Graduate Program Assessment Report

Department of Earth & Atmospheric Sciences

EAS Graduate Education Committee, 4 October 2017

A new evaluation form was created last year with 5 items for 6 student learning outcomes. The form was filled out by all committee members for MSc and PhD candidates after their thesis defense, and by the students themselves in the meteorology program. The form includes scores for the items, and comments for the learning outcomes as well as general comments at the end.

Table 1 shows the summary scores from both sets of forms. Annexes contain Tables A.1a and A.1b that show the results of the self-evaluations, and Tables A.2a and A.2b that show the results of the faculty evaluations.

Faculty Evaluations

The faculty sheets used a 1-2-3 scheme based on the way peer-review system works: 1 means insufficient (reject), 2 means good but still in process (major revision) and 3 means perfect (publish as is). The averages for the 6 outcomes (see Table 1) were as follows: Goal 1 (Scientific literature): 2.2; Goal 2 (Methods): 2.4; Goal 3 (Broader contexts): 2.2; Goal 4a (Oral communication): 2.4; Goal 4b (Written communication): 2.5; Goal 5 (Research ethics): 2.3.

This would suggest that the weaker points of the program are in assessing the scientific literature and in applying knowledge to broader contexts.

Within each goal, the 5 items were intended to be ordered by time required to mastery and from lower order to higher order skills. The scores broadly reflect this progression, although some of the items appeared out of order.

For Goal 1, a particular weakness seems to be in identifying key issues and highly cited papers in the field. This is connected with a lower than average score for identification of research groups in the field.

For Goal 2 the items are in order suggesting that the students are reaching expectations for knowledge of methods and progressing on developing expertise in specific methods.

For Goal 3 there was a weakness for applying knowledge to policy debates and evaluating policy prescriptions.

Students performed well for oral and written communications (Goals 4a and 4b), with high scores reflecting mastery for all the essential skills and slightly lower scores for the higher order skills that are in development. One area of growth could be seeking out, and learning from, exemplars of outstanding oral and written communications.

For Goal 5, we see high scores for citations and reporting positive and negative results. However, we see lower scores for familiarity with cases of fraud. The comments point out that faculty had trouble evaluating this goal.

Student Self-Evaluations

The student evaluations used a 5-point Likert scale. This is similar to most evaluation tools in the university and hence is familiar for the students. It is a linear function of the 1-2-3 scheme used by professors: $L3 = (L5-1)/2+1$, where $L5$ is the 5-point score and $L3$ is the 3-point score.

Table 1 shows the average student scores mapped to the 3-point scale for comparison with the professors' scores. The averages are as follows: Goal 1 (Scientific literature): 2.25; Goal 2 (Methods): 2.18; Goal 3 (Broader contexts): 2.20; Goal 4a (Oral communication): 2.45; Goal 4b (Written communication): 2.23; Goal 5 (Research ethics): 2.48.

These scores are comparable to the ones given by the professors, with some differences. Students rated themselves highest for oral communications (goal 4a) and research ethics (goal 5). The scores for the other 4 goals were similar, with slightly lower numbers for research methods (goal 2) and application to broader contexts (goal 3).

Looking at the specific items for Goal 1, we can see a lower score for identification of key issues and highly-cited papers, as well as notable research groups.

For Goal 2 the scores were relatively uniform with a lower number for different skill sets. For goal 3 the lower scores are for application and evaluation of policy debates.

In terms of communication, the students feel more confident in their oral skills than their written skills. On the oral side, the students gave themselves particularly low scores with knowledge of outstanding speakers in the field. On the written sides, the scores suggest that the students are concerned about the clarity of their writing.

The students seem comfortable with their mastery of Goal 5 (Research ethics), with a lower score nonetheless for the ability to grow from criticism.

Conclusions

For Goal 1, there is a need to strengthen the identification of key issues, highly-cited papers and key research groups.

For Goal 2, it seems the students would like to develop more than one skill set. This is reflected in the comments which mention the development of computer programming skills. The meteorology program has recently decided to focus on the use of the Python programming language for all grad students in all classes. The feedback is positive so far and suggests that we continue in this direction to foster computing excellence in all students in the program.

For Goal 3, both students and professors seem in agreement that they are under-performing in the area of analysis and evaluation of policy debates.

For Goal 4, it appears that there is the need to be more familiar with outstanding speakers and to work on better writing skills.

For Goal 5, although the students appear satisfied it seems that the professors are not communicating on this subject as much as they might.

Action Items

Graduate student committees: Make sure students choose advisors and committees in the first semester.

Journal club: Give more emphasis to discussing key issues and research groups. Use citations as a way of building a conceptual map of the field.

Graduate classes: Increase the relationship of course material to the scientific literature. Include a description of methods used in different fields and provide the opportunity to develop some of those skills. Provide more opportunities for writing about science, for commenting on each other's writing, receiving feedback, and revising their work.

Communication class: Look into expanding the geoscience graduate communication class to the whole department.

Individual mentoring meetings: Discuss research ethics and more general issues about being a scientist.

Department Seminars: Use these as opportunities to discuss science in a broader context and to talk among scientists of different disciplines about general debates.

Recommendations for improvements to the graduate program assessment

Complete the assessment in the Spring of the first year for all graduate students. This will be done after the meeting with their committee towards the end of the semester.

The EAS Graduate Education Committee felt that we would prefer filling out the forms for all 6 goals rather than do just 2 goals per year.

We will change the professor evaluation form to a 1-5 scale which will be the same as the students (and a linear function of the previous 1-3 scale).

Table 1: Average score for the 6 graduate student learning outcomes:

Goal	Advisor Av. Score	Student Av. Score
Goal 1: Assess relevant literature or scholarly contributions	2.19	2.25
Goal 2: Apply the major practices, theories, or research methodologies	2.35	2.18
Goal 3: Apply knowledge to address problems in broader contexts	2.23	2.20
Goal 4a: Articulate arguments or explanations to both a disciplinary or professional audience and to a general audience, in oral forms	2.41	2.45
Goal 4b: Articulate arguments or explanations to both a disciplinary or professional audience and to a general audience, in written forms	2.45	2.23
Goal 5: Evidence scholarly and/or professional integrity	2.26	2.48

Graduate Program Assessment: Evaluation Sheet to be completed by Professors / Advisors

Student: Program:
No. Semesters in Department: Date:
Evaluator:

For each item below, please rate the student's strength on a scale of 1 to 5 where 1: not achieved yet, 2: beginning, 3: making progress, 4: meets expectations, 5: exceeds expectations.
Please add a short comment for each goal to illustrate the way in which the student demonstrated attainment.
Note that the purpose of this evaluation sheet is to assess the program, not the student.

Goal 1: Assess relevant literature or scholarly contributions in the Earth & Atmospheric Sciences:
__   1.1: Student can list the main journals in the field.
__   1.2: Student can outline the main areas of research in their field of study.
__   1.3: Student can identify notable research groups and investigators. Student can demonstrate broad
        knowledge of areas outside of their sub-specialty, and specific knowledge of publications in their field.
__   1.4: Student can indicate the current key issues and highly-cited papers in the field and identify
        emerging trends and new research directions.
__   1.5: Student can identify the most important historical contributions in the field and outline their
        importance.

Comments:

Goal 2: Apply the major practices, theories, or research methodologies in the Earth & Atmospheric Sciences:
__   2.1: Student is aware of different skills needed to carry out research in E&AS, eg. data analysis, field
        work, numerical modeling, computational competence.
__   2.2: Given a figure, student could describe a method that could be used to generate it.
__   2.3: Student has demonstrated competence with several different skill sets.
__   2.4: Student has reached expert level in one type of skill.
__   2.5: Given a paper in the student's specialty, the student could create a plan to reproduce the study.

Comments:

Goal 3: Apply knowledge from the Earth & Atmospheric Sciences to address problems in broader contexts:
__   3.1: Student can identify the main areas of societal relevance in E&AS.
__   3.2: Student can explain how their field impacts society.
__   3.3: Student can apply their knowledge to current policy debates.
__   3.4: Student can create an engaging presentation for the general public about their research.
__   3.5: Student can evaluate policy prescriptions and political debates in the light of their discipline.

Comments:

Goal 4: Articulate arguments or explanations to both a disciplinary or professional audience and to a general audience, in both oral (4a) and written (4b) forms:

__ 4a.1: Student can give a prepared talk.
__ 4a.2: Student integrates figures and graphics into their presentation.
__ 4a.3: Student answers questions competently and adjusts their presentation style based on audience feedback.
__ 4a.4: Student uses technical words precisely and is able to explain concepts without jargon.
__ 4a.5: Student is familiar with examples of outstanding speakers in the field and aspires to excellence themselves.

Comments:

__ 4b.1: Student is familiar with examples of excellent writing and with sources of advice on scientific writing.
__ 4b.2: Student can write about their work clearly.
__ 4b.3: Student can create publication quality figures and graphics.
__ 4b.4: Student revises their written work based on feedback.
__ 4b.5: Student writing is clear and concise while avoiding confusing sentence constructions.

Comments:

Goal 5: Evidence scholarly and/or professional integrity in Earth & Atmospheric Sciences:

__ 5.1: Student knows about cases of fraud in science and can explain the importance of integrity in research.
__ 5.2: Student cite work appropriately.
__ 5.3: Student describe both positive and negative results and give sufficient detail about their work so that it can be replicated.
__ 5.4: Student describes weaknesses in their own work.
__ 5.5: Student is able to question themselves, accept criticism and grow from it.

Comments:

General Comments:

Graduate Program Assessment: Self-Assessment
Program: No. Semesters in Department:
Date:

For each item below, please rate your strength on a scale of 1 to 5 where 1: very weak, 2: weak, 3: average, 4: strong, 5: very strong, relative to your fellow graduate students.
Please add a short comment for each goal to describe one of the more significant areas of progress you feel you have made, and progress you plan to make.
Note that the purpose of this evaluation sheet is to assess the program, not the student.

Goal 1: Assess relevant literature or scholarly contributions in the Earth & Atmospheric Sciences:
____ 1.1: Student can list the main journals in the field.
____ 1.2: Student can outline the main areas of research in their field of study.
____ 1.3: Student can identify notable research groups and investigators. Student can demonstrate broad knowledge of areas outside of their sub-specialty, and specific knowledge of publications in their field.
____ 1.4: Student can indicate the current key issues and highly-cited papers in the field and identify emerging trends and new research directions.
____ 1.5: Student can identify the most important historical contributions in the field and outline their importance.

Something I've progressed on:
Something I plan to work on:

Goal 2: Apply the major practices, theories, or research methodologies in the Earth & Atmospheric Sciences:
____ 2.1: Student is aware of different skills needed to carry out research in E&AS, eg. data analysis, field work, numerical modeling, computational competence.
____ 2.2: Given a figure, student could describe a method that could be used to generate it.
____ 2.3: Student has demonstrated competence with several different skill sets.
____ 2.4: Student has reached expert level in one type of skill.
____ 2.5: Given a paper in the student's specialty, the student could create a plan to reproduce the study.

Something I've progressed on:
Something I plan to work on:

Goal 3: Apply knowledge from the Earth & Atmospheric Sciences to address problems in broader contexts:
____ 3.1: Student can identify the main areas of societal relevance in E&AS.
____ 3.2: Student can explain how their field impacts society.
____ 3.3: Student can apply their knowledge to current policy debates.
____ 3.4: Student can create an engaging presentation for the general public about their research.
____ 3.5: Student can evaluate policy prescriptions and political debates in the light of their discipline.

Something I've progressed on:
Something I plan to work on:

Goal 4: Articulate arguments or explanations to both a disciplinary or professional audience and to a general audience, in both oral (4a) and written (4b) forms:

_____ 4a.1: Student can give a prepared talk.
_____ 4a.2: Student integrates figures and graphics into their presentation.
_____ 4a.3: Student answers questions competently and adjusts their presentation style based on audience feedback.
_____ 4a.4: Student uses technical words precisely and is able to explain concepts without jargon.
_____ 4a.5: Student is familiar with examples of outstanding speakers in the field and aspires to excellence themselves.

Something I've progressed on:
Something I plan to work on:

_____ 4b.1: Student is familiar with examples of excellent writing and with sources of advice on scientific writing.
_____ 4b.2: Student can write about their work clearly.
_____ 4b.3: Student can create publication quality figures and graphics.
_____ 4b.4: Student revises their written work based on feedback.
_____ 4b.5: Student writing is clear and concise while avoiding confusing sentence constructions.

Something I've progressed on:
Something I plan to work on:

Goal 5: Evidence scholarly and/or professional integrity in Earth & Atmospheric Sciences:

_____ 5.1: Student knows about cases of fraud in science and can explain the importance of integrity in research.
_____ 5.2: Student cite work appropriately.
_____ 5.3: Student describe both positive and negative results and give sufficient detail about their work so that it can be replicated.
_____ 5.4: Student describes weaknesses in their own work.
_____ 5.5: Student is able to question themselves, accept criticism and grow from it.

Something I've progressed on:
Something I plan to work on:

General Comments on your Graduate Program: