KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

GROUP TWO(2) PROJECT WORK

INTERPRETATION OF DAILY DATASETS OF GEOPOTENTIAL HEIGHT OF WEST AFRICA AT 0600UTC AND 1800UTC AT THE YEAR 1982 AT A PRESSURE LEVEL OF 700mbar AND 925mbar USING CLIMATE DATA OPERATOR (CDO) AND NCL.

PROGRAM: B.Sc. Meteorology and Climate Science

LEVEL 300

GROUP TWO(2) PROJECT WORK

GROUP MEMBERS

NAMES	INDEX NUMBERS
1. PINKRAH NANA OFOSUHENE	4295120
2. ADJEI-YEBOAH MARTINA	4289420
3. OTI AGYEMAN EMMANUEL	4294820
4. OTENG OBIYAA MARY	4294720
5. ISSAH SAMEERATU	4296820
6. EGYIR ISAAC	4292420
7. NKRUMAH BENJAMIN NYARKO	4293920
8. OPPONG STEPHEN	4296520
9. EWUSI ERIC	4292720
10. ALIFO JOSEPHINE AWUSI ELIKPLEM	4290020
11. MEMIE ETORNAM JOSHUA	4293320
12. FATAWU SALIM, AHMED	4296320
13. GEBEREELA NUHU	4294020
14. MENSAH ARNOLD WILLIAM	4293420

INTRODUCTION

Geopotential height is a measure of the height of a given point in the atmosphere relative to a reference level. It is typically measured in meters and is used to describe the vertical structure of the atmosphere. Geopotential height is related to pressure, temperature, and humidity, and can be used to identify areas of high and low pressure, as well as areas of rising and sinking air. Areas of high pressure are associated with clear skies and light winds, while areas of low pressure are associated with strong winds and heavy rainfall.

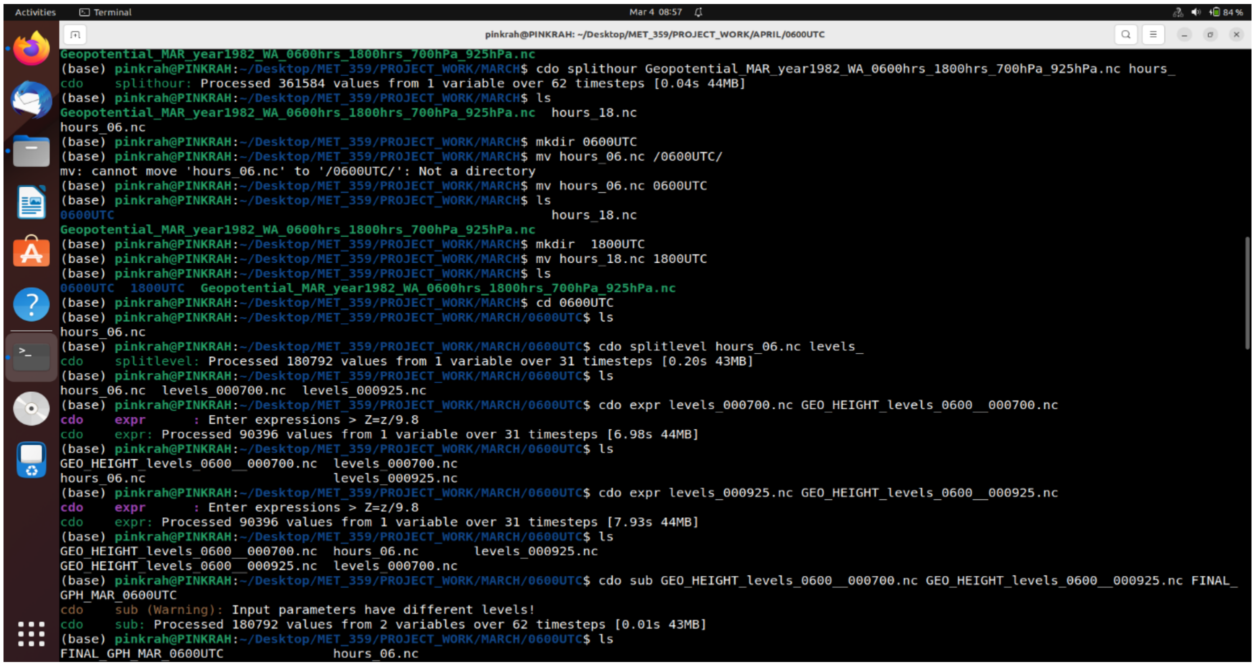
Geopotential height can also be used to identify areas of convergence and divergence, which can be used to identify areas of precipitation. Convergence is when two air masses move towards each other, while divergence is when two air masses move away from each other. When air masses converge, they tend to rise, which can lead to the formation of clouds and precipitation. When air masses diverge, they tend to sink, which can lead to clear skies and dry conditions. Geopotential height can also be used to identify areas of atmospheric instability, which can lead to severe weather such as thunderstorms and tornadoes.

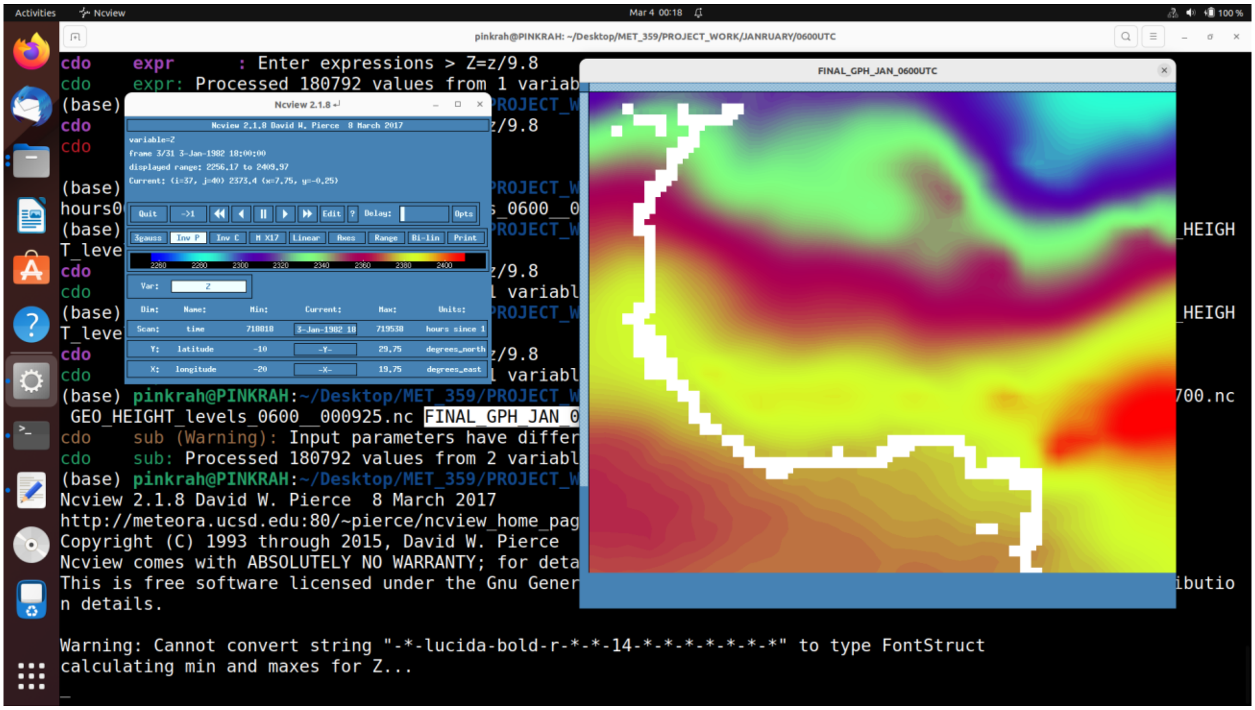
Atmospheric instability occurs when there is a large difference in temperature between two air masses. This difference in temperature can cause the air to become unstable and rise rapidly, leading to the formation of thunderstorms and other severe weather. Atmospheric instability can also be caused by differences in humidity, wind speed, and other factors. Pressure is related to geopotential height because areas of high pressure are associated with clear skies and light winds, while areas of low pressure are associated with strong winds, heavy rain, and even snow. Temperature is related to geopotential height because areas of high temperature are associated with rising air, while areas of low temperature are associated with sinking air. Humidity is related to geopotential height because areas of high humidity are associated with rising air, while areas of low humidity are associated with sinking air.

PROCEDURES

1. Visit ECMWF on web and download "Geopotential" datasets since Geopotential height is exactly not on the site
2. Download daily datasets and rename it in months, time and pressure_levels. Example cdo info "Geopotential_JAN_year1982_WA_0600hrs_1800hrs_700hPa_925hPa.nc
3. Create folders for each month and move the datasets into each folder respectively
4. Split each datasets into hours using "cdo splithour filename.nc output filename.nc"
5. Create folders for each hour and move the splitted hours inside respectively
6. Split each outputted hours into various pressure levels using "cdo splitlevel input filename.nc output filename.nc"
7. Use "cdo infon filenameto view the information from the dataset"
8. Expression " cdo expr input file output file" Geopotential Height "Z=z/9.8"
9. Change in pressure using "cdo sub low_pressurefile.nc high_pressurefile.nc output file.nc"
10. Average of each month "monavg input_filename.nc output_filename.nc"
11. Edit panel using "gedit panel name.nc &"
12. To plot graphs use "ncl panel name.nc"

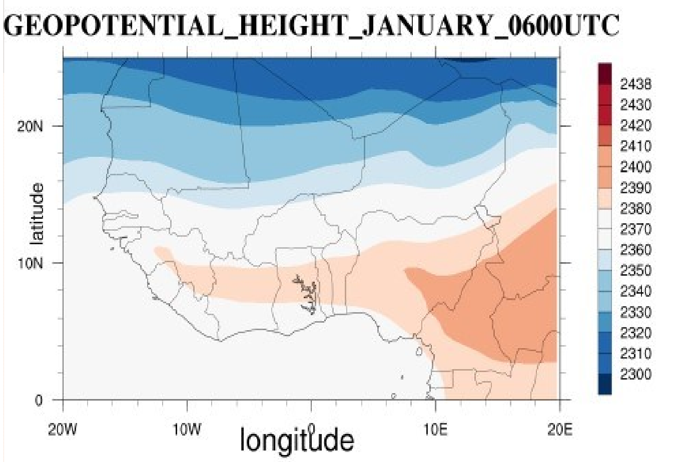
A BRIEF PICTURES ON THE PROCEDURES

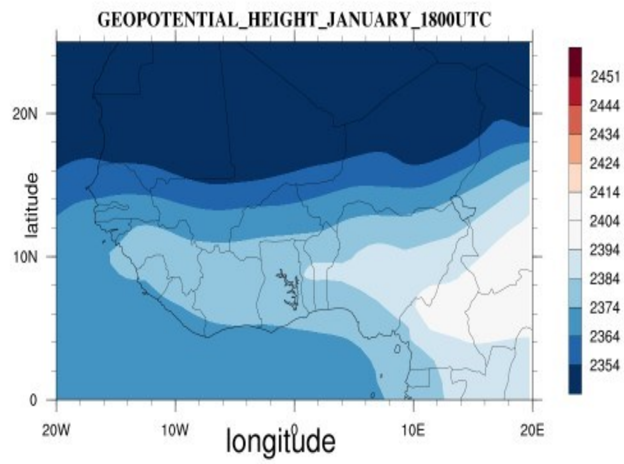




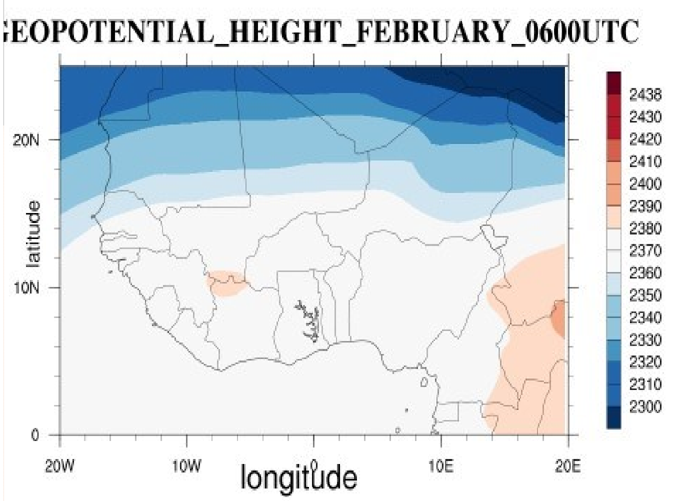
COMPARING GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON THE VARIOUS MONTHS ON 1982

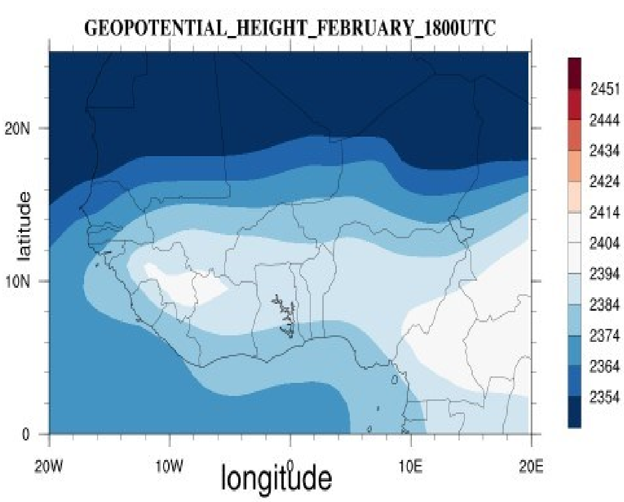
COMPARING GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON JANUARY 1982 AT 225mbar



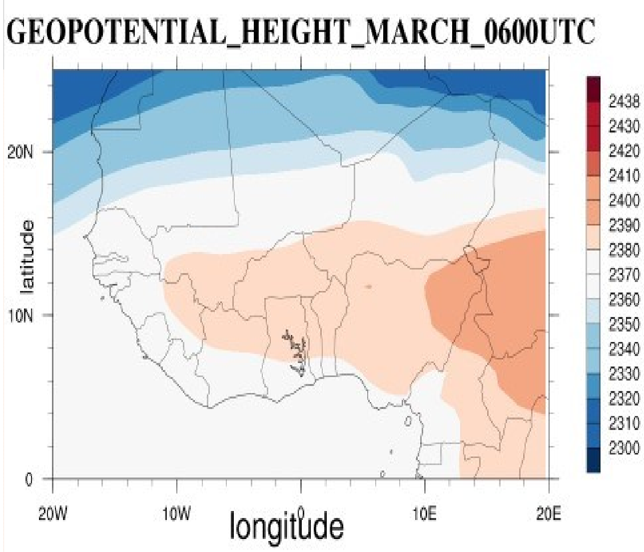


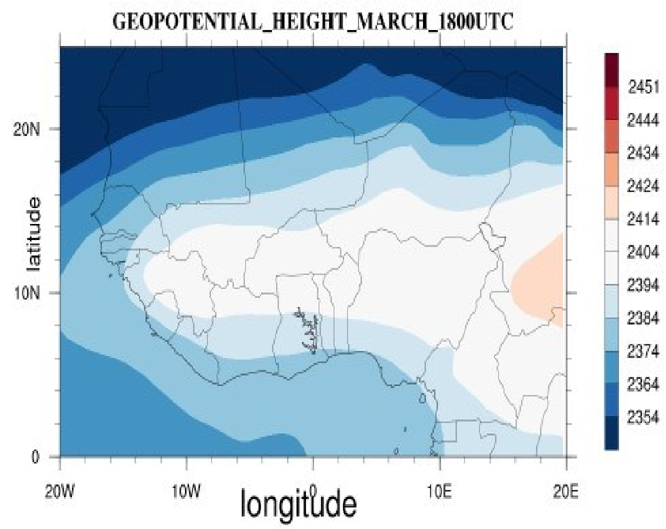
COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON FEBRUARY 1982 AT 225mbar



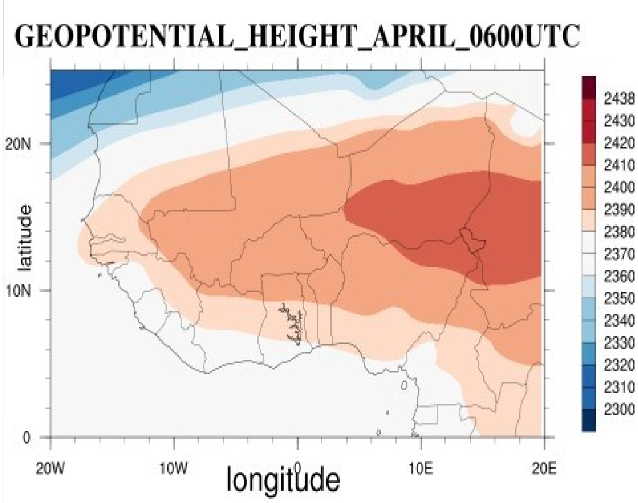


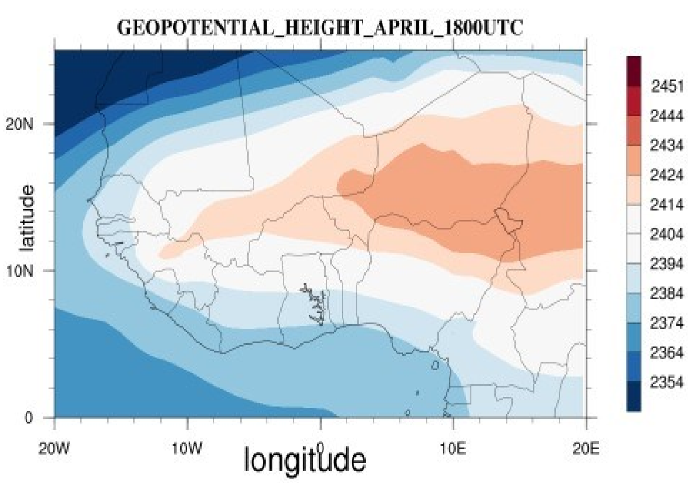
COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON MARCH 1982 AT 225mbar



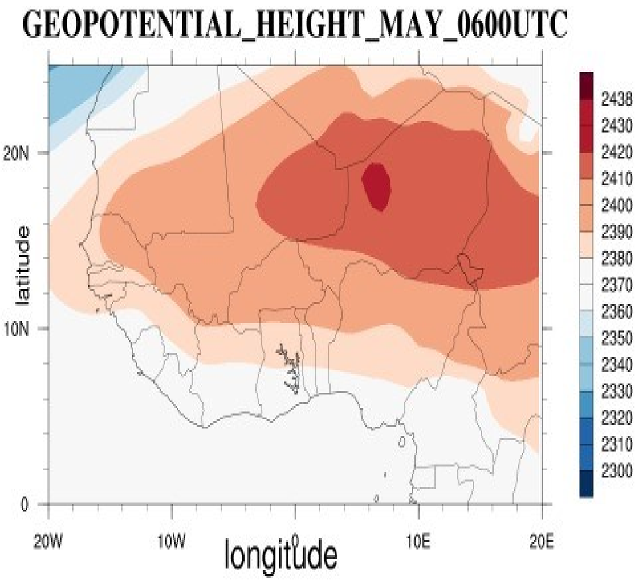


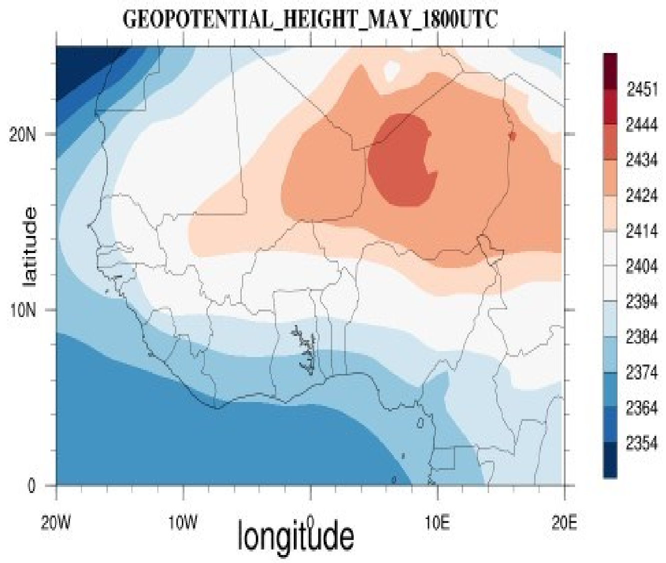
COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON APRIL 1982 AT 225mbar





COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON MAY 1982 AT 225mbar





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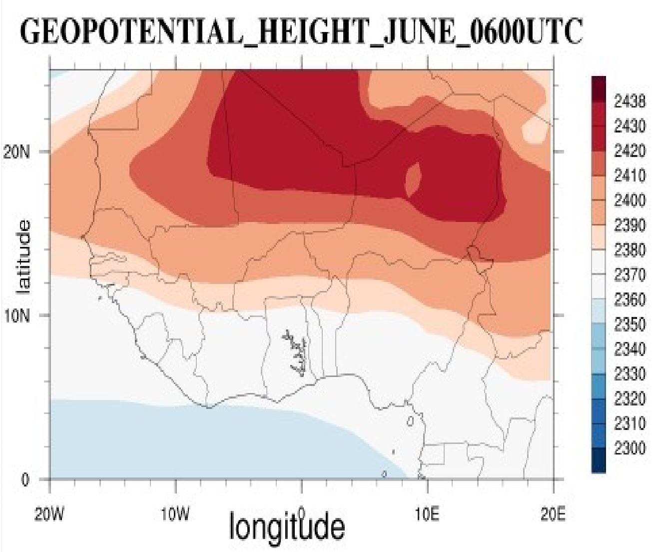
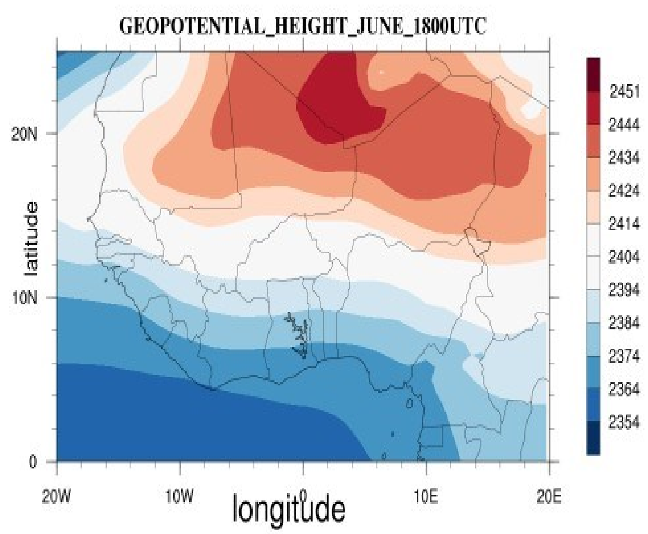
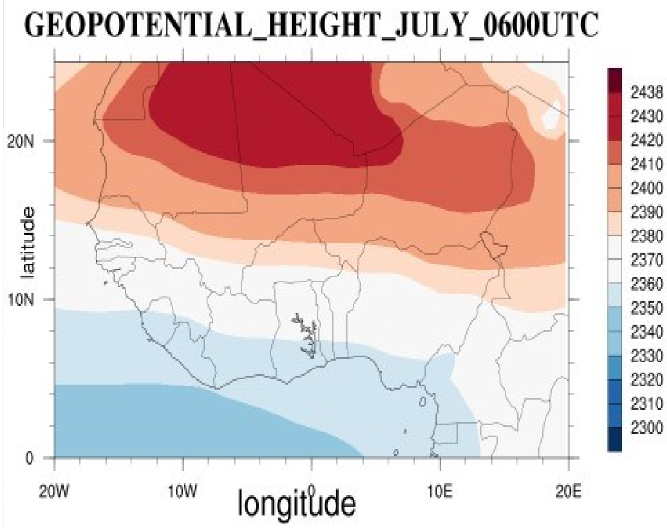
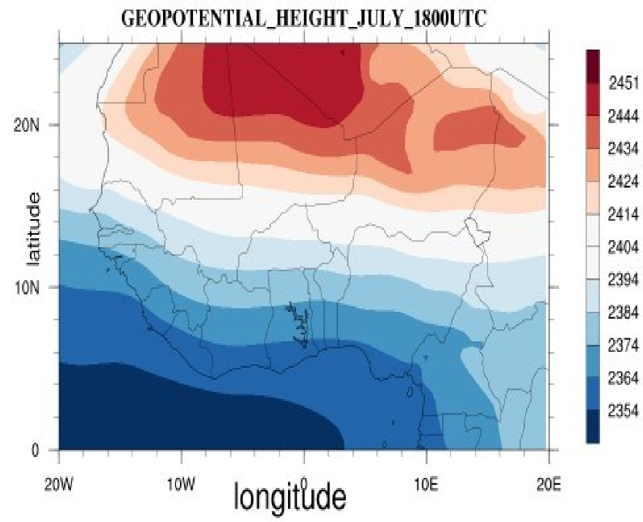


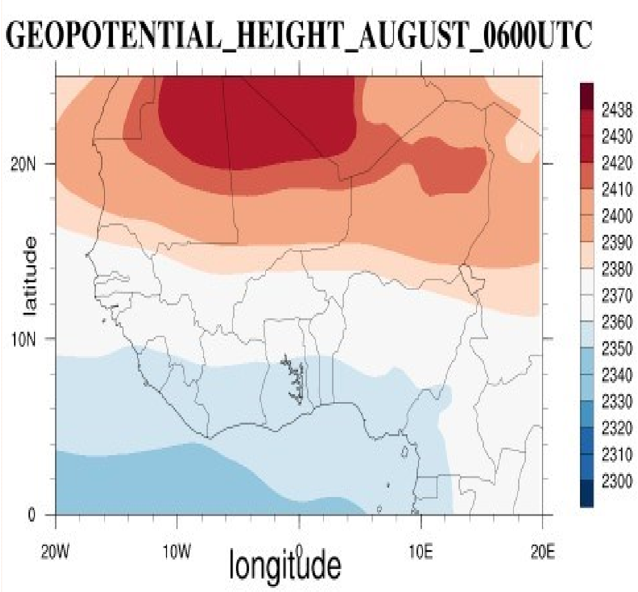


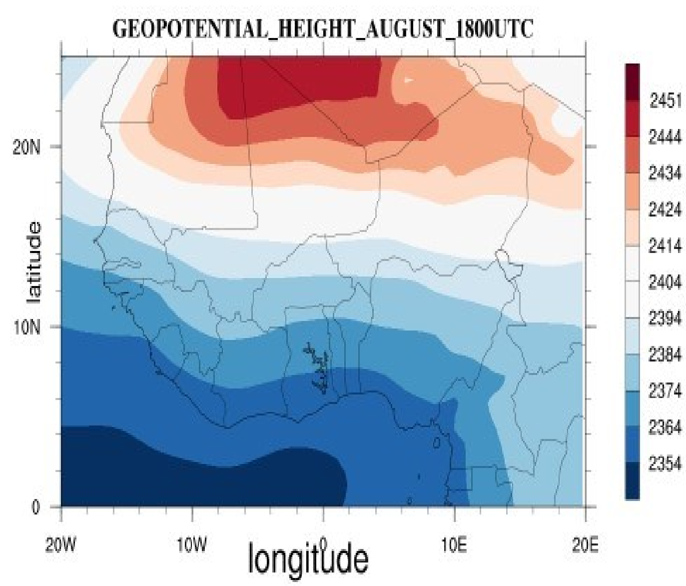
COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON JULY 1982 AT 225mbar



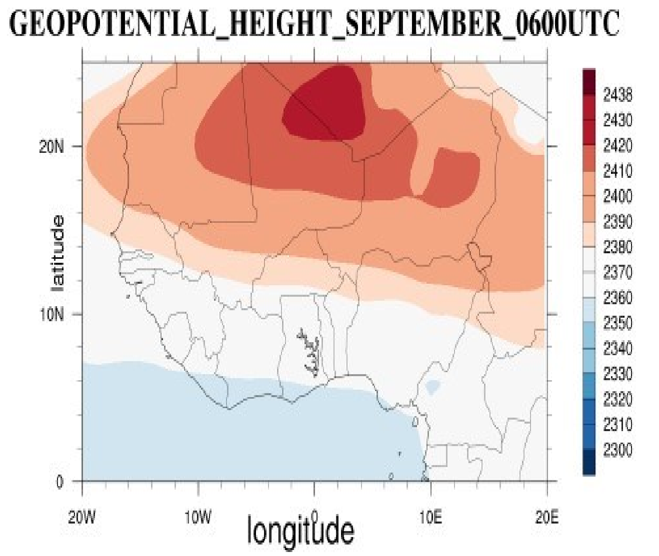


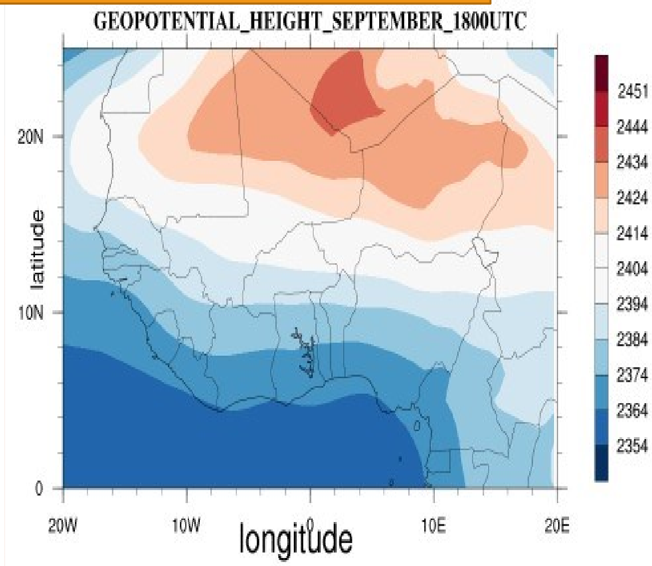
COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON AUGUST1982 AT 225mbar



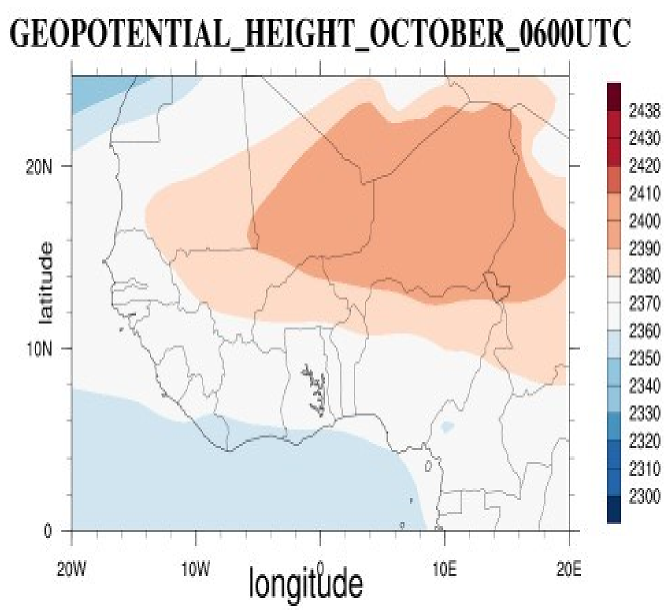


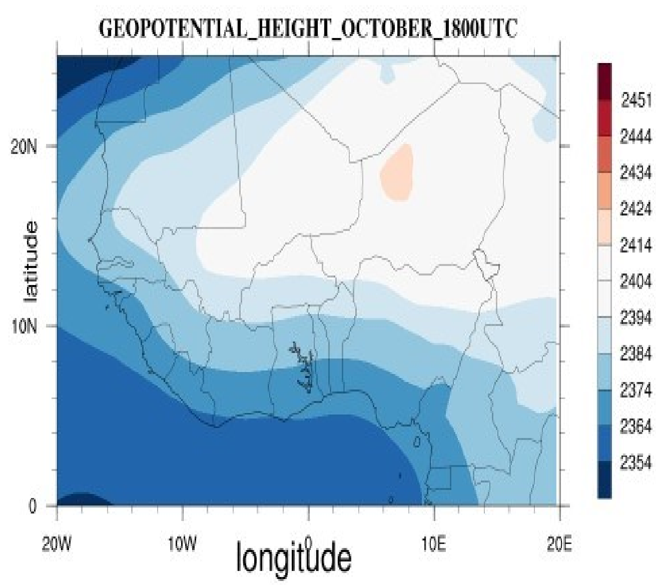
COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON SEPTEMBER 1982 AT 225mbar



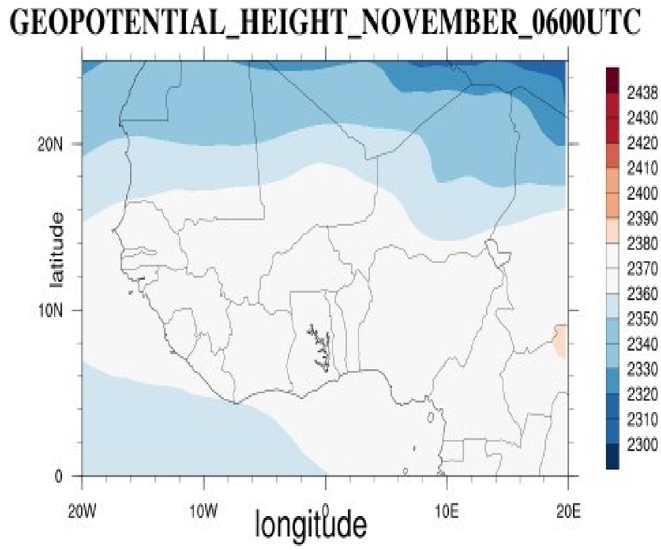


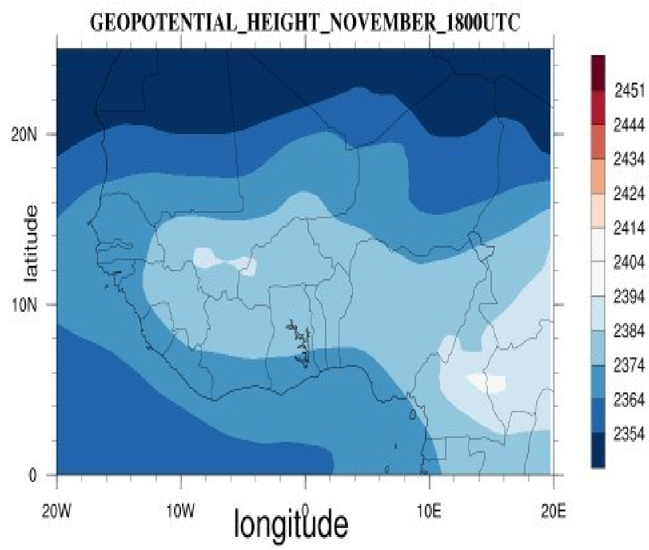
COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON OCTOBER 1982 AT 225mbar



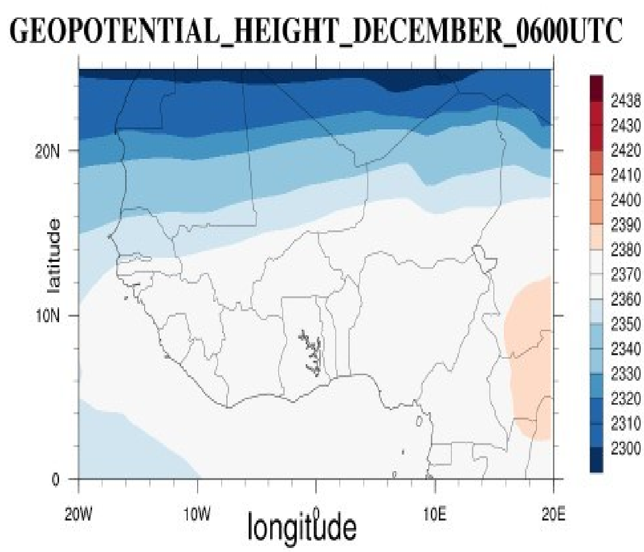


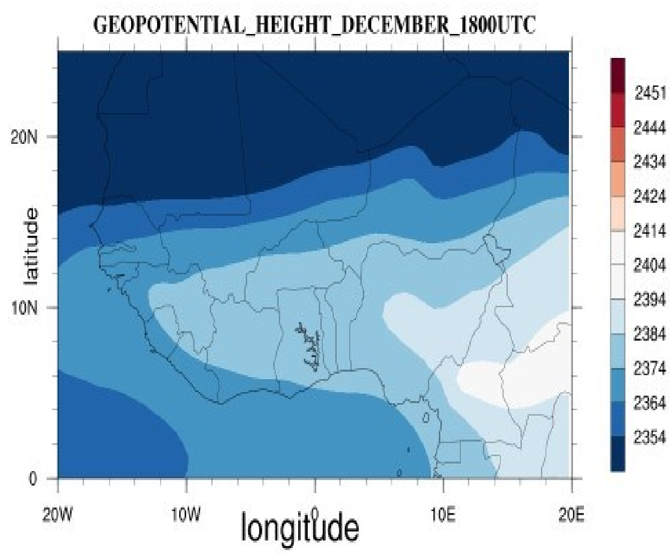
COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON NOVEMBER 1982 AT 225mbar



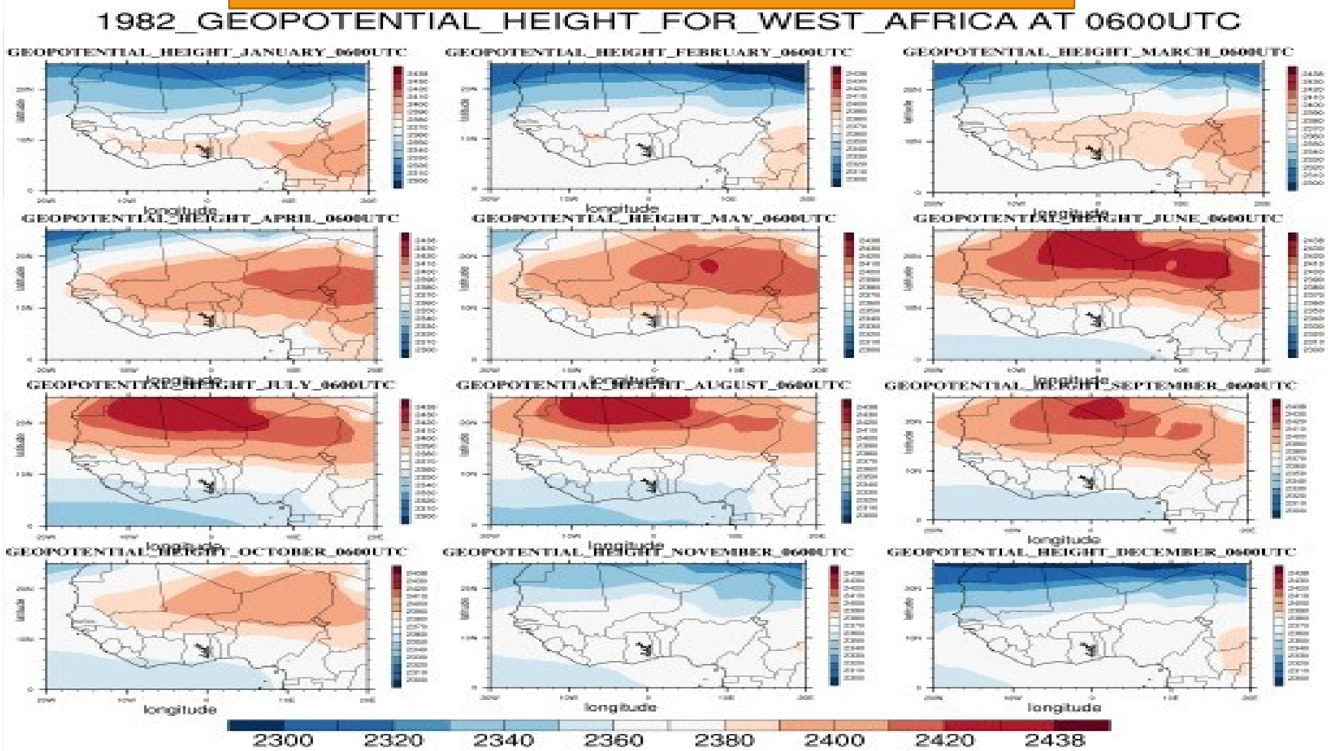


COMPARING OF GEOPOTENTIAL HEIGHT AT 0600UTC AND 1800UTC OF WEST AFRICA ON DECEMBER 1982 AT 225mbar

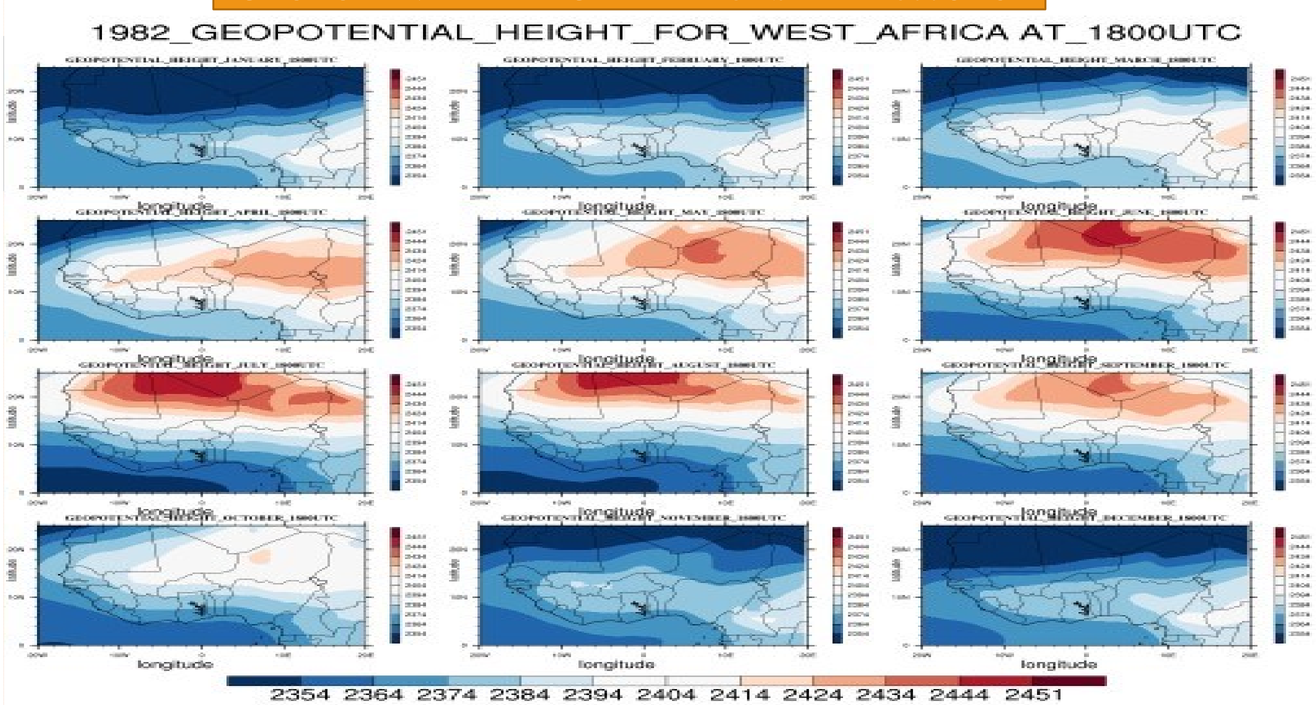




GEOPOTENTIAL HEIGHT AT 0600UTC



GEOPOTENTIAL HEIGHT AT 225mbar AT 1800UTC



DISCUSSION

Geopotential height approximates the actual height of a pressure system above mean sea-level.

Geopotential_height Z = $\frac{\phi(z)}{go}$, g_o =global mean gravitational acceleration = 9.8ms^{-2}

From the legends or color bar the intensed colour(deep-blue) signifies ridge whilst the (deep red) areas represents trough

The geopotential thickness 225mbar which is the difference of the pressure levels– 925mbar and 700mbar – is proportional to mean virtual temperature in that layer. Temperature degree has large effect on geopotential height value.

Geopotential height can be used to identify areas of instability, which can help meteorologists predict the likelihood of severe weather in a given area. Atmospheric instability occurs when there is a large difference in temperature between two air masses. This difference in temperature can cause the air to become unstable and rise rapidly, leading to the formation of thunderstorms and other severe weather. Atmospheric instability can also be caused by differences in humidity, wind speed, and other factors. Geopotential height can be used to identify areas of instability, which can help meteorologists predict the likelihood of severe weather in a given area.

OBSERVATION

In the year 1982, from the plots it was observed that;

1. Geopotential height increased or is high in the Morning at 06UTC as compared with Evenings at 18UTC because of the diurnal temperature cycle. During the day, the sun heats the ground, which causes the air near the ground surface to rise(adiabatic cooling). This rising air creates an area of low pressure near the ground, which is associated with high geopotential height. As the day progresses and the sun sets, the air near the ground surface cools and begins to sink, creating an area of high pressure near the ground. This high pressure is associated with low geopotential height.
2. At 1800UTC areas along the coastal belt were observed to be experiencing a very low geopotential hight ranging between (2354m-2384m) whilst at 0600UTC areas along the coastal belt were observed to be experiencing a moderate geopotential hight ranging from (2340m-2390m)
3. The Geopotential height were high in April, May, June, July, August, September as result of the wet season, in which these months temperature were high, and pressure were low causing convective activities such as rainfall.
4. the geopotential height were low in October, November, December, January, Febuary and March it signifies that these months experienced dry season at west Africa because there were low temperature, and higher pressure, which cause low convective activities, clear skies.

CONCLUSION

In conclusion as Geopotential Height increases temperature increases, humidity increases and pressure decreases, so areas of high pressure will experience low convective activities, whilst areas of low pressure will experience high convective activities such as rainfall activities

From the plots it can be concluded that the Geopotential height have effects on the dry and wet seasons, since the geopotential height were low in October, November, December, January,Febuary and March it signifies that these months experienced dry season at west Africa because there were low temperature, and higher pressure, which cause low convective activities.

The Geopotential height were high in April, May, June, July, August, September as result of the wet season, in which these months temperature were high, and pressure were low causing convective activities such as rainfall. Geopotential height is related to pressure, temperature, and humidity, and can be used to identify areas of high and low pressure, as well as areas of rising and sinking air. Areas of high pressure are associated with clear skies and light winds, while areas of low pressure are associated with strong winds and heavy rainfall.