

21.09.2023



GBON National Gap Analysis

Systematic Observations
Financing Facility

Ethiopia

**Weather
and climate
data for
resilience**





Screening of the National Gap Analysis (NGA) of Ethiopia

WMO Technical Authority screens the GBON National Gap Analysis to ensure consistency with the GBON regulations and provides feedback for revisions as needed. *The screening of the NGA is conducted according to the SOFF Operational Guidance Handbook, version: 04.07.2023 and the provisions in Decision 5.7 of the SOFF Steering Committee.*

Following iterations with the peer advisor and beneficiary country, WMO Technical Authority confirms that the National Gap Analysis is consistent with GBON regulations.

Date: 29th Sep 2023

Signature:

Albert Fischer

Director, WIGOS Branch, Infrastructure Department, WMO



Ethiopia

GBON National Gap Analysis

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Ethiopia GBON Gap Analysis Report by the Peer Advisor

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WMO Technical Authority	

1. Country GBON horizontal resolution requirements

Please complete the number of required GBON stations in the table below based on the global gap analysis results received from the WMO Secretariat.

Table 1: WMO GBON Global Gap Analysis (June 2023)

A. GBON horizontal resolution requirements	B. GBON target (# of stations)	C. Reporting (as per WDQMS)	D. Gap improve	E. Gap new	F. Gap total
SURFACE STATIONS Horizontal resolution: 200km	29	0	29	0	29
UPPER-AIR STATIONS Horizontal resolution: 500km	5	0	1	4	5

2. Analysis of existing GBON stations and their status against GBON requirements

Please fill in the number of existing stations according to the elements described above and present a map of existing stations with color coding according to the station type, ownership, and status.

Table 2: Assessment of existent stations per their operational status and network ownership.

GBON Requirements	Existing observation stations (# of stations)			
	NMHS network		3 rd party network*	
	Reporting	Improve	Reporting	Improve
SURFACE STATIONS Horizontal resolution: 200km Variables: SLP, T, H, W, P, SD	0	16	-	-
UPPER-AIR STATIONS Horizontal resolution: 500km Vertical resolution: 100m, up to 30 hPa Variables: T, H, W	0	2	-	-

Remarks

In accordance with proclamation No. 201/1980, the Ethiopian Meteorology Institute is the only mandated organization to accomplish the following duties and responsibilities:

- Establish and operate a national network of meteorological stations designed to represent various climatic regions of Ethiopia and to satisfy the needs of various national development plans and activities.
- Collecting all meteorological data; Exchange meteorological data in accordance with international agreements to which Ethiopia is a party;
- Establish and operate communication systems, in accordance with the law for the collection and dissemination of meteorological data;
- Publish and disseminate analyzed and interpreted meteorological data and meteorological forecasts;
- Give advance warning on adverse weather conditions; disseminate advice and educational information through the mass media; and provide, upon request meteorological services to any person;
- Collect and centrally administer, notwithstanding the provisions of Article 5 this proclamation, any meteorological data collected by any person in the country;
- Control air pollution and maintain the natural balance of the air in the country;

Station information of operational stations: name, type, ownership, funding source, variables measured, the number of observations reported per day and whether the station is GBON compliant.

Table 3: Existing synoptic weather stations in Ethiopia and their GBON characteristics

Station name	Station type (S/UA)	Owner (NMHS/3rd party)	Funding source	GBON variable measured						Reporting cycle	GBON Compliance (Y/N)
				SLP	T	H	W	P	SD		
Addis Ababa Bole	Surface	EMI	ETH-Gov	X	X	X	X	X	NA*	3-hourly	N
Arba Minch	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-18 LST)	N
Awassa	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-21 LST)	N
Bahir Dar	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-18 LST)	N
Combolcha	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-21 LST)	N
Debre Markos	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-18 LST)	N
Dire Dawa	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly	N
Gode	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-18 LST)	N
Gondar	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-18 LST)	N
Gore	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-18 LST)	N
Harar Meda	Surface	EMI	ETH-Gov	X	X	X	X	X		Stopped reporting	N
Jimma	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-21 LST)	N
Nekemte	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-21 LST)	N
Makale	Surface	EMI	ETH-Gov	X	X	X	X	X		Stopped reporting	N
Metehara	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-18 LST)	N
Negelle	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-18 LST)	N
Robe/Bale	Surface	EMI	ETH-Gov	X	X	X	X	X		3-hourly (06:00-21 LST)	N
Addis Ababa	UA	EMI	ETH-Gov		X	X	X			1-day	N

* NA: not applicable

Assessment of existing GBON stations per station characteristics

Station type: S: Surface, US: Upper-Air; Owner of the station: NMHS or which 3rd party; Funding source of station operations; GBON variables: SLP: Sea-level pressure; T: Temperature; H: Humidity; W: wind; P: Precipitation; SD: Snow depth; Reporting cycle: Number of observation reports exchanged internationally per day (0-24), summary whether the station is GBON compliant.

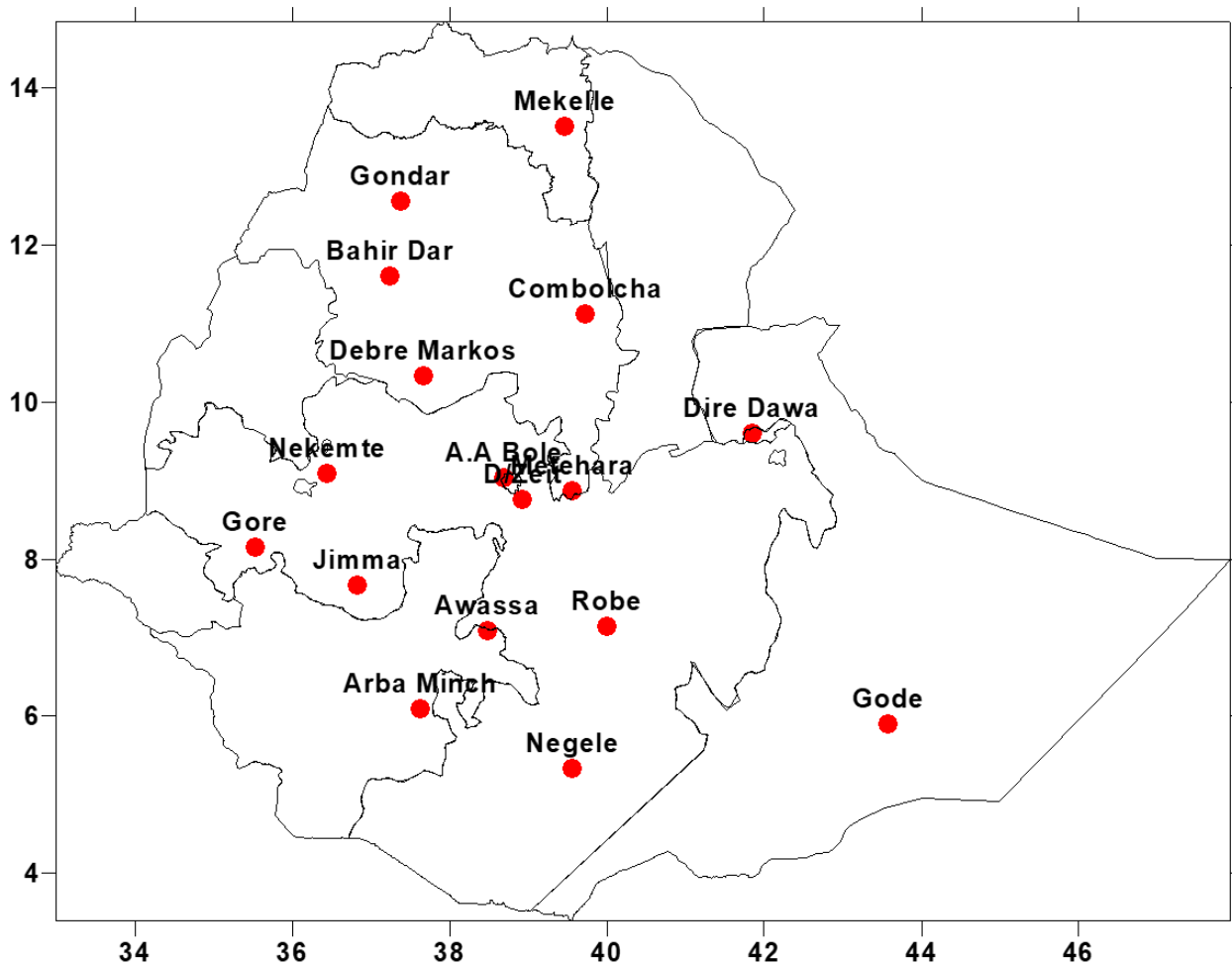


Fig 1: Map of Ethiopia with locations of existing synoptic station

Remarks:

Ethiopian Meteorology Institute, EMI (former Ethiopian National Meteorological Agency (NMA)) revised meteorological station network master plan for 2021 to 2030 report (2021) gives a summary of all meteorological stations in Ethiopia. The report indicates that Ethiopia has established 1543 different meteorological stations across the country which all are fully functional. As of 2020, EMI is reported to have 287 operational Automatic Weather Stations (AWS) measuring temperature (T), wind (W), Humidity (H), precipitation (P) and global radiation at sub-hourly intervals. Based on the report however, none of the AWS is seen to be GBON compliant as they all lack atmospheric pressure sensors. Additionally, some of the AWS only record wind at 2m installed for agricultural purposes, while some require a change of the data-logger and or server to meet the minimum GBON reporting requirement. Thus, based on case by case detailed analysis there may be a need for major AWS upgrade or installation of new AWS in Ethiopia. Here is the current list of the [AWS stations](#) in Ethiopia and their metadata, not as a part of the GBON analysis, but just for information:

3. Results of the GBON Gap Analysis

Please fill in the results from steps 1 and 2 and the outcome of stations needed to install or rehabilitate and provide a map of existing stations with the location of gaps indicated in circles of 200km (surface) and 500km (upper-air) radius.

Table 4. Ethiopia's results of the GBON national gap analysis.

GBON requirements	GBON target (#of stations)	Compliant stations with GBON requirement (# of stations)	Stations needed against GBON requirement	
			New	Improved
SURFACE STATIONS • Horizontal resolution: 200km • Variables: SLP, T, H, W, SD • Observation cycle: 1h	29	0	13	16
UPPER-AIR STATIONS. Horizontal resolution: 500km • Vertical resolution: 100m, up to 30 hpa Variables: T, H, W • Reporting cycle: twice a day	5	0	3	2

Remarks

WMO National Gap Analysis for Ethiopia¹ (January 2022) recommends 29 surface-based and 5 upper air stations for Ethiopia. However based on the results of this gap analysis, 32 surface stations is highly recommended. The reasons behind this are;

1. EMI would like to include 16 of their synoptic stations that are currently reporting to GTS in Ethiopia's GBON station list due to their long historical data. However, some of the previous 16 stations do not keep the recommended 200 km horizontal resolution. They are situated at a horizontal distance of less than 200 km. Harar Meda station will not be included because it is not managed by EMI.
2. Ethiopia is a mountainous country and that necessitates more stations. More sample data means more input for models and better forecast outputs. Adding three stations to those recommended by WMO will give better representation of weather related topography in Ethiopia

Ethiopia has three existing upper air stations, one of them however is too old to be upgraded. Recommendation is thus for installation of three new upper air stations and upgrading of two.

¹ [WMO 2022-CL-Hmp-GBON-Compo-Net-18876_ETH_Ethiopia_en](#)

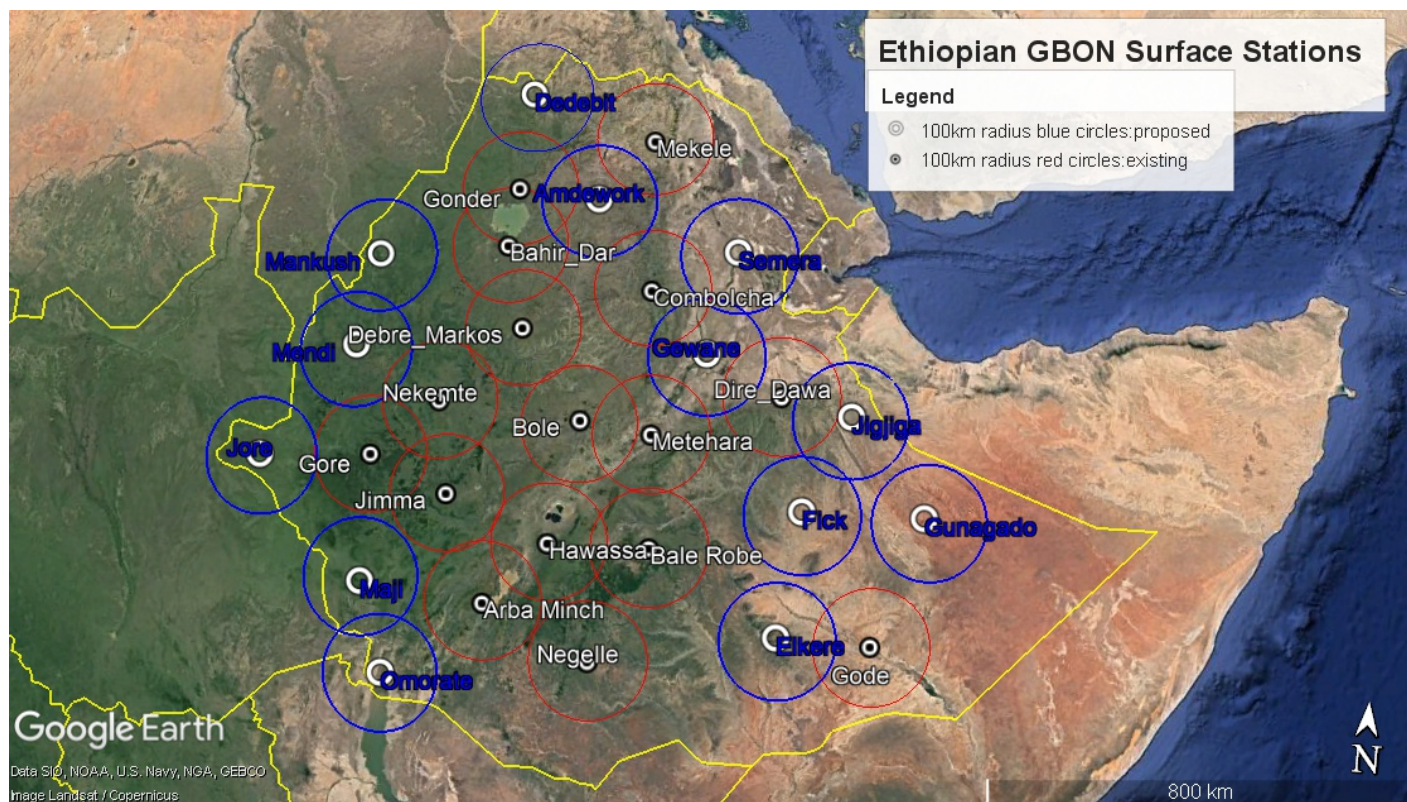


Fig 2: Map of Ethiopia with locations of surface-based stations to improved (red circle) and to be newly installed (blue circle)

Table 2: Proposed GBON Surface Land Stations

WMO ID	Surface Stations	Regional State	Longitude	Latitude	Elevation	Begin date	End date
63450	Addis Ababa Bole	Addis Ababa	38,79871	8,981081	2354	01/01/54	12/31/99
NA	Amde Work	Amhara	38,714722	12,434722	2561	01/01/08	12/31/99
63500	Arba Minch	SNNPR	37,561389	6,062222	1220	01/01/87	12/31/99
63460	Awassa	SNNPR	38,483056	7,065	1694	07/01/72	12/31/99
63332	Bahir Dar New	Amhara	37,36	11,595	1800	11/01/02	12/31/99
63333	Combolcha	Amhara	39,717633	11,083899	1857	06/01/52	12/31/99
63334	Debre Markos	Amhara	37,7392	10,3257	2446	11/01/53	12/31/99
NA	Dedebit	Tigray	37,46	14,06	874	07/01/17	12/31/99
63471	Dire Dawa	Dire Dawa	41,896833	9,613367	1045	04/01/52	12/31/99
NA	Fick	Somali	42,297778	8,139444		10/28/15	12/31/99
63478	Gode Met	Somali	43,5715	5,932	279	01/01/66	12/31/99
63331	Gondar A.P.	Amhara	37,4319	12,52115	1973	06/01/52	12/31/99
63403	Gore	Oromia	35,54983	8,157283	2024	01/01/52	12/31/99
NA	Jijiga	Somali	42,717867	9,365133	1557	04/01/52	12/31/99
63402	Jimma	Oromia	36,821217	7,670133	1710	06/01/52	12/31/99
NA	Jor	Gambella	34,01	7,5	415	04/01/13	12/31/99
NA	Maji	SNNPR	35,58655	6,173183	2367	03/01/09	12/31/99
NA	Mankush	Benishangul Gumuz	35,291	11,272	860	06/01/00	12/31/99
63330	Mekele airport observa	Tigray	39,5312	13,47051	2221	06/01/59	12/31/99
NA	Mendi	Oromia	35,0925	9,805278	1650	01/01/55	12/31/99
63453	Metehara (NMSA)	Oromia	39,921	8,865	952	01/01/73	12/31/99

63533	Neghele	Oromia	39,2675	5,330833	1439	08/01/52	12/31/99
63340	Nekemte	Oromia	36,548889	9,0825	2119	09/01/52	12/31/99
NA	Omorate	SNNPR	36,05375	4,80297	365	01/01/10	12/31/99
63474	Robe	Oromia	40,05	7,133333	2480	01/01/84	12/31/99
NA	Semera	Afar	41,001944	11,800833	434	01/01/02	12/31/99
NA	Gewane	Afar	40,658333	10,155278	618	01/01/80	12/31/99
NA	Elcare	Somali	42,1052	5,8355	924	10/01/57	05/31/03
NA	Gungoda	Somali	43,944788	7,83307	844	New	

Remarks

WMO National Gap Analysis for Ethiopia² (January 2022) recommended 29 surface-based stations for Ethiopia, EMI suggested the number to be 32. The reasons behind this are.

1. EMI would like to include 16 of their synoptic stations that are currently reporting to GTS in Ethiopia's GBON station list due to their long historical data. However, some of the previous 16 stations do not keep the recommended 200 km horizontal resolution. They are situated at a horizontal distance of less than 200 km. Harar Meda station will not be included because it is not managed by EMI
2. Ethiopia is a mountainous country and that necessitates more stations than a plain area. More sample data means more input for models and better forecast outputs. Adding three stations to those recommended by WMO will give better representation of the weather related to topography in Ethiopia.

While easy fixes are highly encouraged, consideration is also taken on EMI wishes to include AWS alongside their existing 16 manual observing stations currently reporting to GBON/GTS. Although most of these stations have overlapping existing AWS, most do not meet GBON compliance, not only because of the missing pressure sensor, but also because most AWS are old (+10 years old) and may require major upgrades to meet GBON requirements. For the 16-stations, the initial investment cost will be significantly reduced because EMI will not require much related civil works. The station's sitting, plot of land, fencing and other basic facilities are adequate.

It should be noted that EMI's ultimate wish is to install new AWS in all the 29 stations mainly because whilst 16 stations are herein identified as to be improved, there is a possibility that a lot of investment, equivalent to that of the new AWS will be required for them to meet the GBON requirements. Thus based on a station by station analysis in the subsequent readiness phases, we will assess the investments needed for full system replacement (new AWS) against investment needed for improvement of existing stations.

² [WMO 2022-CL-Hmp-GBON-Compo-Net-18876_ETH_Ethiopia_en](#)

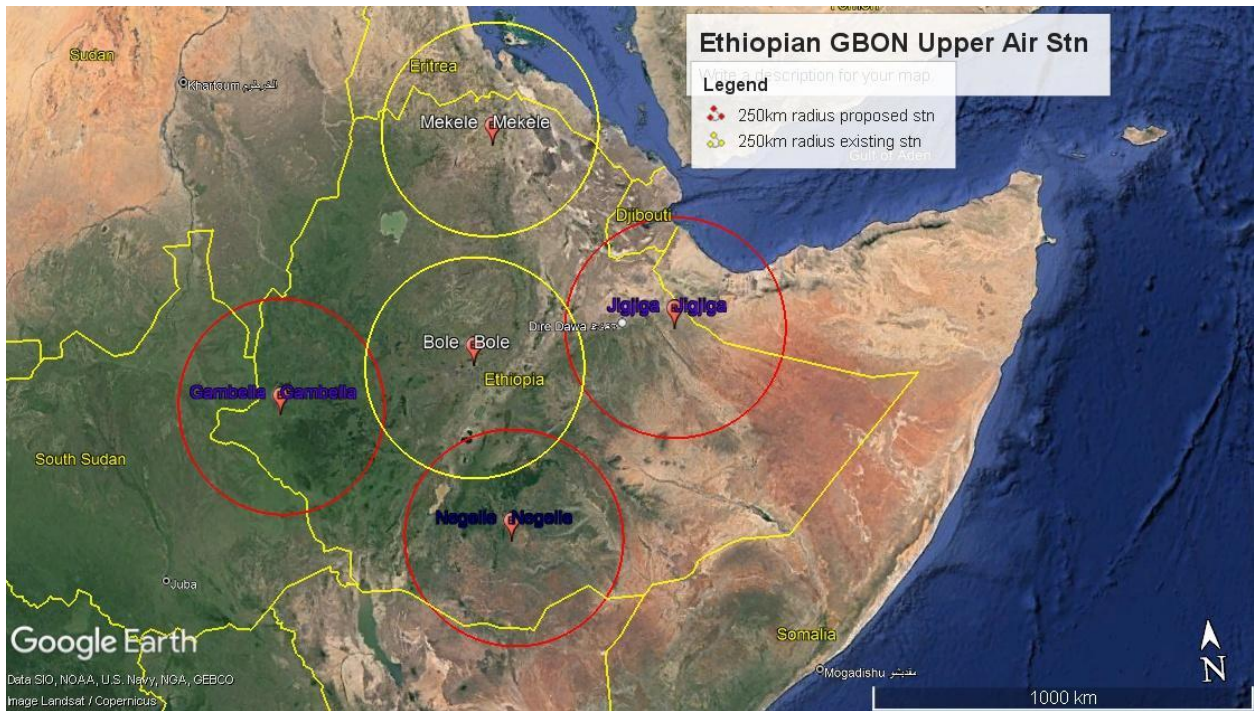


Fig 3: Map of Ethiopia with locations of upper air stations to be of improved (yellow circle) and to be newly installed (red circle)

Table 3: Proposed GBON upper-air stations

WMO ID	Upper Air Stations	Regional State	Longitude	Latitude	Elevation	Begin date	End date
NA	Jijiga	Somali	42,717867	9,365133	1557	04/01/52	12/31/99
NA	Gambela	Gambella	34,54	8,34	453	01/01/76	12/31/99
NA	Neghele	Oromia	39,2675	5,330833	1439	08/01/52	12/31/99
NA	Mekele	Tigray	39,5312	13,47051	2221	06/01/59	12/31/99
NA	Addis Ababa	Addis Ababa	38,78577	8,98528	2330	02/01/75	03/07/20

Remarks

Due to lack of infrastructure related to power supply, roads, settlements also, there will probably be needs for adjustments of locations for the new stations.

4. Report completion signatures

Peer Advisor

Date 22.09.2023



Beneficiary Country

Date 29-09-2023



Fetene Teshome
Director General &
Permanent Representative
Of Ethiopia With WMO

WMO Technical Authority screening remarks and signature

Date 29th Sep 2023

