SoM Curriculum Revision

The Curriculum Revision Committee
9/19/2017
Who is the Committee Revision Committee?

- **Current Faculty**
  - Mike Biggerstaff
  - Steven Cavallo
  - Phil Chilson
  - Jason Furtado
  - Cameron Homeyer
  - David Parsons
  - Mike Richman – chair

- **Emeritus Faculty**
  - Fred Carr
  - Susan Postawko

- **Student Representative(s) from 2 years ago**
  - Joshua Wadler
    - Four Students representing each class who reported to Joshua

- **Staff**
  - Shelby Hill
  - Shawn Riley
  - Christie Upchurch

- **Dean’s Office**
  - Mary Anne Hempe
The General Process – Part of a Cycle – initiated with goals in 2013

Evaluate
Needs assessment
Implement
Goals
Pilot Test
Objectives
Select Learning Experiences
Select Content
Organize Content

Diagram:
- Evaluate
- Needs assessment
- Implement
- Goals
- Pilot Test
- Objectives
- Select Learning Experiences
- Select Content
- Organize Content
Motivation – Why revise?

- Undergraduate curriculum has not undergone an evaluation in > 10 years
- AMS suggested curriculum includes classes solely devoted to climate
- World is changing – maximize flexibility by reducing required course load to 121 credit hours and open up more electives.
- Feedback from employers – e.g., programming, communications skills
- Feedback from students – e.g., synoptic
Goals of School of Meteorology

- Graduate “best” students
- Best - Well trained in various aspects related to weather and climate with necessary tools to succeed
  - Employable in the field
  - Prepared for the next stage of life
    - Graduate School
    - Private Sector
    - Government
- SoM is evaluated internally (OU) and externally. We desire to be a top school internally, nationally and internationally in those rankings.
Professional Guidance

- American Meteorological Society (AMS) has guidelines for undergraduate programs with recommendations including:
  - Faculty
  - Facilities
  - Diversity
  - Educational Goals
AMS Educational Goals

- **Mathematics**
  - Differential and integral calculus
  - Vector and multivariable calculus
  - Probability and applied statistics

- **Physics**
  - Fundamentals of mechanics
  - Basic thermodynamics
  - Electromagnetic radiation
  - Electricity and magnetism
  - The physics coursework must be calculus-based and must include a lab.
  - The mathematics and physics coursework should be that required for other physical science and engineering majors

- **Chemistry**
  - Atomic structure and chemical bonding
  - Properties of gases
AMS Educational Goals

• Mathematics
  • Differential and integral calculus
  • Vector and multivariable calculus
  • Probability and applied statistics

• Physics
  • Fundamentals of mechanics
  • Basic thermodynamics
  • Electromagnetic radiation

• Electricity and magnetism
AMS - Required skills and competencies

- Scientific computing
  - Experience using a high-level structured programming language (e.g., C, C++, Python, Matlab, R, IDL, and/or Fortran) [Even this is old since languages emerge constantly – e.g., Julia https://julialang.org/]
  - Ability to apply numerical and statistical methods to atmospheric science problems
  - Opportunities for enhancement of these skills within discipline-specific coursework is strongly recommended.
AMS - Required skills and competencies

- Oral, written, and multimedia communication
- Ability to create and deliver scientific presentations using appropriate multimedia techniques
- Demonstrated effectiveness in oral discussion and interpretation of current weather events and forecasts
- Ability to write an effective scientific report
- Ability to effectively communicate with technical and lay audiences using scientific evidence
- Opportunities for enhancement of these skills within discipline-specific coursework is strongly recommended.
AMS – “Required” Classes in Meteorology

- Meteorological measurements
  - ... (they list required material for these classes)
- Physical meteorology
- Dynamic meteorology
- Synoptic meteorology
- Mesoscale meteorology
- Climate dynamics
- Capstone experience
AMS – “Beyond the Required Classes”

- In addition to
  - the prerequisite courses
  - courses treating the required topics
  - students should be required to take additional courses that allow for inclusion of topics relevant to regional needs that
    - take advantage of faculty expertise,
    - allow flexibility in the formulation of degree programs by individual institutions
    - this additional course work can be specified or elective, depending upon the needs and requirements of individual programs
    - these courses may be designed for breadth, specialization, or both.
AMS – Specific Specializations

- Graduate school preparation
  - Ordinary differential equations
  - Partial differential equations
  - Linear algebra
  - Computational fluid dynamics
  - Research experience, including effectively communicating the results in writing, orally, and electronically
  - Additional scientific computer programming
AMS – Specific Specializations

- Weather forecasting
- Additional topics in numerical weather prediction beyond those required, with emphasis on understanding the structure, assumptions, and limitations of the models and on ensemble forecasting
- Additional topics in remote sensing beyond those required, with emphasis on the function, limitations and usability of satellite, radar (including dual-polarization), and lightning network data
- Geospatial information science (GIS)
- Boundary layer, micrometeorology, and dispersion processes
AMS – Specific Specializations

- National Weather Service -- Meteorology Series, 1340

- REQUIREMENTS: Degree: meteorology, atmospheric science, or other natural science major that included:

  - At least 24 semester (36 quarter) hours of credit in meteorology/atmospheric science including a minimum of:
    - Six semester hours of atmospheric dynamics and thermodynamics;*
    - Six semester hours of analysis and prediction of weather systems (synoptic/mesoscale);
    - Three semester hours of physical meteorology; and
    - Two semester hours of remote sensing of the atmosphere and/or instrumentation.

  - Six semester hours of physics, with at least one course that includes laboratory sessions.*

  - Three semester hours of ordinary differential equations.*

  - At least nine semester hours of course work appropriate for a physical science major in any combination of three or more of the following: physical hydrology, statistics, chemistry, physical oceanography, physical climatology, radiative transfer, aeronomy, advanced thermodynamics, advanced electricity and magnetism, light and optics, and computer science.
AMS – Specific Specializations

- Military
- Broadcast Meteorology
- Other private sector
- International
- Air quality and Environmental Sciences
- Teaching
- Other
Goals of the Curriculum Revision Committee

- Review Curriculum
  - Note deficiencies and remedy them
  - Removing classes not needed
  - Increasing flexibility (minors, areas of specialization)
  - Adding classes as suggested by the AMS and through faculty, industry and student feedback

- Survey the current and forecast private sector market and prepare students for employment

- Maintain OU SoM’s reputation as a top school
Three goals consistent with AMS statements

- Better coordination of classes to insure skills necessary for success in future courses
- Weave scientific writing and communication skills through the curriculum
- Weave computational skills throughout the curriculum
How important is writing to your/your students professional work after graduation?

- Extremely: Faculty 57%, Students 51%
- Somewhat: Faculty 29%, Students 38%
- Not Very: Faculty 8%
- Not at All:Unknown
- Unknown: 14%
Overall, how would you rate your / your students’ writing skills?

- Excellent: 37%
- Satisfactory: 56%
- Unsatisfactory: 57%
- Extremely Unsatisfactory: 14%
- Unable to Generalize: 29%

Colors:
- Green: Faculty
- Orange: Students
Faculty: At what point do you believe students should develop proficiency in the following abilities?
Faculty: How important do you consider the following writing abilities for writing in Meteorology?

- Analyze Data
- Structure Articles and Essays
- Summarize Ideas
- Describe processes
- Use and Explain terminology
- Synthesize Information
- Identify/Engage Problems
- Refine through Revision
- Use Appropriate Grammar
- Discuss Caveats
- Argue a Position

0 1.75 3.5 5.25 7

- Essential
- Important
- Useful
- Irrelevant
Map Skills into Curriculum (C.S. example)

1. Document programs so they can be understood, reused, and maintained. (low level perspective)
2. Use existing libraries and components to accomplish programming tasks.
3. Design and document new components and relationships between components to maximize reuse, reliability, and simplify maintenance. (big perspective)
4. Implement components using logic that is both comprehensive and elegant.
5. Design or implement testing procedures that cover all code components.
6. Refactor exiting components and relationships.
7. Evaluate the quality of existing code

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Computational Skills in Meteorology

- Shawn Riley has prepared a survey similar to the ones sent for writing
- Will seek to weave computational skills into more classes
- Introduction, Reinforcement and Assessment of the skills are important
Committee work over the past year

- Requested updated Knowledge Expectations for new proposed classes and those that are in place currently
- Incorporated writing assignments/skills into specific classes
- Incorporated computational assignments/skills into specific classes
Timing

- Earliest implementation would be AY2018/2019 since the plan would have to be approved by the faculty, Dean, and various OU Committees.
- We seek student feedback (shown in next slides) on the proposed changes.
- We need feedback quickly as faculty will vote on proposed changes soon.
- Grandfathering issues (if you enter with a plan you have the right to finish under that plan)
1st Year Fall

- ENGL 1113 (core I)
- MATH 1914
- CHEM 1315
- METR 1113: Introduction to Atmospheric Sciences

Credits: 15
Draft of Revised Curriculum (Semester 2)

- **1st Year Spring**
- ENGL 1213 or EXPO 1213
- MATH 2924
- PHYS 1311 Lab
- PHYS 2514
- METR 1313: Introduction to Programming for Meteorology or CS 1323*
  - *Petition College to drop the CS requirement and make it a School requirement.

- **Credits: 15**
Draft of Revised Curriculum (Semester 3)

- 2nd Year Fall
- MATH 2934
- PHYS 2524
- METR 2014: Atmospheric Circulations – includes recitation
- HIST 1483 or 1493 (US Core IV)
- Credits: 15
2nd Year Spring

Free Elective (3 hrs)– [Recommend linear algebra for grad school. Can take Math 3413 here too, but can’t be listed explicitly on curriculum sheet]

PSC 1113: American Federal Govt (Core III)

Gen Ed Western Civ xxx3 (Core IV)

METR 2213*: Thermodynamics (also Honors Section)

* Plan to offer Metr 2123 spring and summer

Gen Ed. Core IV Fine Arts

Credits: 15
Draft of Revised Curriculum (Semester 5)

- **3rd Year Fall**
- METR 3113 Atmospheric Dynamics I (also Honors Section)
- METR 3613: Atmospheric Surface-Based Measurements
- METR 3313*: Statistical Meteorology
  - * Or Math 4753
- MATH 3413
- METR 3513 Atmospheric Chemistry
- **Credits 15**
• **3rd Year Spring**

• METR 3123: Atmospheric Dynamics II

• METR 3324*: Communication and Research Methods (includes advanced programming) – both Junior year semesters [should not be a prerequisite class] Prereqs: Junior status, Metr 1313 and Math 2934
  • *Offer both semesters for exchange students (substitute for Elective)

• METR 3223: Cloud Physics

• Gen Ed – Core IV Non-Western Civ.

• Gen Ed – Core III Social Science

• **Credits 16**
Draft of Revised Curriculum (Semester 7)

- **4th Year Fall**
  - METR 4133: Atmospheric Dynamics III (Mid-latitude Synoptic-Scale Dynamics)
  - METR 4913: Senior Capstone
  - METR 4423: Synoptic Meteorology
  - METR 4233: Radiation and Remote Sensing
  - Free elective (3 hrs)

- **Credits 15**
Draft of Revised Curriculum (Semester 8)

- **4th Year Spring**
- METR 4433 Mesoscale Meteorology
- METR 4513 Climate and General Circulation
- Two Upper-division free electives (6 hrs total) [Committee recommends at least 1 in forecasting, hydro, radar, advanced atmospheric dynamics, polar; air pollution or advisor-approved internship]
- Gen Ed - Core IV NWC
- **Credits 15**
Future Plans

- Use feedback from students and faculty members to create a proposal.
- Faculty would vote on the proposal
  - No → back to the drawing board to rework zombie proposal
  - Yes → start by posting specific knowledge expectations for each class
- Obtain permission to change College requirements from Dean’s Office
- Go through OU red tape (takes a while)
- Implementation (AY2018/2019 incoming class?)
- Assessment
- Further adjustments [Field is constantly changing and OU SoM needs have a nimble process to adapt to changes with less inertia]
YOUR COMMENT COUNTS!

Email to: mrichman@ou.edu