

Weather Transition Periods in Ghana

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Abstract

The transition periods in Ghana are quite interesting because of the hazards they create to the general public and especially the aviation industry. Strong winds accompany rain storms to rip off roofs of buildings. Dust haze will reduce visibility and affect activities of flight operations. Flight routes and destinations will have to be changed for safety measures. Meteorologists in Ghana have studied the synoptic features that trigger these activities. These features include the ITB (Inter Tropical Boundary), the Equatorial Trough and the nature of airmass affecting the West African sub region.

Keywords: ECMWF; NOAA; Cumulonimbus; Azores; St. Helena; Sahel; ITB; Gulf of Guinea; Google earth

Introduction

Ghana is a country that has two distinct transition periods. The country is located in the western flank of the African continent. It is directly intercepted by the Greenwich Meridian, and then slightly north of the Equator. Both sunshine and rainfall are very common in the country. It is bordered in the south by the Gulf of Guinea in the Atlantic Ocean and over the north by the Sahel region. This has made mostly the southern sector to possess rain forest and the north to possess mainly grassland. The transition sector of the country is characterized by shrubs which has weather features that look like a mixture of both the geographical sectors of the north and the south [1].

The transition period (from the dry to the rainy season) is the time when the harmattan hazy conditions that previously reduce visibility over the West African sub region is been cleared by rain or maritime airmass. Visibility can be seen to improve appreciably.

The other transition period is when the moist atmosphere changes to be dry. The previously maritime airmass that affects the region then changes to be continental. Ghana is a country which has two or even more types of unique weather conditions. The weather becomes quite significant when changing from one particular type to the other and can be explained by Meteorologists or very good observers.

Ghana has what is termed as the major rainy season, the minor rainy season, the little dry season and the actual dry season which is prolonged. The prolonged dry season is characterized by mostly dusty atmosphere with reduced surface visibilities. The beginning of the major rainy season seems to mark the end of the dry season. This period is characterized by very strong winds accompanying rain storms whenever they occur. Temperature contrast between the two seasons, associated with contrasting pressure values are mostly associated with destructive weather phenomena.

Northerly winds that affect the country usually originate from the higher latitudes during the dry season so they are relatively colder than the maritime southerly winds. Whenever they converge over the country it brings about contrasting situations that result in severe thundery activities. The interaction between these wind systems usually results in steep pressure and temperature gradients which eventually drives the atmosphere at very high speeds. Ripping off roofs, destruction of billboards and uproot of trees are the most common events that associate these weather systems.

During the harmattan season (between November and January),

winds that mostly affect the country are of continental in nature and northerly, mostly north easterlies. The direction from which the surface wind is blowing at that time determines the strength or intensity of the hazy condition. It defines the transparency of the atmosphere and it has been realized that when the north easterlies affect the country, visibility reduces drastically but when the airmass is directly northerly, though the atmosphere use to be quite dry but not so dusty as compared to the former.

Evidence from satellites, GoogleEarth reveals that the nature of the surface over Niger, which is directly northeast of Ghana, looks quite sandy while directly north of the country, which is Mali, looks a little bit rocky. For these reasons, winds originating or tracking Niger looks dustier than those from Mali.

The above listed weather conditions (major rainy season, the minor rainy season and the little dry season) do not apply to the entire country but depends on the geographical location and the season. They all occur simultaneously within a year, so weather forecasting for the country has been based on certain local elements in order to arrive at a very high accuracy.

The major technique is the location of the Inter Tropical Boundary (ITB) over the West African sub region for which Ghanaian Weather Forecasters and Meteorologists devised in making predictions easier for the country. Because of the geographical location of the country, it is either affected by a maritime air mass or a continental air mass or both at the same time. This led to the exploration of the ITB, a location on the surface of the earth believed to be the boundary or a position where both dry and moist air masses converge on the West African sub region. Experimentally, the ITB has also been realized to coincide with areas on the surface which has dew point temperature of 15°C.

Surface weather charts from ECMWF and NOAA had been the products used by Ghanaian meteorologists most of the time in making their weather predictions. The products have been very helpful and are

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quite reliable in monitoring and predicting weather conditions in the country. During the harmattan it can be realised that high pressure systems build up across North Africa. The Azores high pressure, the Libyan high pressure and the Arabian high pressure systems usually intensify and merge (Figures 1 and 2).

The latitudinal extent of the closing isobar which defines the high pressure system (1015 hPa), and also its orientation best defines the intensity of the haze and also the extent to which the haze will spread to affect the country. At that time the apparent position of the sun is in the southern hemisphere so the northern hemisphere will be in its winter. Winds originating from those high pressure systems turn to take up the properties of the source regions.

Whenever a low pressure troughs into these high pressure systems during the harmattan period rain becomes the outcome over Ghana and the hazy condition clears appreciably. This phenomenon benefits the southern sector of the country mostly. These are signs which mostly Meteorologists use in predicting the onset of rains in the country. Nevertheless, wind direction and speeds at both the surface and the upper atmosphere are not left unconsidered.

Experimentally, it has been observed that during the harmattan period, whenever winds have easterly components at the 700 hPa and the 200 hPa levels respectively over the country, and are quite strong to about 30 knots then rainfall is most likely to occur abundantly. These storms are usually violent in nature. These types of rainfall propagate from the east of the country toward the west of the country. They can be seen on the satellite imagery propagating from Nigeria or even further,

through the Republic of Benin, Togo, Ghana and eventually enter into the Atlantic ocean (Figure 3).

Also, during the harmattan season when winds at the upper atmosphere, like the 200 hPa level are westerly, storms that form to the western flank of Ghana ends up affecting the country from the west. This type of weather condition produces less rain compared to the previously mentioned easterly storms. At that time winds at the 700 hPa which are mostly termed as the steering level of West African storms are mostly easterly and the tops of the cumulonimbus clouds (CB) are been sheared thereby weakening the system.

Mostly storms affecting Ghana starts from the east and propagate towards the west because of, probably, the rotation of the Earth from west to east. If there is a cloud located in the atmosphere or suspended to the east of a station and the earth rotates, observers will see it moving towards the west because they rather get closer the system with time.

The major rainy season (March to July) and the minor rainy season (September to November) are experienced only in the southern sector of the country making it possible for certain crops like maize to be grown twice in a year over the same piece of land. Between these periods, August is described as the little dry season. Farmers used this period in preparing their lands for the second growing period in the south.

The northern sector of the country has only one rainy season which is a little bit prolonged but peaks in August. The little dry season has been the transition period over the southern sector and is

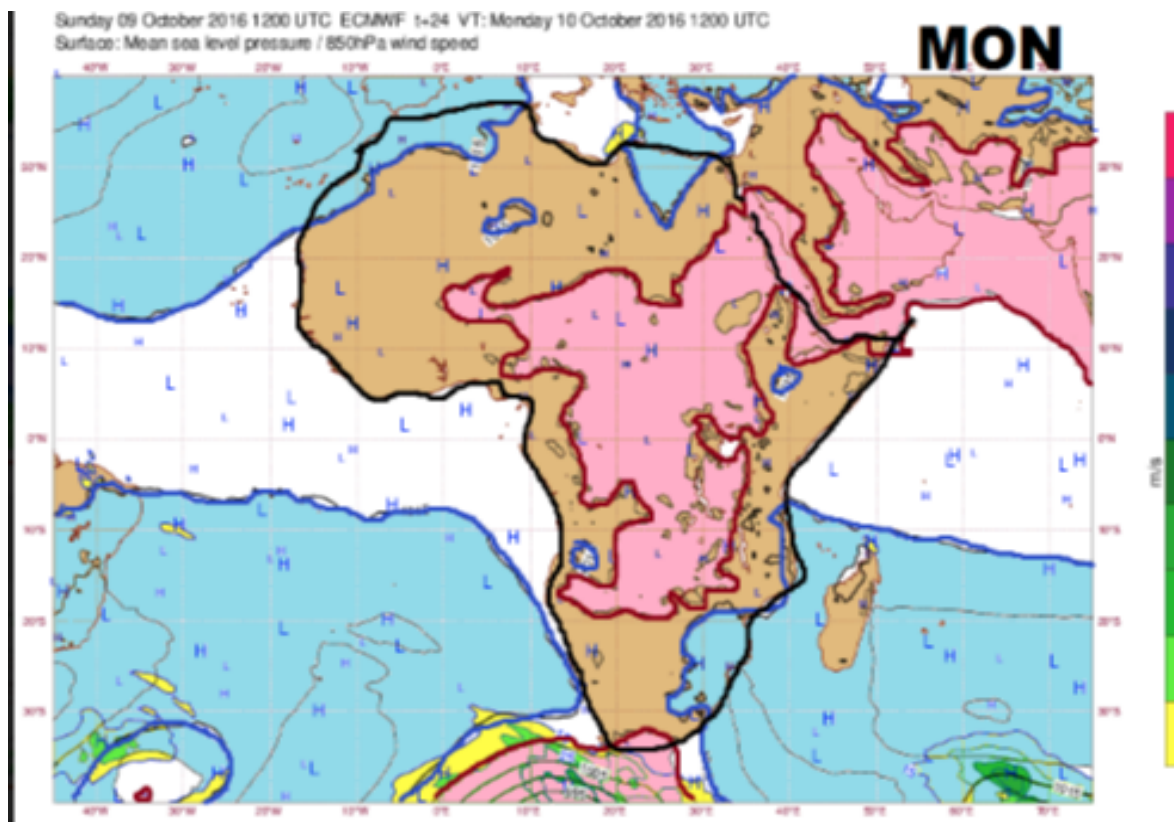


Figure 1: The approach of the minor rainy season (10th October, 2016) in the southern sector of Ghana as the St. Helena weakens and Azores intensifies and expands towards North Africa.

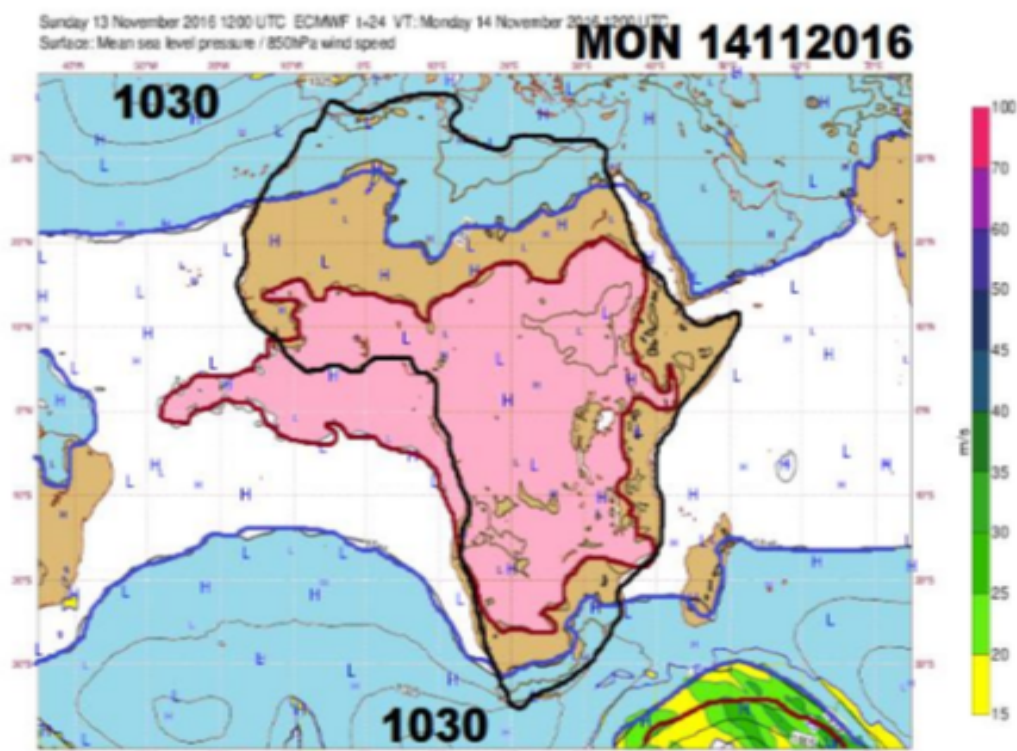


Figure 2: Pressure field on 14th November, 2016 showing the ridging of the high pressure over North Africa (Libyan High). Red areas are low pressures and blue are high pressures.

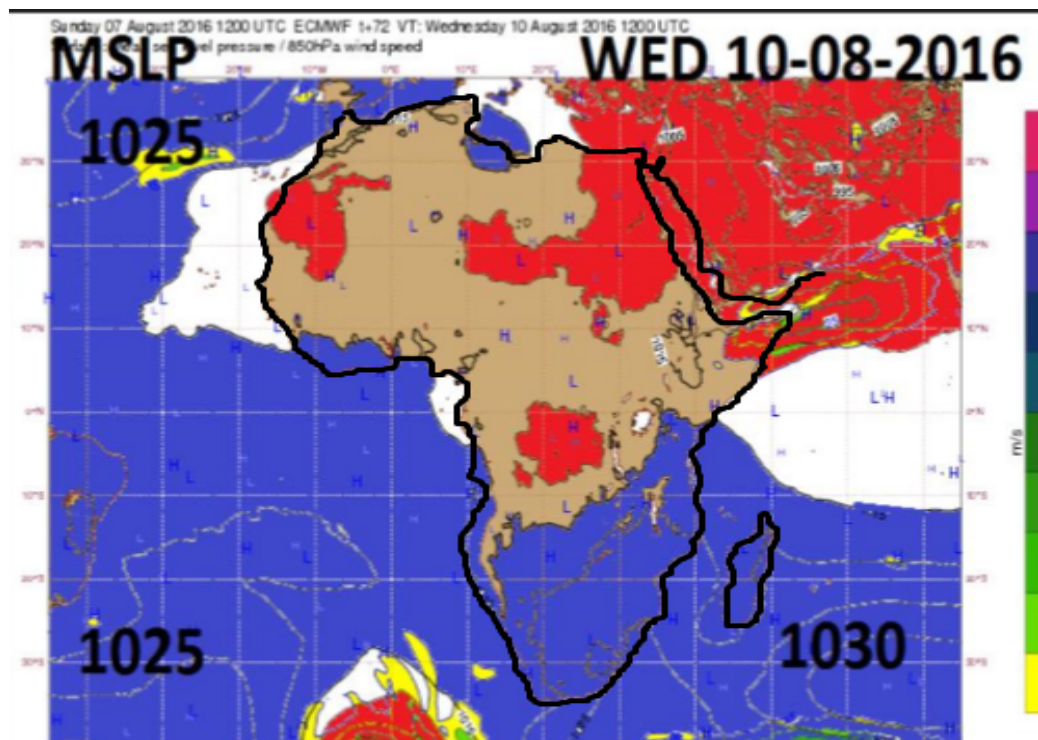


Figure 3: Pressure field in August, 2016 showing the intensification of the St. Helena high pressure over the South Atlantic Ocean. Red areas are low pressures and blue are high pressures.

mostly characterized by relatively low temperatures which make it very difficult for convective activities to take place. CB clouds are very rare so thunderstorms and turbulent activities are mostly absent in the south. Precipitation is mostly of the drizzle type and most often stratified layer clouds cover the skies with sunny spells sometimes. It has also been the time when winds from the higher latitudes, the St. Helena high pressure system penetrate more into the country from the Southern Hemisphere so temperatures are usually low.

The northern sector experiences only two seasons, the dry season and a rainy season. The dry season that affects the country starts from the northern sector because it is closer to the Sahel which is the source of the harmattan haze and move southwards. Each of the two seasons are mostly prolonged over the north than over the south making specific types of crops like yam, millet and guinea corn that takes longer periods to grow thrive better than over the south.

Prior to the harmattan is the end of the rains so skies become clear and the sun's rays reaches the surface directly making daytime temperatures very hot to as high as 40°C and night-time temperatures as low as 19°C. The absence of clouds in the night permits the terrestrial radiations to escape into the atmosphere making greenhouse effect very minimal.

Daytime temperatures starts reducing when the haze sets in where most of the sun's rays are been reflected, refracted and scattered by dust particles present in the atmosphere and night-time temperatures

start to increase due to greenhouse effect. Wind direction changes and relative humidity (RH) reduces, accompanied by reduction in dew point temperatures. At that time the condensation nuclei compete for the little moisture left in the atmosphere making condensation very difficult to occur.

When dew point temperatures are below 15°C then it means that that location is north of the ITB and would be affected by continental air mass so dry conditions can easily be predicted for that locality, making forecasting a bit easier in Ghana. Conversely, areas with dew point above 15°C are automatically known to be south of the ITB and are likely to be affected by maritime air mass. The behaviour of the ITB, if monitored by meteorologists gives an insight of what is likely to happen over the country. It has been observed that when ITB gains latitude for 2° C or more over West Africa, it promotes convective activities over Ghana.

The southernmost position of ITB usually lies along the coastline of Ghana in the harmattan season just for a short period of time, making harmattan usually not so severe over southern Ghana, especially the coastal areas. Just as the harmattan starts from the north, the rainy season also starts from the south and moves towards the inland.

References

1. <https://www.ecmwf.int/en/forecasts/charts/catalogue/medium-mslp-wind850?time=&projection=africa> Google Earth maps.