Atmospheric and Environmental Sciences Student Learning Outcomes Annual Report
2013-2014

Assessment Matrix for Atmospheric Science B.S.				
	Assessment Component			
	Direct		*Indirect*	
Learning Outcome	***Weather Forecasting Contest*** Practice cycle: Each semester; local contest. Review cycle: Yearly.	***Embedded Questions/ Assignments*** Practice cycle: Yearly; start ’08–’09. Review cycle: Yearly.	***Exit Survey*** Practice cycle: Yearly; first administration of survey Spring ’09. Review cycle: Yearly.	***Focus Group*** Practice cycle: Yearly; first in Spring ’09. Review cycle: Yearly.
1) Effectively communicate with colleagues or others via clear and efficient writing or presentation technique	—	***ATM 425*** (Research Pres. For Oral Discourse Requirement)	☻	☻
2) Acquire new knowledge and abilities by embracing a lifelong perspective of inquiry, discovery and learning	—	—	☻	☻

3) Cogently describe the fundamental physical and dynamical processes operating in our atmosphere utilizing appropriate mathematical formulation	—	***ATM 316, 425***	☻	☻
4) Access, interpret and analyze a broad range of meteorological data, most typically for the purpose of generating an operational weather forecast	***ATM 311***	—	☻	☻
5) Apply data, concepts, and models to the solution of problems in the atmospheric sciences	***ATM 311***	***ATM 316, 425***	☻	☻

Assessment Matrix for **Environmental Science B.S.**				
	Assessment Component			
	Direct		*Indirect*	
Learning Outcome	***Portfolio and Projects*** Practice cycle: Yearly; start ’08–’09. Review cycle: Yearly.	***Embedded Questions*** Practice cycle: Yearly; start ’08–’09. Review cycle: Yearly.	***Exit Survey*** Practice cycle: Yearly; first administration of survey Spring ’09. Review cycle: Yearly.	***Focus Group*** Practice cycle: Yearly; first in Spring ’09. Review cycle: Yearly.
1) Effectively communicate with colleagues or others via clear and efficient writing or presentation technique	***ENV 490***	***ENV 250, 315, 490***	☻	☻
2) Acquire new knowledge and abilities by embracing a lifelong perspective of inquiry, discovery and learning	—	—	☻	☻

3) Identify and describe the various systems comprising the Earth's environment, including recognizing key aspects of these systems' interaction and feedback loops	***ENV 490***	***ENV 250, 315, 490***	☻	☻
4) Perform quantitative analyses specific to environmental evaluation, including assessing relevant parameters and interpreting their trends in space and/or time	***ENV 490***	***ENV 250, 315***	☻	☻
5) Apply field methods, data, concepts, and models to the solution of problems in the environmental sciences	***ENV 490***	***ENV 250, 315***	☻	☻

Assessment Matrix for **Graduate Atmospheric Science Degrees**				
	Assessment Component			
	Direct		*Indirect*	
Learning Outcome	***Coursework/ Qualifying Exam (PhD)*** Practice cycle: Yearly; start ’09–’10. Review cycle: Yearly.	***Thesis or Dissertation Quality*** Practice cycle: Yearly; start ’09–’10. Review cycle: Yearly.	***Focus Group*** Practice cycle: Yearly; first to be held in Fall ’08. Review cycle: Yearly.	***Alumni Survey and Success*** Practice cycle: Three years; starting ’08–’09. Review cycle: Yearly.
1) Demonstrate a clear mastery of advanced coursework and knowledge in the discipline;	☻	☻	☻	☻
2) Display requisite skill in common practices specific to the discipline, such as properly interpreting numerical weather forecasts or creating/interpreting detailed, multi-dimensional data fields;	☻	☻	☻	☻
3) Coordinate a credible	—	☻	☻	☻

research project in the discipline and conduct this research via application of appropriate quantitative, computational and IT techniques;				
4) Document, detail and defend the research conducted in a formal written thesis or dissertation, including an oral presentation and defense;	—	☻	☻	☻
5) Communicate effectively with peers and associates, both in writing and public presentation formats.	☻	☻	☻	☻

Annual Assessment Report for ATM 311
Severe and Hazardous Weather Analysis and Forecasting
Fall 2013

Ross A. Lazear, DAES

Weather forecasting in the Atmospheric Science B.S. degree is initially taught in the final month of ATM 211 (Weather Analysis and Forecasting), typically the second semester of a student's sophomore year. The following semester, nearly every ATM B.S. major chooses to take ATM 311 (Severe and Hazardous Weather and Forecasting) as an elective. In this course, students are required to participate in two forecasting contests. One contest involves daily forecasting of temperature, probability of precipitation, and precipitation amounts for Albany, NY, during four successive 12-hour periods. Students must forecast at least 75% of all forecast days (Monday through Friday). The other contest is a medium-range forecast contest based on probabilities. As has been done in previous assessment reports, this report will discuss only the former of the two contests. In addition to the two aforementioned contests, it is optional for ATM 311 students to participate in a third contest, referred to as the National Forecast Contest or "Weather Challenge." Due to the fact that participation in this contest is optional, assessing forecast skill would be statistically unreliable on a year-to-year basis, so it will also not be included in this report. The purpose of these three forecast contests as part of ATM 311 is to enable students to hone their forecasting skills in a competitive, fun environment.

As is typically the case, in the 48-hour locally run Albany forecast contest, there were many other competitors forecasting along with the ATM 311 students. For the Fall 2013 semester, this group of forecasters was made up of an unusually small ATM 311 class (13 students), faculty/staff (1), senior undergraduates (11), department alumni (3), and a National Weather Service forecaster. The makeup of this group remains relatively unchanged year-to-year; thus, it allows us to compare students' forecast accuracy trends both within the semester analyzed and over time. That being said, this year featured slightly less participation by alumni and faculty/staff. Thus, it is possible that scores in this study for the Fall 2013 class may be slightly inflated when compared to previous classes.

The makeup of the Fall 2013 ATM 311 class was fairly similar to the historical average. 12 of the 13 students were atmospheric science majors, and one student was an environmental science major with a concentration in climate.

Figure 1 depicts how students in the Fall 2013 ATM 311 class compared to the average forecaster in the contest for each week. For comparison, Fig. 2 displays the same data but for the average of past five ATM 311 classes. In order to normalize the data, and because the number of students who forecast every day for a given week changes each week, the data are represented as a percentage of ATM 311 students forecasting *better* than the average forecaster for a given week. As an example, for week #1, 57% of students in the Fall 2013 ATM 311 class scored *better* than the average forecaster in the contest. An ideal value is at least 50%, since it implies that students are forecasting on a level comparable with more experienced forecasters. Values greater than 50% suggest that ATM 311 students are forecasting better than more experienced forecasters, which does seem to occur a few times per semester.

The Fall 2013 ATM 311 class (Fig. 1) began forecasting well, but their skill rapidly plummeted by week 3 (from 57% in week 1 to 20% in week 3). Other than a surprising peak in week 7, beyond week 3 the class's skill level appears to match fairly well with the five-year average (Fig. 2). The decrease in forecast skill towards the end of the semester has been noted in previous years, and is likely due to a combination of more challenging forecasts (precipitation type changes) and the increase in work load as students approach due-dates of long-term projects and final exams. Unfortunately, the decrease in forecast skill for the Fall 2013 ATM 311 class appears to persist from mid-semester all the way to the end of the semester, which is a concern. It is worth noting that two of the students in the class scored among the top five in the final standings, with one student finishing in first place. Beyond these two students, however, forecast skill (and final grades issued) was markedly lower than previous years. Due to the relatively small class size, there is some expectation of class-to-class variability in students' raw intelligence and drive to succeed in academia. Although the five-year trend is becoming more smooth over time, it is still worth noting that for two of the 13 full weeks of forecasting, the Fall 2013 ATM 311 class scored better than 50%.

As has been calculated in previous assessment studies, students' scores can also be broken down by the type of forecast made [i.e., temperature, probability of precipitation (POP), and precipitation amount (PA)]. For the Fall 2013 ATM 311 class, the skill scores for each category were 18% (temperature), 36% (POP) and 27% (PA). These scores were overall worse than last year's ATM 311 class (38%, 44% and 44% respectively), with temperature forecasting skill once again the lowest of the three. As has been stated in previous assessment reports, forecasting temperatures likely has the steepest learning curve of each of the three variables, so this result isn't surprising. The overall reduction in skill in these categories once again likely shows the different in the students' overall abilities, as final grades were markedly lower as well.

As has been done in previous assessment reports, in order to assess forecast improvement for specific forecast variables, the scores from the mid-point of the semester through the end of the semester were calculated. The skill scores for two of the three forecast categories increased when scores from mid-semester and on were analyzed, with the PA score staying the same (27% temperature, 45% POP, 27% PA). The improvement by mid-semester is promising, even given the overall reduction in skill of the entire Fall 2013 ATM 311 class.

I continue to try and work on the amount of time devoted to forecasting in the previous semester (ATM 211, Weather Analysis and Forecasting), so I anticipate an improvement in next fall's ATM 311 forecast skill. Because ATM 311 students continue to be least skilled at forecasting temperature, I will make this more of a focus in future ATM 211 classes, and spend more time discussing this in ATM 311 weather discussions.

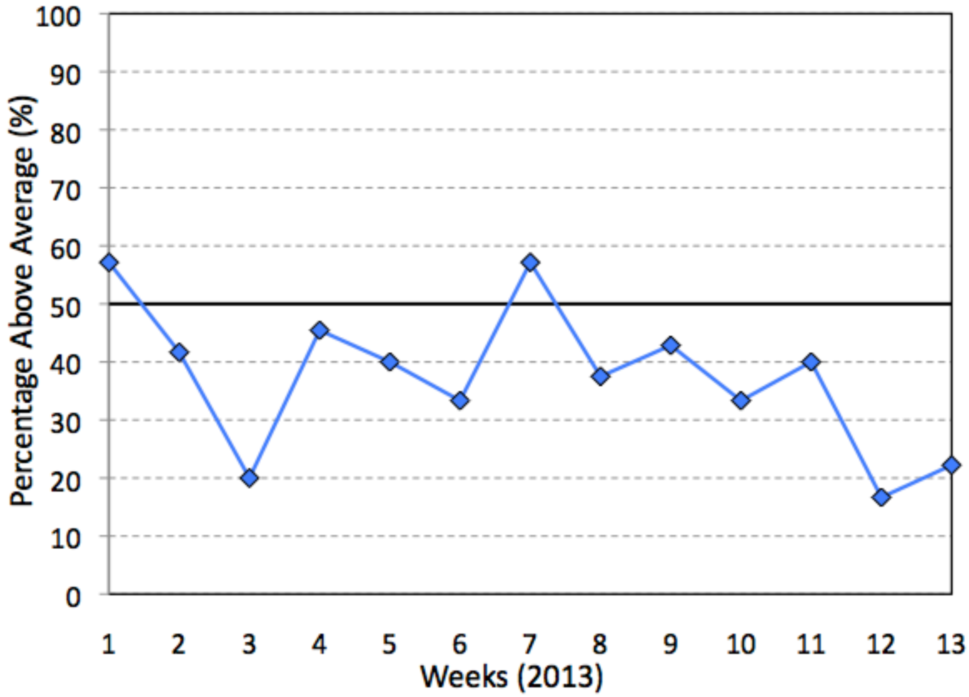


Fig. 1: Percentage, by week, of the Fall 2013 ATM 311 students (13 students total) whose forecast skill was above the average skill of every forecaster in the contest.

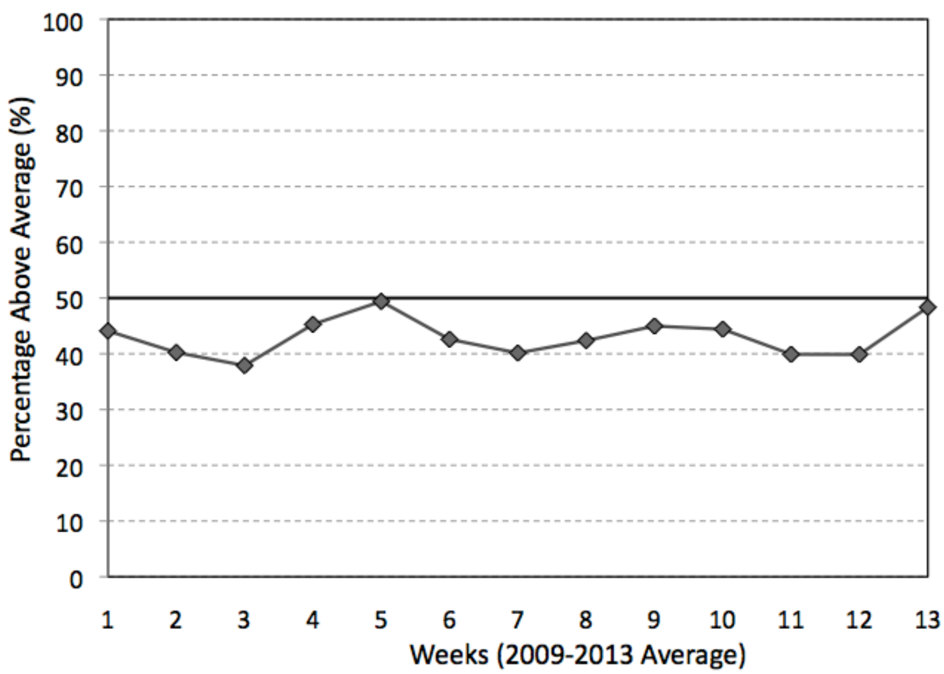


Fig. 2: Percentage, by week, of the average of all ATM 311 classes over the past five years (2009-13; 82 students total) whose forecast skill was above the average skill of every forecaster in the contest.

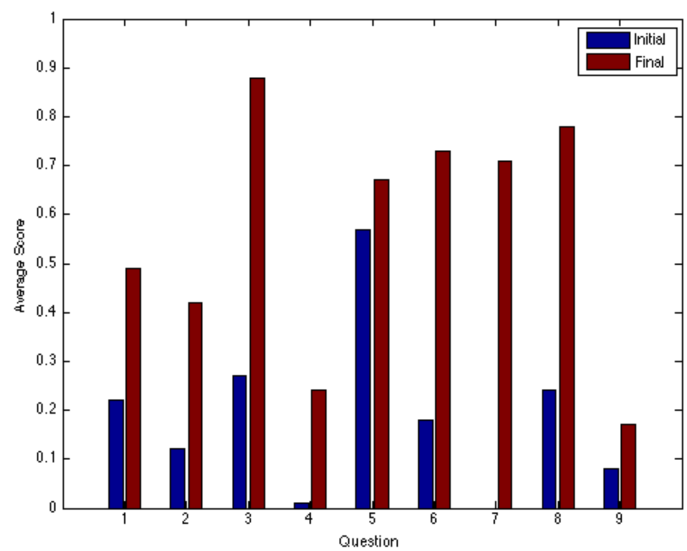
AATM 316 Assessment Results
Fall 2013

Brian Tang

Fourteen students took ATM 316: Dynamic Meteorology I during the fall 2013 semester. The course material consisted of a review of vector calculus concepts needed to understand the basic equations that govern the atmosphere followed by an in-depth discussion of the physical forces that make up the equations.

The assessment (see appendix) asked eight fundamental questions on concepts that were covered for ATM 316. The ninth question was a control question on a topic not covered in ATM 316. The students took the initial assessment on the first day of class and the final assessment on the last day of class. The assessments were identical.

The figure below shows the average scores for each question for both the initial and final assessments. There was improvement in the total assessment score and on all individual questions. The students showed improvements in understanding of all major topics in the class: basic vector arithmetic (question 1-2), interpretation of forces (questions 3-5), and balanced flows (questions 6-8). The greatest improvement was in questions 3, 5, 6, and 7, which were more conceptual in nature. Less improvement was seen in more technical questions (1, 2, and 4) that required students to recall specific methods, definitions, or assumptions.



Prior goals from the last assessment were to 1) better emphasize assumptions, 2) provide greater linkage to the material learned in previous synoptic classes, and 3) incorporate more real-world examples in to the material and student presentations.

The first goal continues to be a challenge. Technical details and assumptions are easily lost during the lecture, but are important for students to retain if they are to fully understand the material. I will continue to pose questions to the class to see if they are following the technical details and assumptions and review items that are causing significant confusion. Next time I teach the class, I plan to fold the basic vector arithmetic review into the rest of the lecture material to make connections more apparent and to avoid having large gaps in between when the material is taught to when it is applied.

I feel the second and third goals were met with an increased number of real-word examples and the introduction of analogue rotating tank examples that helped students visualize forces and balanced flows. I will seek to incorporate more of these types of examples in the future where appropriate and involve the students more in these activities in class and as part of their problem sets. In particular, I feel the analogue rotating tank examples contributed significantly to major improvements in conceptual understanding and is a valuable teaching tool in this class and potentially other classes.

While the student presentations were helpful to those presenting, I feel they did not benefit the rest of the class as much as I would have hoped. Hence, I will adapt a system in which all students will be more engaged in the student presentations, perhaps by giving credit for asking questions or by posing questions to the class during and after the presentation to assess whether they understand the material.

Appendix

1) Briefly explain the difference between a dot (inner) product and a cross product of two vectors. You can do this mathematically with an example, by drawing a sketch, and/or by explaining the geometric meaning of the two.
2) Calculate the divergence of the given vector flow field. Is it diverging, converging, or neither? **u** = x**i** + y**j** + 0**k**
3) Hydrostatic balance is expressed as $\frac{\partial p}{\partial z} = -\rho g$. Qualitatively, what forces do the left and right hand side of the equation represent?
4) What assumption(s) from the full vertical momentum equation are used to arrive at hydrostatic balance?
5) Circle the following forces that appear in a rotating frame of reference (like yourself on Earth) but not in a nonrotating/inertial frame of reference (fixed point in outerspace): pressure gradient force, Coriolis force, centripetal force, centrifugal force, gravitational force
6) Describe or sketch the following balanced flows and associated forces: geostrophic, gradient wind, and cyclostrophic.
7) How does the size of the Rossby number relate to the balanced flows in the previous question?
8) Which of the balanced flows in 6) would be a good approximation for the following: the hemispheric jet stream, a midlatitude cyclone, and a tornado?
9) The first law of thermodynamic can be expressed as $\delta Q = c_p \delta T - \frac{1}{\rho}\delta p$, where δQ is the total heat input, c_p is the specific heat of air at constant pressure, δT is the change in temperature, ρ is the density of air, and δp is the change in

pressure. Cross out the term in the first law that vanishes for an adiabatic process?

A ATM 425Y
Spring 2014 Assessment Report
Justin R. Minder, DAES

Methods
Assessment was based on 24 multiple-choice questions that are representative of major topics in the course. These questions are not comprehensive of all the material in the course, but represent most of the major topics. They were chosen to represent material and concepts that the students were likely unfamiliar with before the course, but should have learned by the end of the course. The questions are included in the Appendix to this report.

This was the first time I taught ATM 425. The assessment method was modeled after previous assessments done in ATM 425 by Professor Idone. However, several of the quiz questions were modified to reflect some differences in the focus of the course as I taught it. Formal assessment was not attempted for the oral discourse discussion session of the course.

The students were given the questions as a multiple-choice ungraded assessment quiz on the first day of class to provide baseline data. This quiz was not announced ahead of time and the graded quizzes were not returned to the students. 17 students were enrolled. One student missed the initial assessment quiz, so this student's scores were not used for statistics.

The students encountered the same multiple choice questions distributed through two in-term exams and the final exam (without warning). The two in-term exams contained a subset of the multiple-choice questions focusing on the topics of the exams (radiation & cloud physics). The final exam contained the remaining questions, which spanned the breadth of the course. There may be some biases in scores depending on if the question was asked during the in-term exam (close to when we covered the material) or during the final (as much as 10 weeks after we covered the material).

Scores were recorded for individual students and the group as a whole and compared to quantify student progress.

Summary

The below table summarizes the results of the 2014 assessment for ATM 425.

Question number	1	2	3	4	5	6	7	8	9	10	11	12
Class Mean for ea. question (initial)	13%	38%	44%	75%	50%	88%	75%	31%	56%	63%	63%	31%
Class Mean for ea. question (exam)	41%	76%	82%	76%	71%	88%	94%	82%	76%	71%	94%	88%
change (%-points)	29%	39%	39%	1%	21%	1%	19%	51%	20%	8%	32%	56%

Question number	13	14	15	16	17	18	19	20	21	22	23	24
Class Mean for ea. question (initial)	6%	50%	13%	44%	19%	50%	44%	75%	31%	81%	63%	38%
Class Mean for ea. question (exam)	19%	94%	94%	75%	47%	88%	50%	69%	75%	94%	76%	71%
change (%-points)	13%	44%	81%	31%	28%	38%	6%	-6%	44%	13%	14%	33%

Question number	questions		
Class Mean for ea. question (initial)	47%		
Class Mean for ea. question (exam)	73%		
change (%-points)	26%	Class Standard deviation	12%

Overall, the results were encouraging and support overall approach of the course as it was taught. The mean score before the course was 47%, suggesting that the majority of the course material was not already familiar to the students. The mean change in score after being taught the material was 26 %-points, a strong improvement that demonstrates most students made significant strides. The inter-student standard deviation of improvement was 12 %-points and all students posted improved scores. The worst improvement was 8 %-points (from a student who scored very high on the initial quiz, so would have needed to do very well to post a large improvement). The highest improvement was 46 %-points.

Grades on individual questions point both to limitations in the quiz, but also to room for improvement in the pedagogy. Several questions (6, 7, 20, 22) had very high (>70%) initial scores, indicating that these topics were already familiar to most students, so they can be treated more quickly in future classes. However, three of these questions had the worst improvements, suggesting that the material didn't stick for the few students that were unfamiliar with it. I will rethink how I teach this material in the next iteration of the class.

Two of the questions with particularly low scores (13, 19) included material that was either not fully covered or only covered quickly. Next time this material will be covered in more depth or the assessment questions will be modified to reflect that they are not major foci. Some questions that dealt with difficult but important material posted good improvement in student scores, but still had substantial numbers of students missing them (1,17,2). I will look for ways to teach these topics more clearly next time and will focus on emphasizing these topics repeatedly in the course.

A very similar assessment quiz will be used next time I teach the course so trends can be identified. A handful of questions may be changed to improve clarity or better reflect the subject matter focus of the course as it is taught.

Appendix

Assessment Quiz
ATM 425
Spring 2014

Circle the single best choice for each question.
NOTE: this is for assessment purposes only and will not affect your grade!

1. The **radiance** (intensity) at a given point is defined to be:
    a. The radiant energy flux across all wavelengths
    b. The radiant energy flux per unit area across all wavelengths
    c. The radiant energy flux per unit area per unit solid angle across all wavelengths
    d. None of the above
2. A **blackbody** ...
    a. Emits radiation depending upon it temperature as described by the Planck Function.
    b. Completely absorbs all radiation incident upon it.
    c. Emits the maximum radiation possible considering its temperature
    d. All of the above
3. According to the **Stephan-Boltzmann Law**, if a blackbody increases its temperature by a factor of two, its total emitted flux density will increase by a factor of…
    a. 2
    b. 4
    c. 8
    d. 16
4. On a cloud free day, **solar radiation** passing through the atmosphere…
    a. Undergoes strong absorption that is independent of wavelength
    b. Undergoes zero absorption until it reaches the surface
    c. Undergoes some absorption that depends on wavelength
    d. None of the above
5. The presence of an **atmosphere** increases the **radiative equilibrium temperature** at the surface because…
    a. The surface responds to the atmospheric pressure by warming, increasing radiative emission
    b. The atmosphere absorbs terrestrial radiation and re-radiates it downwards, so a higher surface temperature is required to attain radiative balance
    c. The atmosphere absorbs solar radiation and transports it downwards to the surface by conduction
    d. All of the above
6. Objects viewed on the **horizon**…
    a. Are viewed through a much longer optical path length than overhead objects
    b. Can appear at a different zenith angle than they are
    c. Sometimes appear pink or reddish due to preferential scattering of the shorter wavelengths
    d. All of the above
7. A **rainbow** is an optical phenomena due primarily to…
    a. Reflection and interference
    b. Diffraction and interference
    c. Refraction and reflection
    d. None of the above
8. Integrating the **solid angle** over a hemisphere yields a value of:
    a. π
    b. 2π
    c. 4π
    d. 1
9. The **optical depth** of a layer of atmosphere…

    a. Depends on the absorption properties of the gasses and particles contained in the layer
    b. Decreases with increasing transmissivity
    c. Depends on the physical depth of the layer
    d. All of the above
10. The **albedo** of a portion of the Earth's surface DOES NOT depend directly on
    a. Temperature
    b. The incidence angle of the radiation considered
    c. The wave length of the radiation considered
    d. The type and amount of surface vegetation
11. The **type of scattering / reflection** (e.g., Raleigh vs. Mie vs. geometric optics) that radiation experiences as it passes through the atmosphere is determined primarily by:
    a. The wavelength of radiation and diameter of the scatterers
    b. The wavelength of radiation and air pressure
    c. The intensity of radiation and number of the scatterers
    d. The intensity of radiation and air temperature
12. Generally, the **concentration** (number per unit volume) of **aerosol particles** in the troposphere…
    a. Decreases with increasing particle diameter
    b. Increases with increasing particle diameter
    c. Is essentially constant with increasing particle diameter
    d. Is largest near 1 μm particle diameter, and decreases for larger and smaller diameters
13. A **pure water droplet** will…
    a. Be in a stable equilibrium with its environment if its surface vapor pressure equals the ambient vapor pressure
    b. Have an elevated vapor pressure relative to a flat pure water surface at the same temperature.
    c. Always grow if the relative humidity is greater than 100%
    d. All of the above
14. A **solution drop** will become **activated** if…
    a. The ambient saturation ratio, $S=e/e_s(T)$, falls below 1.0
    b. The ambient saturation ratio rises above 1.0
    c. The ambient saturation ratio exceeds the critical value (Köhler curve peak) for the droplet
    d. Any water vapor condenses onto it
15. **Diffusional** (condensation) **growth of a cloud droplets** does not adequately explain the rapidity of rain onset in warm clouds because…
    a. Diffusional growth is inversely proportional to droplet radius
    b. Super-saturations are too large in clouds for this mechanism to be effective
    c. Diffusion cannot take place in the presence of latent heat release
    d. All of the above
16. Efficient droplet growth by **collision & coalescence** requires a broad range of droplet sizes, including larger drops (>20 μm). This broadening of the droplet distribution can be aided by…
    a. Large cloud condensation nuclei (such as sea salt) producing large drops upon activation
    b. In-cloud turbulence, which affects droplet evaporation and diffusional growth on small-scales
    c. The stochastic nature of the collision & coalescence process
    d. All of the above
17. Comparisons of warm clouds with similar liquid water contents and environmental conditions reveals that, **compared to continental clouds, maritime clouds** have
    a. fewer cloud droplets, are more likely to rain, and have lower albedos, due to lower CCN concentrations

b. <u>more cloud droplets</u>, are <u>more likely to rain</u>, and have <u>lower albedos</u>, due to <u>lower CCN</u> concentrations
c. <u>fewer cloud droplets</u>, are <u>less likely to rain</u>, and have <u>higher albedos</u>, due to <u>lower CCN</u> concentrations
d. <u>fewer cloud droplets</u>, are <u>more likely to rain</u>, and have <u>lower albedos</u>, due to <u>higher CCN</u> concentrations

18. **Clouds with temperatures below 0°C often do not contain ice** because
    a. The number of available CCN is too low
    b. The layer of cloud below 0°C must attain a minimum depth of 2 km.
    c. The number of super-cooled droplets is too few
    d. The number of ice nuclei active at temperatures of a few degrees below 0°C are deficient
19. The terminal **fall speed for ice crystals** …
    a. Depend on the atmospheric pressure
    b. Depend on the degree of riming
    c. Depend very little on crystal size beyond 1mm for pristine ice
    d. All of the above
20. **Diffusional growth of ice** in a liquid-water-saturated environment
    a. Is maximized near -30°C, because cold temperatures are the most important factor in the snow growth equation
    b. Is maximized near -14°C, since this is near where the difference between the saturation vapor pressure over ice and water maximizes
    c. Is always more important than growth by riming
    d. Is only effective for "plate-like" crystal habits
21. **Cloud liquid water content** (LWC) is generally **less than the adiabatic LWC** in young clouds because
    a. Precipitation has fallen from the cloud, removing liquid
    b. Entrainment occurs
    c. Latent heat release evaporates water
    d. None of the above
22. **Radar reflectivity factor**, expressed as *dBZ*,
    a. Always decreases away from a radar
    b. Is a directly related to rainfall rate
    c. Is meaningless in snow
    d. Is related to 10 $\log_{10}$ () of the power received by the radar
23. The **Doppler velocity** measured by a **precipitation radar pointing vertically** into a rain cloud relates most closely to
    a. The vertical velocity of the air
    b. The average vertical motion of the raindrops, but strongly weighted towards the larger drops
    c. The average vertical motion of the raindrops, but strongly weighted towards the smaller drops
    d. The average vertical motion of the raindrops, weighting all drop sizes equally
24. **Radar differential reflectivity** (Z_{DR})
    a. Compares power received at different frequencies to reveal information about attenuation
    b. Compares power returned from different azimuths to reveal spatial variations
    c. Compares power returned with horizontal and vertical polarizations to reveal information about hydrometeor shape
    d. Compares power returned from successive pulses to reveal time evolution

ENV/GEO 250 Sustainable Development: Energy and Resources
Outcome Assessment: Spring 2014

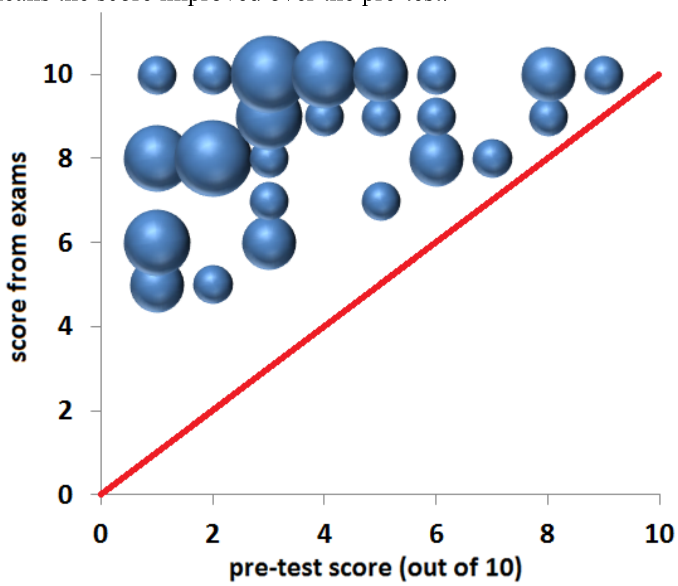
Robert G. Keesee, Associate Professor

A "pre-test" was administered during the first class meeting of ENV/GEO 250 on January 22, 2014. The test consisted of ten multiple choice questions (each with five options for response) and a survey question. The pretest is appended below. Questions #9 and #10 required quantitative calculations. Forty nine students took the pretest with an average score of 3.45 correct and mean of 3.09 out of 10. Random chance would be expected to be 2 correct out of 10. Students were not alerted to the fact that these questions would be used in exams later in the semester. The general outcome of the pretest was shared with the class at the next class meeting, but the answers to the questions were not shared with the class.

Of the 49 students taking the pre-test, 43 eventually remained in the class roster and they all took the three exams during the semester. Another 12 students who did not take the pretest were in the final class roster.

The ten questions appeared on subsequent exams. Pretest questions #1, #2, #3 and #9 were on Exam #1 administered on March 5th. Questions #3 (repeated), #4, #5, and #6 appeared on Exam #2 administered on April 16th. Questions #1 (repeated), #7, #8 and #10 appeared on Exam #3 administered on May 14th. All three exams consisted of 30 multiple choice questions (each with five options) and two brief essay questions. The exams were open book, open note and students may use their laptops. Students had approximately 60 minutes to complete Exams #1 and #2 and were given two hours for Exams #3 although the median time taken was about 70 minutes.

The following assessment has been limited to the 43 students who took the pre-test and all three exams. Overall, this cohort averaged 3.58 correct answers on the pre-test and 8.37 correct answers on the exams. The bubble chart below correlates pretest score with exam score on these ten questions for each student. The chart depicts only the last assessments for Questions #1 and #3. The size of the bubble indicates the number of students falling at that data point (from 1 to 4 for the largest). Bubbles above the red line means the score improved over the pre-test.



Discussion of specific pre-test questions: The Table below lists the number of students (and percentages) of students responding correctly to each question.

Question	Pretest	Exam	
#1	14 (33%)	40 (93%)	[32 (74%) on Exam #1]
#2	26 (60%)	40 (93%)	
#3	13 (30%)	37 (86%)	[28 (65%) on Exam #1]
#4	8 (19%)	31 (72%)	
#5	11 (26%)	37 (86%)	

#6	15 (35%)	33 (77%)
#7	16 (37%)	37 (86%)
#8	16 (37%)	40 (93%)
#9	16 (37%)	29 (67%)
#10	19 (44%)	36 (84%)

Of the eight qualitative questions, improvement was substantial. As a central theme of the course, Question #1 was asked on Exam #1 and Exam #3. On Exam #1, twelve of 14 students answering correctly on the pretest also gave the correct answer on Exam #2 in addition to 20 others who missed the question on the pretest. On Exam #3, only three students missed the question, two of whom never correctly answered the question and the other only answered correctly on the pretest. For Question #3, an overview of indirect solar energy was given before Exam #1 and then we focused on coal. Hydropower and wind were discussed more explicitly before Exam #2. The pattern of answers is interesting. Eleven students consistently answered the question correctly, another 14 students answered the question correctly on both exams, and another 11 finally answered the question correctly on the second exam. Two students never got the correct answer and another only on the pretest, in spite of going over the answers to the first exam in class. Oddly another three got the correct answer on the first exam but missed it on the second exam. Some of that pattern may to attributable to random guessing.

The quantitative question #9 showed the most modest improvement possibly due to lack of time on the exam for some students to work out the problem. Question #10 was on Exam #3 for which most students finished with time remaining, so time was not an issue. Question #10 is similar as in the previous two years (dealing with electric cars instead of electric light bulbs) but this class did better on the question in the pretest and overall showed much better improvement. In general this class did notably better (at least 5 percentage points) on Exams #2 and #3 than the previous two classes for which this assessment has been done. Many of the ENV majors were also in my ATM210 class in the fall semester, and this cohort also did notably better in that class compared to recent years.

Twenty-eight of the 55 students in the class were ENV majors. I was surprised to find that the pretest average among 27 ENV majors was 3.38 while the average was actually higher at 3.88 among 16 non-majors. However, the exam average for these questions was 8.73 for the ENV majors and just 7.82 for the non-majors. The ENV majors started lower but ended up higher.

Another interesting point is the disparity in outcomes between students who were present for the pre-test and those who were not. Their course average was 70.5 and 69.6, respectively, compared to 76.1 and 74.3 for the 43 students who did take the pre-test. The one ENV major who missed the pre-test ended up near the bottom of the class. The Table below shows the grade distribution for those who took the pre-test and those who didn't.

Grade distribution for those who did and did not take pre-test:

Grade	Pre-test (43)	No pre-test (12)
A	14	0
A-	3	1
B+	7	4
B	6	2
B-	7	1
C+	1	2
C	2	1
C-	1	1
S	1	0
U	1	0

ENV/GEO 250 PRE-TEST

name____________________

Spring 2014 (please print legibly)

This is an ungraded exercise to assess what you and the class already knows. Please enter your answers for questions #1 thru #10 on the bubble sheet along with your name and student id. Please enter your answer to question #11 in the space provided on the back of this page.

1. What is the best meaning of "sustainable development"?

a. Increasing production at the lowest possible cost to meet demand.
b. Meeting current needs without compromising the ability to meet needs in the future.
c. Promoting technologies that more efficiently utilize fossil fuels and other natural resources.
d. Formulating fiscal policies that maintain continuous economic growth.
e. All of the above are equally good definitions of the term "sustainable development".

2. Emission of carbon dioxide from human activity (anthropogenic emissions) is a concern because:

a. carbon dioxide destroys ozone
b. carbon dioxide is highly toxic to plants and animals
c. it can account for the observed increase in atmospheric carbon dioxide, which is a greenhouse gas
d. anthropogenic emissions are far greater than natural emissions
e. all of the above

3. Which is a form of indirect solar energy?

a. Coal
b. Hydropower
c. Wind power
d. All of the above
e. None of the above

4. The amount of useful energy from a power plant employing cogeneration is increased because:

a. the efficiency for conversion of thermal energy into electricity is improved
b. heat that otherwise would be wasted is distributed as hot water to consumers
c. several power plants cooperating together are better than one going it alone
d. oil burns cleaner than coal
e. all of the above

5. Which statement about nuclear power is ***false***?

a. A new unused fuel rod is highly radioactive and must be manufactured and delivered under strict safety rules.
b. The fuel needed to power a 1000 MW nuclear power plant for one year can fit on a single truck whereas a 1000 MW coal-fired power plant would need a trainload of coal every day.
c. Electricity generation by nuclear power plants produces a crucial ingredient needed for making nuclear weapons.
d. A nuclear power plant was constructed in Shoreham, New York but largely because of public resistance never produced any commercial electricity.
e. After a hiatus of nearly three decades in the U.S., the Obama administration offered government loan guarantees to encourage the construction of new nuclear power plants.

6. Hydroelectric power is considered a renewable source of energy because:
a. nature provides the energy source (falling water) for free
b. the energy source is inexhaustible and limitless
c. nature replenishes the energy source on time scales and in quantities useful for human activity
d. no pollution or other environmental problems result from exploiting the energy source
e. all of the above

7. In the push to build electric cars, a sobering fact confronts automakers and governments seeking to lower their reliance on foreign oil. What is that fact?
a. Most electricity is generated by burning oil.
b. Consumers will avoid buying electric vehicles for fear of getting electrocuted in minor auto accidents.
c. The increase in electricity demand can only be met by building more nuclear power plants, which would increase the chances of accidents such as at Fukushima and Chernobyl.
d. The reserves for cadmium, used in the batteries, will last only ten years if 20% of vehicles produced are electric.
e. The reserves for lithium, the mineral used in the batteries, are mostly located in just a few nations.

8. An example of passive solar design for home heating is:
a. a geothermal heat pump
b. a solar thermal power plant that produces electricity for electrical heating
c. a solar collector on the roof that heats and circulates water through the house in pipes
d. a south facing window that allows solar heating of the interior of the house in winter
e. all of the above

9. Assume a person has a daily intake of 2500 (food) Calories. If that person could find nourishment by eating coal (Do not try this at home; coal is not digestible), how much coal would that person need to eat daily? One ton (2000 lbs) of coal has an energy content of 25 million Btu and 1 (food) Calorie is the same as 4 Btu.

a. 2.0 oz (= one-eighth of a pound)
b. 0.8 lbs
c. 1.25 lbs
d. 2.5 lbs
e. 8.0 lbs

10. Suppose a plug-in all electric vehicle gets 3 miles/kWh and costs $28,000 while a similar internal combustion vehicle gets 40 mpg and costs $25,000. How long will it take to recover the extra $3,000 cost of the electric vehicle through the savings on energy costs? Assume the vehicle is driven 10,000 miles per year, gasoline costs $4.00 per gallon and electricity costs $0.15 per kWh.

a. one year
b. two years
c. three years
d. six years
e. nine years

11. What are ***three*** **environmental** issues related to the production and/or use of energy that you consider important? Please be as specific as possible

A.

B.

C.

ATM/ENV 315 Assessment – Fall 2013

Professor Roundy devised a pilot assessment approach for ATM 315 for fall 2013 that was intended to help him develop ideas for a more concrete assessment approach in upcoming years. The primary objectives of ATM315 are to provide the students with hands-on experience in analyzing atmospheric and environmental data, and to use the analysis to draw conclusions about the natural systems from which the data are extracted. Students apply basic statistics and modern analysis techniques that have become popular in recent decades in climate science. Students are expected to analyze real datasets in class and on exams. Professor Roundy's first attempt at an assessment approach focused on application of the technical approaches themselves, instead of on interpretation, because such assessment is easier to do objectively.

As a first attempt at an assessment process, Professor Roundy gave the students a dataset on the first day of class and asked them to characterize it with the best statistics that they knew. Most students provided a list of basic statistics for that dataset, including mean, median, range, maximum, minimum, among others, without much interpretation about the physical interpretations of these statistics. This first dataset was relatively simple, including only a single time series of temperature data at a particular geographical location.

At the end of the term, Professor Roundy gave the same students a gridded dataset of temperature at the surface of the earth on the equator around the globe. He asked them to characterize the dataset without telling them its identity. The invitation was purposefully open ended. His intent was to catalog the students' assessment of the dataset, including types of statistics in three bins, including basic, intermediate, and advanced (advanced statistics included empirical orthogonal function and Fourier analysis, among others). The students on entering the course provided only basic statistics. All but two students at the end of the term provided intermediate and advanced statistics. All students correctly identified the dataset as sea surface temperature on the equator.

A major objective of the course was to help the students learn to interpret physically the results of their analysis. Although Professor Roundy did not ask the students directly to interpret their analysis physically in this exercise, all but two students spent most of the allotted time analyzing the characteristics of El Nino and La Nina events observed throughout the dataset in the posttest, along with seasonal changes in land-sea temperature contrast. Although consistent with the objectives of the course, Professor Roundy did not plan an objective assessment of fulfillment of this objective. Since the students spent so much time thinking about the implications of their statistical results, they did not have time to accomplish as many types of analysis as he originally anticipated.

This outcome was consistent with the goals of the course, but was incompatible with the planned assessment approach since it was based on the measuring the quantity of accurate student responses.

To make the assessment approach more effective in future years, Professor Roundy plans to provide students with more time for the post test, with the first half focused on producing analysis products and the second part focused on interpretation. He is considering making the posttest equivalent to a final exam in future years. Based on comparison between pretest and posttest results in 2013, the pre test will not be made part of the assessment report in future years, but instead will be used to help identify what the students know, to help frame the first few class practicums.

ENV490: MAJOR TOPICS IN ENVIRONMENTAL SCIENCE - STUDENT ASSESSMENT

Portfolio and projects

The course ENV 490, Major Topics in Environmental Science, is taught every spring semester. It is a capstone course for all majors in Environmental Science, which they are required to take in their senior year, although I always have a few juniors in the class as well. Every year I track the progress of my students in this course, by asking them the same set of questions. Using the same questionnaire allows me to compare student learning from one year to the next. The students are asked the same questions at the beginning and then again at the end of the semester to assess progress regarding their understanding of climate change issues (see section on "Embedded questions" below).

In addition students have to work independently on a research topic of their choice (but related to climate change) throughout the semester. The students first need to write a short (3-5 pages) proposal, which must include an outline and strategy for their research project. I review and approve these proposals to make sure that students are on track and work on a project that is suited for this course. During the last 3 weeks of the semester all students give a 10-12 minute oral presentation of their research in front of the rest of the class, similar to the setting and time constraints they would encounter when giving a presentation at a scientific meeting. I have noticed that students are often nervous and uncomfortable about this component, but I view it as an important aspect of their undergraduate education to occasionally step outside their comfort zone. The students have time to discuss and comment on each presentation and exchange ideas and different viewpoints. In addition all students receive a written feedback from me, explaining what was excellent in their presentation and in which areas they could still improve.

Embedded questions

The assessment with embedded questions was done exactly the same way as in previous years to facilitate the comparison. The students were given a set of nine statements (listed below) at the beginning and then again toward the end of the semester. The nine statements are commonly heard misconceptions about anthropogenic climate change, often falsely portrayed in the mainstream media. The students were asked to respond to these statements by first indicating whether they agreed with the statement or not. They were told to write 'don't know' if they were unsure, rather than to guess. Then they were asked to explain the reasons for their answer. In each instance, the students had 30 minutes to complete the questionnaire. In both instances students were aware that there was no grade associated with this quiz and that they could fill it out anonymously. Both times the questions were given to the students without warning and I did not tell the students after the first quiz that they would have to answer the same set of questions a second time.

1) We cannot predict weather beyond a week or so; therefore it's impossible to predict how climate will change many years or decades into the future.

2) The current warming is a natural "rebound from the Little Ice Age" and should not be blamed on human actions.

3) Increased CO_2 concentrations in the atmosphere will stimulate plant growth, thereby increase the CO_2 sink and thus take care of the problem.

4) The warming of the surface air temperatures is due to urban warming and not representative of global climate change.

5) The human input of CO_2 to the atmosphere each year is only about 4% of the natural biological flux, so we need not worry about it.

6) Solar variations have caused the recent warming, so the effect of greenhouse gases must be small.

7) Water vapor is a more important greenhouse gas than carbon dioxide (CO_2).

8) Even scientists do not agree whether global warming is real or not and whether it is caused by humans or due to natural climate variability.

9) Given all these uncertainties we need to wait until predictions become more reliable before we take any action to control and prepare for climate change.

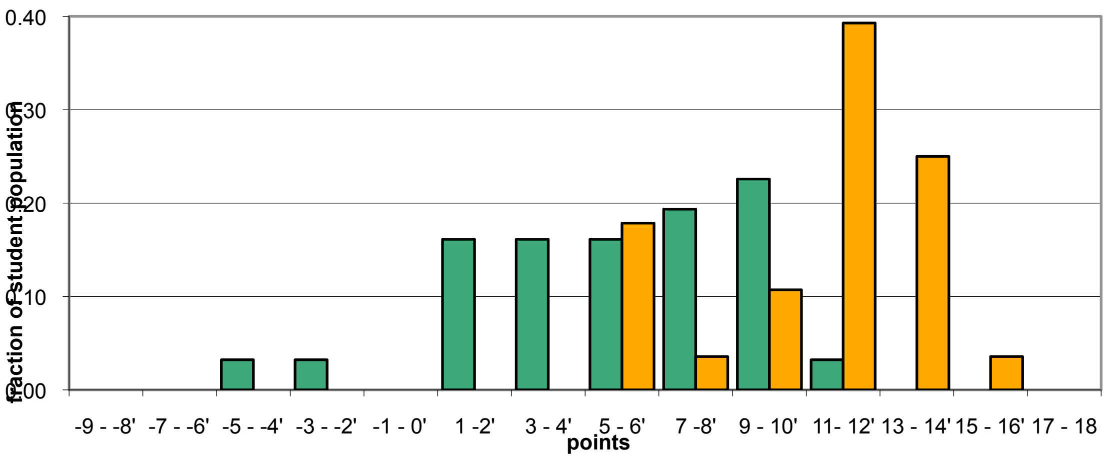
The answers were graded as follows:

correct answer and correct reasoning:	2 points
correct answer but no or false reasoning:	1 point
don't know:	0 points
false answer and false or no reasoning:	-1 point

This yields a possible range from -9 to +18, with negative values indicating a misunderstanding and false preconceived notions regarding causes and consequences of climate change, 0 indicating basically no knowledge and positive values some or significant understanding of the subject.

2014 Results

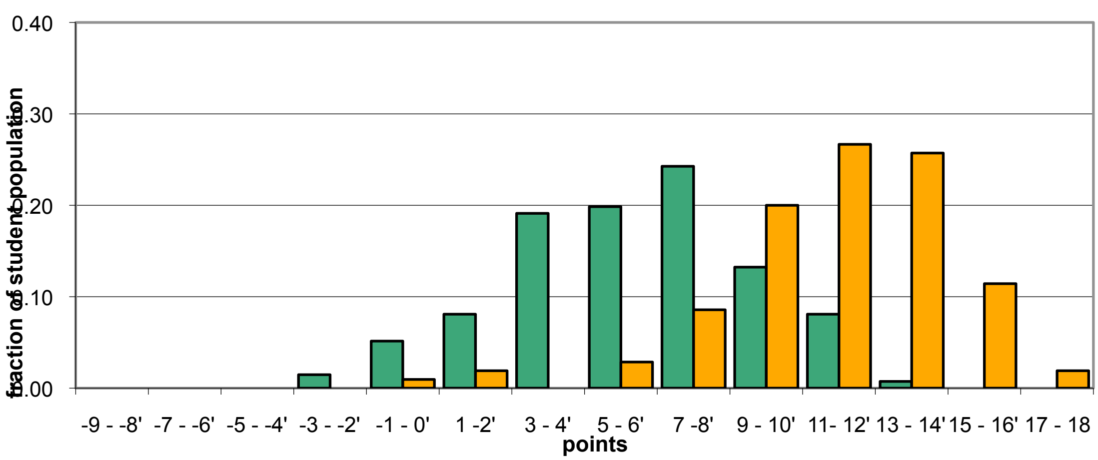
Summary results of the test are indicated in Table and Graphics form below. Note that 31 students answered Test 1 (administered on 01/23/2014, shown in green) and 28 answered Test 2 (administered on 04/17/2014, shown in orange). In every year so far, the average number of points was higher in the 2nd test, significant at $p < 0.001$ (two tailed t-test), as was the median value obtained. The year 2014 is no exception in this regard.



	Test 1 (1/23/14)	Test 2 (4/17/14)
point average	5.35	10.79
median	6	12
std.dev	3.85	2.85

Comparison with the previous five years

It is instructive to compare the results with the previous five assessments in 2009-2013. The results for the previous five years combined are shown below. The general improvement from beginning to the end of the semester was similar in 2009-2013. The average score, however, was somewhat lower this year, both at the beginning (5.35 vs. 5.89 in previous years) and at the end of the semester (10.79 vs. 11.34 in previous years), suggesting a slightly weaker class of 2014. The most remarkable result this year, however, was the drastic reduction in spread (the standard deviation dropped from 3.85 at the beginning of the semester to 2.85 at the end), suggesting that the weakest students were able to catch up and perform much better at the end of the semester. Indeed the spread between the strongest and the weakest students was much lower at the end of the semester in 2014 (standard deviation of 2.85), when compared to previous years (standard deviation of 3.16).



Exit interview: Atmospheric Science B.S.

Members of the graduating Atmospheric Science B.S. class were interviewed by Ross Lazear (Instructional Support Specialist, DAES) on May 9, 2014 in order to learn which aspects of the ATM B.S. curriculum worked for them, and which could be improved. In total, 11 students (approximately three quarters of the graduating class) attended the exit interview.

Suggestions:
The students felt that Physical Meteorology (AATM 425) is taken too late in the curriculum, and it would make sense to take it either concurrent with (or closer to) Thermodynamics (AATM 320). In addition, the students found the AATM 425 discussion section with its emphasis on giving an oral presentation very useful. Thus, learning these skills earlier in one's undergraduate years would allow students to use those skills in later courses.

It was suggested that a required introduction to scientific programming course (e.g., Python) be taught early on in the curriculum. The faculty is currently discussing making this addition, as such a skill is widely used in advanced coursework, and in many aspects of atmospheric science.

Apropos of the previous comment, students also would like to learn the fundamentals of scientific writing earlier on in the curriculum, so that they can also apply those skills to research papers in advanced coursework. This has been discussed extensively among the faculty due to changes in the University's general education requirements.

The students felt as if scientific writing and programming are very important skills, but failed to see the importance of taking Physics III (APHY 240), and thus recommended that these two skills become small courses that replace APHY 240 in the curriculum. We will revisit this, as we have been told by the Physics Department that APHY 240 has been made more appropriate for ATM B.S. majors (i.e., more thermodynamics and less quantum theory).

The students nearly all felt that their senior year had too many long-term projects required, which culminated in periods where they couldn't possibly put in the requisite amount of time on projects, and thus were dissatisfied with their own work.

The students desire more operational courses---courses that have more direct applications to careers in atmospheric science.

It would be beneficial to have some popular electives that are offered every other year (e.g., AATM 421, Tropical Meteorology) offered every year instead.

The students suggested adding an advanced forecasting elective (one credit) to build upon skills learned in AATM 211 and AATM 311.

It was noted that forecasting begins to feel more like busy work by senior year, because they are required to forecast in AATM 400 and 401, but don't discuss their forecasts as they did in AATM 211 and 311.

It was mentioned by one student that they would have liked to have had upper-classmen incorporated in lower-level classes, such as through the peer mentorship program.

The ATM Honors program requires that students take a coherent core of 300+-level courses outside the department, but this prevented some Honors students from taking departmental electives they may have wanted to take.

Positives:
The students liked that the curriculum is fairly customizable; they can take courses in atmospheric science that cater to their specific interests junior and senior year.

Faculty and staff in DAES are extremely welcoming, and the department feels like "one big family."

Professors are so enthusiastic about the material they teach, that they motivate the students to succeed.

Additionally, the faculty genuinely wants the students to succeed.

The students reported that they felt as if being an atmospheric science major at UAlbany felt like a completely different environment than that of other majors on campus. Associated with this, they felt that it was unusual but tremendous that they were able to visit their professors at any time, not just during their office hours.

Regarding the curriculum, the students felt as if it was a real positive to have more qualitative, conceptual courses taken before more quantitative courses, because it enabled them to understand the quantitative material more.

Feedback from seniors on the Environmental Science B.S. degree

Every year at the end of the spring semester I seek feedback from seniors attending my capstone course ENV-490 (Major Topics in Environmental Science) regarding our Environmental Science B.S. curriculum.

Similar to last year I again asked my students to provide answers and feedback to the following four questions:

1) Why did you choose the Environmental Science B.S. degree?
2) What did you like about our program?
3) What did you not like about our program?
4) Do you have any specific concerns or recommendations how the program could be improved?

I handed the students the questions in writing and asked them to respond in writing during class time. 28 students filled out and handed in the survey (3 were absent). A summary of their answers to the four questions is provided below.

1) Why did you choose the Environmental Science B.S. degree?
As in most years, the common response was a general passion about in the environment, concerns about environmental issues, and a positive outlook on jobs. Several students also mentioned that they chose Environmental Sciences as a result of exposure to the subject in High School or in Gen Ed classes.
- *'It's a fast growing industry with great opportunity…'*
-*'It's a growing job field…'*
-*'I thought a B.S. in Environmental Science would be a relevant degree in todays world…'*
- *'I had taken a sustainability course in High School and saw the potential for a career opportunity...'*
- *'I enjoyed intro to ENV which I took as Gen Ed course in my freshmen year …'*
- *'My early environmental classes grabbed my attention …'*
- *'I was very interested in how the climate system impacts the biosphere…'*
- *'I was interested in Environmental Science topics such as Global Warming and renewable energy…'*
- *'After taking AP Environmental Science in High School I realized I loved the subject…'*
- *'Because I like science and think our earth is very important…'*
- *'I care about nature and like understanding it…'*
- *'As far as making a difference in the world I could not think of a more pivotal education…'*
- *'I have always been very interested in the future of our environment…'*
- *'Interested in Earth science and care about the environment…'*
- *'Because I wanted to make an impact in the world we live in…'*
- *'I do have a passion for the environment…'*
- *'I want to be able to make a difference for our children and the earth…'*
- *'I find the science of the environment fascinating…'*
- *'I decided Environmental science was a field where I could make a difference…'*
- *'I have a passion for being outdoors…'*
-*'Because I want to get into environmental policy…'*
- *'Because I have always had a love for this planet…'*
-*'Always has been a personal passion…'*

2) What did you like about our program?

The main comment was that students liked the quality of the teaching, the diversity of the courses offered and the possibility to specialize in a specific concentration.

- *'The teachers had plenty to offer and were easy to talk to…'*
- *'The staff was very well educated and helpful…'*
- *'I enjoyed the enthusiasm of the professors and how up-to-date the classes were…'*
- *'As one climbs through the ranks of classes the passion of the professors toward their subject climbs as well…'*
- *'Great guest speakers and professors…'*
- *'The professors are very passionate about their studies and helping us learn…'*
- *'The professors cared about us learning…'*
- *'Professors are clearly committed to their field of study…'*
- *'The classes were instructed by experts…'*
- *'I liked that all my professors were passionate…'*
- *'I liked the variety of courses and the ability to pick a concentration …'*
- *'I like how you have concentrations. I have an interest in biology and being able to take Bio courses was nice…'*
- *'I liked the different concentrations that one could focus on…'*
- *'Classes covered a variety of topics…'*
- *'The depth of each course in the subject area…'*
- *'The classes offered were interesting…'*
- *'Very in-depth, focused and comprehensive. There was almost nothing that wasn't covered over the 4 years…'*
- *'I liked the broad spectrum of classes required. It made me take courses I would not have normally taken and I'm glad….'*
- *'I liked that we discussed current events…'*
- *'Few colleges offer an ENV. Sci. Program. Most are ENV. Studies. It's a good program if you are interested in scientific issues.*
- *'I was able to study abroad and graduate on time…'*

3) What did you not like about our program?

The main criticism was the overlap between the existing climate courses, the lack of fieldwork, labs and hands-on applications and that most ENV courses are atmosphere-focused. Some students also voiced their discontent over the heavy math requirements of the degree, the lack of a coherent structure in their curriculum and the strong emphasis on atmospheric science in the Department.

- *'Constant change of degree audit…'*
- *'Geology program was dropped half way through my major…'*
- *'Some prerequisite/co-requisite issues led to getting introductory material after in-depth material…'*
- *'Equivalency credits elsewhere are lacking…'*
- *'There should be different classes in the Bio concentration. Most of the classes seemed irrelevant…'*
- *'I was getting a lot of bad advice from my advisor on classes to focus on…*
- *' Some courses seemed repetitive…*
- *'A lot of courses teach about the same topic…'*
- *'Some classes were very redundant'*
- *'Lectures were too repetitive…'*
- *'A lot of the climate related courses had overlap…'*
- *'Some classes often overlap material…'*
- *'There was no field/lab work…'*
- *'Lack of more variety and hands-on courses…'*
- *'Little opportunity for field work experience…'*
- *I wish we did more field work…'*
- *'I would have loved to have research opportunities…'*

-*'I wish we could do more hands-on studies – maybe a lab where you can go outside and take tests…'*
-*'I did not like that until senior year it felt like all concentrations were scattered. It didn't feel like one program, just a bunch of pre-recs and limited environmental courses…'*
- *'I dislike the heavy focus on Atmospheric majors rather than Environmental Science majors…'*
- *'Not enough professors in the dept. working on environmental issues. Most Professors are working on the atmosphere. I am interested in geochemistry. This was not an option for research at this university.*
- *'There were not a lot of courses outside of atmospheric sciences. I wish there were a larger variety…'*
-*'More math than I desired in this program…'*
- *'Lots and lots and lots of math…'*

4) Do you have any specific concerns or recommendations how the program could be improved?

Recommendations that were voiced are similar to last year and focus around the apparent lack of labs and fieldwork. Several students also mentioned a lack of emphasis on sustainability, renewable energy and policy or inadequate course work in the Bio concentration. A couple of students also complained about poor advisement.

- *'More practical courses in the field related to today's careers…'*
- *'Field work and activities that are hands-on…'*
- *'I would like the department to have more labs…'*
- *'More field work and research implemented into the curriculum…'*
- *'More integration of environmental technology and business aspects…'*
- *'More opportunities for laboratory research…'*
- *'I would like to see a class purely on renewable energy, its infrastructure policy and implementation; you could even make a whole concentration on renewable energy…'*
- *'Get a Geology concentration…'*
- *'I would hope to see policy incorporated in to the requirements…'*
- *'The Climate concentration should have more options for classes in sustainability…'*
- *'Make sustainable minor a major…'*
- *'The Bio concentrations could be more environmentally and less medically focused…'*
- *'Better elective courses, in the Bio concentration specifically…'*
- *'Stop changing it…'*
- *'Less importance on tests and more on our writing…'*
- *'More creative thinking assignments…'*
- *'More flexibility within concentrations…'*
- *'Improve advisor knowledge on course and semester structure…'*
- *'Advisement was shotty at times…'*

Atmospheric Science B.S. graduates – one year after graduation

Name	Graduation date	Employed in field?	Where employed?
Adamchick, Eric	May-13	Y	Graduate program in atmospheric science (PhD track) - UAlbany DAES
Basile, Samantha	May-13	Y	Graduate program in applied climate - University of Michigan
Bennett, Brittany	May-13	Y	Student at New School of Radio and Television - Albany, N.Y.
Diamond, Greg	May-13	Y	Graphics meteorologist at The Weather Channel - Atlanta, GA
Eidelman, Rebecca	May-13	Y	Beginning Master of Arts in Teaching at the Museum of Natural History New York, N.Y.

Environmental Science B.S. graduates – one year after graduation

Name	Graduation date	Concentration	Employed in field?	Where employed?
Antidormi, Michael	May-13	Biology	Y	Hydrologic Technician with at USGS - Troy, N.Y.
Bond, Brian	May-13	Biology	-	
Boyle, Sean	May-13	Biology	-	
Brock, John	May-13	Biology	Y	Planning Intern at the New York City Department of Environmental Protection New York, N.Y.
Canale, Philip	Dec-13	Geography	-	
Carroll, Ashley	May-13	Biology	N	Waitress - Longmont, CO
Corey, Sam	May-13	Biology	-	
Covey, Michael	Dec-12	Geology	Y	Manager and Sales Rep. at Organica (garden supply) - Albany, N.Y.
Del Gaudio, Cathy	May-13	Biology	-	
Donaghy, Adam	May-13	Biology	-	
Donovan, Michael	May-13	Geography	-	
Ellis, Stephen	May-13	Geography	-	
Fuller, Stephen	May-13	Geography	N	Employee at Center for Disability Services
Gaffey, Clare	Aug-12	Biology	Y	Training Coordinator at Century Solar Supply - Albany, N.Y.
Gilmore, Jalisa	May-13	Biology	-	
Holland, Lauren	Dec-13	Biology	-	
Hussey, Kyle	May-13	Biology	-	
Larkin, Jenna	May-13	Biology	Y	Graduate school in Public Affairs and Environmental Science - Indiana University, Bloomginton, IN

Lennon, Ryan	Dec-12	Atmos. Sci.	Y	Horticulture Inspector with USDA - Queens, N.Y.
Litras, Nicole	May-13	Biology	N	Customer Service Associate at Wales Darby, Inc. - Islandia, N.Y.
Machiz, Isaiah	May-13	Climate	N	Real estate intern at SHVO - New York, N.Y.
Mallon, Danielle	May-13	Atmos. Sci.	Y	Beginning graduate school in Air Quality at University of California - Davis
McCulley, Melissa	May-13	Biology	-	
Moran, Elizabeth	May-13	Geology	Y	Water and Natural Resources Associate at Environmental Advocates of New York - Albany, N.Y.
Omorodion, Osaretin	May-13	Biology	-	
Puglia, John	Dec-12	Atmos. Sci.	N	Real estate agent - Albany, N.Y.
Santos, Nicolas	May-13	Geology	Y	Graduate student in Sustainable Energy Systems at SUNY Cortland - Cortland, N.Y.
Stropoli, Primo	May-13	Geography	-	
Tran, Michelle	May-13	Biology	Y	Graduate student in Environmental Management at Duke University - Durham, N.C.
Vandeusen, Samantha	Dec-12	Geography	-	
Wilkens, Danielle	Dec-12	Geography	-	
Young, Samantha	May-13	Geography	Y	Graduate student in Urban, Community, and Regional Planning at SUNY Albany

Undergraduate indirect assessment continued:

Students one year removed from graduation in both majors were emailed a brief questionnaire in June 2014 in order to learn what aspects of the curriculum they felt were most beneficial, and what would have helped them better prepare for a career in their feield. The students were also asked for their current place of employment, and whether or not it is related to their major.

The questionnaire (note that the atmospheric science questionnaire was identical, save for the name of the major embedded in the questions):

Hi all,

As part of an ongoing effort in the Department of Atmospheric and Environmental Sciences to assess and improve our undergraduate program, I am contacting you in your capacity as a recent graduate to invite your comments on the quality and effectiveness of your undergraduate degree program in environmental science, as well as to solicit information on your present professional status. We as a department truly enjoy keeping in touch with our graduates, and also want to know what we do well, and what we could do better. Many thanks for your feedback and answers to these questions, which will be kept confidential!

*Please note that you do *not* need to answer all questions. Simply write "no answer" to any you don't wish to answer.*

1) Why did you choose the environmental science degree?

2) What aspect(s) of the environmental science program do you find at this time to have been most effective in your intellectual and professional development?

3) What aspect(s) of the environmental science program do you find at this time to have been least effective in your intellectual and professional development, and how could these be improved?

4) What are you doing professionally (job title, and location/company of current job)? Or, which graduate or professional school are you currently attending?

Once again, many thanks for your answers to this survey; we in the Department of Atmospheric and Environmental Sciences greatly appeciate it!

Ross A. Lazear
rlazear@albany.edu

<u>Responses from Environmental Science majors:</u>

Hi Ross,
Here are my answers to your questions.

1) Why did you choose the environmental science degree?

I have been concerned about the Earth and environment since I was young. I wanted a degree that could prepare me for a professional career involving work that improves the earth and its environment.

2) What aspect(s) of the environmental science program do you find at this time to have been most effective in your intellectual and professional development?

Everything. I liked that the classes were a lot of the actual science. Having interned with other students from around the country and speaking with them about their environmental science degrees and curriculum requirements, many of their degrees were biology and ecology focused. Which is not what I was/am personally interested in and I'm glad we had the option to choose a concentration. I feel like I was likely much more challenged in the classes I completed, compared to these other students. I learned a great deal and was fascinated by the curriculum and motivated by many of my professor's passion for what they were teaching.

I think ENV 490 was one of the most important classes I took. All of my classes taught concepts and the actual science, but in addition to that, this class actually taught you how to communicate and speak about the topics we learned about for so long. I wish there were more classes like it and that communication of relevant topics was something the department helped students to develop further. It was also here that I was exposed to other crucial issues involving environmental science and climate change.

I think it was also extremely important and helpful that I had such strong advisement.

3) What aspect(s) of the environmental science program do you find at this time to have been least effective in your intellectual and professional development, and how could these be improved?

I feel like the degree was maybe not as well rounded as it could have been. The concentrations were good, but I almost wish we were required to take a class in all of the other concentrations or something, to be able to have a more complete understanding and be aware of more issues in the environmental sciences. I hadn't seen some very important topics until the semester before graduating when taking ENV 490.

I think we should also be made aware of other skills that are relevant to the field and having a career in the field. Whether they are things taught through the department or

advisement/the department making students aware of useful skills that are relevant to environmental science, that are offered through other departments at the university. For example, I think basic programming should be introduced/taught. Also one specific example from one of my classes was that some of our homeworks required knowledge of excel. At the time I never really used it before; there were multiple students who were in the same boat as me. I don't think it should be assumed all students have knowledge in things like this. Maybe another class should be required whether it is offered from inside or outside of the department, that teaches basic programming and use of important computer programs like Excel and GIS; or if an assignment is required using a certain computer program, a quick lesson should be taught about what it is the professor would like done in the program, (Some classes did do this, but not all of them).
Also, I think GIS should somehow be integrated into the degree. I found out how useful it was from one of my internships. If I had found out sooner, I would have tried to ingrate classes for the GIS certificate into my undergraduate semesters, instead of spending time doing the graduate certificate like I had. I know a large amount of environmental jobs require GIS skills.

I think the professors in the department are very strong/good teachers. But some of the required classes I took with other professors outside of the department, the teachers were not as strong and I didn't learn and take as much from these classes as I should have or would have liked to. This ended up sometimes causing challenges for me when applying what I learned in these classes to classes from the department. This is in reference to many of the classes I took through the math department.

4) What are you doing professionally (job title, and location/company of current job)? Or, which graduate or professional school are you currently attending?

Currently I am a GIS intern with the NYS Department of Environmental Conservation. I will be attending UC Davis in the fall to pursue my MS in Atmospheric Science doing research related to air quality.

Responses from Atmospheric Science majors:

1) I always had a love for the weather from a young age, and after completing of my finance degree and working a few jobs I didn't necessarily enjoy, I realized I needed to do something I had a passion for and that was atmospheric science.

2) The family like environment in the department and how invested the faculty was with our success as students.

3) I don't believe there was one area that was the least effective in my intellectual development. However, as the necessity for programming skills continues to increase

both in graduate school and the professional world, earlier exposure or required computer science courses would be beneficial. (Not entirely sure how that could be done with such a tough curriculum to start with)

4) Graduate school at the University at Albany.

DAES Graduate Focus Group
Spring 2014

A meeting took place on May 20th to discuss graduate program issues. This included two faculty (Professors Thorncroft and Torn) and 19 graduate students (Josh Alland, Hannah Attard, Alicia Bentley, Cristina Carrasco, Bo Dong, Travis Elless, Michael Fischer, Chip Helms, Hannah Huelsing, Bill Lamberson, Ben Moore, Leon Nguyen, Philippe Papin, Casey Peirano, Rosimar Rios-Berrios, Naoko Sakaeda, Nick Schiraldi, Chris Selca, Matt Vaughan). The bullet points represent the main points raised by students. Where appropriate the DAES response is included in brackets and italics.

Based on last year's meeting, the following action items were undertaken by DAES in the past year:

- Creation of a graduate student handbook that includes all department policies and academic requirements. This book was distributed to both faculty and students and will be revised on a yearly basis.
- Expanded introductory sessions to include more NCL training, with quality of life lectures given by graduate student Hannah Attard.
- Greater variety in TA assignments, so that the same students are not being consistently assigned to either easy or difficult classes.
- The PhD written exam policy was revised for clarity based on requests by both faculty and students
- An additional orientation session for new graduate students was added to cover academic requirements
- The graduate program coordinator emailed accepted students early in the summer to provide information prior to their arrival in the fall.

During this year's meeting, the following topics were discussed.

1) Curriculum

- Most students were satisfied with the current breadth of courses being offered within DAES.
- There was a request for a more basic statistics course, similar to what Dennis Hartmann teaches at the University of Washington. If a course cannot be developed, then the students requested that statistical significance be incorporated into a course. *(Explore with faculty who teach courses with statistics to determine appropriate class)*
- Students wanted more computer programming integrated into individual courses.
- Department is lacking a course in theoretical dynamics, geophysical fluid dynamics (GFD), or waves. *(A GFD course will be developed as part of the new core curriculum that will be implemented in 2015/2016)*

2) Orientation

- Request to add appropriate thesis due dates to the Graduate Student Handbook. *(Will be added to 2014/2015 version)*
- Request to add description of research courses to the Graduate Student Handbook. *(will be added to 2014/2015 version)*

3) Preparation to conduct research

- Request for short seminars in ethics, publishing, scientific writing and grants
- Students wanted an additional informal seminar on LaTeX.
- Some felt like the seminars should be either for a longer period of time (more than one hour) or multiple sessions on a single topic. *(All of these ideas will be discussed with the faculty member who will coordinate the seminars)*

4) TA Duties

- Given the space issues within the department, students indicated that it might be better to have an office where TAs could hold office hours. This would prevent the TA office hours from disrupting other graduate students in the office. *(This will be explored before the Fall semester)*

5) Other

- There is a gap in paychecks for those students who are GAs or TAs during the academic year and paid out of state start-up accounts during the summer. *(This is something beyond DAES control)*
- The students are interested in more interaction with external seminar speakers, including a special meeting where they can discuss career paths and advice. *(DAES will provide a set meeting slot with future speakers for this purpose)*
- On occasion, department seminars were poorly attended by graduate students. The students indicated that this often happened during times when several assignments were due, thus the students requested fewer seminars scheduled during exam and project due dates.
- Some students requested that an archive of PhD written exam questions be made available. *(Although there are copies of past exams circulating among graduate students, this idea would need to be discussed with the DAES faculty)*
- Some of the international students have had difficulty with the international student office and renewing visas. *(DAES will follow up with international students in a future meeting)*

Response to IRPE feedback:

Last year, IRPE indicated that they would like to see DAES to develop a graduate course assessment scheme similar to what was developed for the DAES undergraduate degrees. Given that the DAES graduate program does not require that a student take any specific courses (students are only required to take 18 credits of coursework in AATM courses), this makes it more difficult to do course assessment compared to the undergraduate program. During the 2014/2015 academic year, DAES will be developing a new set of core courses that all graduate students will take starting with those admitted for the Fall 2015 term. Once this core course sequence is in place, a course-based assessment program will be developed.

Professional status of DAES Atmospheric Science M.S. and Ph.D. graduates fives years following graduation

M.S. Degrees: August 2008, December 2008, and May 2009

Name	Degree Date	Professional Status
Frank, Jaclyn	May-09	Senior Research Scientist at AWS Truepower - Albany, N.Y.
Nicholls, Stephen	May-09	Post Doctoral Researcher at NASA Goddard Space Flight Center Greenbelt, MD
Wilson, Patrick	Dec-08	Meteorologist at National Weather Service - Blacksburg, VA

Ph.D. Degrees: August 2008, December 2008, and May 2009

Name	Degree Date	Professional Status
Berry, Gareth	May-09	Research Fellow at Monash University - Melbourne, Australia
Czikowsky, Matthew	May-09	Post Doctoral Researcher at State University of Amazonas Manaus, Brazil
Dua, Hu	May-09	Clean Energy Consultant at The World Bank - Washington, D.C.
Hopsch, Susanna	Dec-08	Research Associate at Karlsruhe Institute of Technology Karlsruhe, Germany