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| **Assurance of Student Learning Report****2021-2022** |
| *Ogden College of Science and Engineering* | *Department of Earth, Environmental, and Atmospheric Sciences* |
| *Meteorology #578* |
| *Greg Goodrich* |

***Is this an online program***? [ ]  Yes **[x]**  No

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| ***Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages.*** |
| **Student Learning Outcome 1:**  Students completing the Meteorology program will be able to demonstrate understanding of the theoretical principles surrounding the basic equations and conservation laws that govern atmospheric motion and energy transfer. (*Theoretical Meteorology*) |
| **Instrument 1** | A comprehensive exam is given during the final senior semester to all students completing the Meteorology program. The exam partly consists of four questions that represent key concepts from the each of the five theoretical upper-division courses in the B.S. degree in Meteorology curriculum. The average grade on the 20-question theoretical portion of the exam will be no less than 75%. For no individual course will the four-question average score be less than 60%. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Student Learning Outcome 2:**  Students completing the Meteorology program will be able to demonstrate understanding of the technical principles surrounding the fundamentals of remote sensing and in situ weather instrumentation as well as weather forecasting. (*Technical Meteorology*) |
| **Instrument 1** | A comprehensive exam is given during the final senior semester to all students completing the Meteorology program. The exam partly consists of four questions that represent key concepts from each of the three technical upper-division courses in the B.S. degree in Meteorology curriculum. The average grade on the 12-question technical portion of the exam will be no less than 80%. For no individual course will the four-question average score be less than 60%. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Student Learning Outcome 3:**  Sophomore Meteorology students will be able to quickly and accurately analyze a surface map and present a weather forecast discussion based on their analysis (*Applied Meteorology*) |
| **Instrument 1** | As part of Weather Analysis and Forecasting (METR 324), sophomore-level students will be given a surface map for analysis. Each week a different student will be responsible for leading a map discussion of current and future weather conditions. Both the map analysis and map discussion will be scored on a rubric. The average score of METR 324 students on the map analysis and map discussion will be no less than 80%. On no individual rubric category will the average score be less than 70% of the possible points. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Summary (Briefly summarize the action and follow up items from your detailed responses on subsequent pages.)**  |
| Starting in 2021-22 the comprehensive assessment for graduating seniors was broken into two segments, 1) Theoretical meteorology and 2) Technical meteorology. This was done in response to changes in the Meteorology program curriculum caused by the departure of a faculty member. The Theoretical meteorology assessment consists of five courses while the technical meteorology assessment consists of three courses. In general, the results for the five theoretical meteorology courses are similar to past cohorts dating back to 2010 with one exception. The two courses (Synoptic and Mesoscale Meteorology) that were taught in 2020-21 during the online COVID era had scores that were about 8-10% less than in previous years when those courses were taught in person. We suspect that the online learning modality contributed to the relatively lower scores for those two classes. This was reinforced during our senior exit interviews, as all five seniors mentioned that they wished they could have taken those courses in person instead of online. The other three courses (Physical Meteorology and Dynamic Meteorology I and II), all of which were taught in person in 2021-22 as in past years, scored slightly above previous years. The relatively small cohort size (N = 5) may have contributed to the variability of scores. We also made a change to the 3rd Learning Outcome from previous years. Historically, we only assessed map discussion and map analysis during METR 437 (Mesoscale Meteorology) which is only offered every other year to our junior/senior students. In order to have a map discussion assessment every year, we decided to include an assessment on our METR 324 (Weather Analysis and Forecasting) students, who are sophomores in the program. This allows us to track the student’s development in map discussions as they advance through our program. In the summer of 2022, the Meteorology faculty will grow from 3 to 5 with the addition of a new Assistant Professor as well as a new Director of the Kentucky Climate Center/State Climatologist. The Meteorology faculty will conduct a self-study of our curriculum in early August 2022 in order to evaluate our current curriculum and create additional courses to be taught by the new faculty. This opportunity to evolve and expand our curriculum will also give us an opportunity to evaluate our Student Learning Outcomes going forward as well as the means of assessment. This will be a great opportunity to grow as a program. In general, the goals of all three student learning outcomes were met during the 2021-22 academic year. All of the seniors I talked to during our senior exit interviews mentioned that this was by far the hardest year of the academic careers. Part of it was the challenge of being a senior and completing a degree program, but also with the return of in-person classes and the increased expectations of the faculty compared to the online COVID pandemic year. Despite the struggles caused by the post-pandemic malaise, the Meteorology majors performed at a similar level when compared to past cohorts. Finally, Meteorology faculty remain in close contact with the top employers in the field as well as the WKU Meteorology Advisory Board to collect necessary feedback regarding employable students. This information is brought directly into the classroom via assignments, activities, and initiatives. Further, faculty and students in the Meteorology Program routinely invite and host these employers (multiple times each semester) to give workshops, presentations, and network. White Squirrel Weather, the WKU Campus Weather Service, continues to involve as many as 20 students per semester in creating weather forecasts and decision support for WKU and our external partners. In June 2022, 17 student members of White Squirrel Weather will serve as the official weather decision support for the Special Olympics Summer Games in Orlando, FL while receiving academic credit.  |

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| **Student Learning Outcome 1** |
| **Student Learning Outcome**  | Students completing the Meteorology program will be able to demonstrate understanding of the theoretical principles surrounding the basic equations and conservation laws that govern atmospheric motion and energy transfer. (*Theoretical Meteorology*) |
| **Measurement Instrument 1**  | A comprehensive exam is given during the final senior semester to all students completing the Meteorology program. The exam partly consists of four questions that represent key concepts from the each of the five theoretical upper-division courses in the B.S. degree in Meteorology curriculum.  |
| **Criteria for Student Success** | The average grade on the 20-question theoretical portion of the exam will be no less than 75%. For no individual course will the four-question average score be less than 60%. |
| **Program Success Target for this Measurement** | The goal is for the class average to be 75% on the assessment. No individual course will be less than 60% | **Percent of Program Achieving Target** | The class average was 78.0%. The lowest individual course was 65.0% |
| **Methods**  | * **Overall score 78.0% N = 5**
	+ *Theoretical Meteorology sequence*
		- Physical Meteorology 85.0%
		- Dynamic Meteorology I 80.0%
		- Dynamic Meteorology II 65.0%
		- Synoptic Meteorology 80.0%
		- Mesoscale Meteorology 80.0%
 |
| **Based on your results, highlight whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| As discussed in the program summary above, we will not be making any major changes to the curriculum at this time. The curriculum for the B.S. in Meteorology degree is essentially standardized across all Universities and taken from guidelines set forth by both the National Oceanic and Atmospheric Administration (NOAA) and the American Meteorological Society (AMS), there is no real reason to make dramatic changes to the curriculum. The one course that had the lowest score (Dynamic Meteorology II) traditionally has the lowest score in this assessment since that is universally considered the most challenging meteorology course. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| Since the program goals were met no follow up is needed.  |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| The comprehensive Meteorology exam for seniors is given every year and will occur again in Spring 2023. The assessment will be taken by the 7 students expected to graduate in May 2023.  |

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| **Student Learning Outcome 2** |
| **Student Learning Outcome**  | Students completing the Meteorology program will be able to demonstrate understanding of the technical principles surrounding the fundamentals of remote sensing and in situ weather instrumentation as well as weather forecasting. (*Technical Meteorology*) |
| **Measurement Instrument 1** | A comprehensive exam is given during the final senior semester to all students completing the Meteorology program. The exam partly consists of four questions that represent key concepts from each of the three technical upper-division courses in the B.S. degree in Meteorology curriculum.  |
| **Criteria for Student Success** | The average grade on the 12-question exam will be no less than 80%. For no individual course will the four-question average score be less than 60%. |
| **Program Success Target for this Measurement** | The goal is for the class average to be 80% on the assessment. No individual course will be less than 60% | **Percent of Program Achieving Target** | The class average was 83.3%. The lowest individual course was 80% |
| **Methods**  | * **Overall score 83.3% N = 5**
	+ *Technical Meteorology sequence*
		- Weather Analysis and Forecasting 85.0%
		- Meteorological Instruments 80.0%
		- Radar/Satellite Meteorology 85.0%
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| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions planned for program improvement. The actions should include a timeline.) |
| As discussed in the program summary above, we will not be making any major changes to the curriculum at this time. The curriculum for the B.S. in Meteorology degree is essentially standardized across all Universities and taken from guidelines set forth by both the National Oceanic and Atmospheric Administration (NOAA) and the American Meteorological Society (AMS), there is no real reason to make dramatic changes to the curriculum.  |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| No follow up is needed at this time |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| The comprehensive Meteorology exam for seniors is given every year and will occur again in Spring 2023. The assessment will be taken by the 7 students expected to graduate in May 2023. |

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| **Student Learning Outcome 3** |
| **Student Learning Outcome**  | Students completing the Meteorology program will be able to quickly and accurately analyze a surface map and present a weather forecast discussion based on their analysis (*Applied Meteorology*) |
| **Measurement Instrument 1** | As part of Weather Analysis and Forecasting (METR 324), sophomore-level students will be given a surface map for analysis. Each week a different student will be responsible for leading a map discussion of current and future weather conditions. Both the map analysis and map discussion will be scored on a rubric.  |
| **Criteria for Student Success** | The average score of students completing the Meteorology program on the map analysis and map discussion will be no less than 80%. On no individual rubric category will the average score be less than 70% of the possible points. |
| **Program Success Target for this Measurement** | The average score will be no less than 80% | **Percent of Program Achieving Target** | The average score for the class was 89.9%. No category was less than 70% |
| **Methods**  | The rubrics for the map discussion and map analysis contain the following categories: Map discussion: * Current surface conditions
* Current upper air conditions
* Model forecast discussion
* Surface predictions
* Correct use of terminology

Map analysis: * Smooth contour lines
* Proper labels and units
* Pressure analysis
* Temperature analysis
* Dew point analysis
* Frontal analysis
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| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| The map discussion and map analysis is always our highest scored assessment since nearly all of our students pursue careers in applied meteorology where weather forecast analysis is an integral part of the skill set. Meteorology students do map discussion in every semester starting with the spring semester of sophomore year and they do map analysis every semester starting with spring semester of freshman year. We also offer students opportunities to enhance these skills by working with White Squirrel Weather, the WKU Campus Weather Service each semester. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| No follow up is needed at this time |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| The Applied Meteorology map discussion and map analysis will occur again in Spring 2023 when senior-level students take METR 437. The assessment will be taken by the 15-20 students expected to be in that class in Spring 2023. |

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| **Program name:** | Meteorology |  |  |
| **Department:** | Earth, Environmental, and Atmospheric Sciences |  |  |
| **College:** | Ogden College of Science and Engineering |  |  |
| **Contact person:** | Greg Goodrich |  |  |
| **Email:** | gregory.goodrich@wku.edu  |  |  |
| **KEY:** |  |  |  |  |
| **I = Introduced** |  |  |  |  |
| **R = Reinforced/Developed** |  |  |  |  |
| **M = Mastered** |  |  |  |  |
| **A = Assessed** |  |  |  |  |
|  |  |  | **Learning Outcomes** |  |  |
|  |  |  | **LO1:** | **LO2:** | **LO3:** |
|   |  |  | Demonstrate understanding of the theoretical principles surrounding the basic equations of motion and conservation laws | Demonstrate understanding of the technical principles surrounding weather instrumentation and forecasting | Be able to quickly and accurately analyze a surface map and present a weather forecast discussion  |
| **Course Subject** | **Number** | **Course Title** |   |   |   |
| METR | 121 | Meteorology | I | I |   |
| METR | 122 | Aviation Meteorology | R | R | I |
| METR  | 324 | Weather Analysis and Forecasting | R | R | R/A |
| METR | 325 | Meteorological Instruments |   | M/A |   |
| METR | 335 | Satellite/Radar Meteorology |   | M/A |   |
| METR | 431 | Dynamic Meteorology I | R |   |   |
| METR | 432 | Synoptic Meteorology | R |   | R |
| METR | 433 | Dynamic Meteorology II | M/A |   |   |
| METR | 437 | Mesoscale Meteorology | M/A |   | M/A |
| METR | 438 | Physical Meteorology | M/A |   |   |
| METR | 460 | Climate Teleconnections | M  |   |   |