AOS Faculty Fall 2010 Retreat

Memorial Library Commons, Room 460
Sat Oct 16
9 am - 3 pm

Contents

Agenda

- 9:00 Charge of the retreat
- 9:15 Presentation by GC-SAC
- 9:45 Questions to GC-SAC
- 10:15 break (students sent home)
- 10:30 Faculty break into groups (by sub-discipline)
- 11:30 Regroup into whole, report by sub-groups
- 12:00 Break for lunch (discuss proposals over lunch)
- 1:30 Open discussion, finalize revised proposals
- 2:30 Possible vote on proposals with strongest support
- 2:50 Next steps, plans
- 3:00 Adjourn

GC-SAC Proposals

These proposals are starting points to discuss more formal directions to take. Some proposals are more concrete, others are more open-ended, and they can be mutually exclusive. The proposals arose out of a brainstorming session with the GC-SAC in summer 2010 and reflect those with support by at least a few members among the group and also support by the analysis of data as presented in the pages that follow. Each analyses also highlights proposals most supported by findings within that analysis. The analyses were written by the graduate students in GC-SAC, and coordinated and collated, but not edited, by Ankur.

GC-SAC members: Ankur Desai (coordinator), Katie Holman, Nick Bassill, Brett Hoover, Sarah Monette, Dianna Nelson, Sharon Jaffe, Andrea Lang, Lee Welhouse. Also contributed: Angel Skram, Jon Martin, and Grant Petty.

Proposal 1

The recommended core classes will be organized by categories (e.g., dynamics, physics) and students be recommended to select 1-2 classes per each category. Each category can have multiple courses that likely provide the requisite skills we expect of PhD and MS students. The QE should reflect critical thinking skills gained from general knowledge within these subjects.

Proposal 2

Develop a new course that combines essentials of the climate system and synoptic systems, similar in some sense to the original 650, and have this class be taught every other year as 651 (or a new number), perhaps alternate with 660 or 650. This class could be co-taught to reduce teaching demand.

Proposal 3

The existing 650 should be re-listed as 575, or the course description for 650 should be updated. Material from the original 650, especially on general circulation and synoptics, should be incorporated into existing classes.

Proposal 4

Two classes: one in general circulation/climate, and one in synoptics should be offered in alternate years. The recommended core should include a recommendation of taking one of these courses.

Proposal 5

Reduce faculty teaching load at 100 level: Option 5a) AOS100 and 101 should be taught entirely by lecturers. Option 5b) In any semester only one section of 100/101 should be taught by a tenure-track faculty. Option 5c) Remove one section of AOS171 or AOS121.

Proposal 6

AOS website course descriptions shall be updated annually and recent sample syllabi should be posted for all courses where possible. To assist, a student should be invited to the AOS website committee.

Proposal 7

It is recommended that all graduate lecture courses contain at least one programming assignment. A committee of students and faculty will develop guidelines and tutorials from existing material on introductory programming background for major languages used by our field. These guidelines will be provided to all faculty to help them prepare these assignments.

Proposal 8

QE topics should better reflect content of courses taken by graduate students in recent years (last 4 semesters), respecting that student research interests diversify early. For example, the QE could consist of 5 categories with 3 questions and students will select 2 questions from 4 categories. Sample categories: radiation/physics, dynamics, oceans/climate, synoptics/mesoscale

Proposal 9

AOS should formalize the currently offered introduction to Matlab/IDL being offered by the GSA and the Introduction to Unix class offered by Pete into a 1-credit fall seminar that focuses on “Computational research tools in atmospheric and oceanic sciences”. To alleviate teaching load, we propose removing the AOS 900 (Current and Classical Problems) seminar from the list of required seminars.

Proposal 10

Enter your proposal here:

Curriculum Committee – Syllabus Subcommittee

Objectives:

1. Check for consistency between online core course descriptions and topics covered in the actual course based from class syllabi.
2. Look for any possible deficiencies in the graduate curriculum using information gathered from class syllabi, compare topics covered in all grad level classes to topics listed in the core course descriptions as well as Wallace and Hobbs (2006).

Findings:

1. Most of the topics listed in the syllabi were consistent with the online course descriptions with the exception of 650 whose description was not updated to match the current 650 class.
2. All theoretical aspects of topics listed in Wallace and Hobbs (2006) are covered in the grad curriculum syllabi.
3. Main deficiencies found in the current curriculum include weather and climate systems and variability as well as computer programming skills.

Proposals:

1. Change 650 description and pre-requisites on the website/catalog to reflect the way 650 is currently being taught or re-list the existing 650 as 575. Furthermore, website course descriptions should be updated annually and possibly include sample syllabi when possible.
2. Create a new version of the original 650. This course should combine the essentials of both synoptic and climate systems. (Note: this course could be co-taught to reduce teaching load.)
    a. The first half of the course could focus on weather systems while the second half could focus on climate.
    b. Programming would be emphasized in the course, perhaps using 2 different programming languages/methods for the first and second half of the course

   Alternately, there could be two courses taught, one focusing on synoptic systems and one focusing on climate.
3. Alter most or all of the current core courses to incorporate deficiencies – add applications of the theory to each course.
    a. Add weather systems topics to 610
    b. Add climate topics to the current 650
    c. Option to add chemistry and precipitation topics to 630
4. Encourage incorporation of at least one programming assignment in all graduate lectures. A committee of students and faculty will develop guidelines and tutorials from existing material on introductory programming background for major languages used by our field. These guidelines can be provided to all faculty to help them prepare these assignments.

Sections in Wallace & Hobbs and Relevant Courses

Highlighting means no <u>currently offered</u> core courses cover this topic

1. <u>Thermodynamics</u>
    1. Gas Laws – 630,453
    2. Hydrostatic Equation – 610, 611, 630, 650, 660, 425, 452,453
    3. First Law of Thermodynamics – 630
    4. Adiabatic Processes – 425, 452, 630, 453
    5. Water Vapor in Air – 452, 630, 637
    6. Static Stability – 452, 610, 611, 630, 660
    7. 2nd Law of Thermodynamics – 630, 453

2. <u>Radiative Transfer</u>
    1. Spectrum of Radiation – 640
    2. Quantitative Description of Radiation – 640
    3. Blackbody Radiation – 640
    4. Physics of Scattering/Absorption/Emission – 640
    5. Radiative Transfer & Planetary Atmosphere – 425, 640, 660, 760
    6. Radiation Balance at Top of Atmosphere – 425, 640, 660

3. <u>Atmospheric Chemistry</u>
    1. Composition of Tropospheric Air – 425, 535, 630
    2. Sources/Transport/Sinks of Trace Gases – 535, 801 (deep convection)
    3. Important Tropospheric Trace Gases – 425, 535, 640
    4. Tropospheric Aerosols – 535, 630, 640
    5. Air Pollution – 535, 640, 773
    6. Tropospheric Chemical Cycles – 535
    7. Stratospheric Chemical Cycles – 535

4. <u>Cloud Microphysics</u>
    1. Nucleation of Water Vapor Condensation – 630, 637
    2. Microstructures of Warm Clouds – 630, 637
    3. Cloud Liquid water content and Entrainment – 630, 637, 773, 925
    4. Microphysics of Cold Clouds – 630, 637
    5. Growth of Cloud Droplets in Warm Clouds – 630, 637
    6. Artificial Modification Of Clouds and Precipitation - N/A
    7. Cloud & Precipitation Chemistry – atmospheric chemistry class?

5. <u>Atmospheric Dynamics</u>
    1. Kinematics of large-scale horizontal flow – 452, 610, 650, 651
    2. Dynamics of Horizontal Flow – 425, 452, 610, 650, 651, 712
    3. Primitive Equations – 425, 452, 522, 610, 611, 650, 651, 660, Math 801
    4. General Circulation - 425, 522, 610, 650, 660, 712
    5. Numerical Weather Predication – 452, 651, 801 (fall 06 Morgan)

6. <u>Weather Systems</u>
    1. Extratropical Cyclones – 452, 650, 651
    2. Orographic Effects – 453, 611, 712, 773
    3. Deep Convection – 453, 522, 801 (deep convection), 925 (spring 10)

4. Tropical Cyclones – 522, 650, 453

7. Atmospheric Boundary Layer
    1. Turbulence – 610, 630, 773
    2. Surface Energy Balance – 425, 522, 660, 712, 773
    3. Vertical Structure – 522, 630, 773, 453
    4. Evolution – 522, 773, 453
    5. Special Effects (terrain, urban, sea breeze...) - 425, 453, 773

8. Climate Dynamics
    1. Present Day Climate – 425, 522, 660
    2. Climate Variability – 425, 760
    3. Climate Equilibrium, Sensitivity, Feedbacks – 425, 760, 925 (spring 10)
    4. Greenhouse Warming – 425
    5. Climate Monitoring and Predication - N/A

Course Descriptions/Pre-reqs from the AOS website

Highlighting means no currently offered core courses cover this topic

610: Geophys. Fluid Dynamics 1 (Pre-reqs: PHY 208 = General Physics, Math 234 = Multivariable Calc.)

- Equations of motion
- Basic approximations
- Coriolis force
- Wave motions
- Normal modes (only covered in some syllabi)
- Gravity waves
- Friction & turbulence
- Convective processes
- Geostrophic adjustments
- Scaling arguments
- Effects of rotation on wave motions
- Vorticity and potential vorticity

611: Geophysical Fluid Dynamics 2 (Pre-reqs: 610)

- Quasi-geostrophic motion
- Potential vorticity equations
- E-P fluxes
- Rossby waves
- Boundary layer processes
- Wind- driven ocean circulation and western boundary currents
- Barotropic and baroclinic instability
- Tropical flows (only covered in some syllabi)

630: Introduction to Atmospheric Physics (Pre-reqs: PHY 208, Math 234)

- Thermodynamic theory of multiphase systems
- Thermodynamic analysis of the atmosphere
- Microphysical processes in the atmosphere
- Atmospheric and oceanic chemical processes (never covered)
- Conduction of heat and moisture into the atmosphere from the ocean and land surface

640: Radiation in the Atmosphere & Ocean (Pre-reqs: PHY 208, Math 234)

- Introduction to basic laws
- Radiative transfer under clear sky conditions
- Scattering by individual particles
- Multiple scattering
- Radiative properties of clouds and aerosols
- Energy budget
- Miscellaneous applications

650: Analysis of Atmospheric Systems (Pre-reqs: 610, 630)

- Observation and analysis on many scales (boundary layer turbulence up to climate scale)
- Quantitatively analyze, describe and physically interpret

Note: These pre-reqs and objectives fit perfectly with the former 650 course. The new statistics course taught by Dan Vimont does not fit this description or use these pre-requisites at all

660: Physical Oceanography (Pre-reqs: PHY 208, Math 234)

- Physical properties of sea water and their measurement
- Ocean climatology (including thermocline)
- Water, salt and heat budgets
- Ocean circulation (wind driven and thermohaline)
- Water masses of the world ocean (including equatorial and southern ocean)

Review of Curricular Requirements from Peer Institutions

Objectives

In an effort to put our graduate curriculum in the context of the larger academic community, we surveyed the curricular requirements of peer institutions. The institutions selected were separated into two groups. Group 1 consisted of well known institutions with historically strong departments in the field of atmospheric science, while Group 2 consisted of well known institutions with strong atmospheric and oceanic components in their departments.

Group 1	*Group 2*
Pennsylvania State University (PSU)	University of Maryland (UMd)
Colorado State University (CSU)	University of Colorado-Boulder (UCB)
University of Washington (Wash)	McGill University (MU)
University of Oklahoma (OU)	University of California-Los Angeles (UCLA)

Findings

1. Group 1 departments tended to be much larger that our own AOS department, with faculty numbers in the 20-30 range for all but CSU which has no undergraduate department. These were purely atmospheric science departments where the regularity and availability of core courses was certain. These departments also had at least one seemingly permanent lecturer generally assigned to low to mid level courses.
2. Group 2 departments tended to be on the scale of our own department in terms of numbers of faculty and graduate students, though UCB has no undergraduate program.
3. All of these institutions, in both groups 1 and 2, have required courses for their graduate students.
4. Their was a dichotomy in the specifics of the requirements. Mostly of group 1 (CSU, Wash, OU, and UCB) asked students to specialize in a particular track of core courses, (e.g. dynamics vs. data analysis) or provided options (e.g. choose two of four courses on various topics). The other set of schools, most of Group 2 (UMd, MU, UCLA, and PSU), have a set of 5-6 required courses that cover a breadth of topics for all of their graduate students. The breadth of courses covered was similar to those listed for our department, however climate and synoptic based have been taught in a regular rotation in these other departments.
5. The qualifying exams at these institutions also reflected this course specialization or a breadth of knowledge represented by the course requirements.
6. Several of these institutions have recently created basic programming and research tools seminars/courses to prepare their students for the changing demands of potential employers.

Suggestions

If a breadth of knowledge in the disciplines of atmospheric and oceanic sciences is what we want out students to attain, then our course offerings should reflect this desire. Qualifying Exam should lean towards reflecting recently available courses not desired knowledge.

1. Create a rotation of set core courses, including courses covering the topics of synoptic and climate, to cover the range of the department's specialties.
2. Create a list of desired topics to be covered by the core courses and bin courses appropriately, then allow students to pick courses from each category.

Summary of Curricular Requirements from Peer Institutions

	Penn State	**Colorado State**	**Washington**	**Oklahoma**
	Dept. of Meteorology	*Dept of Atm. Sci*	*Dept of Atm. Sci.*	*School of Meteoro.*
Pre Arrival	Bkgrd: in physical, math & computational sciences, working knowledge of one computer language. Review Text: Wallace&Hobbs	Undergrad degree in physics, mathematics, engineering, chemistry, meteorology, or physical sciences. No undergraduate degree program here.	mathematics, computer science and the various physical sciences – the first year of graduate study is devoted largely to basic courses	working knowledge of calculus, statistics, and computer programming (e.g. Unix and either Fortran or C).
After1st Year	Should be done with core courses	n/a – Side note: offering intro to programming short course this fall	Req to give a 20-minute presentation on proposed MS research during a one-day seminar	complete prerequisite material if needed
Core Courses	*Req:* (1) Fluid Dynamics (2)Dynamic Meteorology (3)Thermodynamics (4)Cloud Physics (5)Communication of Meteo Reseach	*Req* Discipline based core courses, 4 disciplines: (1)Dynamics (2)Physics & Chem (3)Circulation Systems (4)Measurements & Data Analysis, with 4/5 courses for each	*Req:* (1)Physical Meteo (2)Synoptic Meteo (3)Radiation (4)Cloud Physics (5)Chem (6) 3 courses,fluid dynamics &mid-lat weather OR 2 courses in atm motion (non dynamics focus)	*Mandatory*: (1)Adv Dynamics I (2)Adv Synoptic, Two of four: (1)Radiation (2)Cloud/Precip Physics (3)Climate Dynamics (4)Wx Radar Theory/Practice
MS info	Routes for strong/weak Meteorology bkgrnd - 31 cr with 13 in core classes – weak bkgrnd req synoptic & atm phenomena courses	30/32 cr with 16 in *core* course topics, topics are (1)4cr in dynamics (2)5 cr in physics & chemistry (3)5 cr in circulation systems (4)2 cr in atm. Measurments	36 cr with 24 above 500, (on quarter system)	30 cr with 12 from req core courses – Offers MS in Professional Meteorology for those intending to go into private industry (see packet)
PhD info	Exam material: core courses + synoptic & atm phenomena + topics from dept. seminar	QE includes bkgrnd, methods, & current research that applies to the specific area(s) of the proposed research topic – 42 cr beyond an MS degree	MS course reqs then go through committee on Grad Studies to be evaluated for PhD candidacy	90 cr, up to 44 transferred from MS – General Exam and Qual. Exam
Nmbrs	~31 profs, 3 or 4 lecs, 300 undergrads (60+ pre year), 60 grads (12 MS, 5PhD /yr)	~17 faculty, ~95 grads, no undergrad dept., many researchers	~18 academic/7 research prof, 1 lect, ~20 adjunct/affiliate, ~60 grads	~21 academic/4 research prof. 34 affiliate/adjunct.280 undgrads, 110 grads

Summary of Curricular Requirements from Peer Institutions

Maryland	**Colorado-Boulder**	**McGill**	**UCLA**	***Wisconsin***
Dept. Atm & Ocn Sci	*Dept. Atm & Ocn Sci*	*Dept. Atm & Ocn Sci*	*Dept. Atm & Ocn Sci*	*Dept of Atm&O*
Encourage atm/ocn, physics, chem, math, bio, engineering majors to apply. Not much in pre-arrival info	No undergrad major, just a minor.	Encourage atm/ocn, physics, chem, math, engineering majors to apply. No pre arrival info	-	*Prior work in atm or ocn sci is not req, but it is beneficial. Knowledge of comp program is recommend*
Submit course plan and tentative schedule of completion by end of first 9cr.	*n/a*	Thesis research begins – paired with researcher/prof after "interviews"	Must submit *program of study* prior to 2nd year, can be updated at anytime	*n/a*
req:(1)Dyn of Atm/ Ocn I (2)Dyn of Atm/ Ocn I OR Synoptic (3)Phys&Chem of Atm I (4)Phys&Chem of Atm II (5)Atm& Ocn Climate (6)Intro to Earth System Sci	*2 Tracks Atm or Ocn.* (1)Intro to Atm Dyn (2)Intro to Ocn Dyn (3)Dyn of (a)Atm (o) Ocn (4a)Atm Chem (5a) Atm Rad (6a) Phys/Chem of cloud aerosols (4o)Phys Ocn (5o)Fluid Dyn (6o) Marine chem/geochem	*Req Dept component* (1) Atm/Ocn Dyn (2)Dyn of Current Clim (3)Synoptic (4) Weather disc / special topics (5)Phy Meteor. *Thesis component* (6) Lit Rev. (7) Research Progress Sem. (8) Thesis	*Req:* (1) Intro to Atm/ Ocn Fluid (2)Intro to Dyn of Earth Syst (3)Intro to Atm Chem (4)Intro to Atm Phys (5)Intro to Solar System Plasmas OR Intro to Solar Terrestrial Physics	*Not Req: (1) GFD 1 (2) GFD 2 (3)Atm Physics (4)Radiation (5)Atm Systems (6)Oceanography*
MS of Professional Studies: for working prof, 2of3 certificates AND MS: non-thesis – 30 cr course wrk, scholarly paper, presentations, comp exam	30 cr with 24 above 5000 including req courses in atm or ocn tracks, thesis, non-thesis options	MS, MS with CS and Engineering, MS with Environment specialties. 45 cr including thesis crs Thesis option	Non-Thesis option: committee gives oral comp exam based on prog of study Thesis: graded as fail, masters pass, phd pass. 30 cr inc req courses	*24 cr with 12 in the dept. OR non thesis option: 36 cr*
Course work (30cr+ research cr), candidacy exam, minor, dissertation. CE = QE+prelims	36 cr with 30 above 5000 inc req courses for track. Comp Exam 1: closed book exam based on track CE2: oral defense of proposed research	MS courses+ proposal sem, Comp sem, Phys Meteor Sem, Atm/ Ocn/Clim Sem. QE topics based on 9 offered courses, picks 3 for QE	36 cr, 16 cr that devel specialization. Comp Exam based on *prog of study* Oral Exam based on graded sem of written research proposal, B or better	*32 cr with 15 cr of lecture courses and AOS 900, QE from core course material*
13 academic/2 resea prof, 11 adjunct/ affiliate, ~70 grads, develop undergrad	15 faculty, 26 adjunct/affiliate, 3 lecturers, NO undergrad, ~65 grad	10 faculty, 9 adjunct/associate, 20 researchers. ~40 undergrad, ~50 grad	21 faculty, 1 lecturer, 6 adjunct, ~25 grad	~15 faculty, 6 adj/affil, ~60 grads, 50 undergra

Curriculum Survey Results

Objectives: The objectives of this survey were to quantify the number of students taking which courses in the grad program, as well as get their opinion on the core courses, qualifying exam, and PhD minor.

Findings:

1. Most taken courses: Core classes with AOS 640, 650, and 660 having slightly less students than AOS 610, 611, and 630

2. Most taken elective courses: Topics in Meteorology-Tank Lab (801), Boundary Layer Meteorology (773), and Meteorological Satellite Applications (745)

3. Students have found their advisor as well as the UW timetable to be the most useful in selecting classes. Most students also commented on the lack of available course syllabi and would like to see it made available.

4. About half the students surveyed did not feel the available grad student curriculum was meeting needs to conduct research or acquire a career in atmospheric and oceanic sciences, the responses were mixed
    a. When asked what was missing, most students cited the lack of a graduate level synoptic class (like 452 without the lab workload) and graduate level climate class.

    b. Also, "There desperately needs to be a 'crash course' in the main programming languages used in this department."

    c. Another recommendation was for a good instrumentation class

5. Most popular classes students would like to take but couldn't include: Global Climates (531), General Circulation of the Atmosphere (712), and Numerical Modeling in Meteorology (771)

6. Qualifying Exam: 75% of the students responding to the survey felt the core did not adequately prepare them for the qualifying exam.
    a. Synoptic emphasis and climate course were stated as not being represented in the core curriculum.

    b. When asked if the core should be fundamentally altered, there was about a 50-50 split between yes and no.
        i. Courses students thought should be added were, again, synoptic and climate courses.

ii. Classes students thought should be dropped from the core include 630 (for meteorology undergrads) as well as GFD 2, replaced with a modify 452.

7. PhD minor: students were again split on whether it was useful or not.
    a. Some students, like those intending to teach, are using the Delta program to fulfill this requirement. Others feel it is a marketing tool to obtain a job.

    b. However, other students felt like minor was a distraction from research.

8. Overall, most students felt they could tailor their graduate school curriculum to their research and personal interests
    a. Some students accomplished this through not taking all 6 required core courses to allow for greater variety.

    b. About 17 students who took the survey said they felt obligated to take the core, or their advisors required it. 13 students did not feel obligated.

Suggestions: The addition of a graduate level synoptic class (or modify 452 for grad students taking the course and move the class time of GFD I to allow first year students to take it), as well as a grad student climate would benefit those students taking the Qualifying Exam and those preparing for the work force after their Master's Degree. The core courses should be modified of the core to include these courses, as well as a programming class.

Curriculum Committee Statistical Student Survey Results

Select all of the following courses you have taken here as a graduate student. Courses with an asterisk are AOS "core courses" (Non-zero responses)

401 (Topics)	1 (3%)	638 (Chemistry)	2 (6%)
405 (Capstone)	2 (6%)	640* (Radiation)	20 (65%)
425 (Global Climate)	9 (29%)	650* (Analysis)	14 (45%)
441 (Radar/Satellite)	2 (6%)	651 (Synoptic-Dynamic)	5 (16%)
452 (Synoptic)	7 (23%)	712 (Gen Circ)	4 (13%)
453 (Mesoscale)	3 (10%)	718 (Moist convection)	4 (13%)
471 (Numerical technique)	3 (10%)	740 (Adv. Radiation)	4 (13%)
520 (Bioclim)	1 (3%)	745 (Satellite Met.)	10 (32%)
522 (Tropical)	5 (16%)	760 (Atmos-Ocean coup)	5 (16%)
528 (Past Climate)	2 (6%)	771 (Numerical mod.)	1 (3%)
532 (Env. Biophys)	1 (3%)	773 (Boundary Layer)	11 (35%)
535 (Dispersion)	1 (3%)	801 (Theoretical Met)	13 (42%)
575 (Climate analysis)	6 (19%)	900 (Current/classical)	7 (23%)
610* (GFD I)	26 (84%)	915 (Dynamics sem)	2 (6%)
611* (GFD II)	24 (77%)	925 (Climate sem)	6 (19%)
630* (Physics)	28 (90%)	955 (Weather sem)	2 (6%)
637 (Cloud Phys)	5 (16%)	980 (Earth sys sem)	2 (6%)

What courses are offered by our department that you would like to have taken but could not due to scheduling or lack of recent offering? (Answers with non-zero response)

441 (Radar/Satellite)	1 (5%)	718 (Moist convection)	1 (5%)
452 (Synoptic)	1 (5%)	720 (Glaciology)	3 (15%)
455 (Severe storms)	2 (10%)	745 (Satellite Met)	2 (10%)
522 (Tropical)	1 (5%)	750 (Oceanography Prob)	3 (15%)
528 (Past climate)	2 (10%)	760 (Ocean-Atm coupling)	4 (20%)
531 (Global climate)	5 (25%)	761 (Ocean dynamics)	4 (20%)
535 (Dispersion)	2 (10%)	771 (Numerical modeling)	5 (25%)
575 (Climate Analysis)	2 (10%)	773 (Boundary layer)	4 (20%)
601 (Challenges in AOS)	2 (10%)	801 (Theoretical met)	3 (15%)
623 (Electronics)	1 (5%)	935 (Physical Met)	1 (5%)
637 (Cloud Physics)	2 (10%)	945 (Radiation Seminar)	1 (5%)
638 (Chemistry)	1 (5%)	955 (Weather seminar)	2 (10%)
650 (Analysis of AOS)	3 (15%)	965 (Oceanography sem.)	1 (5%)
651 (Synoptic-Dynamic)	1 (5%)	975 (Numerical model sem)	2 (10%)
705 (Middle Atm)	4 (20%)	980 (Earth sys. Sci. sem)	1 (5%)
712 (General Circ)	7 (35%)		

Prior to enrolling, where did you learn information about courses you have taken? Please rank as many of the following as you use (5 is least important and 1 is most important)

#	Question	5	4	3	2	1	Responses	Mean
1	AOS website	4	3	9	4	4	24	3.04
2	Faculty hosted websites	7	7	4	3	3	24	2.50
3	Advisor	3	2	10	5	8	28	3.46
4	Fellow students	5	6	6	3	7	27	3.04
5	AOS Course Coordinator (Angel)	4	7	2	7	3	23	2.91
6	AOS syllabi archive (paper and online)	7	3	5	5	1	21	2.52
7	UW timetable / course guide	4	3	3	9	6	25	3.40
8	Other	6	0	1	0	4	11	2.64

Do you feel that the 6 core classes adequately represent the breadth of core knowledge that all atmospheric and oceanic science graduate students should know?

YES (15, 52%) NO (14, 48%) N = 29

Are core classes offered regularly so as to be able to take all during your tenure here?

YES (27, 90%) NO (3, 10%) N = 30

Do you feel obligated to take the core? Does your advisor require it?

YES (17, 57%) NO (13, 43%) N = 30

If you needed a particular AOS-relevant skill for your research, which of the following activities would you undertake to gain that skill. Rank in terms of importance 1 being highest rank.

#	Question	5	4	3	2	1	Responses	Mean
1	Take an AOS course or seminar	3	2	5	8	7	25	3.56
2	Attend an external conference or workshop on the topic	2	6	6	8	4	26	3.23
3	Develop an independent reading with a faculty member	4	4	11	5	2	26	2.88
4	Learn from fellow students and post-docs in your lab	2	5	3	6	10	26	3.65
5	Gain mentoring from your advisor(s) or committee	4	1	6	11	5	27	3.44
6	Find and read a textbook	2	2	4	10	8	26	3.77
7	Other	5	0	1	2	2	10	2.60

Post-QE PhD students: Do you feel the core provides adequate preparation for the range of questions found on the qualifying exam?

YES (3, 25%) NO (9, 75%) N = 12

Should the core be fundamentally altered?

YES (14, 52%) NO (13, 48%) N = 27

Does the certain number of credit hours provide enough flexibility to tailor your curriculum to your research and personal interests?

YES (25, 89%) NO (3, 11%) N = 28