KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF SCIENCE

FACULTY OF METEOROLOGY AND CLIMATE SCIENCES

AN ANALYSIS FOR GEOPOTENTIAL HEIGHT THICKNESS IN WEST AFRICA.

WORK BY:

AGBORGBOR MILLICENT MAWUNYO

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INTRODUCTION

Geopotential height called the geopotential altitude. The geopotential Φ at any point in the atmosphere is defined as the work that must be done against the gravitational field to raise a unit mass from sea level to that point. Φ(z) = the integral from 0 to z, gdz ; where g is the acceleration due to gravity, and by definition we set Φ (0) = 0, therefore Φ depends only on altitude. But g is a function of the location and altitude z and therefore the geopotential height Z, is introduced in order to assume a constant value for g. g the global mean gravitational acceleration = 9.81 m/s2. Geopotential height approximates the actual height of a pressure surface above mean sea-level. Therefore, a geopotential height observation represents the height of the pressure surface on which the observation was taken. The difference in the geopotential height of two constant-pressure surfaces in the atmosphere is proportional to the defined mean air temperature between the two surfaces. The thickness is the vertical distance in meters from P1 to P2 millibar level. The thickness is a function of two properties, the average temperature of the air between P1 and P2 and the average moisture content of the air between P1 and P2. In practical meteorology, the lower height value is subtracted from the upper height value hence a positive value is always attained. The 500-1000 hPa value is used to define 'bulk' airmass mean temperature. The other 'partial' thicknesses are used for special purposes, for example, the 850-1000 hPa thickness is used for snow probability.

METHOD

The below method was used to achieve the results for the geopotential height;

1. The data, ERA-interim Geopotential dataset was downloaded from the European Centre for Medium-Range Weather Forecasts (ECMWF) website from 1981 to 2010 for pressure levels at different hours; at 06hours and 18hours. All mathematical analysis and calculations performed on the datasets were aided by the Climate Data Operator (CDO).

2. After the dataset was downloaded, it was split into the pressure levels of 700hpa and 925hpa for a particular hour say for 06hours from 1981 to 2010.

3. After the splitting, the files were merged to have a dataset of 6am nc file containing both 700hpa and 925hpa and with same for 18pm.

4. The files were then converted such that the geopotential at 700hpa and 900hpa for a particular time to geopotential heights.

1. After the conversion, geopotential heights were used to find the thickness between two pressure levels at a particular time in a year.

2. The thickness found for a particular time was used to calculate the monthly thickness for that particular time.

3. The monthly thickness was used to calculate the yearly mean thickness for the twelve months for a particular time.

4. Finally, NCL was used for the graphical representations of all the yearly monthly mean geopotential height thickness. In total, we had twenty-four plots as expected.

RESULTS AND DISCUSSION.

Figure 1;

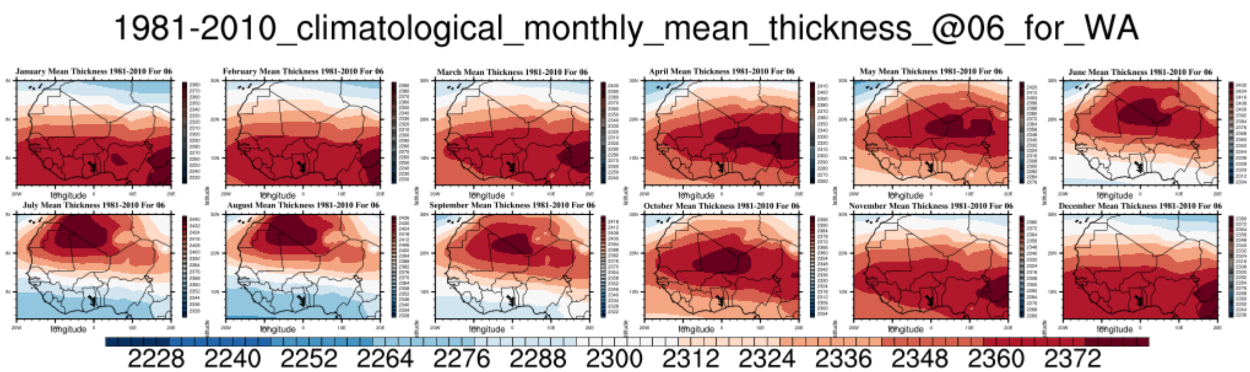
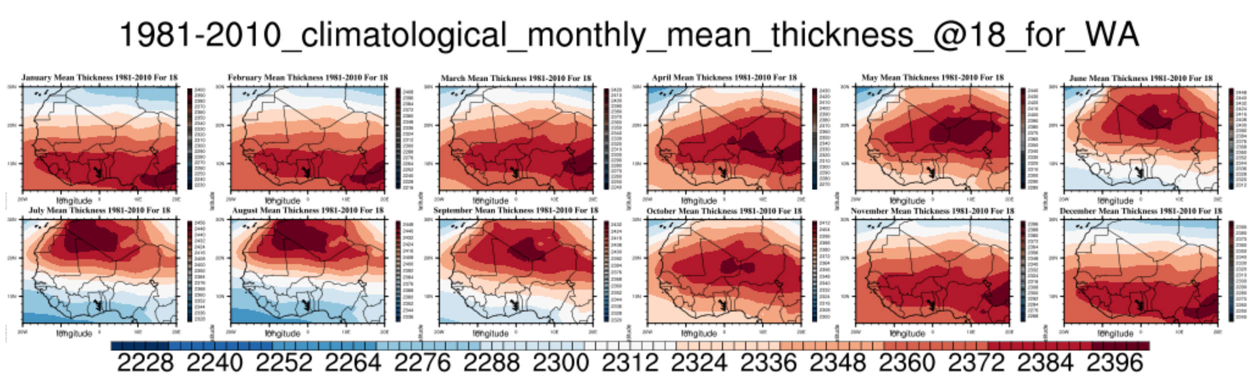


Figure 2



When we compare figs. 1 and 2, the following observations were made:

High temperatures were recorded during the day at 6:00 a.m. than at night at 6:00 p.m. The thickness of the geopotential height is directly

proportional to the mean temperature of the air hence higher thickness values represents higher mean temperature in a region and vice versa Hence comparing figure 1 and figure 2, region of high geopotential height thickness values were significant in figure 1 compared to figure 2 because high temperatures are observed during daytime compared to at night.(6pm). As a result, low temperatures at night lead to low geopotential height thickness values, whereas higher temperatures during the day lead to larger geopotential height thickness values.

CONCLUSION

Cold air is denser than warm air, pressure surfaces in colder air masses are lower, whereas less dense, warmer air allows for greater pressure surfaces. The change of pressure with height is governed by the mean temperature over the vertical distance involved. Hence low values of Tv will yield large $dP\ dz$ values or putting it another way, when you are at 925mb and ascend vertically; in cold air, you would reach the level of 700mb sooner (greater rate of change of p) than in warm air therefore it can be concluded that, the vertical distance from the level of 925mb to the level of 700mb is less in cold air than in warm air. Cold air yield low thickness values; warm air yield high thickness values. Also, the true height of a pressure surface above mean sea level is approximated by geopotential height. As a result, a geopotential height measurement represents the height of the pressure surface on which the measurement was made. Finally, the geopotential thickness is larger during the day, and vice versa.