

## **Knowledge Expectations for METR 4424 Synoptic Meteorology Laboratory**

**Purpose:** This document describes the principal concepts, technical skills, and fundamental understanding that all students are expected to possess upon completion of METR 4424, Synoptic Meteorology Laboratory. Individual instructors may deviate somewhat from the specific topics and order listed here.

**Pre-requisites:** Grade of C or better in METR 3123, METR 3223.

Students should have a basic understanding of the structure, physics, dynamics and thermodynamics of the atmosphere prior to starting this course.

**Goal of the Course:** This course is a lecture/laboratory course designed to provide students with an in-depth physical understanding of atmospheric principles. Students will be expected to explain theoretical concepts in an oral and written format. They also will be expected to demonstrate a mastery in understanding various physical processes that impact weather analysis and forecasting, surface and upper air analysis, fronts and wave cyclones, satellite meteorology, sounding analysis, thermodynamic diagram, cross sections, forecasting, NCEP models, MOS, radar meteorology, and severe spring and winter weather. Oral and written communications skills are emphasized.

### **Topical Knowledge Expectations**

#### **I. Synoptic Meteorology Concepts.**

- Understand the three dimensional nature of fronts using the wave cyclone model, conveyor belts, and isentropic analysis.
- Understand the concepts of temperature and vorticity advection.
- Understand the concept of the thermal wind relationship and apply the knowledge gained to understand the development, structure, and impact of jet streaks.
- Understand the impact of latent heat release on atmospheric processes including the rapid intensification of cyclones and the structure of mesoscale convective systems.
- Using Quasi-Geostrophic theory, understand the relationships between the advection of temperature and vorticity with vertical motion and structure of the atmosphere.
- Understand the relationship between synoptic scale atmospheric processes and outbreaks of severe weather.
- Be able to synthesize knowledge gained in METR 4424 to understand the four dimensional nature of the atmosphere and forecast synoptic scale weather conditions.

#### **II. Synoptic Meteorology Tools**

- Be able to use the thermodynamic diagram in conjunction with observed profiles of temperature, humidity, wind speed, and wind direction to diagnose the vertical structure of the atmosphere in relation to specific weather phenomena.
- Understand the basic concepts associated with analyses of surface and upper air charts.

- Understand the utility and limitations of data used in synoptic meteorology including in situ sensors, atmospheric soundings, and remote sensing devices (i.e., radar and satellites).
- Understand the utility and limitations of numerical methods used to display and forecast synoptic weather conditions including objective analysis, NMC models, and MOS.
- Be able to communicate weather conditions and phenomena in a clear and concise manner to peers through a series of oral weather briefings.
- Be able to use existing technologies including GEMPAK, GARP, NTRANS, NSHARP, Weather Scope, and html to display and communicate specific weather phenomena.
- Be able to synthesize the tools used in METR 4424 to understand and forecast synoptic scale weather conditions.

### **III. Case Study Analysis**

- Be able to work within a team of peers during the semester to diagnose physical processes involved in the specific weather phenomena studied within the case study environment.
- Be able to communicate to and educate remaining class peers about the principal findings of the case study.