Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)

1. Educational Attainment - increase educational attainment to match the best-performing states.
2. College Affordability - ensure college affordability for students, families, and taxpayers.
3. High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.
4. Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

The new degree program supports goals #3 and 4.

4) Describe how the proposed program supports the goals above:

The proposed program It will address rapidly growing needs for atmospheric scientists who require post-graduate degrees with: (i) high-end skills in computational analysis/analytics of weather and climate data, (ii) expertise in predictive models for the weather-climate interface, and (iii) an ability to assess weather- and climate-related risk.

For example, the State of Illinois' agricultural sector is a recipient of negative and beneficial impacts of weather and climate. Advanced knowledge of these impacts helps inform the need for irrigation, a decision to use drought-resistant seeds, and perhaps a plan for longer-term grain storage. It also informs industries that work at the intersection of agricultural commodity production, transportation, and marketing. Graduates of our program will possess the tools and abilities to provide this knowledge.

One of the requirements of the proposed degree program is at least one non-thesis research project (ATMS 596). This is designed to help the online M.S. students apply their growing knowledge of *Weather and Climate Risk and Analytics* to a specific problem. We anticipate that some problems will be coordinated through the Discovery Partners Institute (DPI). Indeed, work on DPI-associated problems could be conducted onsite in DPI facilities in Chicago, as appropriate and feasible. Solutions to these applied problems should contribute to prosperity in the State of Illinois, and otherwise help bring recognition to the program and students throughout the country and world.

ADMISSION REQUIREMENTS

1) Desired admissions term: *For LAS units, a fall semester effective term for all curricula will be requested, please indicate the proposed year*

Fall, 2022

2) Provide a brief description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

Students applying to the online M.S. program will need to fulfill the same admission requirements as those applying to the current on-campus M.S. in Atmospheric Sciences, except completion of the Graduate Record Examination. As listed on our graduate admissions page, the current requirements include a minimum grade point average of 3.0 (on a 4.0 scale), and submission of three letters of reference. Applicants whose native tongue is not English are required to take the Test of English as a Foreign Language (TOEFL). Details regarding this requirement can be found at the Graduate College TOEFL web site.

Although not required, we anticipate that students with a bachelor's degree in atmospheric science and oceanography, or with degrees/backgrounds in physics, mathematics, computer science, geography, engineering, and related fields, will be most interested in this program.

3) Describe how critical academic functions such as admissions and student advising are managed.

As with on-campus ATMS graduate students, admission of students in the online program will be handled by the Departmental Graduate Admissions Committee. Unlike on-campus graduate students, the students in the online program will receive academic advising by new ATMS Teaching Assistant Professor Alicia Klees, whose position is fully dedicated to the online program. Because this is a non-thesis program, students will not require thesis advisors. However, Departmental faculty can serve as mentors for non-thesis research (ATMS 596) projects.

In addition, per the Departmental bylaws, all graduate students will be required to undergo an annual review, conducted by the online program academic advisor:

> *All Graduate Students who are continuing (not graduating) are also required to undergo an annual review. Graduate students provide their primary advisor with a statement summarizing their activities and achievements during the past academic year that summarizes their progress in research, courses, major exams, any special achievements, presentations, papers etc., and progress toward their degree. The advisor then meets with the student, and following the meeting, provides a formal written review of the student's performance. The review does not have to be long, but should summarize the key points that emerge from your discussion with the student, and give guidance to the student about expectations for the coming year. The review form is signed by the student and advisor. The Department Head will then examine the review, and if there are any concerns, follow up with the advisor, or possibly with the advisor and student. Graduate student reviews will be conducted after the Spring semester in May-June.*

ENROLLMENT

1) Number of students in program estimates

Year 1 estimate: 5

Year 5 estimate (or when fully implemented): 15

2) Estimated Annual Number of Degrees Awarded (degrees, majors and concentrations ONLY)

Year 1: 0

Year 5 (or when fully implemented): 15

3) Delivery Method, what is the program's primary delivery method? Choose from following:

This program and its courses will be completely online.

BUDGET

1) Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available? If yes, please describe.

The additional instructional, support, and administrative effort will be provided through the IFG grant, and include:

- One full-time, specialized faculty member in Atmospheric Sciences. This specialized faculty member will be dedicated to supporting online instruction. This person will also be responsible for general academic advising of new students. Teaching Assistant Professor Alicia Klees will occupy this position, beginning August 16, 2020.
- One School (SESE)-level program coordinator, covered 33% by Atmospheric Sciences, who will have responsibility to manage advertisement of this and the other new online programs in the School, as well as recruiting, applications and admission, course registration, grades, and related duties.
- Summer and/or overload salary for current faculty to develop and offer online courses.
- Additional TA support, if needed to expand courses.
- Additional IT support effort at the School level to help administer the online courses.

These activities are fully funded via the IFG grant for the first three years of the program, and are fully costed as part of the self-sustaining model, thereafter.

2) Please provide any additional budget information needed to effectively evaluate the proposal.

Degree-program start-up costs are funded through the IFG grant, and the long-term additional costs related to the online option will be covered sustainably by tuition return after startup (with net positive revenue for the Department and revenue for the College of LAS). The Resources section below contains details regarding IFG funding and sustainability of finances.

Additional costs are budgeted to:

- Develop and deliver new online courses
- Advise M.S. students in the new program
- Handle administrative tasks related to admissions, advertising, and other general aspects

All ATMS courses for the online program will be taught either by the new IFG-supported Teaching Assistant Professor Alicia Klees or by existing faculty members including Profs. Ryan Sriver, Jeff Trapp, and Brian Jewett. The majority of the instruction will thus be on-load, although there will also be occasional service-in-excess instruction, primarily in the summer sessions.

All five required ATMS courses (see below) have been approved, and the more specific online content and presentation of each will be developed over the next two years, to be ready for Fall 2022, by ATMS faculty under IFG funding. One required GEOG course, GEOG 407 (*Foundations of CyberGIS and Geospatial Data Science*), is an online course being developed by GEOG under IFG funding. It is designed

to be a shared course across the three departments in SESE, and will be taught by a GEOG faculty member. ATMS 517 (*Data Science for the Geosciences*) is also designed to be a shared course across SESE.

Additional IT support, advertising costs, and miscellaneous costs are also budgeted in the IFG grant, at $35,000 per year.

Although the program is initially supported by IFG grant funds, it is planned to be self-supporting, with AY 20/21 tuition set at $686/credit hour. The revenue model in the approved IFG grant proposal is that the Department will be responsible for all costs but will receive 70% of the gross tuition revenue. Of the remainder of the tuition revenue, 25% will go to the College of LAS, and 5% will go to the Office of the Provost. Based on this model, if the enrollment goal of 15 students per year is met, then the program will be net revenue positive to the Department.

RESOURCE IMPLICATIONS

1) Facilities- Will the program require new or additional facilities or significant improvements to already existing facilities?

No new facilities will be required.

2) Technology- Will the program need additional technology beyond what is currently available for the unit?

No new technology will be required. All the planned platforms are already available.

3) Non-Technical Resources- Will the program require additional supplies, services or equipment (non-technical)?
No.

RESOURCES

1) Faculty Resources: Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

An additional specialized faculty member has been hired through IFG funding to support this program (see "Budget", above); a program coordinator will be hired in 2020 or early 2021. As a consequence, we do not expect that existing faculty will be significantly impacted. Current and future UIUC students will benefit from the new online courses that will be developed for this program.

The new specialized faculty member in Atmospheric Sciences will be dedicated to supporting the online instruction required by this program. This person will also be responsible for general academic advising of students in the online program.

There is no expectation to increase regular semester teaching loads for current faculty. Some faculty will instruct online classes as part of their regular teaching commitment, and some overload or summer

teaching may occur on an optional basis. Given the projected enrollment, any impact on student-faculty ratios will be minor (albeit positive). Our online courses will have course caps of no more than 30 students.

The School (SESE)-level program coordinator will have responsibility to manage advertisement of this and the other new online programs in the School, as well as recruiting, applications and admission, course registration, grades, and related duties.

2) Library Resources: Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

No unusual impact on the University Library is expected.

3) Instructional Resources: Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No – to the contrary, course offerings will expand.

4) Does this new program/proposed change result in the replacement of another program?

No.

5) Does the program include any required or recommended subjects that are offered by other departments? If yes, please list the courses. Explain how these additional courses will be used by the program and provide letters of support from the departments.

One of the required courses for the Atmospheric Sciences online M.S. is GEOG 407 (*Foundations of CyberGIS and Geospatial Data Science*), an online course under development by GEOG under IFG funding. It has been designed to be a shared course across the three departments in SESE, and will be taught by a GEOG faculty member.

FINANCIAL RESOURCES

1) How does the unit intend to financially support this proposal?

The first three years of the program are supported by the IFG grant; it is planned to be self-supporting afterward, with AY 20/21 tuition set at $686/credit hour. The revenue model in the approved IFG grant proposal is that the Department will be responsible for all costs but will receive 70% of the gross tuition revenue. Of the remainder of the tuition revenue, 25% will go to the College of LAS, and 5% will go to the Office of the Provost. Based on this model, if the enrollment goal of 15 students per year is met, then the program will be net revenue positive to the Department.

2) Will the unit need to seek campus or other external resources? If yes, please provide a summary of the sources and an indication of the approved support.

No.

3) Will an existing tuition rate be used or continue to be used for this program? (degrees, majors and concentrations ONLY)? If no, please provide information on the request.

The $686/credit hour rate is an established existing tuition rate for graduate programs in CITL; it will be newly applied to this program. Previously, students were subject to the standard range rate for graduate students in the College.

4) Is this program requesting self-supporting status? (degrees, majors and concentrations ONLY)? If yes, please explain.

Given the proposed revenue model in the IFG grant, the online degree is meant to be self-supporting, after the initial IFG-funding period.

MARKET DEMAND

1) What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students.

The specific skill set that we will emphasize in your proposed degree program is different than that of traditional weather forecasting, and is particularly desirable in the private sector, which is the fastest-growing employment sector in the atmospheric sciences according to the U.S. Bureau of Labor Statistics (https://www.bls.gov/ooh/Life-Physical-and-Social-Science/Atmospheric-scientists-including-meteorologists.htm).

2) What type of employment outlook should these graduate expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

As just noted, private industry is the fastest-growing employment sector in the atmospheric sciences, and therefore the graduates of this program would expect a particularly bright outlook. In more general terms, the *USA Today* published a study in 2019 citing that majors in meteorology and atmospheric sciences had the lowest unemployment rate (https://www.usatoday.com/story/money/2019/06/26/college-majors-with-the-lowest-unemployment/39583811/). This is consistent with a survey of graduates from our existing programs. Generally speaking, the number of potential jobs in state agencies and research centers is relatively small. On the other hand, we anticipate that graduates of this program will be in high demand in private firms in Chicago and statewide, especially those engaged in commodities and energy trading, and/or focused on the agricultural and energy sectors, which are especially sensitive to the weather and climate.

3) What resources will be provided to assist students with job placement?

The students in the online program will receive academic advising and mentoring by new ATMS Teaching Assistant Professor Alicia Klees, whose position is fully dedicated to the online program. More generally, the Department will continue to communicate all job announcements to all students.

PROGRAM REGULATION AND ASSESSMENT

Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).

The outcomes and assessment procedures will essentially follow those already in place within the Department. Specifically, the learning outcomes for the proposed online M.S. degree are:

1. All students will have a fundamental understanding of the core theoretical underpinnings of atmospheric sciences
2. All students will have the ability to formulate a research problem, and develop an approach towards solving that problem.
3. All students will have ethically responsible and effective communication skills, written and verbal, at a professional scientific level.
4. All students will have knowledge of the frontiers in atmospheric science research.

The Department performs formal annual evaluations of every graduate student to determine their progress in achieving the learning outcomes, as well as to identify any roadblocks that may be inhibiting the student from progress toward the degree. This evaluation includes a self-evaluation by the student, a written review of the self-evaluation and a separate evaluation by the student's advisor, and a final evaluation of the review process by the Department Head. In the case where deficiencies have been identified, the Department Head in consultation with the student advisor recommends approaches to address the deficiencies.

The Department does an annual anonymous survey of current graduate student outcomes. The survey was developed in response to the Graduate College's Assessment of the Illinois Doctoral Experience Report in 2015. The survey asks questions such as "Has the Department provided me with an excellent educational experience while in graduate school?", "Has the Department prepared me for a career in my chosen discipline (whether in Atmospheric Sciences or another field)?", "Does the Department have an adequate range of courses at the graduate level?". In total there are 28 questions. The survey also requests, but does not require, that the students self- identify gender and if they are domestic or international students. The survey does not ask if they are from an underrepresented minority since there are currently a sufficiently small number that their survey could be used to identify them. The results of the survey are presented by the Graduate Affairs committee to the faculty, and later by the Graduate Affairs Committee Chair to all the graduate students. The committee chair gathers all comments and suggestions made by the students and faculty about the survey outcome and take actions to improve the graduate program.

Finally, the Department continually gathers information about our alumni and their careers beyond our graduate program. This is done through direct contact, and/or searches through LinkedIn and professional directories such as the American Meteorological Society's directory. The Department updates the database every year to keep track of student outcomes.

ACADEMIC CATALOG ENTRY

All proposals must submit the major requirements (courses, hours) for the proposed curricula. Please see the University of Illinois Academic Catalog- http://catalog.illinois.edu/ for your unit for an example of the entry.

Weather and Climate Risk and Analytics, MS

Students in the Master of Science Degree program will focus specifically on *Weather and Climate Risk and Analytics*. This program is intended as a terminal degree for students already engaged in preparing for professional work in atmospheric science and related fields. It is delivered online and is designed to be completed within two years.

Course Requirements

Code	Title	Hours
ATMS 517	Data science for the geosciences	4
ATMS 520	Physical and dynamic meteorology	4
ATMS 521	Climate analysis, variability, and prediction	4
ATMS 523	Weather and climate data analytics	4
ATMS 526	Risk analysis in the geosciences	4
GEOG 407	Foundations of CyberGIS and Geospatial Data Science	4
ATMS 596	Non-thesis research (8 hours max applied toward degree)	8
Total Hours		**32**

Course List

Other Requirements[1]

Requirement	Description
Other requirements may overlap	

All students must maintain a minimum grade point average (GPA) of 3.0 (A = 4.0). If the GPA falls below this minimum after 12 or more graduate hours of graded coursework, it must be raised to 3.0 or above after the completion of 12 additional graduate hours of graded coursework and must be maintained at or above the minimum thereafter.

The expectation of the Graduate College is that a master's degree will be completed within five years of initial enrollment as a degree-seeking student in the degree program.

[1] *For additional details and requirements refer to the Department's Graduate Degree Programs and the Graduate College Handbook.*

1.Describe the reasons for this request and explain: (a) the pros and cons of the classification requested, and (b) how the requested classification will benefit and not adversely affect the academic quality of the program.

(a) The advantage of the self-supporting classification is that it allows us to offer a new M.S. degree program to non-traditional students whose work/life situation precludes them from pursuing a traditional, on-campus, thesis-based M.S. degree. The disadvantage for the student is that is precludes them from obtaining assistantships; however, such assistantships would not be justifiable because the students in the new degree program could not, because of their work/life situation devote additional time to assistantship duties.

(b) This new M.S. degree program is in addition to our existing, traditional M.S. degree program. It is meant to appeal to working professionals, in domestic as well as international markets, who wish to advance their careers. Such working professionals would not be permitted to take an extended absence from a current position and/or familial responsibilities, and thus comprise an inherently different pool of students than those pursuing traditional, on-campus, thesis-based M.S. degrees.

2.What type of financial assistance will be offered to students in the program?
No research or teaching assistantships will be offered to the students in this M.S. degree program. This is meant to be self funded.

3.Has this program had past practice of offering graduate assistantships? If so, please describe.
This is a new (proposed) M.S. degree, which therefore has no history of offering graduate assistantships.

4.What provisions will be made to communicate the new classification to prospective and newly admitted students?
The M.S. degree program is new and has yet to be approved. Thus, no students have yet to be admitted, and there are not yet prospective students.

ILLINOIS

GRADUATE COLLEGE
110 Coble Hall, MC-322
801 S. Wright St.
Champaign, IL 61820

PROGRAM TUITION WAIVER POLICY PROPOSAL

Proposals to establish or revise tuition waiver policy for a graduate program will follow a shared governance approval process (Department, School, College, Graduate College).

Definitions of Tuition Waiver Policy Designations:

Traditional Programs. Programs either designated as generating **full or base-rate** tuition waivers. Base rate waivers waives only the Resident Graduate Base tuition amount. Non-Residents or students in a program with an additional tuition differential will be responsible for the remaining portion of tuition.

Reimbursable Programs. Programs identified as programs that would be reimbursed from an appointing unit outside their academic college.

Cost-recovery and self-supporting programs. Students in approved cost-recovery and self-supporting programs are not eligible to receive tuition and fee waivers except statutory waivers. Students in these programs are not eligible to hold a waiver generating graduate appointment (Assistantship or Fellowship). Full time employees may be admitted to these programs, but their employee waiver is not eligible for use towards a program with this designation.

Additional information related to these tuition waiver designations can be found here: http://www.grad.illinois.edu/gradhandbook/2/chapter7/tuition-waivers#otherprovisions.

PROGRAM INFORMATION

COLLEGE OR SCHOOL: LAS/SESE

PROGRAM(s) (Include Program Codes if applicable):
Atmospheric Sciences/M.S. in Weather and Climate Risk and Data Analytics

REQUESTED DESIGNATION (Check box next to desired designation type):

Self-Supporting

Comments:

JUSTIFICATION: On a separate sheet, please address the following.

1. Describe the reasons for this request and explain: (a) the pros and cons of the classification requested, and (b) how the requested classification will benefit and not adversely affect the academic quality of the program.

2. What type of financial assistance will be offered to students in the program?

3. Has this program had past practice of offering graduate assistantships? If so, please describe.

4. What provisions will be made to communicate the new classification to prospective and newly admitted students?

APPROVALS: (May use Adobe Signature or print and sign the document)

Department Executive Officer Signature and Date: Jeff Trapp Digitally signed by Jeff Trapp Date: 2020.11.04 14:44:35 -06'00'

Disciplinary College Signature and Date: Matthew Ando Digitally signed by Matthew Ando Date: 2020.12.03 10:37:09 -06'00'

Graduate College Signature and Date: Allison McKinney Digitally signed by Allison McKinney Date: 2020.12.04 11:29:59 -06'00'