



ClimSA Climate Station Applications

16th EUMETSAT User Forum in Africa 2024,
Cotonou, Benin, 16-20 September 2024.

Session #4: Climate, Air quality and GHG Monitoring

M. Clerici, C. Arias Muñoz, V. Venkatachalam, J. Van't Klooster, B. Desclée, D. Simonetti
September 19th 2024

Presentation overview and objective

1. CS for Climate Monitoring

Work done with AGRHYMET and ACMAD

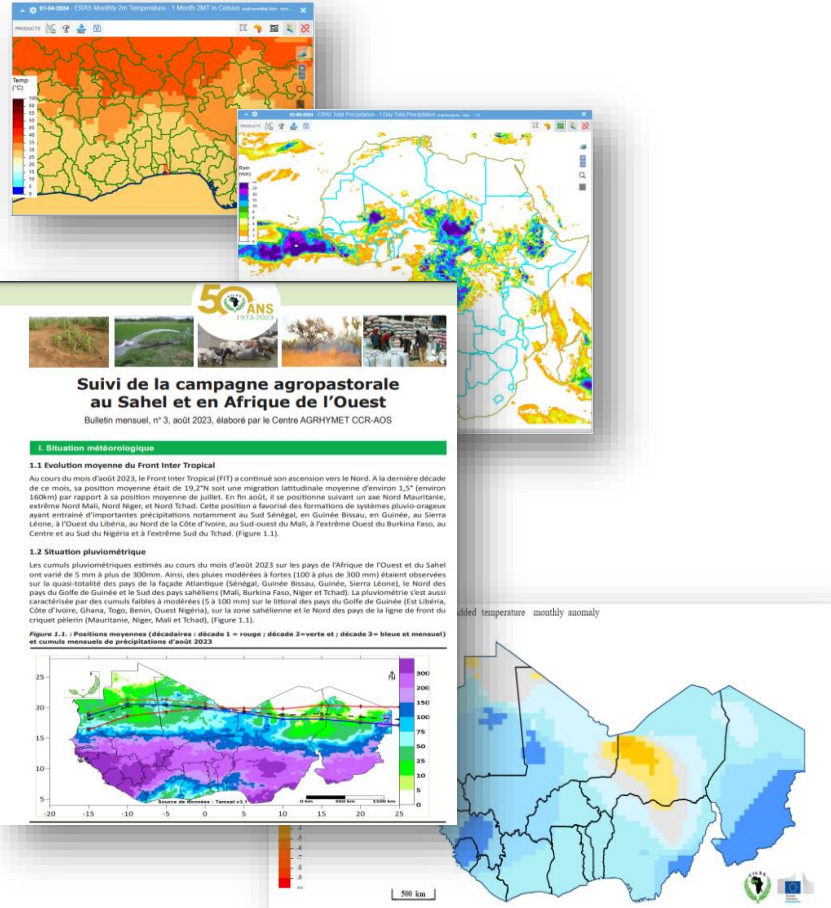
2. Take ways

What you should know after this presentation

How is the ClimSA Station supporting climate monitoring operations in Africa?

Our goal is to enhance regional and national capabilities in **climate monitoring and data management**

Supporting AGRHYMET on Climate Monitoring

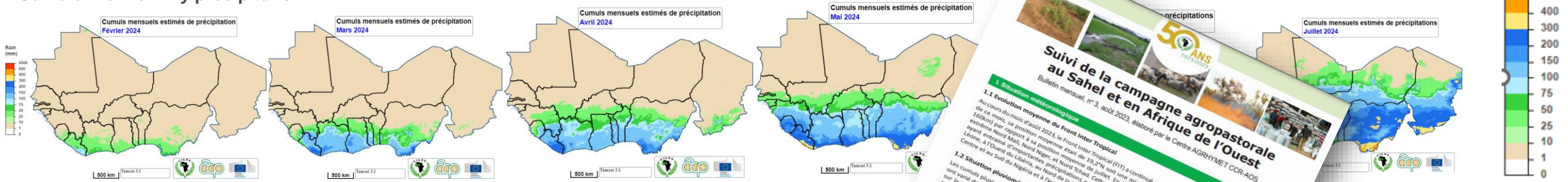


- Including the AGRHYMET Climate Monitoring operational scripts in ClimSA station acquisition module to produce specific graphs for monthly bulletins.
 - Adding new products like Monthly Temperature & Anomalies and Daily Temperature max and min from IRI data libraries.
- Integration of script to generate ERA5 re-analysis in Jupyter notebook and integration for later integration into the analysis module.
- Development of draft Jupyter notebook for preparing the bulletins

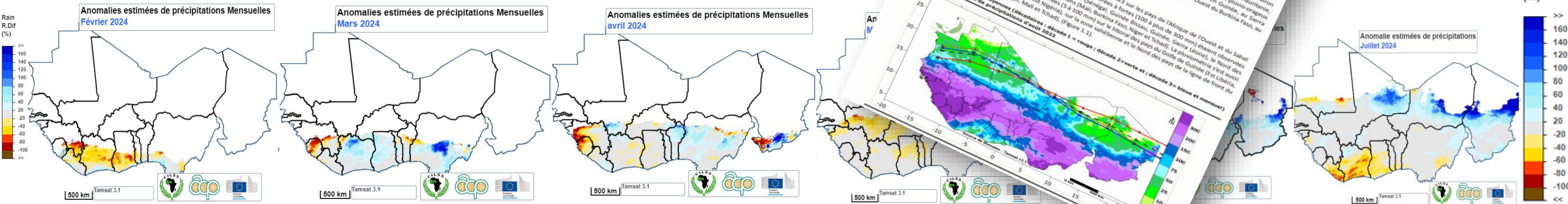
Supporting AGRHYMET on Climate Monitoring

- Monitoring of the agricultural season
 - Assessing regional meteorological situation
 - Identifying deviations from typical weather patterns

Cumulative monthly precipitation

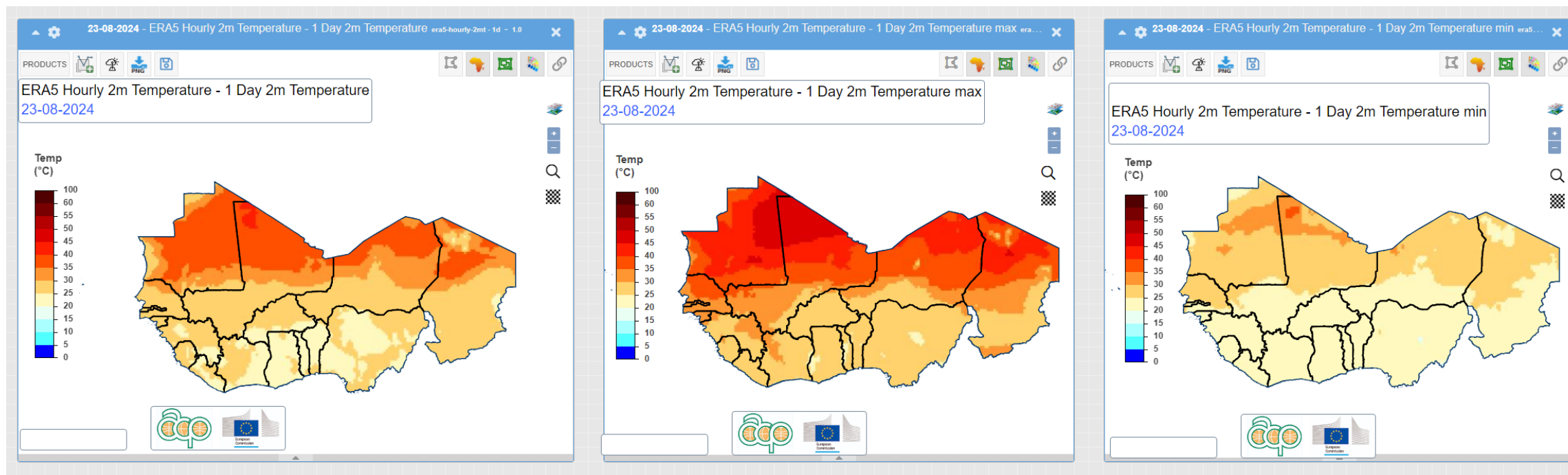


Precipitation anomaly estimates



Supporting AGRHYMET on Climate Monitoring

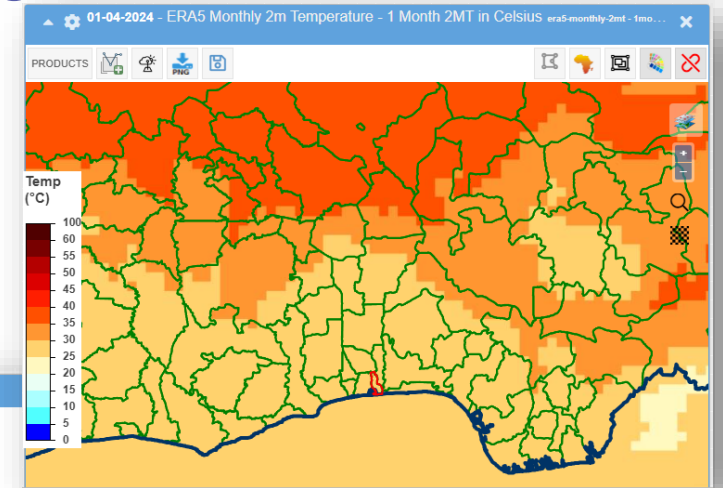
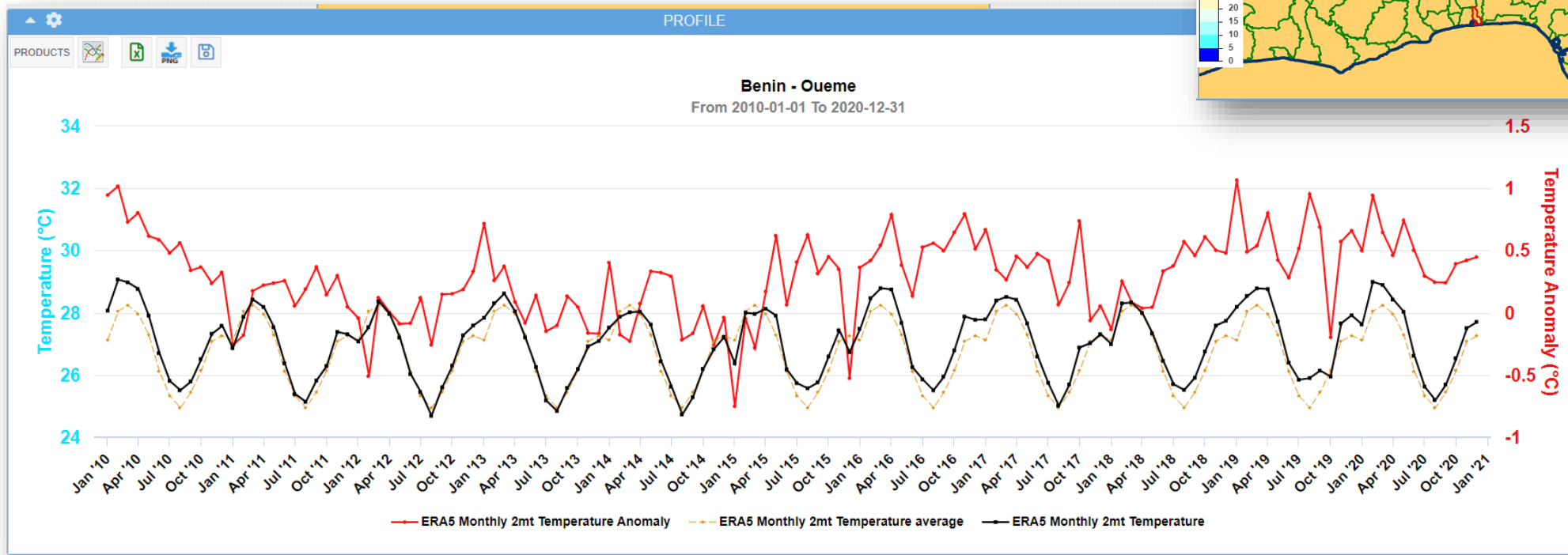
- ERA5 2 metre temperature **daily** temperature average, maximum, minimum
- Daily aggregation from hourly data



Supporting AGRHYMET on Climate Monitoring

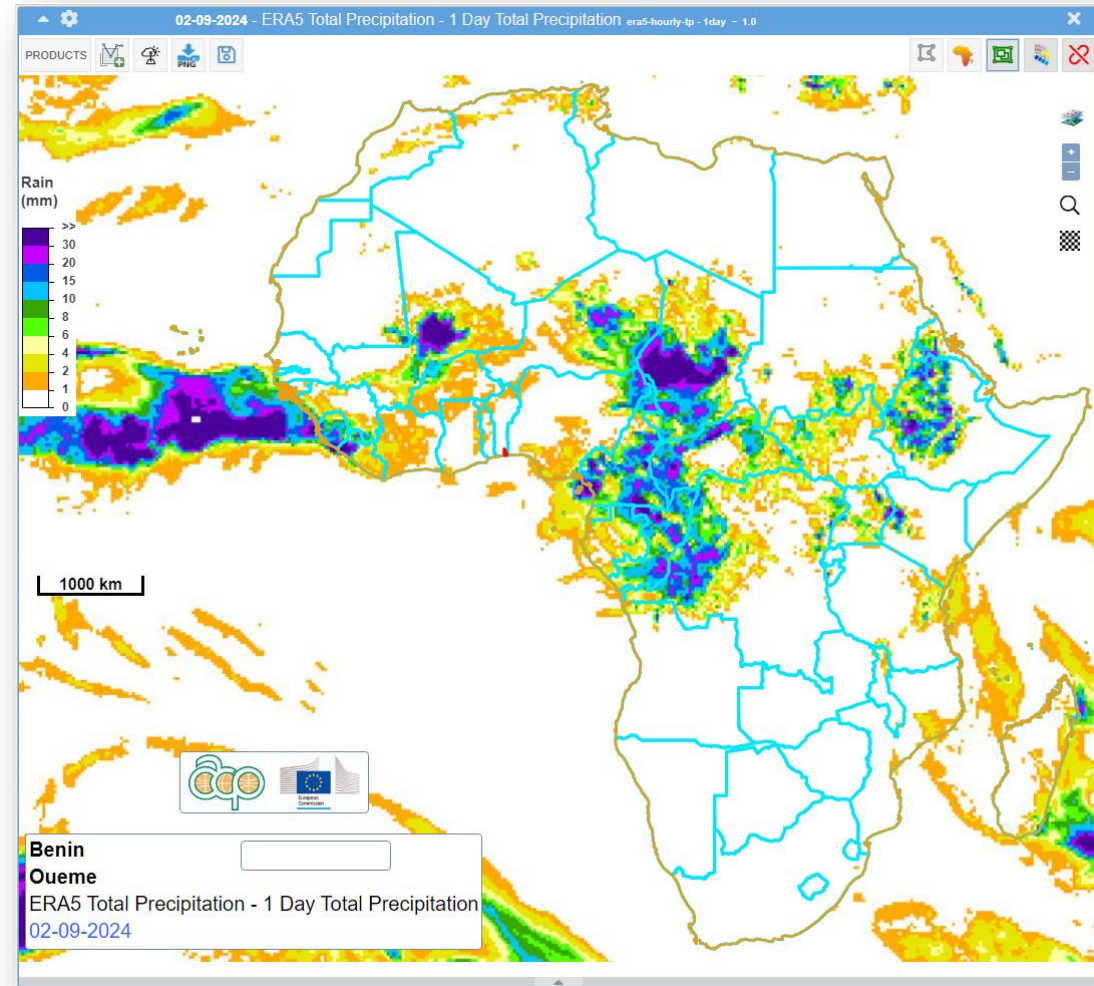
Ouèmè, Benin

- ERA5 2 metre temperature, **monthly** average & its anomaly in Celsius



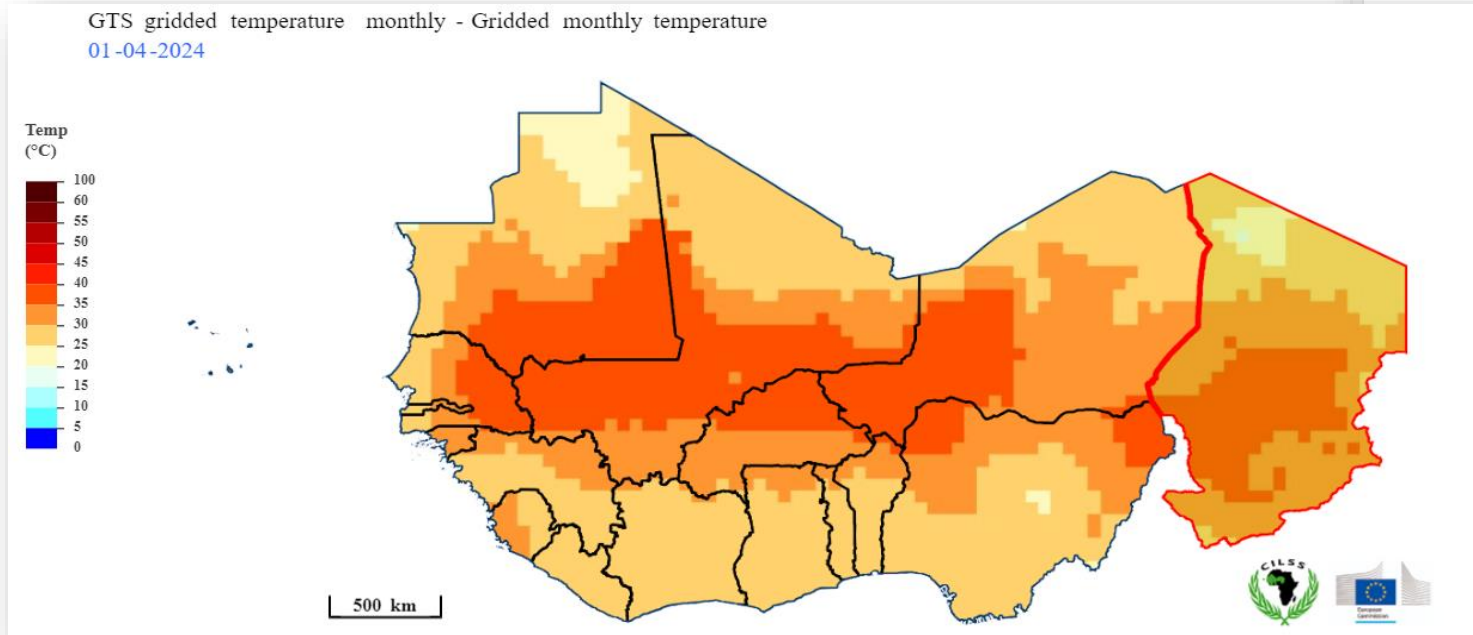
Supporting AGRHYMET on Climate Monitoring

- ERA5 total daily precipitation in mm



Supporting AGRHYMET on Climate Monitoring

- GTS gridded monthly temperature



COMITE PERMANENT INTER-ETATS DE LUTTE CONTRE LA SECHERESSE DANS LE SAHEL
PERMANENT INTERSTATE COMMITTEE FOR DROUGHT CONTROL IN THE SAHEL
الجنة الدائمة المشتركة لمكافحة التصحر في الساحل

Centre Régional AGRHYMET

Suivi climatique pour l'Afrique de l'Ouest et le Sahel

Bulletin mensuel
ISSUE N°: 2024/04
ISSUE DATE: 23/04/2024

Climate Report

I. Suivi des indices océaniques et de l'état des températures de surfaces de la mer

...

IV. Situation des températures

Les moyennes mensuelles de températures de l'air du mois d'août 2023 ont varié entre 18°C et 42°C sur les pays de l'Afrique de l'Ouest et du Sahel. Les plus faibles moyennes (entre 18 et 20°C) sont

GTS gridded temperature monthly - Gridded monthly temperature
01-04-2024

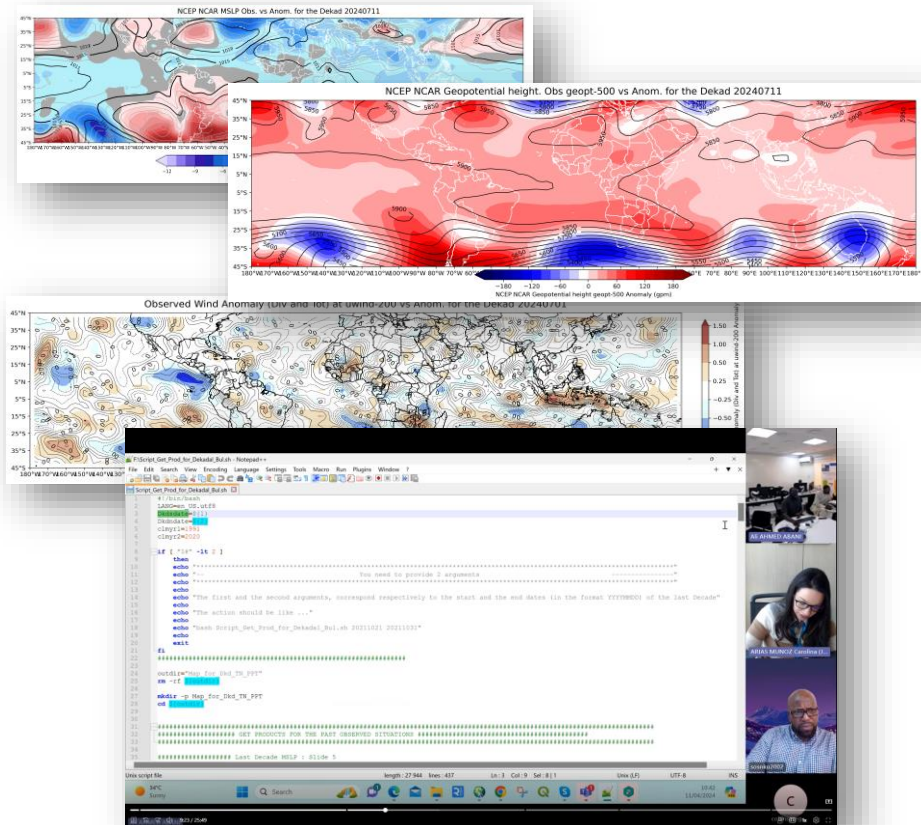
Temp (°C)

100
80
60
55
50
45
40
35
30
25
20
15
10
5
0

Supporting AGRHYMET on Climate Monitoring

- Climate monitoring report in Jupyter notebook
- This template can be customized and can be published to the website

Supporting ACMAD on Climate Monitoring



- Development of **draft Jupyter notebook** for preparing the bulletins
- Operationalizing the **10 day Climate diagnostic bulletins**
- Acquisition of all requested **NCEP NCAR products** from IRI & processing its Climatology and acquisition of the same ERA5 products from Climate Data Store
- **Generation of Anomaly plots** with contours for MSLP, RHUM, GEOPT. U&V component



Supporting ACMAD on Climate Monitoring

Climate Bulletin Generation

conditions are very likely over Liberia, la Cote d'Ivoire, Ghana, south of Togo and Benin, southwest of Nigeria, South of Mali and Burkina Faso. Also normal to dry conditions are expected over south of Congo, Gabon, Equatorial Guinea, north of South Sudan, south of Sudan, parts of Chad, Somalia, east parts of Kenya and the southeast parts of Ethiopia.

- **Second week:** Characterized by wet to normal conditions over the DRC, Rwanda, Burundi, northwest of Tanzania and north eastern parts of Madagascar. The dry to normal situation is expected over Senegal, Gambia, south west of Mali, south of Congo, southeast of DRC, south of Sudan, the north of South Sudan, north western parts of Ethiopia and

1.0 GENERAL CLIMATOLOGICAL SITUATION

1.1 SURFACE

Pressure Systems

- The Azores anticyclone was observed at a value of 1025hPa. It increased by 6hPa compared to the last dekad and decreased by 10hPa compared to the climatological average (1991 – 2020). It was located at 31°w and 37°N. It is more active and is on the northern part of the continent.
- St. Helena High was observed at a value of 1021hPa. It experienced no change from the last dekad and 13hPa compared to the climatological average (1991 – 2020). It was located at 4°W and 27°S. It has moved further from the continent.
- Mascarene High was observed at a central value of 1022hPa. Its value decreased by 1hPa as compared to the last dekad and decreased by 3hPa compared to the climatological average (1991 – 2020). It was positioned at 50°E and 32°S.

Figure 1: Observed Mean Sea Level Pressure (Contour) and anomaly (shaded) from 11th- 20th May 2024

- Heat Low: A thermal depression (low pressure zone) was observed over the southern part of Chad at a central value of 1006hPa.

1.2 TROPOSPHERE

1.2.1 African Monsoon

The African Monsoons, combined with the influence of the Indo-Pacific and the Atlantic Oceans drive the inter-annual and the dekadal



TEN-DAY CLIMATE DIAGNOSTICS BULLETIN

ISSUE N°: 2024/11
REPORTING PERIOD: Dekad 11th - 20th May 2024
ISSUE DATE: 23/05/2024

Climate Report

Summary of Observations

HIGHLIGHTS

During the second decade of May 2024, below average to well below average precipitation conditions were observed over most places in the Central African Region, some few areas in the south of the Gulf of Guinea Region and East African Region. Above average rainfall conditions were observed over south of the Gulf of Guinea countries, few places in the central and east African region and Madagascar.

The outlook for the next two weeks, from 24 May - 06 June, 2024, shows that during the;

- **First week:** The wet conditions are expected over Guinea, some few places in Uganda and Kenya, and east of Madagascar. Dry to normal conditions are very likely over Liberia, la Cote d'Ivoire, Ghana, south of Togo and Benin, southwest of Nigeria, South of Mali and Burkina Faso. Also normal to dry conditions are expected over south of Congo, Gabon, Equatorial Guinea, north of South Sudan, south of Sudan, parts of Chad, Somalia, east parts of Kenya and the southeast parts of Ethiopia.
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Supporting ACMAD on Climate Monitoring

```
File Edit View Run Kernel Tabs Settings Help
+ + + + +
Filter files by name
/ examples / Bulletin /
Name Last Modified
20240601_mslp_anom.png 2 months ago
acplogo.png 2 months ago
auloogo.png 2 months ago
background.jpg 2 months ago
Climate_bulletin_example.ipynb 2 months ago
climSA Logo.png 2 months ago

Terminal 2 x Climate_bulletin_example.ipynb x
Markdown v Python 3 (ipykernel)
VARIABLES
CALLSTACK
BREAKPOINTS
SOURCE
KERNEL SOURCES

/* First page background */
.first-page {
  background-image: url('images/background.jpg');
  background-size: cover;
  color: white;
  padding: 40px;
  text-align: center;
}

.first-page h1 {
  font-size: 36px;
  margin-bottom: 20px;
}

.first-page h2, .first-page h3, .first-page h4 {
  font-size: 28px;
}

/* Main content styles */
.content {
  padding: 20px;
}

.content h2 {
  font-size: 28px;
  color: #1E90FF;
  border-bottom: 2px solid #1E90FF;
  padding-bottom: 10px;
}

.content h3 {
  font-size: 24px;
  color: #1E90FF;
  padding-bottom: 10px;
}

/* Header styles */
.header .right-text {
  position: absolute;
  text-align: left;
  width: 280px;
}

.header .center+logo {
  position: absolute;
  top: 10px;
  left: 50%;
  transform: translateX(-50%);
  height: 60px;
}

.header .line {
  border-top: 2px solid #1E90FF;
  margin: 70px 0 10px; /* Adjusted margin to ensure space below the logo */
}

.header .subtitle {
  font-size: 12px;
  text-align: center;
  margin-top: 10px; /* Ensure space after the blue line */
}
```



Supporting ACMAD on Climate Monitoring

The screenshot displays a Jupyter Notebook environment with a file explorer on the left and a terminal window at the top. The main content area shows a rendered HTML document for a climate bulletin. The document header includes the ACMAD logo and the text: "CENTRE AFRICAIN POUR LES APPLICATIONS DE LA METEOROLOGIE AU DEVELOPPEMENT", "AFRICAN CENTRE OF METEOROLOGICAL APPLICATIONS FOR DEVELOPMENT", "Institution Africaine parrainée par la CEA et l'OMM", and "African Institution under the aegis of UNECA and WMO".

The main title is "TEN-DAY CLIMATE DIAGNOSTICS BULLETIN". Below it, the following information is provided:

- ISSUE N°: 2024/05
- REPORTING PERIOD: Dekad 11th- 20th May 2024
- ISSUE DATE: 20/06/2024

A code editor shows the HTML structure for the first page:

```
<div class="first-page">
  <h1>Climate Report</h1>
  <h2>Summary of Observations</h2>
</div>
```

The "HIGHLIGHTS" section contains the following text:

During the second decade of May 2024, below average to well below average precipitation conditions were observed over most places in the Central African Region, some few areas in the south of the Gulf of Guinean Region and East African Region. Above-average rainfall conditions were observed over south of the Gulf of Guinean countries, few places in the central and east African region and Madagascar.

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The document concludes with the section "1.0 GENERAL CLIMATOLOGICAL SITUATION".

Supporting ACMAD on Climate Monitoring



1.0 GENERAL CLIMATOLOGICAL SITUATION

```

<div>
<h3>1.1 SURFACE</h3>
<h4>Pressure Systems</h4>
<ul>
<li>The Azores anticyclone was observed at a value of 1025hPa. It increased by 6hPa compared to the last dekad and decreased by 10hPa compared to the climatological average (1991 - 2020). It was located at 31°N and 37°W. It is more active and is on the northern part of the continent.</li>
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</ul>
</div>
<img src='20240601_mslp_anom.png' alt='Figure 1' />
<figcaption>Figure 1: Observed Mean Sea Level Pressure (Contour) and anomaly (maps) from 1st- 10th June 2024.</figcaption>
</div>
<div>
<h4>Heat Low</h4>
<ul>
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</ul>
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MSLP Obs. vs Anom. for the Dekad 20240601

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Supporting ACMAD on Climate Monitoring

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1.2 TROPOSPHERE

1.2.1 African Monsoon

The African Monsoons, combined with the influence of the Indo-Pacific and the Atlantic Oceans drive the inter-annual and the decadal variability over these regions.

- Final result

Supporting ACMAD on Climate Monitoring



- New Jupyter notebook graphical user interface

```
plot_anomaly_vs_observations(ano_yri, yri, GeolabelsFormatter(), config, gdf)
#display.clear_button)
button.on_click(on_button_clicked)

[13]: output = widgets.Output()
#Dimension_output = widgets.Output()
#View_output = widgets.Output()
# #display(datePicker_widget, date_max, layout_2x2_1, indicator, button, output, Dimension_output, view_output)
display(spro_dropdown, date_dropdown_button, output)
```

Rel. hum. Pressure level selection rhum-700
Date selection 2024-06-21
Generate plots

DEBUG:matplotlib.colorbar:locator: <matplotlib.ticker.FixedLocator object at 0x7f024e4d8bb>
DEBUG:matplotlib.colorbar:Using Fixed Locator on colorbar
DEBUG:matplotlib.colorbar:Setting pcolormesh

Rel. hum. Pressure level selection rhum-700

Date selection 2024-06-21

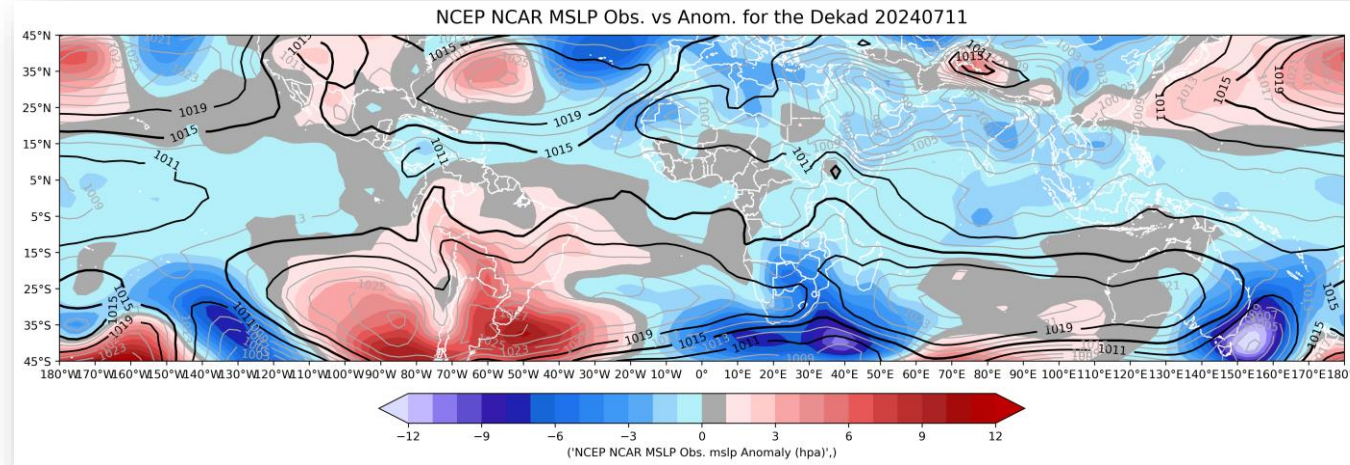
Generate plots

rhum-850
rhum-700

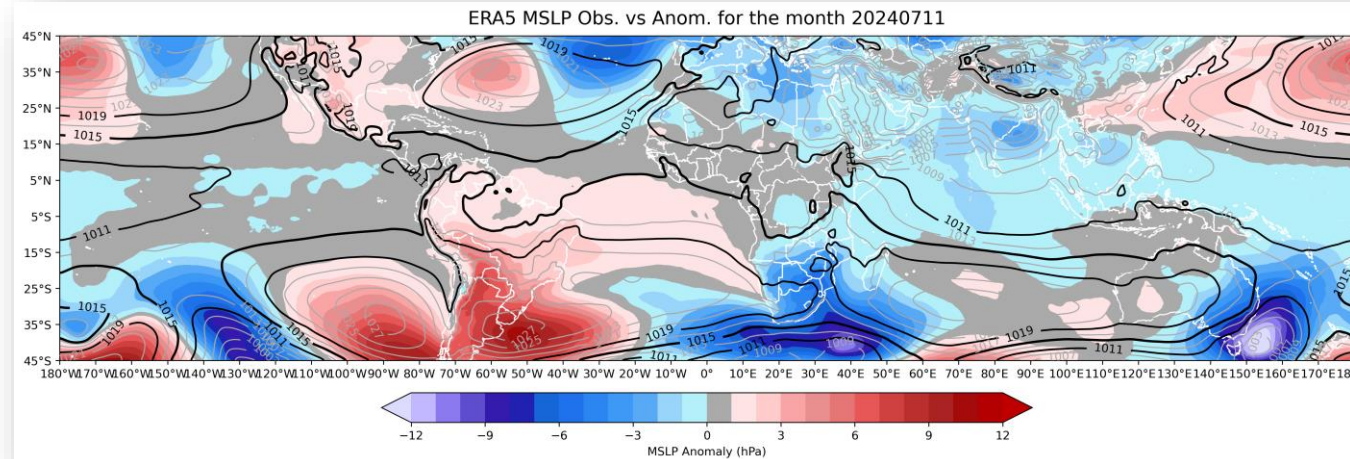
Supporting ACMAD on Climate Monitoring



- NCEP NCAR MSLP (climatology 1991-2020)



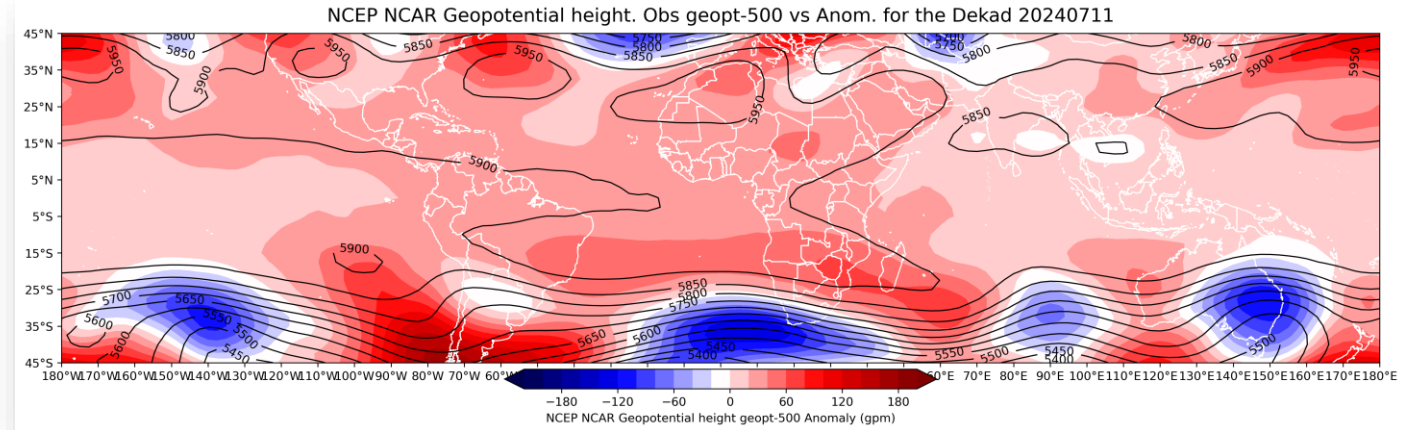
- ERA5 MSLP (climatology 1991-2020)



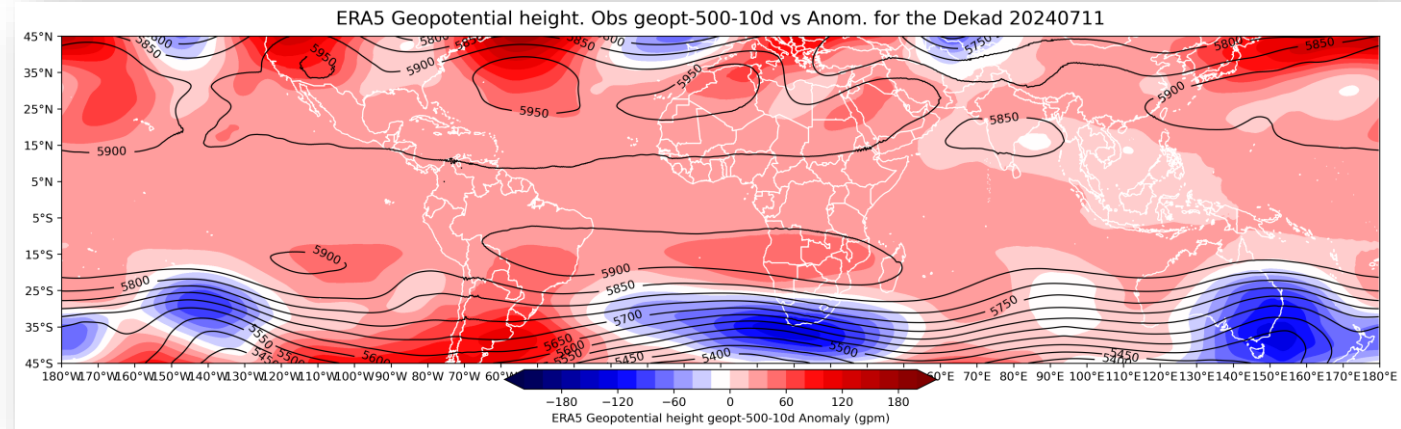
Supporting ACMAD on Climate Monitoring



- NCEP NCAR GEOPT
(climatology 1991-2020)



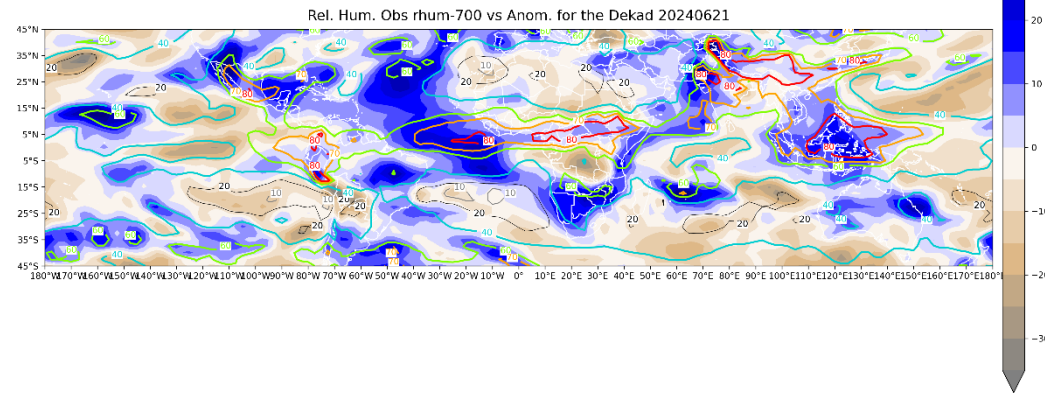
- ERA5 GEOPT
(climatology 1991-2020)



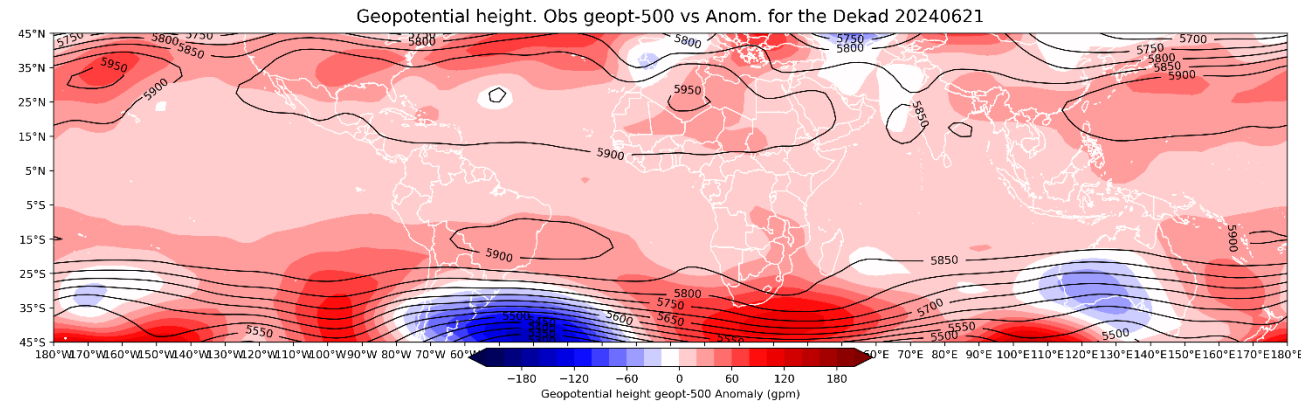
Supporting ACMAD on Climate Monitoring



- NCEP NCAR
Relative humidity
@ 700 (climatology
2000-2020)



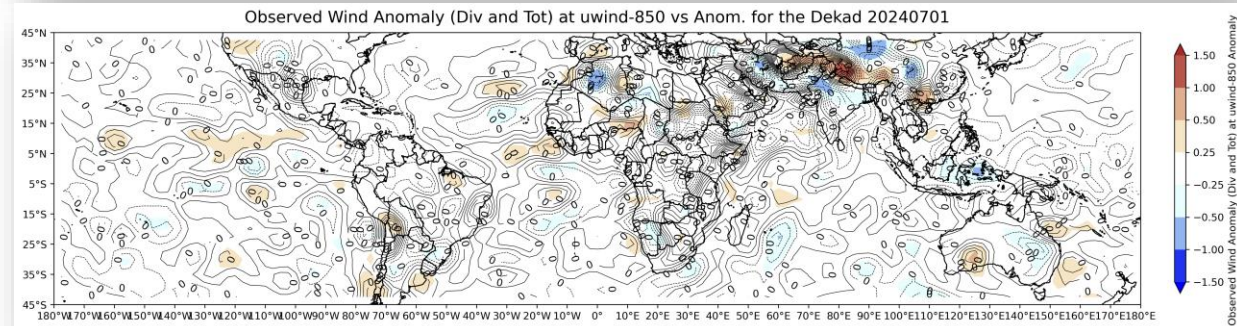
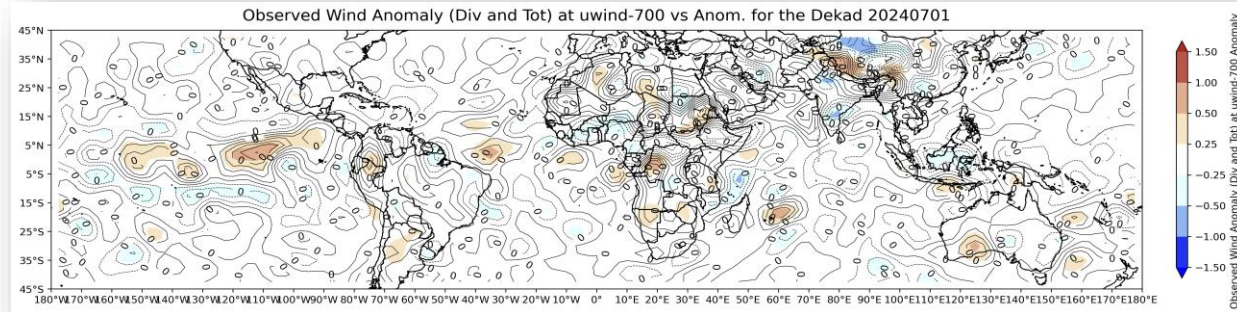
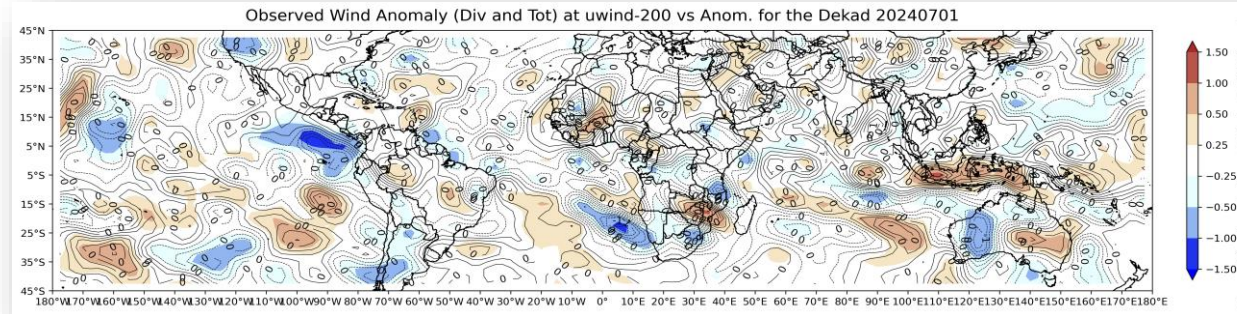
- NCEP NCAR
Geopotential
height @ 500





Supporting ACMAD on Climate Monitoring

- NCEP NCAR
Wind divergence
@200
- NCEP NCAR
Wind divergence
@700
- NCEP NCAR
Wind divergence
@850



Please take away this message with you...

- We are **actively seeking to expand our collaboration** with RCCs and NMHSs to co-develop tailored solutions that address specific regional **climate monitoring** needs.
- Key features of the Climate Station include its **ability to deliver tailored climate services** through a user-friendly web client, the integration of **Jupyter Notebooks for customizable analysis**, and the **seamless combination of** different data sources
- To effectively manage and utilize climate data, **you require tools that allow you to use, reuse, adapt, and compile** information for regional and national reporting. - This is precisely the function of the Climsa station we are currently developing. –
- We have already integrated numerous exceptional products from data providers in the ClimSA Station facilitating **in-depth analysis and reporting.**





Online version,

<https://estation.jrc.ec.europa.eu/eStation3/>
<https://europa.eu/!Wvp7QJ>



Try it!!!

Video tutorials

Climate Station ClimSA
32 videos 884 views Last updated on Mar 2, 2023

Play all Shuffle

The screenshot shows a YouTube video player interface. At the top, there is a thumbnail image of the software's dashboard, which includes a map of Africa, a line graph, and several bar charts. Below the thumbnail, the video title 'Climate Station ClimSA' is displayed, along with the number of videos (32) and views (884), and the last update date (Mar 2, 2023). There are icons for bookmark, share, download, and a menu. At the bottom, there are two buttons: 'Play all' and 'Shuffle'.



Video tutorial 0 General overview

Climate Station ClimSA • 223 views • 1 year ago



Video tutorial 1 - Dashboard

Climate Station ClimSA • 81 views • 1 year ago



Video tutorial 2 - Portfolio

Climate Station ClimSA • 97 views • 1 year ago



Video tutorial 3.1 - Acquisition basics

Climate Station ClimSA • 64 views • 1 year ago



Video tutorial 3.2.1 - Acquisition advanced

Climate Station ClimSA • 56 views • 1 year ago



Video tutorial 3.2.2 - Acquisition data source settings

Climate Station ClimSA • 62 views • 1 year ago



Video tutorial 3.2.3 - Acquisition CDS user creation

Thank you



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