Overview of Midterm Exam #2
METR 4403/5403 – Spring 2023

The second midterm exam will cover materials taught in lectures from Feb 22 (convective modes) through April 17 (Fire weather) or lecture 11 through 21.

Format:
- Closed notes (like traditional in-class exam), closed everything (e.g., phones, etc.).
- Everyone is expected to take exam in person in NWC 1350 (except for special situations)
- Several multiple choice, fill-in-the-blank, or true-false questions.
- 3-4 multipart questions.
- No calculations. There may be simple derivations starting from equations given. A list of equations will be provided to you on last page of exam.

Materials needed:
- Pen/pencils. You may find color pencils to be helpful as well. I will provide paper.

Topics we covered:
1. Lecture 11: Convective mode
    a. Modes (ordinary, multicell, supercell) and environment conditions
    b. Importance of vertical wind shear in determining the modes
    c. Cell movement versus system propagation of multi-cell storms
    d. Supercell characteristics, features, types and motion
    e. Recipe for a squall line
    f. Recipe for discrete storms
    g. Case examples

2. Lecture 12: Mesoscale convective systems and derechos
    a. MCS and derecho definitions.
    b. MCS motion
    c. Derecho climatology.
    d. Synoptic patterns for derechos.
    e. External forcing and inhomogeneity in environments.
    f. MCSs and derechos near jet streaks and role of inertial instability.
    g. Anticipating MCS severity.
    h. Anticipating MCS longevity.
    i. Derecho failure modes.

3. Lecture 15–18, 20: Supercells and tornadoes
    a. Origin of midlevel rotation in supercells (linearized vorticity equation)
    b. Supercell propagation and diagnostic pressure equation.
    c. Linear versus nonlinear dynamic forcing.
    d. Forecasting supercell motion.

     e.   Source of mid-level versus low-level versus near-surface rotation in supercells.
     f.   Tornadogenesis.
     g. Nonsupercell tornadogenesis and tornado life cycle.
     h. Supercell Composite Parameter and Significant Tornado Parameter.
     i.   How to determine effective inflow layer of supercell storms.
     j.   Tornado climatology.

4. Lecture 19: Tropical Cyclone tornadoes
     a. Tornado facts and climatology
     b. Climatological application to forecasting concepts
     c. Forecasting concepts (synoptic and mesoscale)
     d. Radar application
     e. Convection-allowing models and SPC forecasts
     f.   Case examples

5. Lecture 21: Fire weather
     a. Basics of fire weather forecasting
     b. Climatology
     c. Fuel types and indices
     d. Fire weather indices
     e. Plume versus wind-driven
     f.   Fire weather regimes and circulation patterns (synoptic, mesoscale, and local)
     g. SPC products