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Bachelor's Degree in Atmospheric Science

An Information Statement of the American Meteorological Society

(Adopted by AMS Council on 17 November 2023)

1. Introduction

This statement provides guidance to university faculty and administrators responsible for undergraduate programs in atmospheric science (for the purposes of this document, “meteorology” and “atmospheric science” are considered equivalent). It describes the minimum curricular composition, faculty size, and facility requirements recommended by the American Meteorological Society (AMS) for an undergraduate degree program with the intent that such a program will prepare graduates for the growing diversity of careers addressing weather, climate, and the atmospheric environment, or for graduate study leading to such careers. The AMS encourages colleges and universities to develop programs that exceed these minimum recommendations. This statement provides information to help students prepare for various career pathways within and beyond the atmospheric sciences as well as inform employers of the typical expectations associated with a bachelor’s degree in atmospheric science. This statement also includes best practices for advising of students, including preparing 2-Year College (2YC) students for transfer to 4-year bachelor’s degree programming, along with recommendations for teaching online, hybrid or in-person courses.

Section 2 outlines the essential components regarding undergraduate degree program infrastructure (e.g., faculty and staff, advising, facilities, equipment and equity and inclusion considerations). Students completing the requirements for an undergraduate degree should possess a core set of coursework, skills, and competencies, which are outlined in Section 3. Best practices for students pursuing atmospheric sciences careers within the private, public, and academic sectors are suggested in Section 4. Several appendices are provided elaborating on international standards, expectations for AMS certifications, best practices for preparation for private sector careers and detailed recommendations for 2YC colleges and students interested in transferring to 4-year degree programming.

2. Program attributes

a. Faculty and Support Personnel

A viable program should have full-time regular faculty holding advanced degrees (e.g., masters or doctoral degrees) and with appropriate, diverse expertise sufficient to address all the subject areas identified in Section 3c. In departments where atmospheric science faculty are expected to carry out active research programs, the minimum number of faculty should be increased in relation to the university's research expectations; this should include consideration of hiring full-time teaching-based faculty positions associated with significantly less research expectation. Faculty, along with sufficient information technology (IT) support, should be qualified in enhancing student computational skills, which includes teaching computer programming and applications to reading in and analyzing weather analysis, weather forecast, and climate datasets.

b. Facilities

Programs should have facilities that provide the following:

- Adequate classroom space that can be equipped with modern teaching resources that enable pedagogical methods such as group or team-based learning, interactive polling devices, white boards and/or blackboards, access to internet resources, and other relevant interactive tools or software
- Lab space that provides safe access to updated observational instrumentation and computational equipment and materials with enough room for exercises to be carried out safely and effectively among students.
- Computational facilities that provide students access to programming software, reanalysis datasets, data analysis and visualization tools, statistical packages, Geographic Information Systems (GIS) software, and other relevant resources
- Work or study space

- Journal access to mainstream, peer reviewed publications (e.g., AMS journals, American Geophysical Union (AGU) journals)
- Other related resources, including those developed after publication of this statement

All the above are necessary to provide hands-on learning, introductory data analysis, and undergraduate research opportunities.

c. Justice, Equity and Inclusion

AMS is committed to creating an inclusive, equitable, and welcoming culture that fosters creativity, innovation, and collaboration among individuals of all ages, races, ethnicities, gender identifications, socioeconomic circumstances, and religious beliefs. Furthermore, the AMS advocates for the effective engagement, recruitment, and retention of underserved groups and populations within the atmospheric sciences. Such diversity richly strengthens the weather and climate community's ability to tackle research questions of great complexity and socio-economic consequence. The environmental science literacy of the general public will be enhanced by their engagement with a diverse atmospheric science workforce that is well connected to all segments of society.

Given the low numbers of students from traditionally underserved populations in atmospheric sciences, programs, faculty, students, and staff are expected to create inclusive environments in line with AMS recommendations, programs should explicitly work to recruit and retain diverse students and prepare them for careers throughout the spectrum of opportunities afforded by the science. Examples include faculty participation in justice, equity, diversity, and inclusion (JEDI) training programs, partnering with 2YC's and minority serving institutions (MSIs) to create relationships for student recruitment and transfer (see Appendix E), other programs designed to improve fostering inclusivity, and transitioning equity and inclusion statements from "words on a page" to that of intentional inclusivity. Increasing the diversity of atmospheric sciences faculty and students is an important step toward meeting this goal. It is also recommended that educational resources are created and published in an accessible manner in line with the AMS Accessibility Statement and that programs consider policies that provide persons of disability equitable learning opportunities.

Discrimination, harassment, creating a hostile learning environment, or any other infringement that might make a student feel uncomfortable, targeted, or disadvantaged should not be tolerated and appropriate action should be taken.

d. Nature and quality of instruction

Course instruction in the program should employ best practices for effective undergraduate instruction and draw upon effective practices revealed by discipline-based research in higher education. Involving undergraduates in research is highly encouraged.

e. Advising

The diversity of career paths and opportunities within atmospheric and related sciences elevates the importance of academic advising and mentoring. Ideally, advisors should be experienced faculty in the program that have an understanding of course requirements for graduation along with AMS professional certification, operational government employment, and private sector positions. Students should meet with their academic advisor at least once during each academic term to discuss the advisee's degree progress as well as career goals, interests, internship and/or undergraduate research opportunities (e.g., Research Experiences for Undergraduates (REU) programs), including strategies for seeking out research mentors, and possible career opportunities as they evolve over the student's academic career (see Appendix D regarding more information about preparing students for the private sector). Advisors should also have the training and resources needed to help transfer students succeed within their atmospheric science degree programs as well as inform prospective transfer students interested in their degree program, and develop relationships with 2YC's and other transfer partners to advise students prior to transfer on appropriate coursework to ease transition and reduce student credit loss (see Appendix E).

3. Program-level learning outcomes

The objectives of a bachelor's degree program in atmospheric science should be clearly defined by the faculty and openly shared with current and prospective students, and department alumni should play a role in refining such objectives over time. Programs should frame their objectives in terms of measurable learning outcomes that reflect the full breadth of the degree program and should systematically monitor their students' success in achieving those learning outcomes. While each program should maintain its own specific course-level learning outcomes, program-level outcomes should encompass the following described below:

Students graduating with a degree in atmospheric science will be able to:

1. apply and use equations that govern physical atmospheric processes to explain fundamental principles and behaviors of the atmosphere across spatial and temporal scales

2. demonstrate understanding of the integrated Earth system, i.e., the relationships and connections between the atmosphere, ocean, cryosphere, biosphere, and lithosphere

3. interpret and use one or more commonly used computer programming languages (e.g., Python, MATLAB, FORTRAN) to investigate problems in the atmospheric sciences, analyze data, and create relevant visualizations

4. utilize diagnostic, prognostic, and technological tools such as surface observations (e.g., Mesonets, Meteorological Aerodrome Reports (METARs) and Terminal Area Forecasts (TAFs)), satellite data, upper-air data, radar data, thermodynamic soundings, hodographs, numerical weather model and climate model output to evaluate atmospheric processes, features, and phenomena across a multitude of spatial and temporal scales

5. apply critical and analytical thinking to solve relevant scientific problems in both individual and collaborative settings across and related to the atmospheric sciences, including global climate change

6. effectively communicate scientific information and its uncertainties in oral, written, and visual form for audiences having different levels of scientific awareness and understanding, including awareness of hazard communication resources such as National Oceanic and Atmospheric Administration (NOAA) weather radio information

7. understand and exercise the principles of proper ethical behavior within the atmospheric sciences regarding professional conduct and be aware of the scientific limits of prediction (see AMS Code of Conduct)

8. create, synthesize, or apply knowledge within the atmospheric sciences or between the atmospheric sciences and other disciplines, for example, through a capstone experience (discussed in Section 4d)

4. Basic components of an undergraduate degree in atmospheric sciences

a. Prerequisite topics

Because the atmospheric sciences involve application of the principles and techniques of physical science to the atmosphere, a strong background in mathematics, physics and computer programming is necessary. These subjects or courses are prerequisites for the required topics in atmospheric science and should be completed prior to enrollment in advanced level coursework. Some mathematical, physics and computer programming disciplinary-specific material may be incorporated into atmospheric science courses. The prerequisite mathematics, physics, and chemistry course work should be consistent with that required for other physical science and engineering majors. The physics coursework must be calculus-based.

Mathematics

- Differential and integral calculus
- Vector and multivariable calculus

Physics

- Fundamentals of mechanics
- Thermodynamics

Computer Skills

- Introductory programming and coding course

Chemistry

- At least one semester of introductory chemistry

4-year programs should reach out to those 2-year colleges with which it articulates agreements or draws students so that they are aware of these undergraduate criteria. Along with this, for students planning to transfer from a 2YC or other transfer institution to a four-year college, students should be encouraged by faculty and advisors at their institution to communicate with departmental advisors at the four-year college the student aspires to attend about appropriate prerequisite and introductory course work. Departmental advisors should develop relationships with 2YCs and other transfer partners to ensure consistent student advising prior to and after transfer and reduce student credit loss (see Appendix D).

b. Required skills and competencies

Competency in the areas described below is essential for students to be successful within the atmospheric sciences and to be highly competitive for related career and graduate school positions. Opportunities for enhancement of these skills within discipline-specific course work are strongly recommended.

Scientific computing and data analytics

- Data analysis, modeling, and visualization to make inferences about and analyze the atmosphere
- Application of numerical and statistical methods to atmospheric science problems
- Scientific software development in a suitable computing environment[1]
- Exposure to commonly used programming tools within the atmospheric sciences (e.g., Python, MATLAB, R, NCL, FORTRAN, and IDL), and practices of open-source software development and FAIR data principles

Oral, written, and multimedia communication

- Effective communication of scientific information, both formally and informally, with a wide variety of audiences ranging from a technical audience to the general public, including social media
- Discussion and interpretation of weather and climate processes, past and current events, and forecasts through multiple modes (e.g., oral presentation, written weather analysis or forecasting report, video recording of weather discussion)
- Creation and delivery (oral and visual) of a scientific presentation and a written scientific report

c. Required topics in atmospheric science

The topics listed below should be addressed within required courses. They should be infused throughout the curriculum, with the understanding that mastery will be achieved only after students have taken mathematics and physics prerequisites.[2]

In that the atmosphere is a fluid, the following topics should be covered within coursework:

- Governing equations
- The importance of spatial and temporal scales in determining the nature of fluid motions
    - Dynamical balances
    - Waves
    - Instabilities, and growth and decay mechanisms
    - Structure and evolution of polar, tropical, and mid-latitude weather systems across spatial and temporal scales
- Application of the principles of fluid motion to understand and predict atmospheric circulation systems
    - Clouds and storms
    - Synoptic and mesoscale weather systems
    - The general circulation of the atmosphere and its interaction with climatological processes on a variety of spatial and temporal scales

In that the atmosphere is a physical and chemical system, the following topics should be covered:

- Energy transfers within the atmosphere and across its boundaries by radiation, convection, turbulence, and advection, and the implications of these transfers for weather and climate
- Processes that produce clouds and precipitation
- Air pollution and pollution dispersal
- Atmospheric chemistry and aerosol systems
    - Chemical composition, distribution, and evolution
    - Natural and anthropogenic sources of atmospheric constituents

In that climate is an integral component of the Earth system, the following topics should be covered:

- Global energy balance and the general circulation of the atmosphere and ocean
- Phenomena resulting from this coupled system including El Niño–Southern Oscillation, the Gulf stream, and monsoons
- Causes of climate change, including anthropogenic emissions, volcanic eruptions, and natural variability; climate change impacts; climate policy; and climate modeling
- Hydrologic and biogeochemical cycles

In that knowledge of the atmosphere derives from measurements, the following topics should be covered:

- Principles of measurement and uncertainty
- In situ observations
- Active and passive remote sensing (especially radar and satellite measurements)
- Statistical analysis of observations
- Familiarity with emerging technologies for data acquisition

In that weather and climate information is vital to address societal needs, the following topics should be addressed:

- Making weather forecasts

- Principles of numerical weather prediction (data assimilation, forecast, statistical and machine-learning based postprocessing, and dissemination)
- How climate predictions and projections are made
- Communication of forecasts, forecast uncertainty, and resultant outcome risks to users
- Weather and climate impacts to reduce risks and bolster the resilience of society

d. Capstone experience

Every graduate from an undergraduate program in atmospheric science should complete a capstone experience for academic credit. A capstone experience in the final semesters, trimesters, or quarters of study encourages students to synthesize and apply knowledge and skills gained throughout an atmospheric sciences curriculum. It allows the student to develop a product, preferably relevant to their career goal, that provides a tangible manifestation of the student's ability to apply the knowledge gained from academic work. Capstone experiences can be embedded in an upper-level course, or they can involve participation in an on- or off-campus research project or internship. Capstone activities may involve authentic research, field work experiences, such as storm observation or site visits to collect observational data, the development of software or instrumentation, applying atmospheric science knowledge towards solving problems within the public or private sectors, or involvement in atmospheric science education or outreach.

Attributes of effective capstone experiences include the following:

- The development of a shareable product, such as a research poster or presentation, materials for a course or lesson, a science demonstration or exhibit; or a technical report or product (e.g., term paper about internship experience, material software application and its description).
- Supervision of the activity and evaluation of the product by a faculty member or a suitable outside expert.
- Student reflection in the form of a paper, journal, or portfolio. Reflection encourages the student to address connections between the capstone experience and course work and to use the experience to inform her/his career plans and aspirations.

5. Career Paths in Meteorology and the Atmospheric Sciences

The field of meteorology encompasses a broad and diverse workforce that connects the Earth system with society. The field is, therefore, inherently interdisciplinary, multifaceted, and complex. While many meteorologists work in traditional roles such as forecasting and operations and atmospheric science research, most jobs in the field now lie within an intersection of several roles. For example, fundamental research can be used to drive private-sector innovation (e.g., using computer programming skills for big data and machine learning applications of weather and climate data). The role of a broadcast meteorologist is becoming increasingly diversified, with scientists playing a role with the reporting and reporters acquiring additional scientific training. Operational government meteorologists benefit from communication skills that improve national weather readiness. The social and behavioral sciences interact with every facet of the field, from the development of new technologies to forecasting and communicating life-saving information. Careers focused on climate adaptation are vital given the observed and forecasted changes to Earth's climate and the subsequent societal impacts (e.g., impacts from extreme weather events and sea level rise).

Therefore, in addition to the core curriculum outlined above, programs should embrace this complexity as they help students plan the early stages of their careers. Programs should offer robust advising and professional development opportunities, in collaboration with faculty, alumni, professionals and professional societies, to enable students to achieve the greatest possible success. Appropriate skills and competencies—some of which vary with the intended career goal and others of which are transferable—can be garnered through coursework, participation in research, or internship experiences. Every student should gain additional knowledge and experiences depending upon his or her specific interests; deepening and broadening their backgrounds in this way will likely benefit students in pursuing careers across a range of employment sectors. Lastly, departments should partner with career advising resources at their respective institutions to provide students the resources needed to prepare for applying for jobs, including practice with the interview process.

Specific recommendations for common career trajectories are described below.

a. Private sector

The private sector performs a broad spectrum of meteorological services and increasingly overlaps with the traditional roles of government and academia in research and delivering operational and consulting services. The private sector serves a wide variety of users ranging from the general public to industry sectors such as transportation, energy, agriculture, retail, insurance, financial services, recreation, communication, health, and governments. As such, a rich set of career opportunities is available in the private sector, including forecasting, risk assessment, decision support, science and technology development, and business execution.

Students interested in private-sector careers should be offered opportunities to gain and apply additional knowledge depending upon their specific interests. For example, experience in software development is crucial for meteorological technical careers. Business classes or a minor are useful for more business-oriented careers. Forecasting experience and market-specific or industry-specific knowledge is desirable for those seeking careers related to applications of weather forecasting and solutions development. Further, the private sector increasingly is providing weather impacts and decision support services, which require additional sector-specific knowledge and technical skills, such as data science and analytics and machine learning. The forthcoming AMS Best Practices for Preparing Students for the Private Sector will provide guidance on skillsets essential to the private sector. Appendix C, as well as the AMS careers page, provide recommendations for electives and skills specific to the diverse set of industries that employ atmospheric sciences.

b. Government sector and GS-1340 requirements

All students pursuing employment with the federal government as a meteorologist, with the National Weather Service (NWS) or any federal agency, should take course work that satisfies the GS-1340 federal civil service requirements for meteorologist positions (http://www.opm.gov/qualifications/standards/IORs/gs1300/1340.htm). While the core academic requirements for government service remain unchanged, it is desirable for those seeking government service to combine atmospheric science with other highly sought after backgrounds such as computer science, communications, social science, emergency management, GIS or data analytics. Students are strongly encouraged to complete an M.S. degree (e.g., professional M.S. degree or M.S. with thesis) in the atmospheric sciences if pursuing government-related career positions given the competitive application process. Furthermore, students may increase their chances of obtaining an entry-level NWS position through NWS internship experience, volunteering at a NWS Forecast Office, or prior private-sector or military forecasting experience.

Undergraduates entering the military generally serve as military Weather and Environmental Sciences Officers with the Department of the Air Force or METOC Officers with the Department of the Navy and often work initially in forecast-intensive assignments, then may enter graduate school and eventually assume leadership roles in their military career. Along with achieving the course prerequisites, skills and atmospheric sciences knowledge described in Section 4, students intending to enter the military after undergraduate studies should also have strong computer programming and communication skills to prepare them to tailor scientific information for military decision makers.

Students interested in other government-related meteorology and atmospheric sciences positions are encouraged to review other series requirements outlined in Appendix E.

c. Graduate school and academic research and faculty positions

A career in atmospheric sciences research will generally require a graduate degree. Undergraduate advising is essential to ensure that students obtain the combination of courses and experiences that will prepare them to succeed in a career involving research. Atmospheric science research takes place across public, private, and academic sectors. Students should be encouraged to take appropriate course work in theory and methods (e.g., math/physics prerequisites required for graduate programs; computer programming courses; statistics), participate in undergraduate research experiences (for pay, course credit, REU programs, or to complete an undergraduate thesis) and other hands-on opportunities, attend and participate in seminars and colloquia, and present and/or publish their research findings at major conferences (e.g., AMS Annual Meeting).

d. Broadcast and other multimedia meteorology

Besides forecasting ability, broadcast meteorologists and other journalists need a combination of strong scientific communication skills (especially addressing a general audience) and general scientific knowledge. For students pursuing a career in broadcasting, a minor in broadcast journalism/communication - including work in broadcast news writing, reporting, television or radio production, and dissemination of forecasts via social media - is ideal. Departments preparing students for broadcast careers must provide students with opportunities to prepare high-quality demonstration weathercasts and to intern at a television/radio station.

In addition, students planning to pursue a broadcast meteorology career should be given formal instruction on the requirements and procedures for gaining certification, such as the American Meteorological Society's Certified Broadcast Meteorologist program.

General scientific knowledge is necessary because broadcast meteorologists often serve as the "station scientist," reporting on a wide range of scientific stories. Introductory courses in environmental science, oceanography, geology, hydrology, and astronomy provide a valuable foundational background. This general scientific knowledge will also prepare broadcast meteorologists for opportunities to guest lecture or part-time teach at local colleges and universities, which is becoming a more common practice.

e. Human dimensions of weather and climate

As is the trend in most sciences, interdisciplinary studies and opportunities that link human dimensions with physical science are rapidly increasing. Some topical areas that lie at the intersection of human dimensions and atmospheric sciences include risk communication, disaster sociology, hazards geography, behavioral economics, and environmental law and policy. Students with interests in these human dimensions will benefit from an array of introductory courses and activities in these fields. Students benefit especially from minors or second majors in fields of particular interest. A strong understanding of the common theories and methodological approaches of these fields will enable a student to become a boundary spanner, an important kind of collaborator who brings together and translates between physical and social science colleagues.

For students who wish to pursue a career that is based predominantly in human dimensions, a major in one of those disciplines is strongly encouraged. Students with such an interest should also consider the appropriate preparations for graduate school in that discipline, which is commonly required to enter a career in those fields.

f. Non-University education

Educational opportunities in the atmospheric sciences include classroom teaching in addition to educational and outreach occurring in other settings. Department faculty should inform students wishing to become middle or high school teachers of the educational requirements for licensure and hiring eligibility in their state. Preparation for non-classroom educational careers could include coursework in web and graphic design, creative writing, and other forms of communication, including public speaking and theater.

[1] Recommended environments relevant to the atmospheric sciences include C, C++, and FORTRAN as well as higher-level development environments such as Python, MATLAB, R, and IDL.

[2] There is a prerequisite or corequisite of calculus for course work in atmospheric dynamics and thermodynamics, physics, and differential equations. Calculus courses must be appropriate for a physical science major.

Appendix A: International standards

The World Meteorological Organization (WMO) has set standards for education and training to become a WMO meteorologist in WMO Publication 1083. All personnel worldwide issuing official aeronautical meteorological forecasts have to meet the standards in WMO 1083. Note that this statement is due to be updated in 2023.

Appendix B: AMS Resources of Interest

a. AMS Professional Certification Programs

AMS offers three professional certification programs designed for undergraduate students to demonstrate proficiency within the atmospheric sciences when applying for career positions within broadcast meteorology, consulting and K-12 education. The list below briefly describes each certification and links to the certification page.

- Certified Broadcast Meteorologist (CBM) - certification for students who have completed their B.S. degree and wish to demonstrate proficiency of atmospheric sciences knowledge within broadcast meteorology positions
- Certified Consulting Meteorologist (CCM) - certification for students interested in consulting positions that require effective communication of atmospheric sciences material with various stakeholders and the general public
- Certified AMS Teacher Program (CAT) - certification for K-12 instructors who wish to demonstrate proficient atmospheric science literacy as well as increase atmospheric science literacy
- Certified Digital Meteorologist Program (CDM) - certification granted to meteorologists who meet established criteria for scientific competence and effective communication skills in their weather presentations on all forms of digital media

b. AMS Career Guides and Tools

AMS has developed a webpage providing resources to help students learn more about the variety of career paths within meteorology and the atmospheric sciences. This information can be accessed here.

c. AMS Webinars

AMS archives webinars focused on professional development and career topics for members to view to grow their network and learn more about how to succeed within meteorology and the atmospheric sciences. Webinars can be found here.

Appendix C: Preparing Students for the Private Sector

a. General Skills for All Private Sector Careers

The following skills listed below are vital for success within any sector, but have been highlighted as essential skills needed for a successful private sector career:

- Communication - this includes both oral and written and effective communication for a general audience
- Group and team work, co-production
- Time management/Project management flows
- Creative problem solving

b. Recommended Skills for Various Private Sector Careers

The table below lists recommended courses to best prepare students for various private sector careers; this information was obtained from the following website link here.

Career	Recommended Courses
Agriculture	Climatology Introduction to Microeconomics Global Economics Agronomy Programming in Python, R, SQL
Aviation	Synoptic and Mesoscale Meteorology Tropical Meteorology Radar and Meteorology

	Satellite/Remote Sensing Weather Communications/Intro to Aviation Weather Public Speaking/Writing
Finance	Financial Risk Management Advanced Statistics, Data Science, and Machine Learning
Insurance	Introduction to Insurance/Reinsurance Natural Hazards Introduction to Statistics GIS Public Speaking/Writing Project Management Other business courses
Energy	Introduction to Statistics Introduction to Data Analytics Programming in Python, R, SQL, Excel Introduction to Economics/Finance Public Speaking/Writing

	Introduction to Energy Markets
Marine	Introduction to the Oil & Gas Industry Meteorological Risk Communication World Geography Physical Oceanography & Climate Dynamics Operational Applications of Marine Meteorology Offshore Wind Energy Marine Engineering/Ship Structure & Stability
Meteorological Developer/Software Engineer	Algorithm development Artificial Intelligence (Machine Learning, Fuzzy Logic, Rule Based Systems) Cloud Computing Data Engineering/Science/Modeling/Mining Data Visualization GIS

	Internet Programming and Web Applications Numerical Weather Prediction/Modeling Programming (Python, C, Fortran, Java, R, etc.) Software development/engineering
Supply Chain	Introduction to Business Logistics Warehouse and Distribution Center Management Global Supply Chain Management Operations Management or Business Continuity Logistics and Analysis Inventory Management External Supply Chain Transportation Risks Freight Transport

Appendix D: Best Practices for student transfer and transition from 2-year colleges to 4-year programs

a. Relationship building between 4-year programs and 2-year colleges 2YCs and transfer institutions

4-year programs should work to develop relationships with appropriate 2YCs and transfer institutions to aid in student recruitment, consistent advising, easing transfer and transition challenges for students, and creating a collegial academic community with partner institutions.

Possible activities to achieve these goals include:

- Identification of primary transfer institutions (including 2YCs)
- Regular meetings with faculty or advisors of transfer institutions
- Partnering with transfer institutions to develop consistent curriculum and courses
- Development of transfer agreements with transfer institutions
- Attending transfer fairs or events at 2YCs or transfer institutions
- Serving as a guest lecturer or speaker at 2YCs or transfer institutions
- Collaborating on grant proposals with transfer institution faculty or advisors
- Inviting prospective students from 2YCs or transfer institutions to department events
- Recruiting 2YC students for undergraduate research opportunities such as REU's

b. Recommendations for 2YC and transfer institutions

Below is a checklist of recommendations for **2YC programs** to consider to best prepare meteorology and atmospheric sciences students for transferring to 4-year programs:

- [ ] 2YC advisors should meet regularly with students at their institutions to check in regarding student course progress, timeline for students to complete their 2YC coursework and timeline for applying to transfer to 4-year programs
- [ ] Course prerequisites listed in Section 4a of this document should be offered as frequently as possible to allow for flexibility for 2YC students to complete the necessary courses required for both successful transfer to 4-year institutions and to allow for students to readily begin junior/senior undergraduate coursework at 4-year programs.

- ☐ 2YC institutions should strongly consider offering at least one freshman level introductory atmospheric sciences or weather and climate course for students to complete with credits that successfully transfer as an equivalent course at 4-year institutions with atmospheric sciences or meteorology undergraduate degree programming.
- ☐ While less common, it is also strongly recommended that 2YC institutions consider creating or consistently offering a sophomore-level undergraduate atmospheric sciences or meteorology course designed to teach students key dynamical and thermodynamic content to best prepare students for junior-level undergraduate calculus-based dynamics and thermodynamics courses typically offered at 4-year institutions.
- ☐ Atmospheric sciences or meteorology courses offered at 2YC institutions should ingest student-centered, active-learning, or High Impact Practices (HIPs) that engage students within the learning process, increase interest within the field and provide students "real-world" experiences (e.g., programming exercises, analysis of observational and forecasting data, weather discussion assignments, undergraduate research experiences)

c. Best practices for 2YC students to prepare for an atmospheric sciences or meteorology undergraduate degree program at a 4-year program

Below is a checklist of recommendations for **2YC students** to consider to best prepare for transfer into 4-year undergraduate atmospheric sciences or meteorology degree programming:

- ☐ Research, prior to applying to 4-year institutions with B.S. atmospheric sciences or meteorology degree programs, the minimum courses required to successfully transfer
- ☐ Meet with at least one advisor within their 2YC program and one advisor within the potential 4-year B.S. degree program of interest to make sure that all minimum courses will be completed and will transfer successfully from the 2YC program to the 4-year B.S. degree program
- ☐ Determine whether any additional coursework can be completed at the 2YC institution that will successfully transfer to the 4-year B.S. degree program of interest to make sure that the student will graduate in 4 years (rather than require one or more additional semesters).

☐ Meet with an advisor within the 4-year institution B.S. degree program to discuss strategies and best practices for adjusting to the pace of instruction and course load at the 4-year institution, including learning if any resources exist to help best prepare transfer students from 2YC programs for immediate success

Appendix E: Government Employment Series Requirements

- Meteorology Series 1340
- Meteorological Technician Series 1341
- Hydrology Series 1315
- Geophysics Series 1313
- Geology Series 1350
- Oceanography Series 1360
- Navigational Information Series 1361
- Geography Series 0150