Spring 2018

Advanced Topics: Synoptic Meteorology

Monday 1:25 pm to 3:15 pm, Warren Weaver Hall 705

Instructor

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Course Description

The goals of this course are to explore the foundations of weather prediction and synoptic meteorology. We will take a historical perspective, reading the classic papers that propelled the field forward, and reviews looking backward to capture the full context of these pivotal efforts. What makes a paper "classical" is subjective, but I take the year of my birth — 1978 — as a demarkation point; it works nicely because I arrived at the very end of the pre-satellite era … and I'm facing round birthday at the end of the term, ugh!

We'll start at the turn of the previous century, when scientists first started to think about applying physics to predict the weather (as opposed to relying on the behavior of large marmots, the length of bands in fuzzy caterpillars, etc.). This will lead us to the "Bergen school of meteorology" and the first numerical weather predictions efforts in the UK and Princeton. The direction from there on will depend part on the interests of the class, but I hope to explore the "air mass" view of meteorology, frontegenesis (and the more explosive elements of extratropical cyclones, such as we witnessed earlier this month), the fundamentals of tropical cyclones, the mesoscale meteorology associated with extreme convection and thunderstorms, and the limits of predictability.

It is my hope that this course will provide a nice complement to what you have learned in Geophysical Fluid and Atmospheric Dynamics, which tends to focus more on the large scale circulation (or on yet smaller scale gravity waves). If nothing else, you will be better prepared to handle questions from your friends and family about the weather, or more importantly, handle a meteorologist in the elevator while on a job interview in department with strong meteorological component!

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Expectations

I hope that students will have taken a course on Geophysical Fluid Dynamics, or the equivalent, and so are already familiar with the equations of fluid flow appropriate for the Earth's atmosphere. Given that we are starting at the very beginning, however, there's room for anyone to attend as long as you are willing to make an extra effort to get yourself familiar with the governing equations.

Requirements and Grades

As this is a seminar course, class participation is required. You are allowed one unexcused absence, but otherwise must attend all sessions. Absences are of course excused for due cause (illness, family emergency, research related travel), but please do try to let me know in advance, if at all possible.

Each student will be required to present and lead the discussion of 2-3 papers over the seminar, chosen in consultation with the instructor. The goal is to find something that interests you personally (e.g. tropical cyclones, numerical weather prediction, frontegensis), but keeps us focussed on synoptic meteorology.

On the danger of a taking a historical perspective

The advantage of a historical perspective is that gives us a sense of the actual process of science, as opposed to just the end results that end up in text books. It's easy to forget the bad ideas and rabbit holes that ultimately got us to our current understanding. It also speaks to the wonder of the human mind — the amazing insights possible without computers or satellites.

In adding the human element, however, one cannot avoid the fact that the *vast majority of the world* — women and all people of color — were denied the educational opportunities and resource to participate in science until fairly recently (and even today it is not a level playing field). The few who did faced active and passive discrimination. I will make an effort to include contributions by pioneering scientists from under-represented groups, but want to emphasize that the historical papers do not reflect the diversity of our field today, and vastly underrepresent its future.

Postscript. The picture on the first page is a crude view of a shelf cloud, advancing in front a pretty intense thunderstorm, complete with hail!