***Advanced synoptic meteorology***

***for 1st stage postgraduate (Masters)***

***lecturer***

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***The principal of Synoptic meteorology***

A synoptic chart is any map those summaries atmospheric conditions (temperature, precipitation, wind speed and direction, atmospheric pressure and cloud coverage) over a wide area at a given time. They display an overview of the weather conditions observed from many different weather stations, aeroplanes, balloons and satellites.

 By collating the information over a wide area, meteorologists can observe the behavior and movement of weather formations that might affect their local area in the future. This allows meteorologists to make more accurate weather forecasts. Charts are updated at least every six hours.

surface weather maps and level charts are ( 1000,950,850,700,500,300,200)

 There are many different types of weather map, all drawn using internationally agreed standards and using accepted symbols. To make the plotted data more comprehensible,you can simplify the weather map by drawing isopleths (lines of equal value ).

**The primary isopleths and their definition:**

***Isobar***- contour of equal [pressure](http://www.theweatherprediction.com/habyhints2/410/) .***Isohypse***- contour of equal geopotential height***. Isotherm***- contour of equal temperature.***Isotach***- contour of equal wind speed .***Isodrosotherm***- contour of equal [dewpoint](http://www.theweatherprediction.com/habyhints/190/).***Isohyet***- contour of equal rainfall. ***Isentrope***- contour of equal [potential temperature (Theta)](http://www.theweatherprediction.com/habyhints/162/).***Isallobar***- contour of equal surface barometric pressure change.***Isoster***- contour of a constant density.

A station-plot model is often used to plot weather data on weather maps. Map analysis is routinely performed by computer, but you can also draw isopleths and identify fronts, highs, lows, and airmasses by hand.

-***A geopotential height***, H,

 is defined to compensate for the decrease of gravitational acceleration magnitude |g| above the Earth’s surface:

H = Ro ·z /(Ro + z)

where:

The average radius of the Earth is Ro = 6356.766 km. An air parcel (a group of air molecules moving together) raised to geometric height z would have the same potential energy as if lifted only to height H under constant gravitational acceleration. By using H instead of z, you can use |g| = 9.8 m s–2

as a constant in your equations, even though in reality it decreases slightly with altitude

The difference (z – H) between geometric and geopotential height increases from 0 to 16 m as height increases from 0 to 10 km above sea level.

Sometimes g and H are combined into a new variable called the geopotential

Φ­ = g ·H

Geopotential is defined as the work done against gravity to lift 1 kg of mass from sea level up to height H. It has units of m2 s–2.

* ***Sea surface level (SSL)***

 Near the bottom of the troposphere, pressure gradients are large in the vertical (order of 10 kPa km–1) but small in the horizontal (order of 0.001 kPa km–1). As a result, pressure differences between neighboring surface weather stations are dominated by their relative station elevations zstn (m) above sea level

However, horizontal pressure variations are important for weather forecasting, because they drive horizontal winds. To remove the dominating influence of station elevation via the vertical pressure gradient, the reported station pressure Pstn is extrapolated to a constant altitude such as mean sea level (MSL). Weather maps of mean-sea-level pressure(PMSL) are frequently used to locate high- and low pressure centers at the bottom of the atmosphere.

The extrapolation procedure is called sea-level pressure reduction, and is made using the

hypsometric equation:



Where

 a = ℜd/|g| = 29.3 m K–1, and the average air virtual temperature Tv is in Kelvin.

A difficulty is that Tv is undefined below ground.

Instead, a fictitious average virtual temperature is invented:



Where
 γsa = 0.0065 K m–1 is the standard-atmosphere lapse rate for the troposphere, and to is the time of the observations at the weather station.

extrapolates from the station to halfway toward sea level to try to get a reasonable temperature.

***-Thickness***

 Is the difference in height between two atmospheric pressure levels. The hypsometric equation, also known as the thickness equation, relates an atmospheric pressure ratio to the equivalent thickness of an atmospheric layer under the assumptions of constant temperature and gravity. It is derived from the hydrostatic equation and the ideal gas law.

The hypsometric equation is expressed as

