Metro State External Reviewer Report

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Introduction

This report is based on the information contained in the Program Review Packet, on the impressions I gathered during my tour of the program and college facilities, and on the many conversations I held with faculty, students, and administrators during my visit to campus on October 15 and 16 2009. In addition, I had the opportunity to meet on October 14 with a group of MSCD Meteorology Program alumni that are currently working at the University Corporation for Atmospheric Research (UCAR) in Boulder. I was impressed by the ability and dedication of the faculty, the enthusiasm of the students, the support for the program from the department chair, dean and provost, and by the gratitude of the alumni for the quality of the education they received at Metro State. I want to take this opportunity to thank everyone I met during my visit for the warm welcome they extended me, and in particular Dr. Richard Wagner for the time and effort he invested in managing my schedule so effectively, and patiently answering the myriad questions that I posed to him.

In the report that follows, I have tried to follow closely the format suggested in the “Instructions for Consultants” document that I received from Dr. Wagner, and I list a set of recommendations (numbered and shown in boldface) that, in my best estimate, can be considered by the faculty of the program and the department for improving what is already a good program that fills an important niche in the education system of the State of Colorado.

I. Role and Mission

Is the program consistent with the role and mission of Metropolitan State College of Denver?

The program review documents and my visit to campus provided me with ample evidence of the Meteorology Program’s congruence with the stated mission of Metro State College: “to provide a high-quality, accessible, enriching education that prepares students for successful careers, post-graduate education, and lifelong learning in a multicultural, global, and technological society”. The program’s faculty strive to foster excellence in teaching and learning, by refining the curriculum and seeking to improve and update the facilities available for instruction, and are taking steps to increase the diversity of the student population served by the program so as to more closely approximate the diversity found on campus.
II. Curriculum

A. Is the core curriculum appropriate?

Meteorology developed as a separate academic field of study in the U.S. largely after World War II and has no formal accreditation of its academic programs. The American Meteorological Society (AMS) has adopted guidelines that list specific courses that should be included in the curriculum for a B.S. degree in the field. In addition, the National Weather Service (NWS), traditionally the largest employer in the field, has an independent set of course requirements that must be met by meteorology program graduates before they are hired as meteorologists under Civil Service rules. Most of the meteorology courses required under AMS and NWS guidelines have significant calculus-based math and physics prerequisites, a fact that limits the flexibility of meteorology majors to take electives that could broaden their set of skills before entering the marketplace. The math and physics prerequisites often serve to discourage students from entering meteorology programs in spite of their interest in the field and their innate abilities, as they often have to spend extra semesters in school making up the deficiencies in their preparation. This is especially true of those students that come from communities that are under-served in the K-12 (and community college) stage of their education. The Metro State B.S. Meteorology Program curriculum satisfies the AMS and NWS guidelines, so its course offerings are clearly appropriate and aligned with professional standards. The program has a significant advantage compared to similar meteorology programs at other institutions by requiring all meteorology majors to minor in math. Students entering the field, therefore, have a good understanding of what is required to complete the degree from the moment they join the program. Students native to Metro State, therefore, have an opportunity to complete their degree in a timely fashion, although those that transfer from community colleges or decide to change majors after a year or two at Metro State, take longer to graduate.

Metro State is an Academic Affiliate of UCAR, and as represented by Prof. Wagner, recently joined with those of other Academic Affiliate institutions in urging the AMS to move away from course-based requirements to competency-based requirements for the B.S. degree. Should the AMS adopt this approach in the near future, we can expect added flexibility to the curricular offerings of meteorology programs across the country.
B. Do the service courses meet the needs of the audiences for whom they are intended?

The MTR 1400 class is the General Studies Level II service course that the program contributes to the College. Often this type of course is the only exposure that students outside the field get to meteorology or any of the earth sciences. This class is offered frequently and has been taken by over 2,000 students in the last five years, with an average class attendance of 32. This level of class enrollment allows individual attention to be paid to students and makes it possible to identify those who show promise to major in the field. It was not clear to me whether MTR 1400 serves as a place where students are recruited into the major, but a transcript analysis of program majors would reveal how many students are first exposed to the field while taking this class. If, in fact, the enrollment in MTR 1400 is typical of the college-wide percentage of students from underrepresented minorities, a concerted effort to recruit majors in this class can help increase diversity in the program’s student population.

RECOMMENDATION 1: The program faculty should analyze the student enrollment in the MTR 1400 class and consider making improvements in the content and pedagogical delivery of the class so as to make the material compelling and attract students into the major, especially those from underrepresented minorities.

C. Are the elective courses current and useful?

The meteorology electives available to the majors are very useful. Clearly, taking the four-semester sequence 1-unit forecasting labs allows the students to develop their weather analysis and forecasting skills over an extended period, and keeps an active involvement with the faculty and fellow students. Other meteorology electives, are clearly useful and appear to be pitched at the appropriate level, such as the two that I had the opportunity to visit: Radar and Satellite Meteorology (MTR 3120) and Air Pollution (MTR 3100). Both these courses are also accessible to students from other departments (especially aviation students). The air pollution course should be particularly popular for other students in the EAS department and anyone else concerned with environmental issues. With the exception of the Numerical Weather Prediction class (MTR 4410), the meteorology electives do not have prerequisites of Calculus-based classes, a fact that allow students to take those courses at various stages of their undergraduate career. These courses are clearly challenging and quantitative, but accessible to a wider group of students.
The list of general electives that is suggested to meteorology majors is useful and appropriate. Programming courses such as C++ and UNIX, Geographical Information Systems (GIS) and Remote Sensing techniques are becoming indispensable to the work environment that most graduates of the program will find in the future. Moreover, some of these courses are given within the other programs run by the EAS department, and provide opportunities for closer contact between meteorology students and students majoring in other programs run by the department.

D. Are the educational goals (desired student outcomes or competencies) that the program has for its students clear and reasonable?

The assessment Activities and Results section of the Program Review Packet lists 12 specific competencies that are universal to all meteorology programs, and in that sense they are clear, reasonable, and necessary of all students receiving a B.S. degree in meteorology. The list of student learning goals is properly couched in active verbs (describe, explain, apply, etc.) but it does not directly address the set of oral and written communication skills that are needed to accomplish these goals. Another fundamental skill that needs to be developed in students is the ability to work in groups in order to solve challenging problems. I will come back to this subject in the section dealing with students and student satisfaction below are, however, too specific in detail and lack enough focus on competencies that are broader in scope and at a more fundamental level.

E. Are there areas of emphasis that should be developed by the program to meet future needs?

Yes, the meteorological profession will be increasingly called upon to give input to policymakers and the public in general as society tries to deal with the problems of local adaptation to global climate change. The recent annual UCAR meeting featured a forum on climate adaptation that highlighted the need for meteorologists to interact with people from a variety of academic fields and from government and non-government organizations alike, to address the multitude of problems that will be facing society for the rest of this century. The presentations from this forum are now available in .pdf format at:

http://www.ucar.edu/governance/meetings/oct09/followup/index.shtml

One of the most ardent advocates of the urgency to educate people to deal with climate change challenges is Michael Glantz, currently at the University of Colorado, Boulder. Dr. Glantz has developed what he calls a “Climate Affairs” curriculum that is intended to address the myriad societal problems that are likely to be exacerbated by climate change. The website maintained by Dr. Glantz contains a lot of information about his ideas in this regard:

http://ccb.colorado.edu/glantz/
With these resources located within a short drive to campus, and the active support of the meteorology faculty, Metro State College is uniquely positioned to make innovative changes in their curriculum to develop expertise in this area. The EAS department, with its large number of geographers on staff has an ideal set of players that can craft a curriculum involving courses from the three branches of the department to address local adaptation to local climate change. The meteorology faculty are already considering expanding their range of elective courses to include climate change and the adaptations that will be required. The local climate of each region of the country will be affected by climate change in different ways. The EAS Department, with its existing faculty resources housing meteorologists and geographers under one roof, and already existing programs in Land Use planning is very well positioned to make major contribution to the evolving curricular discussions at the national level.

**RECOMMENDATION 2:** The faculty of the EAS department should engage in ongoing discussions about the expected local impacts of global climate change and gather ideas for curricular innovations from experts such as Dr. Glantz, and stakeholders from local and state governments and entities such as public utilities and public health agencies. This could be accomplished by sponsoring a seminar series focused on how climate change is likely to affect the city of Denver and the State of Colorado. This would be a low-cost undertaking that can spark brainstorming about the ways in which Metro State can take a leading role in training citizens that are informed in this area.

**F. Areas that should be de-emphasized**

There were no areas of emphasis in the present meteorology curriculum that should be given low priority or discontinued, as the curriculum has been designed to adhere to the guidelines for the B.S. degree. Established by the AMS. I did not see any apparent overlap or duplications between other units and the meteorology program. In fact, the existing collaborations between the Meteorology program and the Aviation Department clearly benefit both programs by helping to keep a healthy enrollment in some of the elective meteorology classes and by fostering close interactions between students from both departments.
G. Are courses scheduled at times, locations, and frequencies that are consistent with the objectives of the program?

The short answer is yes. In my conversations with students from the classes I attended I heard some mild dissatisfaction from Aviation students about the meteorology elective courses available to them: too many in one semester and too few in another. This situation appears to have resulted mainly from Dr. Wagner’s involvement with program review at the college level in recent semester, and should be easily resolved with his return to full-time teaching status. That said, I could not help but notice how empty the campus feels on Fridays. I was surprised to find out the typical course schedules at Metro State are Mon-Wed or Tue-Thu. Considering instituting more Friday classes might help this situation, but changing a well-established tradition would be a Herculean, and wildly unpopular task with faculty and students alike. On the plus side, a class-free Friday does allow hard working faculty and staff to catch up on administrative work that pile up during the week.

H. How does the curriculum of this program compare with similar programs at comparable institutions?

The Metro State Meteorology curriculum is very similar to other meteorology programs across the country thanks to the rigid set of courses and their attendant pre-requisites incorporated into the AMS guidelines. Should the guidelines be revised based on competencies rather than courses, this will give this program, and others a greater flexibility in course offerings, since a single competency can be spread over more than one course. This approach would also facilitate more effective assessment of specific competencies as they develop over time, and allow for the development of effective interventions if students are found not to be achieving the desired level of competency at the proper time.

III. Students and Student Satisfaction

A. Based on the data provided, consider the program’s effectiveness with respect to (various measures)

Diversity of student population in the Meteorology program

Although diversity was not explicitly mentioned for discussion in this category, I observed in the classes that I attended a relative good gender balance (about 1/3 female) and a distinct lack of minority students. Walking around campus it was evident that the campus as a whole is very ethnically and culturally diverse. The student data provided in the Program Review Packet corroborate this observation. College-wide, 24% of the students come from minority groups, a percentage which is almost identical in the School of Letters, Humanities and Sciences (23.3%). By comparison, the Meteorology Program minority student participation was only
10.5% in 2007-2008, although it has topped 15% in recent years.

There is clearly a need for the program to reach out to minority students, and the program should have as a goal for its minority students to be represented in numbers comparable to those of the school and the college (achieving student diversity at the college level that approaches the diversity of the City of Denver – 31.7% Hispanic and 11.1% African American tall order, but an achievable one that can make Metro State qualify as a Hispanic Serving Institution).

The task of increasing diversity in meteorology and the geosciences in general is not an easy task, because the roots of the imbalance reach deep into the K-12 realm. Simply put, especially among Hispanics that have immigrated to the US in recent decades, students that attend college are often the first ones in their family to do so, and their parents expect them to become, physicians, lawyers or businessmen. The idea that one can have a satisfying career in meteorology or other earth sciences is unknown to many minority students entering Metro State until they have the opportunity to take a course such as METR 1400 to satisfy their General Studies II Natural Sciences requirement. Those students transferring from community colleges will either remain unaware of the opportunities provided by the program, or decide not to enter the field because satisfying the extensive pre-requisites of the program will delay their graduation to an extent they cannot afford, especially in these times of economic recession.

I was delighted to find during my visit that Dr. Wagner has been working with UCAR to co-sponsor a meeting scheduled for 2 March 2010 entitled “Meeting the Challenge of Colorado’s Future: Preparing a diverse next generation of weather and climate professionals”. This conference will bring together leaders in education, climate and meteorology, and leaders of the Latino community of Colorado. A key player in this process will be the Community College of Denver, a place where a significant number of minority students can be reached early in their careers so they can begin to take the necessary math pre-requisites to facilitate the path to timely graduation with a meteorology degree. The desired outcome of this meeting will be to identify concrete ways in which education, community and industry leaders can brainstorm concrete ways in which to increase minority participation in the process of societal adaptation to climate change. I commend Dr. Wagner for his leadership role in this endeavor.

RECOMMENDATION 3: The Meteorology Program, the EAS Department, the School and the College should support this conference and seriously consider implementing any concrete suggestions that emanate from it in order to enhance diversity among students and contribute to a well-prepared workforce that can thrive in a green economy.
Number of degrees awarded, FTE generated, number of courses offered, class sizes, etc.

Analysis of the Program Productivity Measures Tables reveals that, on the average over the last five years, the program has graduated a little over 6 students and recruited approximately 40 new majors per year, a very impressive number. At any one time, the number of meteorology majors during this period have averaged near 70 (and fluctuated between 65 and 85). The recruitment trends have been up over the last two years. Enrollment in the program is healthy, a surprisingly large number of courses are offered given the limited faculty resources available, and class sizes are ideal for the close faculty-student interactions needed for effective instruction in meteorology.

Nobody, of course, would expect the typical native Metro State student to graduate in four years, but the annual graduation rates as a percentage of total majors have only ranged between 6% and 12%. This provides some evidence of significant attrition and begs the question of what is making so many students start the program and not finish it. Are some of the students dropping out of the program because it is so challenging and they feel they lack the necessary math skills to succeed? Are some dropping out because they do not see good job prospects after graduating with a meteorology degree? Because the courses they need to graduate are not offered at convenient time and often enough

As a faculty member (and department chair) struggling with similar issues at my institution, I am aware that finding the answer to these questions requires access to timely data and investment of faculty time. Effective solutions usually require the deployment of significant resources and require institutional support at crucial points. Below are some observations and questions that might be worth exploring.

• The number of new majors recruited by the program every year is very impressive. Does the faculty know where the students first learn about the meteorology program and where and how they make the decision to major in meteorology? What specific measures are taken to recruit new majors?

• The meteorology faculty have prepared a very effective advising tool (called the “roadmap to graduation” at my institution). The Metro State versions outline 2, 3 and 4 -year course-selection plans that fit students entering the programs as well-prepared natives (4 year plan), well prepared transfers from community colleges (2- year plan) and students that need to make up math deficiencies as they transfer to Metro State with different levels of preparation.
Whether fully prepared in their math coursework or not, students take the “gateway” 2400 class in the spring of the freshman year (or the following summer or fall) and there are well defined paths they can pursue to that they can take their first calculus based class in the year before graduation. The course that serves as the effective “capstone” to the program, Advanced Synoptic Meteorology (MTR 4400) is taken in the last semester of the program. This is the point at which the summative assessment instrument is administered: the 100-question test that is designed to test the student attainment of the 12 learning goals that have been selected for the program.

Given the relatively low graduation rates, what does the program faculty know what happens to students between MTR 2400 (gateway) and MTR 4400 (capstone)? Can early signs of trouble be identified so as to reduce attrition along the way? It seems clear that other assessment instruments need to be devised to identify problems and their possible solutions. Transcript analyses are a good way to begin. If the transcripts of students that have taken the 2400 course in the last few years can be analyzed, starting with the grade in that class and following their performance in subsequent majors (and minor) classes, can provide clues as to where targeted intervention can result in better retention rates for students in the program.

RECOMMENDATION 4: Consider performing a transcript analysis of the students that have joined the program in the last five years. How many are making satisfactory progress to graduation? Are some switching majors out of the field? Is the requirement for a Math minor an impediment to progress to graduation? If so, is there any particular bottleneck course that can be identified?
B. Does the assessment plan devised by the program faculty have the potential for effectively determining if students have achieved the desired competencies? Are program faculty making effective use of the information gained from assessment activities? What changes, if any, should be made in the assessment plan?

The 100-question exam that is given to students in the final semester during the course of the Advanced Synoptic Meteorology class is a good summative assessment tool. The assessment covers student understanding of four general categories of content knowledge: general characteristics of the atmosphere, physical processes in the atmosphere, weather systems, and observations and measurements of atmospheric phenomena. The sampling size is too small to draw many conclusions, as the faculty rightfully assert in their assessment report, although the results appear relatively consistent over time. Student score lowest in their content knowledge of the “Weather Systems” a category that roughly overlaps the material covered in the Synoptic Meteorology course. As this happens to be the area of specialization of Dr. Ng, the most recent full time tenure-track hire for the program, it is to be expected that students in coming years will begin to score better in this area.

In brief, I would describe the current assessment efforts of the Meteorology program as inadequate in its present form. Its principal flaw is that it is a summative assessment, and by definition only tests students that have successfully completed most of the requirements for graduation and will be receiving the degree in a few weeks after taking the test. There is a need for formative assessments to be given along the way. A transcript analysis is a relatively easy tool that can be used that can answer many questions, for instance: is there a strong correlation between the grade students receive in the 2400 (gateway) class and their success in other classes for which it is a prerequisite? Do students need to repeat some of the calculus classes required for the upper division meteorology majors class? Can the causes for delayed time from graduation be gleaned from the student transcripts (poor grades in some pre-requisites, taking time off from full time attendance for personal reasons? etc.) Perhaps scheduling a similar type of content knowledge assessment at the conclusion or the MTR 2400 course might indicate, when compared to the assessment currently given at the conclusion of the MTR 4400 classes might reveal areas where significant progress is made by the students and others where that is not the case, in which case appropriate intervention strategies can be devised for emphasis in other courses taken along the way.
Perhaps the biggest lapse of the current assessment tool being used is its failure to yield data in basic skills and competencies that are essential both in the marketplace and in graduate education. How does the faculty know the level of skill that graduating meteorology students have in communicating in writing, orally, or with the use of tools such as PowerPoint or web pages? Are the students able to communicate their understanding of the way the atmosphere works to audiences of different levels of sophistication? Even more important is to determine the level to which students are aware of the progress they make along the way to their degree. Do they understand and are they able to communicate to others how to build upon the knowledge learned in one class to another, more advanced class? Do they see the connection between the material they are learning and the skills they will be called upon to apply in the marketplace?

One approach that is being tried to conduct a formative assessment of student learning along the way is to maintain a portfolio of their work. In brief, here is how this would work: the program faculty selects and refines student learning objectives at the program level, parts of which that can be directly addressed in each course syllabus. A syllabus might contain a statement like: “If you complete this course successfully, you should be able to analyze and describe the changes in the local weather conditions in your local area that precede, accompany and follow the passage of a cold front”. There might then be a lab report or homework assignment at the particular course where the student might be called upon to orally present in class a 5 minute PowerPoint presentation of their analysis of a cold front passage, which she might then save as a pdf file and post to a web site that illustrates her presentation. At a later semester, the same student might make a similar presentation, but this time, with the benefit of a more mature understanding of the physical processes that affect the atmosphere, the focus might be on the analysis of some of the factors than might make a cold front passage over an area be quite different from what a typical “textbook” example might look like. This, more advanced assignment might require the student to provide clear and technically accurate justifications for their analysis of the synoptic weather situation, and a casual observer of the portfolio, especially if it is easily available in electronic form over the web, can follow the progress that the student is making in her deepening knowledge of the field. This type of portfolio can be a great advantage as graduates apply for jobs, as one can imagine, for instance the potential employer looking for people with skills in Geographical Information Systems, can see the actual work the student has done in this area.
Implementing an electronic portfolio as an assessment tool involves a lot of hard work on the part of many people, but it is proving quite successful in many different fields. It is essential to simplify the process of maintaining an electronic portfolio for students, so that they are not discouraged by technical difficulties, there have to be clear guidelines for what should and should not be put in the portfolio, and the material in the portfolio should be amenable to the application of rubrics that can provide information on the student progress toward accomplishing the learning objectives of the degree. Once students “buy in” to this process, there will be greater awareness on their part of where they are headed professionally, and hopefully this will translate into greater retention rates for the students that join the program.

**RECOMMENDATION 5: Consider employing, with the support of any available resources, a variety of formative assessment tools for the program.**

Here are a couple of resources that can help in this endeavor:

On assessment techniques being employed in the geosciences;

http://serc.carleton.edu/NAGTWorkshops/assess/index.html

on electronic portfolios as they are being employed at San Francisco State:

http://eportfolio.sfsu.edu/

**C. Do students in the program and graduates of the program seem satisfied? perceive that they were prepared for graduate or professional school? obtain suitable employment?**

The program, with the help of the college, has done an excellent job of surveying outgoing seniors, recent graduates, and senior experience students. I also had the opportunity to talk at length with program alumni and more briefly with student taking two elective classes. There is remarkable consistency in the data gathered from all of these sources. In short, the students are tremendously appreciative of the faculty, their dedication to student learning, their availability outside of the classroom. Alumni are appreciative of the individual attention they received at Metro State and compare their experiences favorably with their peers that attended more prestigious institutions with faculty that carry on extensive research work, but where undergraduate students are often just a face in the crowd and insufficient attention is paid to their education at the undergraduate level.
The areas where dissatisfaction was expressed were also very consistent. The instructional facilities are viewed as inadequate, the current students in particular want to see less lecturing, more hands-on work, more opportunities to work in groups, more connections made between theory and real-life applications. Students that are in internships or had them in the past single them out as enormously important to their career. Metro State is in enviable geographical situation, within commuting distance to the UCAR and NOAA labs, as well as the National Weather Service, the FAA and the Colorado State agencies that deal with environmental issues.

**RECOMMENDATION 6: Continue to develop internship opportunities for students and find a vehicle, whether it be student club activities or time devoted in formal classes, for students to report back to their peers about their internship experiences**

**IV. Faculty**

**A. Are the areas of faculty specialization and competence appropriate for the program? Are other specialties needed?**

The Meteorology Program has been undergoing a difficult period where the retirement of a long-time professor overlapped with the stint Dr. Wagner served as Director of Program review. Having served in a similar capacity I can personally attest both to the time demands it imposes as well as the potential advantage it gives to the program to have somebody with the breadth of vision this type of position affords. With Dr. Wagner’s return to full time teaching, the program course offerings and assessment practices will, no doubt, benefit significantly. Dr. Wagner’s expertise in Physical Meteorology and Climatology will allow him to take a leading role in curriculum development in the area of climate change. He has had an opportunity to see how assessment of student learning outcomes in carried out in various disciplines and he will, no doubt take an active part in refining the assessment efforts of both the Meteorology Program and the EAS Department.

Professor Sam Ng has done a heroic effort to carry the major burden of the program during the last couple of years while Dr. Wagner was engaged with his program review obligations. Dr. Ng, is clearly beloved by his students, is available outside of office hours, runs the computer lab, and organizes the Metro State participation in the Weather Challenge forecasting contest, in which students attending meteorology programs from all over the country compete. This is a great motivational tool that keeps students engaged in the subject matter and builds an *esprit de corps* that bonds students with one another and undoubtedly helps many to maintain their motivation during the toughest periods of their undergraduate careers. It is highly unusual to see a junior faculty member take on so much responsibility and do it so successfully and with such enthusiasm.
Matt Cross is another key member of the Meteorology Program faculty. He holds an MA in Climatology from the University of Nebraska and has extensive experience in a variety of settings in industry. His technical knowledge in areas such as GIS and Remote Sensing make him particularly valuable in teaching the sort of hands-on applied courses that the students like. I would expect that his expertise can be of great use to other programs in the EAS department.

There is one area of faculty expertise that the program definitely needs, and that is in the area of Atmospheric Dynamics. The AMS guidelines call for three full-time permanent faculty members as a minimum number to mount a sustainable meteorology program, and Metro State Meteorology clearly needs a PhD–level faculty member in the area of dynamics to round out their faculty roster. A well chosen dynamicist can be of tremendous help in the refinement of mesoscale computer models of the atmosphere that can be applied to the Front Range and other parts of Colorado in the service of studying the local effects of climate change.

If resources permit, the addition of a full time PhD faculty member specializing in Dynamics, while retaining the existing faculty team, which also includes Scott Landolt’s able teaching of the meteorological instruments class, will allow the Meteorology Program to continue to thrive and adapt to changing conditions in the field for many years to come.

RECOMMENDATION 7: Give high priority to hiring a PhD level tenure track professor that specializes in the field of Dynamic Meteorology
V. Resources / Institutional Support

A. Are resources adequate? Consider the facilities, office, laboratory, classroom, etc.

No, at the moment the resources are totally inadequate. The department's facilities were recently moved temporarily to the administration building, are scheduled to move to the new wing of the science building in a few weeks, and then move again a few months to their permanent facilities in the renovated wing of the building. I was shown the blueprints for the program’s and the department's new permanent facilities, which will include computer labs and separate classrooms. I was struck by what seemed to me an artificial separation of computer labs and classrooms in those plans. My department at San Francisco State has benefited for many years by the use of a room that is a hybrid between these two categories: lecture room vs. computer lab. The concept we used was very simple: instead of creating a typical lecture room, with rows of seats facing a lectern and blackboard, or a computer lab with rows of large computer monitors where students work with computers in isolation from one another, we created a room where students sit on swivel chairs around tables where they can either face one another when working on group project, or swivel around to face the instructor when the situation calls for “lecture” mode.

This room is equipped with two dozen laptop computers that are tethered to the tables so they don’t “walk away”. Classes held in this room can switch from small group activities (or individual work with computers is the enrollment is low enough) to more traditional lecturers where the instructor can ask the student to close the laptop flaps and direct attention to the lecturer. This room has proven wildly successful and is in constant demand by instructors that follow a variety of teaching styles.

The cost of conversion of this room were borne, in our case, by a grant we received from the National Science Foundation from the CCLI program, which is focused on curricular improvements. Here is the web site for this program, which I urge the EAS faculty as a whole to consider applying to:


RECOMMENDATION 8: Consider building one or more flexible learning environment room that can serve both as a “computer lab”, a group activities learning setting, and a lecture room.
There are many potential areas of collaboration in curriculum development across programs in EAS, such as the Integrated Science course taught by Dr. Keah Schuenemann in the Land Use program. I can see great benefit deriving to the EAS department from innovative curriculum development funded by sources such as the CCLI program. Even in the absence of such external funding, the college should consider the installation of this type of flexible learning environment in the new facilities that will be occupied by the EAS department.

**RECOMMENDATION 9:** Explore the possibility of having the faculty from at least two units in the department collaborate in creating new curricula that integrate more than one field from the earth sciences and apply for funding from the NSF or other agencies to facilitate the development of the new curricula

Finally, the Meteorology Program is in need of upgrading its existing computer lab facilities, both in terms of its software. I would highly recommend considering the Java based integrated Data Viewer (IDV) software package available for free from the Unidata program run by UCAR:

http://www.unidata.ucar.edu/software/idv/

IDV facilitates the visualization of weather features from a variety of perspectives and allows the viewer to “see” features in three dimensions that are normally rendered as “contour” maps on two dimensions. The Meteorology program is in dire need of a dedicated a part-time technician to help run and maintain the computer lab. There are way more productive uses of Professor Ng’s valuable time than maintaining the computer lab run by the program, as he is doing now.

**RECOMMENDATION 10:** Consider hiring a part-time technician to run the program’s computer lab and maintain its hardware and software holdings
## SUMMARY RATING FORM

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<td>The future potential of the program</td>
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### Rationale

| The perceived quality of the curriculum                         | Well designed, well sequenced, should improve as Dr. Wagner returns to full-time teaching duties and with the hire of a dynamicist |
| The perceived quality of the facilities (laboratories, library collection, computers, etc.) | Current facilities inadequate. They should improve substantially once the permanent facilities for the department are constructed |
| The perceived quality of the program faculty                    | Very good – very dedicated, but very overworked. The addition of another full time tenure-track faculty member will help immensely |
| The importance of the program to general education               | The program provides a great service to general education by providing in many cases the only exposure that students have to global environmental issues |
| The importance of the program as a support for, or as an integral part of, other programs offered by MSCD or other colleges in the state college system. | The program’s curricular offerings are particularly useful to your Aviation department |
| The importance of the program to the region, the state, or the Denver metropolitan area. | As Denver begins to plan its adaptation strategy to global climate change, this program will become an ever more vital resource to the city, the region and the state |
| The future potential of the program                              | The program has a great future. Efforts should me made to protect and enhance it. It will be needed for many years to come |