Availability and Quality of Weather and Climate Data

Michael Padi

ABSTRACT

Data can be available at all times but the quality and reliability are the paramount issues. Weather and climate data must be made available online for the accessibility of end-users like pilots and other flight operators, including the general public for planning and decision making. The information must be real representation of the atmosphere so that it can fit and contribute to what the meteorological community expects. If a weather observer refuses to provide the actual weather due to ignorance or deliberate action then it tends to affect the whole meteorological organization. This kind of report will not agree and comply with the surrounding accurately observed weather from the other stations and will not support the 'value chain' that the meteorological body tries to arrive at to boost the image of meteorology. Models that take their 'bases-run' from this dubiously observed weather information will always have challenges in their output. It will not represent the real atmosphere and the forecast will not be reliable. Automatic weather observing stations have been provided to assist in weather observations but their maintenance at most of the stations for continuous operations are quite challenging.

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ABBREVIATIONS:

NOAA (National Oceanic and Atmospheric Administration), MESA (Monitoring for Environment and Security for Africa), PUMA (Permission to Use EUMETSAT in Africa), GCAA (Ghana Civil Aviation Authority), GMet (Ghana Meteorological Agency), ECMWF (European Center for Medium-range Weather Forecast), UKMO (United Kingdom Meteorological Office).

I. ABSTRACT

Data can be available at all times but the quality and reliability are the paramount issues. Weather and climate data must be made available online for the accessibility of end-users like pilots and other flight operators, including the general public for planning and decision making. The information must be real representation of the atmosphere so that it can fit and contribute to what the meteorological community expects. If a weather observer refuses to provide the actual weather due to ignorance or deliberate action then it tends to affect the whole meteorological organization. This kind of report will not agree and comply with the surrounding accurately observed weather from the other stations and will not support the 'value chain' that the meteorological body tries to arrive at to boost the image of meteorology. Models that take their 'bases-run' from this dubiously observed weather information will always have challenges in their output. It will not represent the real atmosphere and the forecast will not be reliable. Automatic weather observing stations have been provided to assist in weather observations but their maintenance at most of the stations for continuous operations are quite challenging.

Author: (Senior Meteorologist) Ghana Meteorological Agency, P. O. Box 87, Legon - Accra, Ghana.

II. INTRODUCTION

Weather products, like models and satellite imagery are made available for Meteorologists to use when making daily and extended weather forecasts for decisions to be taken by the public. Images from satellites and other technical documents, like models are made available on the internet for public use. Lack of access to this information should not be an excuse in this 21st Century. Visual weather observations made at the Meteorological Stations are now available on the internet so that individuals can use in monitoring the weather privately [8].

During the 2018 HAJJ pilgrimage in Ghana, from Tamale to Mecca, an incoming pilot complained in his 'post-flight report' that TAF and METAR for Tamale Meteorological station must be made available online for flight planning so it was accepted and quickly resolved. Other flight operators like the Air Traffic Controller and Flight Dispatchers can now access Tamale weather online.

Satellite imageries are weather products that describe the weather and climate of the Earth if they are well interpreted. There are different types of satellite imageries which are near-real-time images, they are not prognostics, they are selfies of the Earth and have date and time inscribed on them for the sake of analysis. Subsequent watches of these satellite imageries can lead to the prediction of weather for a place [9]. These lots of weather products in the system will now need

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choices to be made when describing the atmosphere.

EUMETSAT has made numerous satellite products available on the internet, including RGB composites such that any mobile phone or computer that can connect to the internet can access satellite imagery. Dust RGB satellite imagery monitors dust particles in the atmosphere (Figure 5) so areas on the surface of the earth or in the atmosphere with hazy conditions could be monitored. The imagery displays different colors on the same picture frame with their respective meanings.

The previously available satellite imageries were just infrared and visible imageries. Visible channels are not useful in the night because they function on the reflection of sunlight while the infrared channels are functions throughout both day and night. The choice of meteorological products is tactical when making a forecast. Satellite products previously consist of black and white colors, where the white indicate clouds and the black signifies clear skies. Techniques of interpreting satellite imagery has to be deployed in other to distinguish between cloud types and other atmospheric constituents like dust particles [11].

Latest innovations include the representation of observed weather codes plotted on maps (Figure 6) which are perfect ways of digesting weather information in the meteorological office. Satellite observations can be validated with the ground information from the meteorological offices. Weather plots are a representation of weather elements that is happening at the station (at the time of observation) and what has already happened in the past few hours. A concise weather description which includes various cloud types, the transparency of the atmosphere, air temperature and pressure, as well as humidity, and the precise location of the station are indicated on a map for easy analysis.

Numerical weather prediction consists of equations built into high-speed running computers that factor the rotation of the Earth into account before producing the output as forecast. Equal distances termed as grids are considered in this kind of production because the Earth continues to rotate and revolve at the same constant speeds.

Winds charts from the Weather Re-analysis and Forecast model by the Ghana Meteorological Agency seem not to be on grid points and look quite suspicious, and a little bit different from those that are produced by other models like the ECMWF, NOAA, UKMO and Meteo France [10]. Looking at the product critically (Figure 1), adjacent wind barbs do not lie on consistent longitude and latitude as the others do, and wind barbs in the southern hemisphere still look like those in the northern hemisphere. Analyzing them seems to be quite challenging because it is difficult to determine the direction of the wind when the winds are light [3]. In this situation the choice of products to use when making forecast would have to go to the model that everybody would agree to its production.

Weather forecasters would lose confidence in using products that are confusing, and would not even like to evaluate them. Whether the product is doing well or not doing well would not be a concern to chart analysts. In this case resources would be wasted in the production while other models will continue to be famous in the production of weather charts.

Weather and climate data become quality when the producer knows why he or she is giving out the information. Report of rainfall amount in Meteorology is made such that insight of the cloudy condition within the day should be realized from the main synoptic hour reports. Rainfall is reported every six hourlies, and has been given codes from 1 to 4, in multiples of 6 hours to make up the 24 hours in the day [8]. The idea is to add rainfall amounts and report them in the morning at 0600 UTC as a multiple of 4 of every 6 hours of rainfall amounts within the previous day for the station. 1200 UTC will be 1 of 6 hours duration within which the total amount of rainfall is measured after 0600 UTC [1], 1800 UTC will be 2 of 6 hours of rain totals after 0600 UTC [2]. For this reason, if it should rain in the morning before 1200 UTC, the codes must reflect in the 1200, 1800, 0000 and 0600 UTC weather reports respectively to show that the place had been very cloudy during a certain period of the day.

On 6th May 2018 the Accra Met Office failed to report the code for the totals of rainfall amounts at 1800 UTC [2] which occurred in the morning before 1200 UTC. These are things that define the quality of meteorological data. The observer might not know the reason for reporting the rain again at 1800 UTC, so it makes the report quite misleading regarding reviewing and making weather forecasts for the station.

Comparing wind models from GMet (Figure 1) and Meteo France (Figure 3); Meteo France, like the other models, indicate dots at points of observation and circles around the dots where winds are calm, but GMet's model leaves the place blank, making the chart quite different from the others [7]. All these dots lie on consistent longitudes and latitudes producing perfect squares with every four of adjacent points across the chart (Figure 3).

Figure 2. and figure 3. have their winds originating from uniform longitudes and latitudes on the wind chart which form the grid points. The spatial distribution of the wind barbs in Figure 1. does not follow the trend of perfect grids; the winds do not originate form particular longitudes and latitudes when observed, and making analyses.

III. MATERIALS AND METHODS

Methods and materials include the retrieval of weather charts from various models like the ECMWF, NOAA, METEO FRANCE, and from the GMet WRF models, and analyzing them. Organizing daily and weekly weather chart discussions with Meteorologists in the GMet Forecast Office. Training newly employed Meteorologists in Ghana, and also university graduates on attachments, and National service personnel.

This training includes the analysis of surface pressure charts, wind charts at standard levels and the interpretation of satellite imagery of various kinds; RGB composites, Infra-Red, Water Vapour, and Visible, then comparing with the ground observations made at various synoptic stations in Ghana and around the African continent.

IV. RESULTS AND DISCUSSIONS

Analyzing winds from the GMet models seems difficult as compared to the other models because of the non-grids of the wind barbs, and also identification of wind directions when they are less than 3 knots. Sometimes the determination of wind direction in areas of ridges, troughs, and vortices becomes challenging due to the lack of standard representation of wind barbs.

Dialogue with producers of this model have suggested that the problem could be due to the computer program used in producing the models, and that efforts are on the way to resolve these problems.

V. CONCLUSIONS

It would be strongly suggested that meteorological reports should be thoroughly checked, including the codes of synop report from the Meteorological stations before transmissions are made into the global systems. Also, the renovation of Meteorological offices, and the capacity of personnel as well as training and motivation of workers be considered so that they can be highly dedicated to the work and give out their best to make weather and climate data a real representative of what it is supposed to be.

Visits to most of the Meteorological stations in Ghana showed how some of the stations are under-staffed, and some instruments broken down, including the destruction of enclosure fences which puts the few instruments that are left to vulnerable threats by inhabitants in the community. Some stations need relocation due to the encroachment of people which seriously affect weather readings.

There were instances where squalls were not recorded at a station for the whole year just because the anemometer could turn so fast enough to reach the threshold of a squall. The station is surrounded by buildings and trees which act as obstructions and reduce wind speeds reaching the station. The observer, in this way would also be compelled not to report of a squall making the information suspicious and challenging.

It would also be very good if model users in the institutions could be tasked to investigate and validate products from different models that are available, and document them for consistency. This would help meteorologists to be able to make choices of products in relation to the seasons.

FIGURES

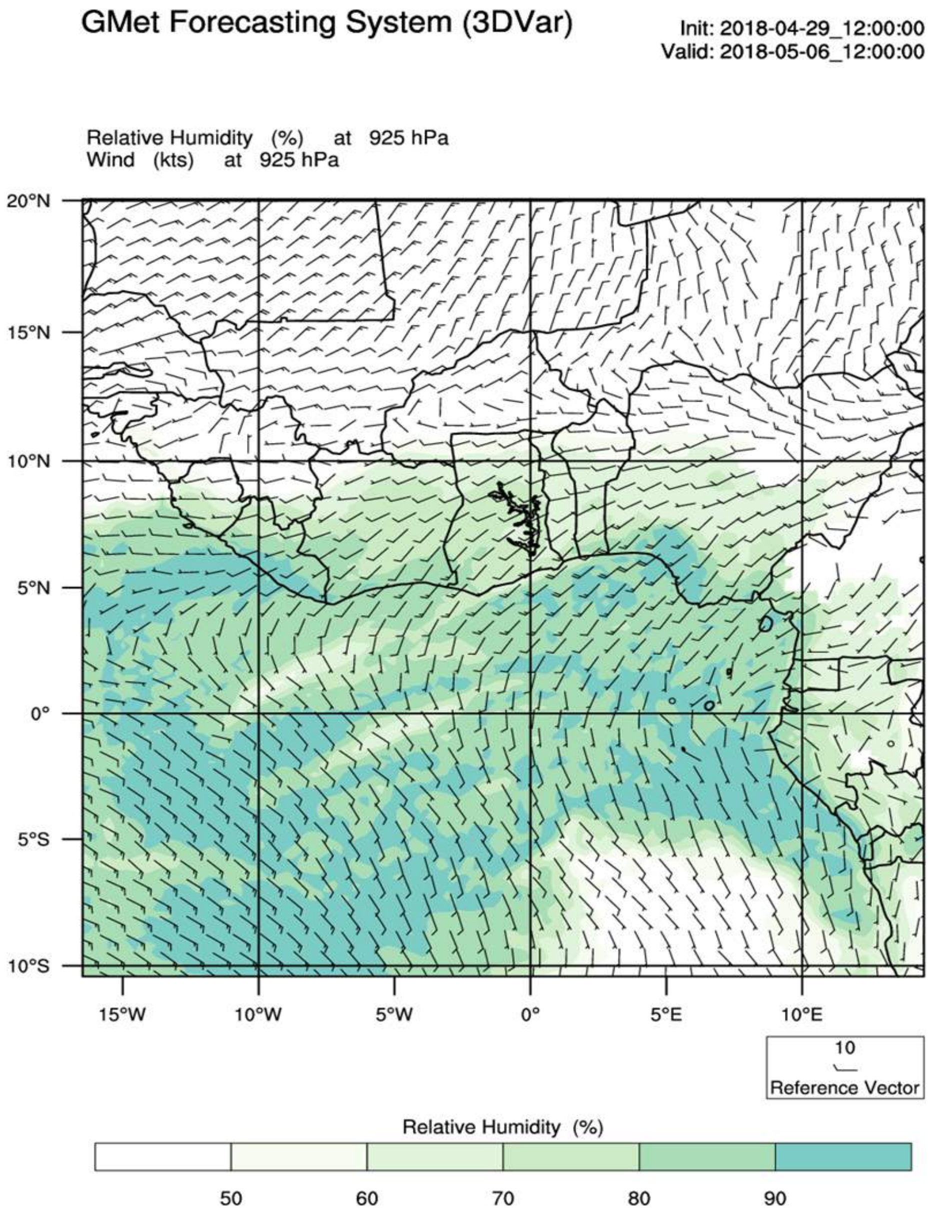


Figure 1: Model winds barbs chart at 925 hPa level from GMet WRF model for 6th May, 2018 at 1200 UTC [3].

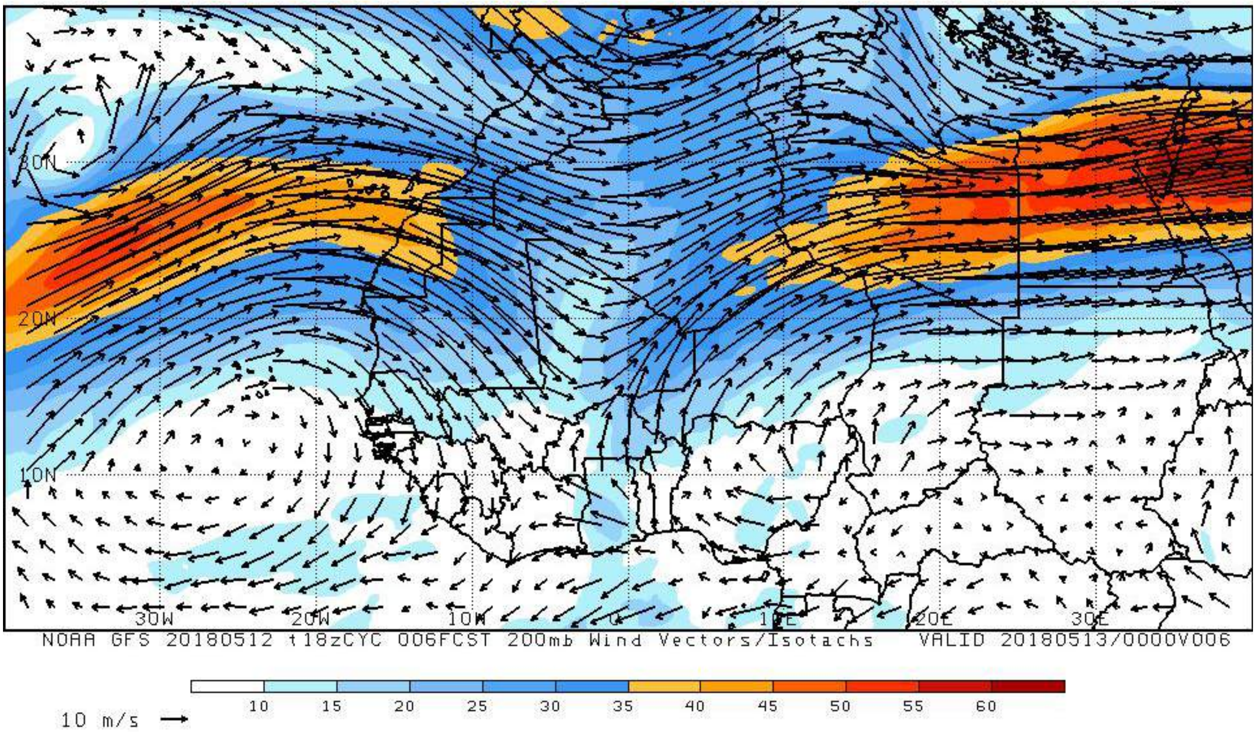


Figure 2: Model wind vectors chart at the 200 hPa by NOAA for 13th May, 2018 at 0000 UTC [4].

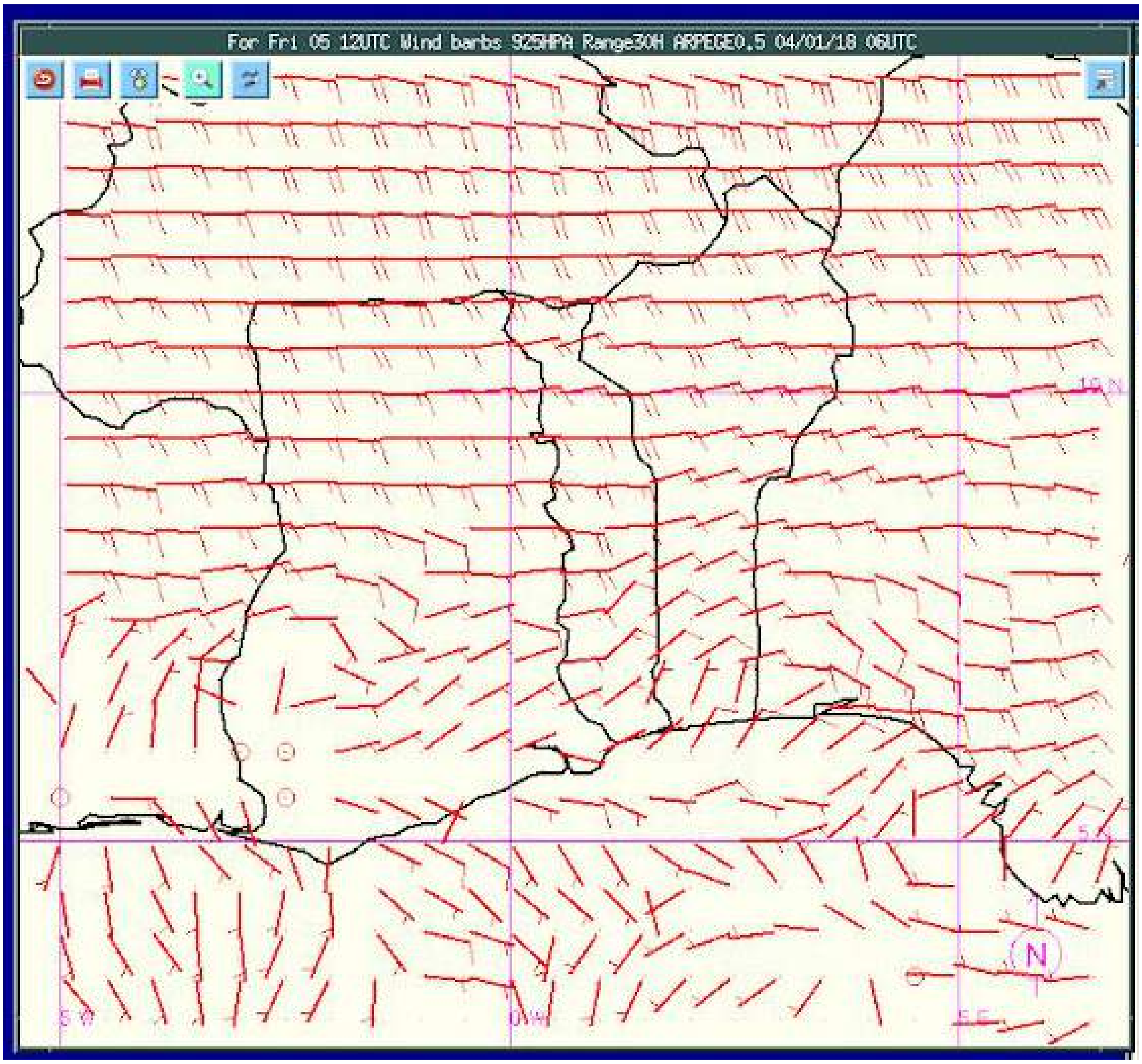
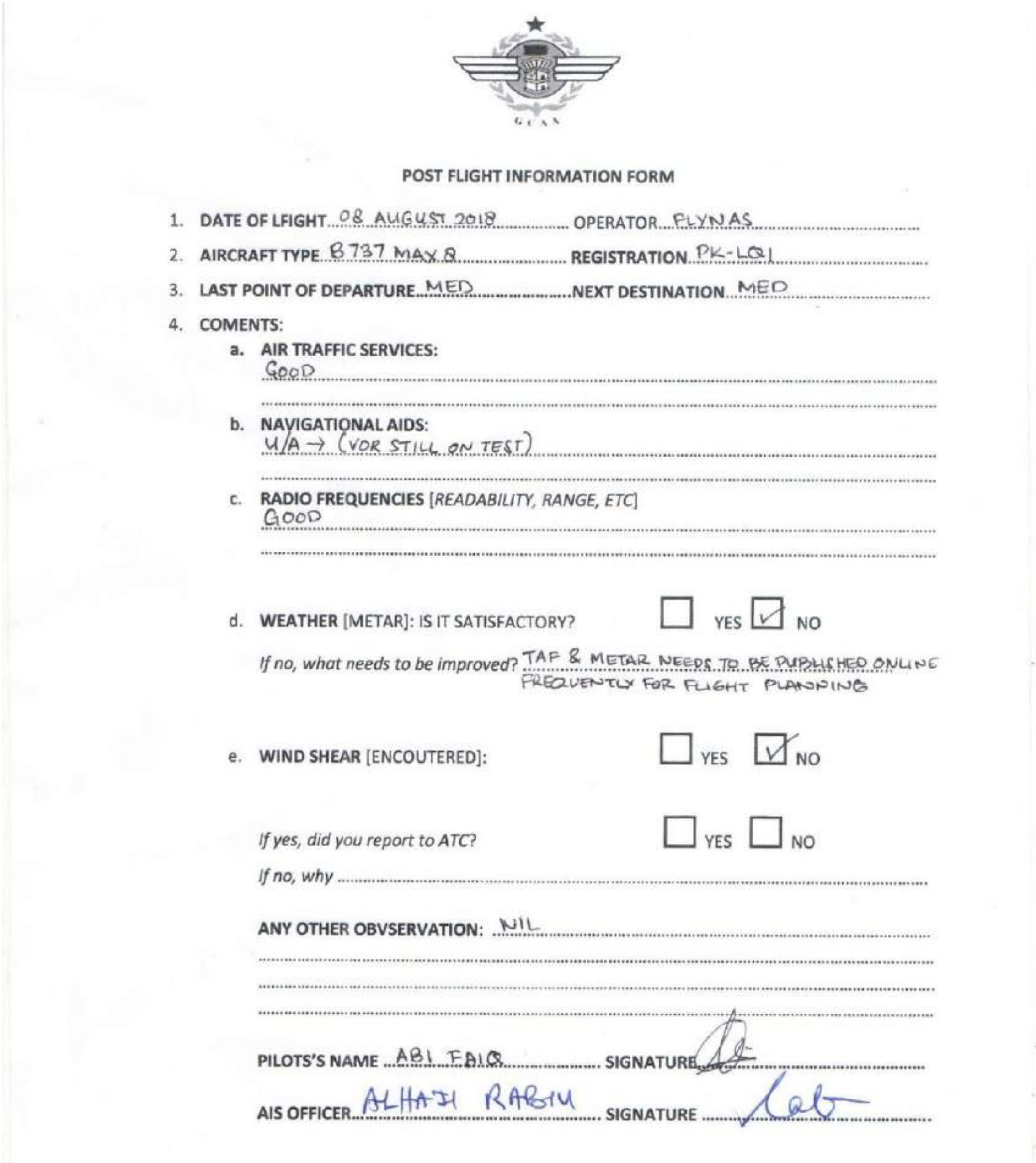


Figure 3: Model winds barbs chart at 925 hPa by Meteo France for 5th January, 2018 at 1200 UTC [5].



GCAA

POST FLIGHT INFORMATION FORM

1. DATE OF LFIGHT 08 AUGUST 2018 OPERATOR FLYNAS
2. AIRCRAFT TYPE B737 MAX 8 REGISTRATION PK-LQI
3. LAST POINT OF DEPARTURE MED NEXT DESTINATION MED
4. COMENTS:
   a. AIR TRAFFIC SERVICES:
      GOOD
   b. NAVIGATIONAL AIDS:
      U/A → (VOR STILL ON TEST)
   c. RADIO FREQUENCIES [*READABILITY, RANGE, ETC*]
      GOOD
   d. WEATHER [METAR]: IS IT SATISFACTORY? ☐ YES ☑ NO
      If no, what needs to be improved? TAF & METAR NEEDS TO BE PUBLISHED ONLINE FREQUENTLY FOR FLIGHT PLANNING
   e. WIND SHEAR [ENCOUTERED]: ☐ YES ☑ NO
      If yes, did you report to ATC? ☐ YES ☐ NO
      If no, why
      ANY OTHER OBVSERVATION: NIL

PILOTS'S NAME ABI FAIQ SIGNATURE
AIS OFFICER ALHAJI RABIU SIGNATURE

Figure 4: Post flight information form from a pilot requesting for Meteorological data to be published online.

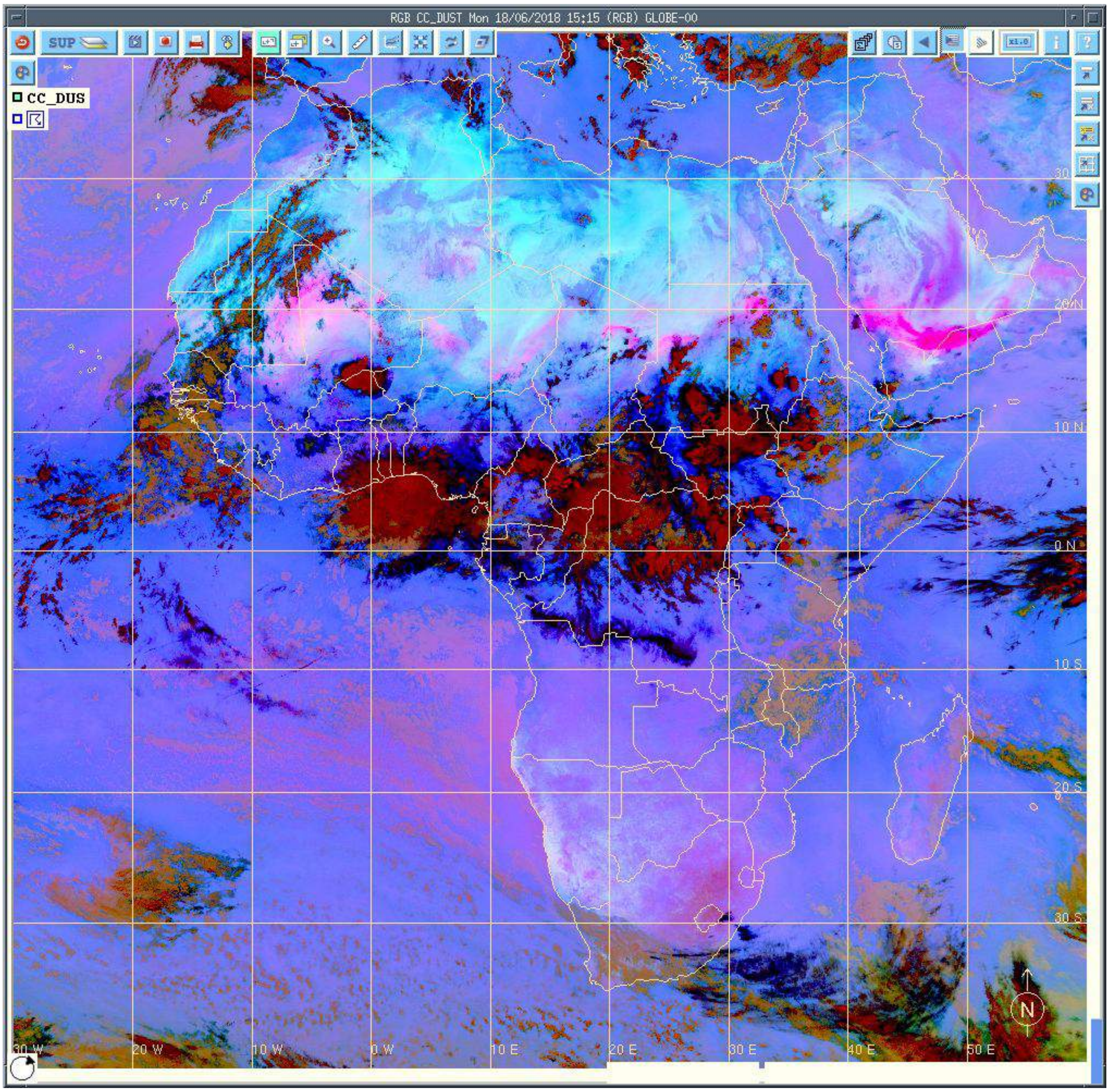


Figure 5: Dust RGB satellite imagery from EUMETSAT on 18th June, 2018 at 1515 UTC indicating dust storms over Mali, Niger, and Saudi Arabia (Magenta), and rain storms over the Gulf of Guinea [5].

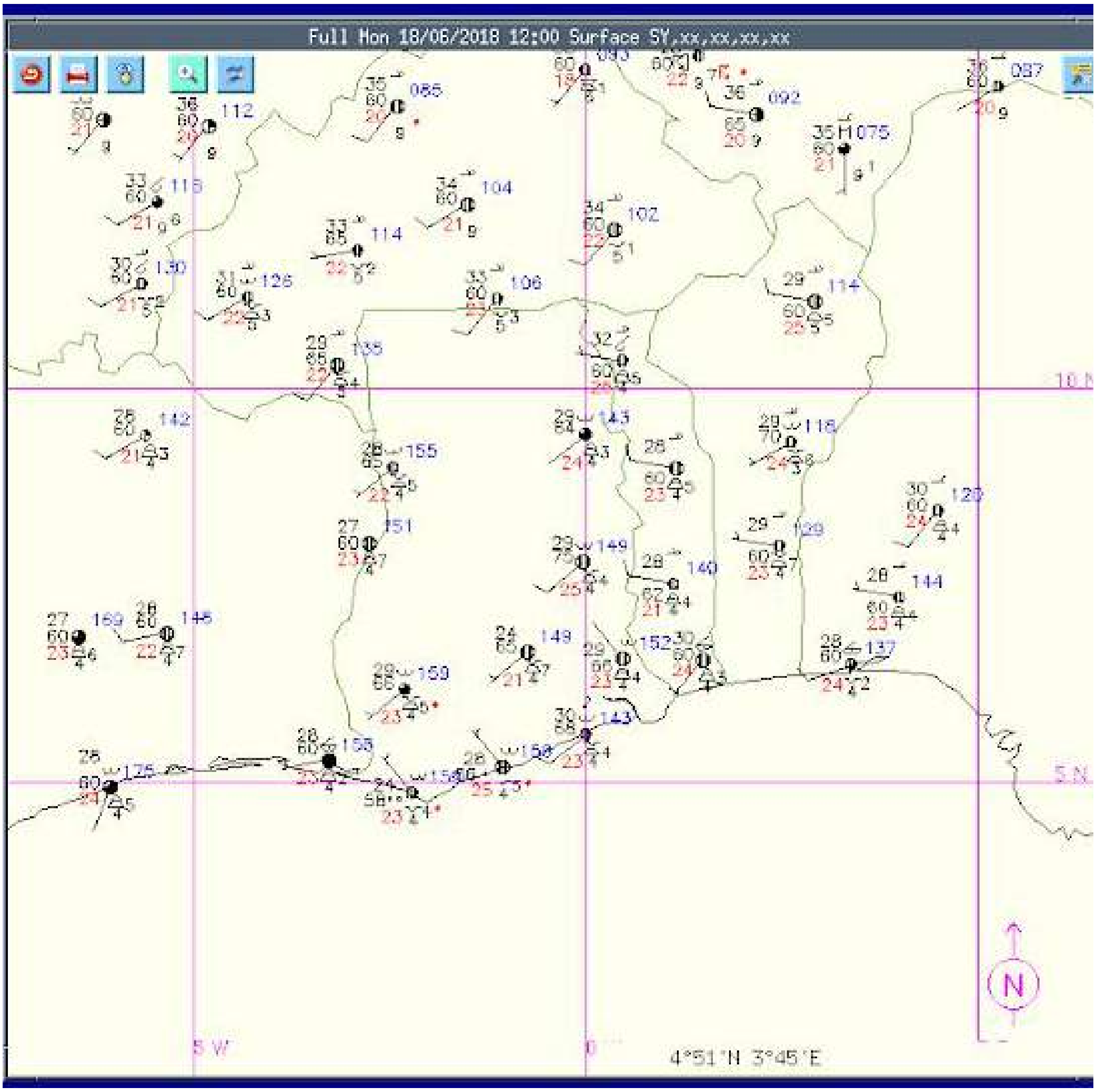


Figure 6: Synop plots from PUMA for Ghana and neighboring countries on 18th June, 2018 at 1200 UTC showing surface weather observations [5].

REFERENCES

1. Synop for Ghana on 06/05/2018 at 1200 UTC by Ogimet https://www.ogimet.com/display_synopsc2.php?lang=en&estado=Ghan&tipo=ALL&ord=REV&nil=SI&fmt=txt&ano=2018&mes=05&day=06&hora=12&anof=2018&mesf=05&dayf=06&horaf=12&send=send
2. Synop for Ghana on 06/05/2018 at 1800 UTC https://www.ogimet.com/display_synopsc2.php?lang=en&estado=Ghan&tipo=ALL&ord=REV&nil=SI&fmt=txt&ano=2018&mes=05&day=06&hora=18&anof=2018&mesf=05&dayf=06&horaf=18&send=send
3. GMet Forecasting System
4. NOAA African Desk
5. MESA, PUMA (synergie) Meteo France.
6. GCAA
7. JC Palomares-Salas, Comparison of Models for Wind Speed Forecasting - CiteSeerX- Cited by 28 - Related articles http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.640.7900&rep=rep1&type=pdf

8. L McElwain - 2007 - Cited by 36 - Related articles Key Meteorological Indicators of Climate Change in Ireland https://www.epa.ie/pubs/reports/research/climate/ERC-6-Climate%20Change-web-ready3.pdf
9. Michael Padi, 2018 - Predicting weather changes - MedCrave http://medcraveonline.com/OAJS/OAJS-02-00072.pdf
10. M Tolera - 2018 - Evaluation of the Climate Forecast System Reanalysis Weather ... - MDPI https://www.mdpi.com/2073-4441/10/6/725/pdf
11. Ziad Al Achkar – 2012 - Satellite Imagery Interpretation Guide, https://hhi.Harvard.edu/sites/default/files/publications/siig_ii_burned_tukuls_3.pdf

APPENDIX

(SYNOP from 65472, Accra (Ghana) | 05-36N | 000-10W | 68 m
201805061200 AAXX 06124 65472 11465 72704 10291 20242 40130 69901 70262 8117/
333 58014 81814 87460 =) [1]

(SYNOPS from 65472, Accra (Ghana) | 05-36N | 000-10W | 68 m
201805061800 AAXX 06184 65472 32465 72305 10290 20241 40119 8483/
333 10310 58019 82610 83816 87360= [2]

SYNOPS from 65442, Kumasi (Ghana) | 06-43N | 001-36W | 287 m
201805061800 AAXX 06184 65442 11470 62304 10265 20230 40133 69922 70362 84230
333 10278 58035 84814 86360= [2]

SYNOPS from 65445, Sefwi Bekwai (Ghana) | 06-12N | 002-20W | 171 m
201805061800 AAXX 06184 65445 11464 72702 10260 20246 40126 69902 70162 8153/
333 10285 58040 81611 87362=) [2]