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Building An Open, Flexible, Online Radar Meteorology Course

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AGS-2303653
AGS-2303654

OVERVIEW

The inherently data-rich and four-dimensional nature of radar data requires a departure from basic textbooks and two-dimensional displays as means of learning. Additionally, radar meteorology instructors desire open educational materials on a wide range of topics to accelerate their course development. In response to these needs, the authors are creating a new, asynchronous, fully online Radar Meteorology course to be hosted on the COMET program's MetEd web site.

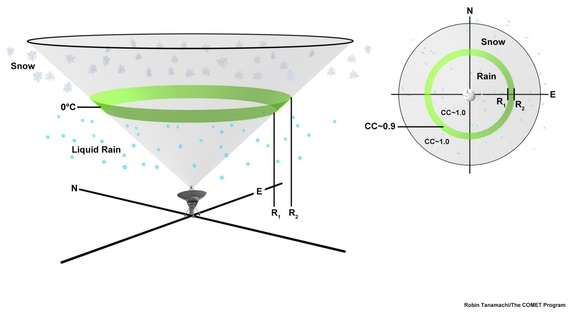


Fig. 1. A graphic from the forthcoming module, "Dual Pol Radar Fundamentals", illustrating the geometry of a high elevation scan of the 0 C layer and its consequent appearance as an annulus on a radar display.

Improving access to radar meteorology education

The authors of this course envision this resource as a constantly-evolving online textbook, including elements that a standard textbook can't deliver. There will be eight radar lessons in total, covering a wide variety of topics in radar meteorology, plus a case study gallery. The more innovative elements include 3D animations, VR elements, content on the open radar science ecosystem, and links to external resources where students can find opportunities for radar-focused experiential education. Additionally, as the field of radar meteorology continues to evolve, COMET will be open to creating additional lessons with interested collaborators.

The first lesson, "Dual Pol Radar Fundamentals," can be found on COMET's Meteorology Education (MetEd) web site. MetEd, which is free to use with registration, contains lessons on a multitude of geoscience topics. MetEd has a long history of producing high quality, open teaching materials to support both learners and instructors. Accordingly, all the content of these MetEd lessons are and will remain free to reproduce and use (with acknowledgement).

Multimedia/VR Explorations

One particularly novel aspect of this course is the integration of virtual reality (VR) elements, which allow learners to immerse themselves in the 3D/4D structure of the radar data. Some of the VR elements were tested with Purdue radar meteorology students in Spring 2024 (Fig. 2), with reaction overwhelmingly positive (Fig. 3). For example, all participants (n = 7) somewhat or strongly agreed with statements that the VR display "enhanced my learning of radar meteorology," "helped me visualize or understand how radars scan the atmosphere," and "helped me visualize or understand the spatial relationships between different parts of a storm."

For those learners who do not have access to VR equipment, web-browser-based versions of the experiences will be provided. **You are invited to try the VR experience at this station during the appointed poster session.**



Fig. 2. The first author (User 9466) uses a handheld controller to annotate a 3D VR visualization of a supercell with air flow trajectories for her Radar Meteorology students.

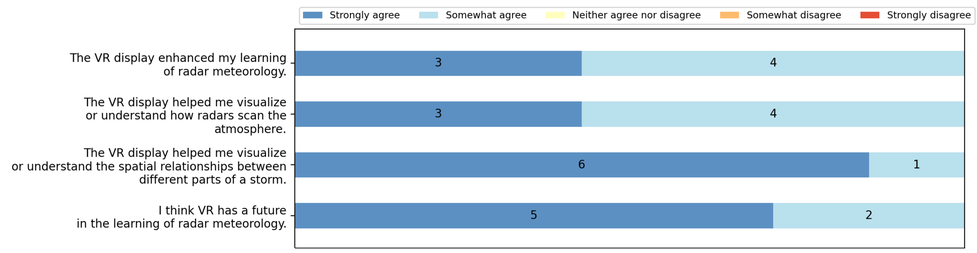
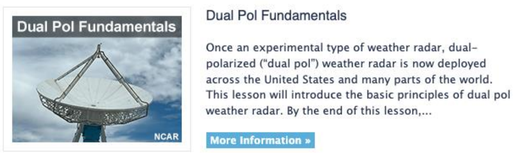


Fig. 3. Student responses to a Likert-scale survey given after the VR activity shown in Fig. 2 (n = 7).

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Accessibility is a key focus

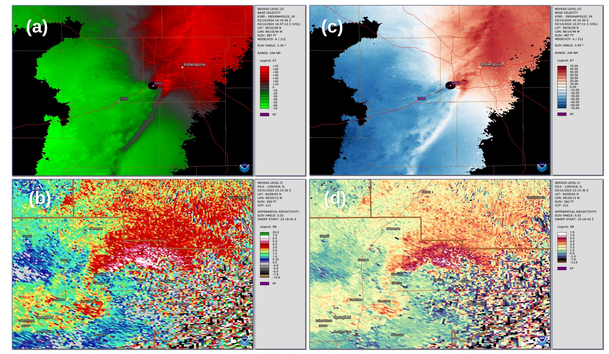


Fig. 4. Examples of (a, b) legacy and (c, d) CVD-friendly color maps used in these lessons for visualizing (a, c) Doppler velocity in a squall line, and (b, d) Z_{DR} in a supercell.

As COMET serves a diverse population of learners, with registered users spanning more than 190 countries, the project team has focused on making the course content as flexible and accessible as possible. Examples of these efforts include:

- Equations and visualizations coded for screen readers (US section 508 Web Content Accessibility Guidelines)
- Color vision deficiency (CVD)-friendly color maps (Sherman et al. 2024; Fig. 4)
- Low- and high-memory versions of some animated and/or interactive elements.

Acknowledgments

This project is sponsored by the National Science Foundation (AGS-2303653, AGS-2303654). The PI's sabbatical is partly supported by the Purdue College of Science. Fig. 4 was generated using Weather and Climate Toolkit v.4.8.1.

References

Sherman, Z., and Coauthors, 2024: Effective Visualization of Radar Data for Users Impacted by Color Vision Deficiency. *Bull. Amer. Meteor. Soc.*, **108**, E1479–E1489, 10.1175/BAMS-D-23-0056.1.