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KENYA
METEOROLOGICAL
DEPARTMENT

AIR QUALITY MONITORING

GLOBAL ATMOSPHERE WATCH (GAW)

By: Rose N. Lekalesoi



LAYOUT

- Establishment of the Kenya Meteorological Department (KMD)
- Mission, Vision and Mandate of KMD
- Organization Structure
- Infrastructure of KMD
- Observation network
- Air quality monitoring
- Air quality regulation contribution
- Role in data management
- Climate Services Section data role
- Dissemination



ESTABLISHMENT OF KENYA METEOROLOGICAL DEPARTMENT

- Provision of meteorological service in Kenya started in 1929, following the establishment of the British East African Meteorological Service (BEAMS), to provide meteorological and climatological services to various sectors of the economy.
- KMD became a Department of the Government of Kenya in 1977 from the previous East African Meteorological Department (EAMD) after the collapse of the East African Community (EAC).



MISSION, VISION AND MANDATE OF KENYA METEOROLOGICAL DEPARTMENT

Vision:

- A world class weather and climate service

Mission

- To provide and facilitate weather and climate information services for sustainable development.

Mandate

- Provide timely and accurate Early Warning Information for the Safety of Life, Protection of Property and safeguarding of the natural environment.



KMD ORGANIZATIONAL STRUCTURE

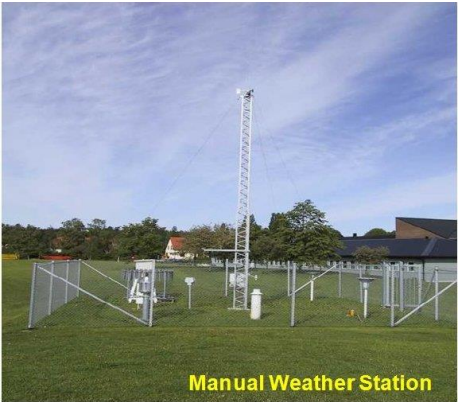
D - DIRECTOR
DD - DEPUTY DIRECTOR
AeMS - AERONAUTICAL
METEOROLOGICAL SERVICES
MS - METEOROLOGICAL SUPPORT
SERVICES
CLS - CLIMATE SERVICES
ETRD - EDUCATION, TRAINING,
RESEARCH AND DEVELOPMENT
FS - FORECASTING SERVICES
MAS - METEOROLOGICAL APPLICATIONS
SERVICES
RC - REGIONAL METEOROLOGICAL
SERVICES CENTRAL
RE - REGIONAL METEOROLOGICAL
SERVICES EASTERN
RW - REGIONAL METEOROLOGICAL
SERVICES WESTERN
TS - TECHNICAL SERVICES



METEOROLOGICAL INFRASTRUCTURE

- Observational Systems and Networks;
- Telecommunication Systems and Networks;
- Data Processing, Analysis and Forecasting System;
- Data-base Management System and Archiving;
- Product and Information Dissemination System; and
- Human Capital.

CURRENT OBSERVATIONAL NETWORK



39 manned 24-hr
Synoptic & **14**
Agro Met Stations



100 Automatic
Weather Stations
(AWSs)



19 Hydromet
Automatic Weather
Stations



5 Airport Weather
Observation Systems
(AWOSs) at **JKIA,**
Wilson, MIA, EIA & KIA



2 fixed buoys at
Lake Victoria



Over **1000**
rainfall stations

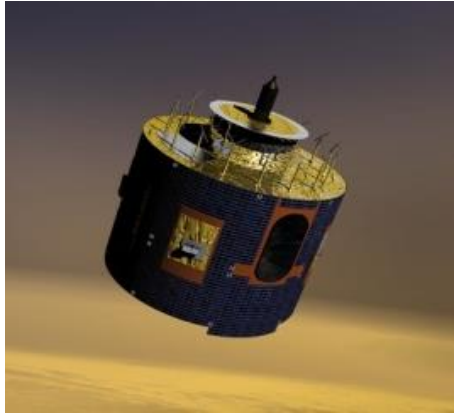


4 tidal gauge stations
at **Lamu, Mailindi,**
Kilifi and Shimoni



4 Seismic Stations
in **Lodwar, Voi,**
Mombasa and Kibwezi

CURRENT OBSERVATIONAL NETWORK II



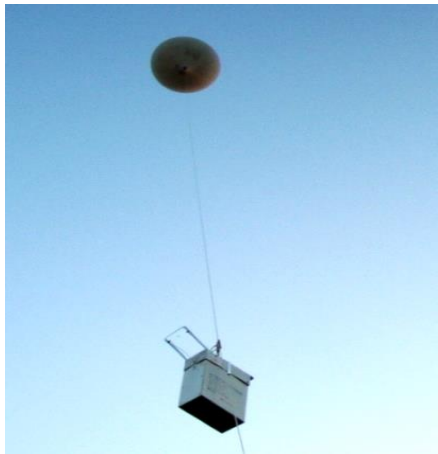
3 MSG
Receiving Stations



1 Ozone Profile measuring
system in Nairobi



1 Global Atmospheric
Watch at Mt Kenya



1 Upper Air Station at
Dagoretti, Two have
been installed at
Lodwar and Garissa



One Mobile Air Pollution
Monitoring Laboratory



2 urban pollution
stations at Chiromo
and JKIA

AIR QUALITY MONITORING

- KMD has a national, regional and global mandate of monitoring atmospheric chemical composition including greenhouse gases (GHGs), and environmental background pollution for air quality assessment over Kenya.
- Monitoring through;
 - Nairobi regional GAW station
 - Mt. Kenya Global Atmosphere Watch station (MKN GAW),
 - The state of the art Mobile Air Pollution Monitoring Station

NAIROBI REGIONAL GAW STATION

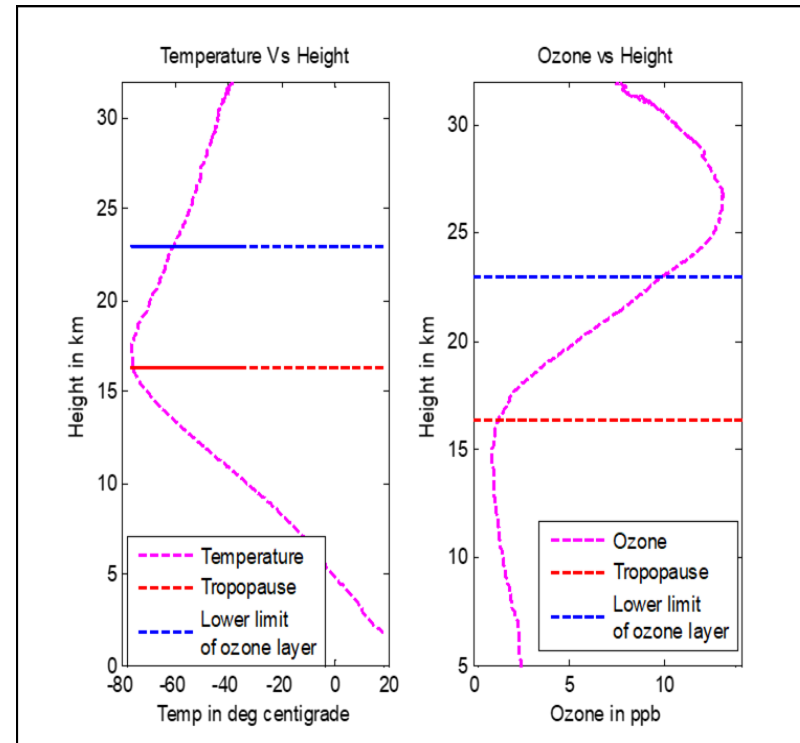
Measurements conducted at the station

- Total column ozone
- Vertical profile of ozone
- Ground level ozone
- Various weather parameters

2019: Brewer 071 established at KMD

- Tracker broke down after a few months
- Efforts are underway to fix this

Started 1996, about 50 ascents yearly



Vertical profile ozone measurement



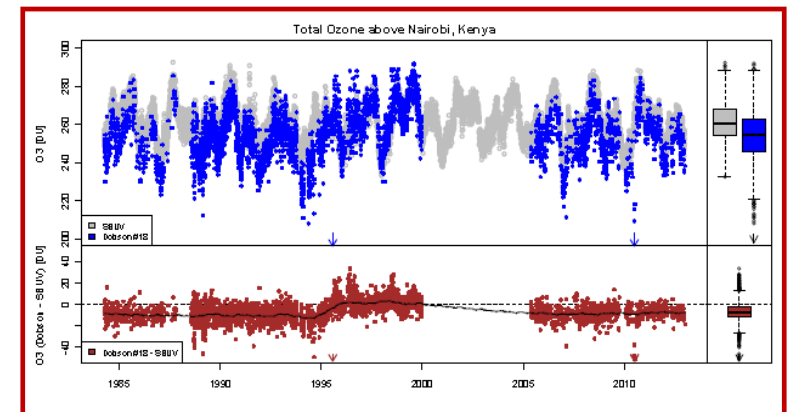
Automatic Standard Operating Procedure Applications System (ASAP)

OZONE MONITORING INSTRUMENTS- DOBSON SPECTROPHOTOMETER

- Its a ground-based instrument that measures the amount of total ozone present in the atmospheric column.
- It measures UVB and UVA which are used to calculate how much ozone is present in the entire atmospheric column.
- Supplements ozone sonde data and used to calculate residual ozone.
- Uses O_3 Dobson software .
- Initially at Chiromo campus, UoN from 1984.
- Moved to KMS in 2005 upto date.



Dobson Spectrophotometer No. 18



Klaue, Shilenje et al., 2014. data source; GAW Nairobi

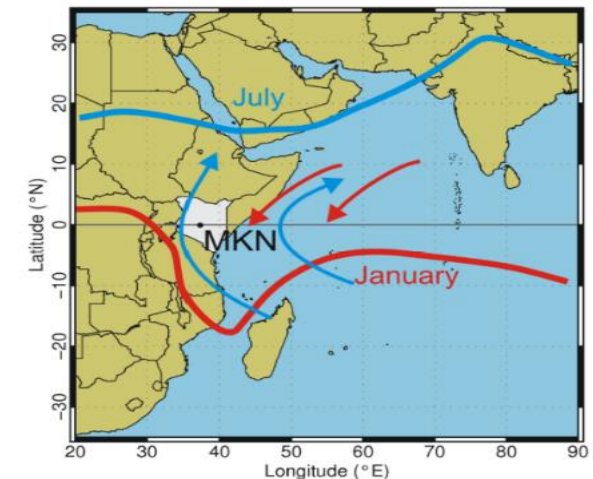
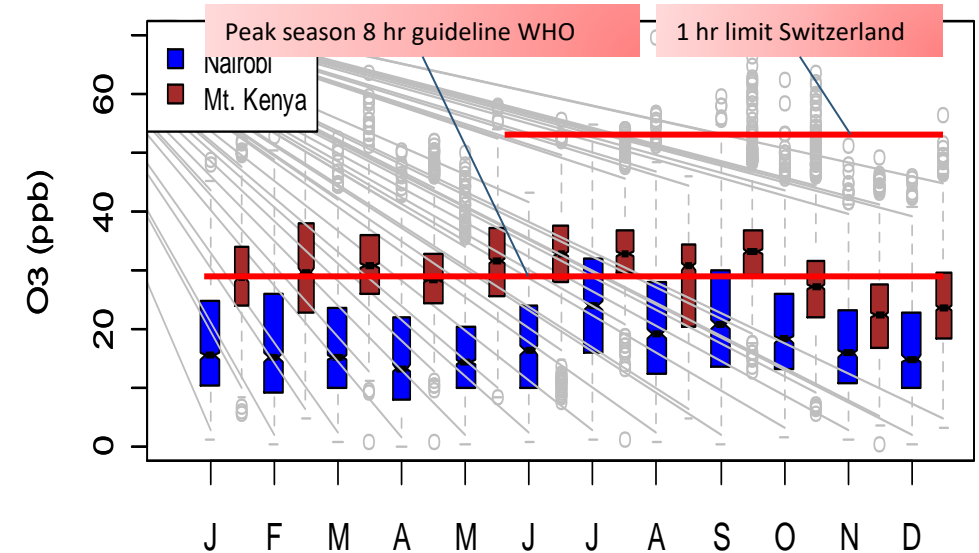
SURFACE OZONE

MKN: 2002 onwards; NRB: 2012 onwards

Comparable small seasonal variation at these sites

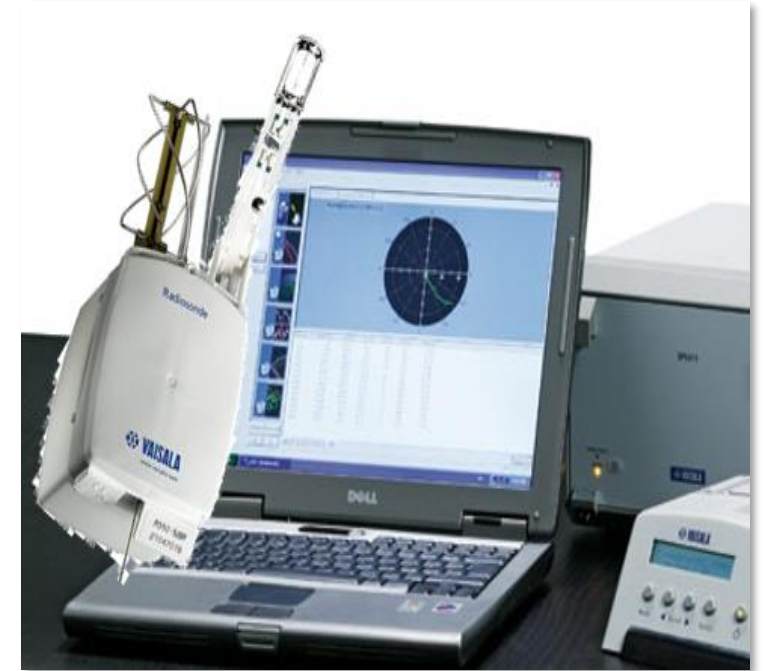
Generally dominated by position of ITCZ (Henne et al., 2008)

- NH ozone-depleted air masses during boreal winter
- Predominantly SH air masses influenced by biomass burning during boreal summer, increased ozone
- In urbanized Nairobi, these seasonal effects moderated by the effect of local emissions.
- Not a significant health hazard at these locations

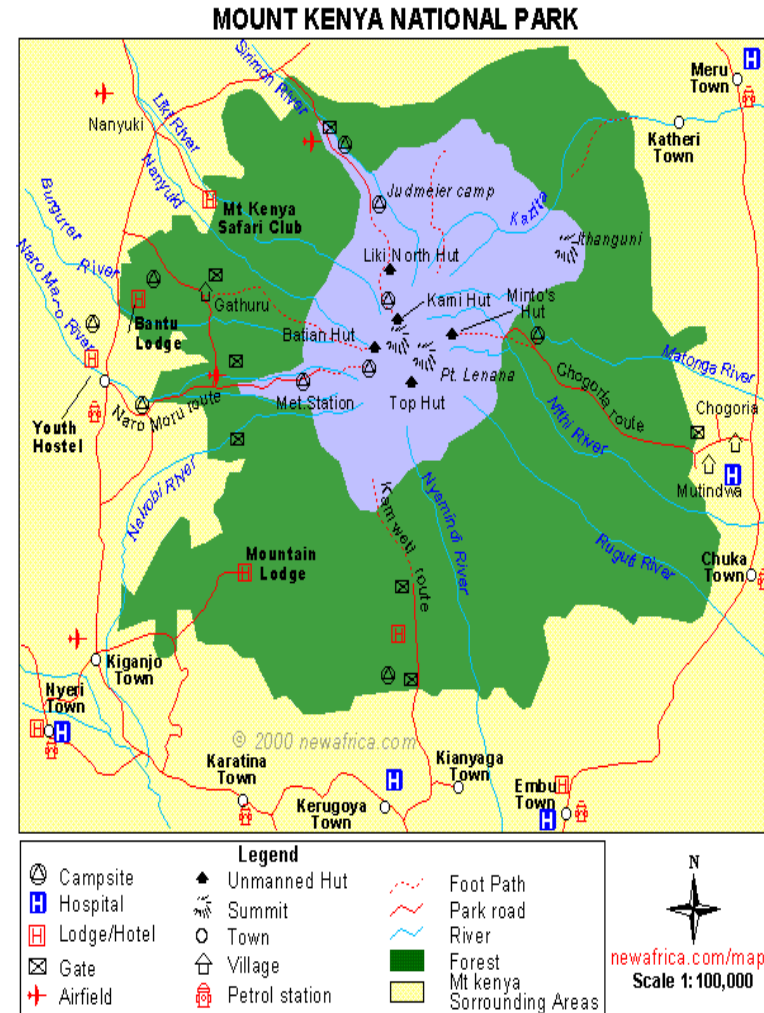


THE OZONE SONDE

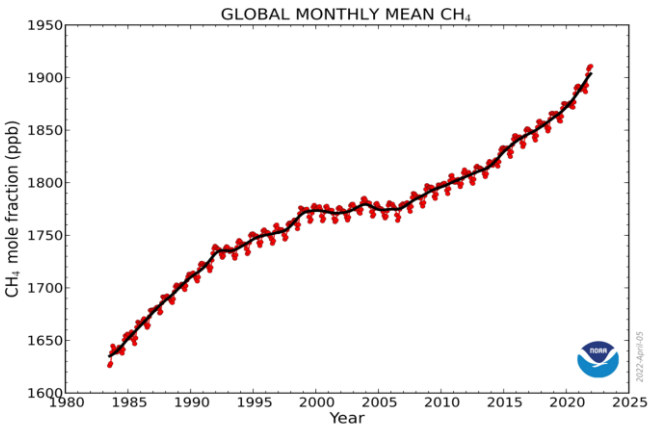
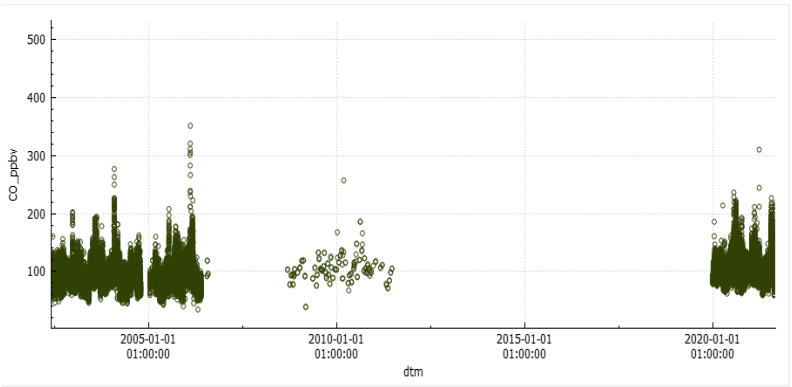
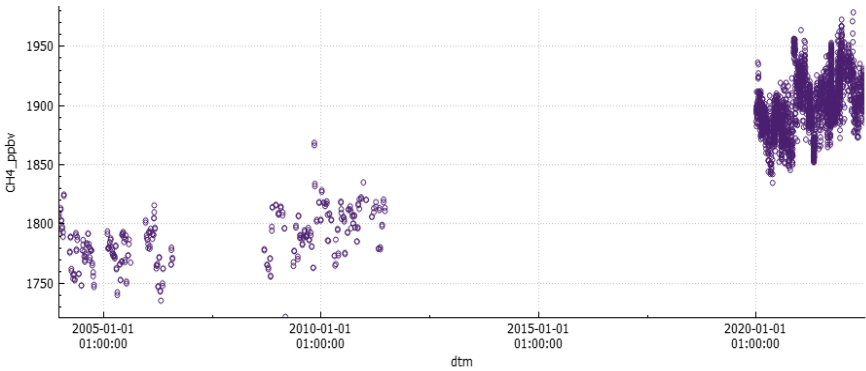
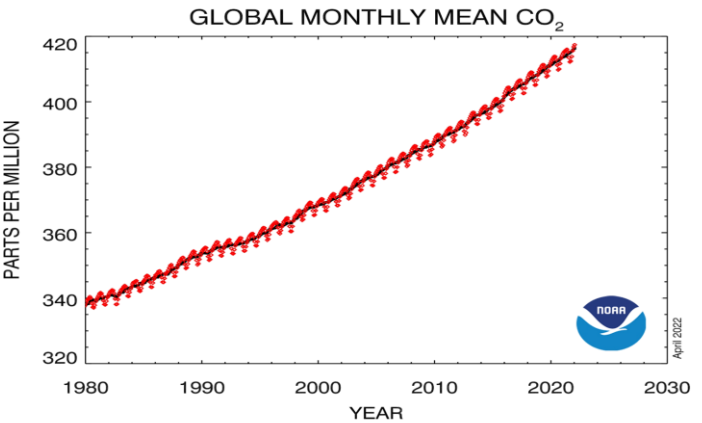
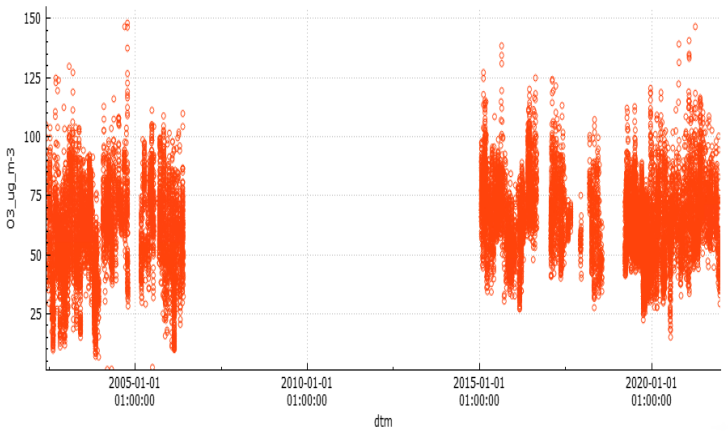
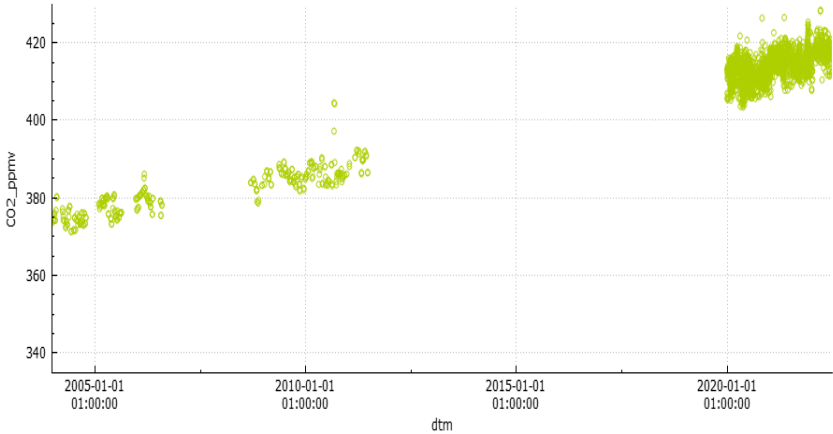
- It's a lightweight, balloon-borne instrument mated to a conventional meteorological radiosonde
- During it's ascent through the atmosphere, the ozone sonde transmits ozone and standard meteorological quantities to the ground receiving station.
- It's used to monitor the vertical ozone profile .



MOUNT KENYA GAW STATION- ITS LOCATION



GREENHOUSE AND REACTIVE GASES VS GLOBAL MEAN



INSTRUMENTS

Elements measured:

Ozone: From December 1999

Carbon monoxide: From September 2002

Carbon dioxide: From March 2009

Methane: From March 2009

Aerosols: From February 2003

Air sampling: From 2005 to 2010

-Aethalometer- measures aerosols

-Picarro- measures- Carbon dioxide, Methane, Carbon monoxide and Water Vapour.

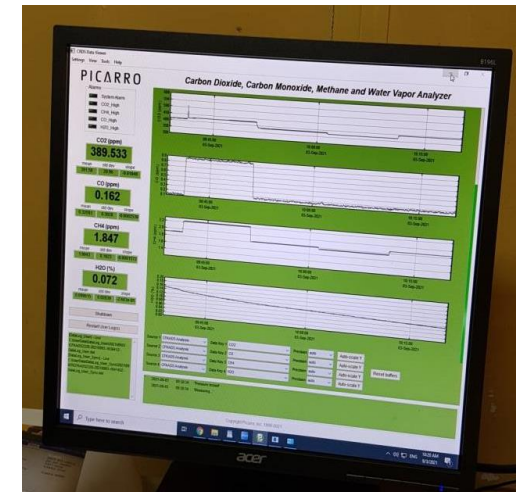
-2021: WMO SG Petteri Taalas mentions station w.r.t the new WMO GHG initiative.



Aethalometer



Picarro



Picarro screen

MOBILE AIR MONITORING LABORATORY



PARAMETERS MONITORED

- PM2.5, PM10
- Black carbon
- Ozone
- Carbon monoxide
- Carbon dioxide
- Sulphur Dioxide (SO₂)
- Nitrogen Dioxide (NO₂)
- Nitric Oxide (NO)
- Hydrogen Sulphide (H₂S)
- Methane
- Ammonia



CALIBRATION GASES



METEOROLOGICAL PARAMETERS

- Wind speed
- Wind direction
- Temperature
- Relative humidity
- Precipitation
- Pressure



AIR QUALITY REGULATION CONTRIBUTION

- Participated in formulation of **The Air Quality Regulations 2014**
- Closely works with NEMA-Kenya on air quality issues
- Member of Kenya Bureau of Standards (KEBS) Technical Committee on air quality

CLIMATE DATA MANAGEMENT

- Is critically important to ensure that current and future generations of scientists and other data users have access to all the information necessary for their studies and projects.
- Enable better assessments of projections of the climate which can serve as input for the policy makers to mitigate loss due to natural disasters and provide increased information for economic development.
- The Climate Data Management Services Division (CDMS) has the mandate of managing climate data from all meteorological observation systems owned by KMD and other partners in weather observations.
- Climate data is received through paper registers/forms, email, internet from Automatic Weather Stations (AWSs).
- This data undergoes initial quality control. It is then keyed-in into the computerized electronic database where it undergoes further quality checks before it is archived ready to be made available to users.

CLIMATE SERVICES SECTION DATA ROLE

- Generation of trends of extremes, trends of rainfall and temperatures as proxies for climate change
- Contributed in drafting of the National Climate Change Response Strategy (NCCRS, 2010)
- Contributed in drafting of the National Climate Change Action Plan (NCCAP, 2013-2017)
- Contributed in drafting of the National Climate Change Action Plan (NCCAP, 2018-2022)
- Contributed in drafting of The Climate Change Act 2016
 - To provide regulatory framework for enhanced response to climate change
 - To provide for mechanism and measures to improve resilient to climate change and achieve low carbon climate development
 - Establishes the National Climate Change Council, Climate Change Fund and Climate Change Directory.

INTERNATIONAL CONTEXT AND OBJECTIVES

The mission of GAW is to:

- Reduce environmental risks to society and meet the requirements of environmental conventions
 - United Nations Framework Convention on Climate Change (UNFCCC)
 - Vienna Convention for the Protection of the Ozone Layer
 - Convention on Long-Range Transboundary Air Pollution (CLRTAP)
- Strengthen capabilities to predict climate, weather and air quality
- Contribute to scientific assessments in support of environmental policy.

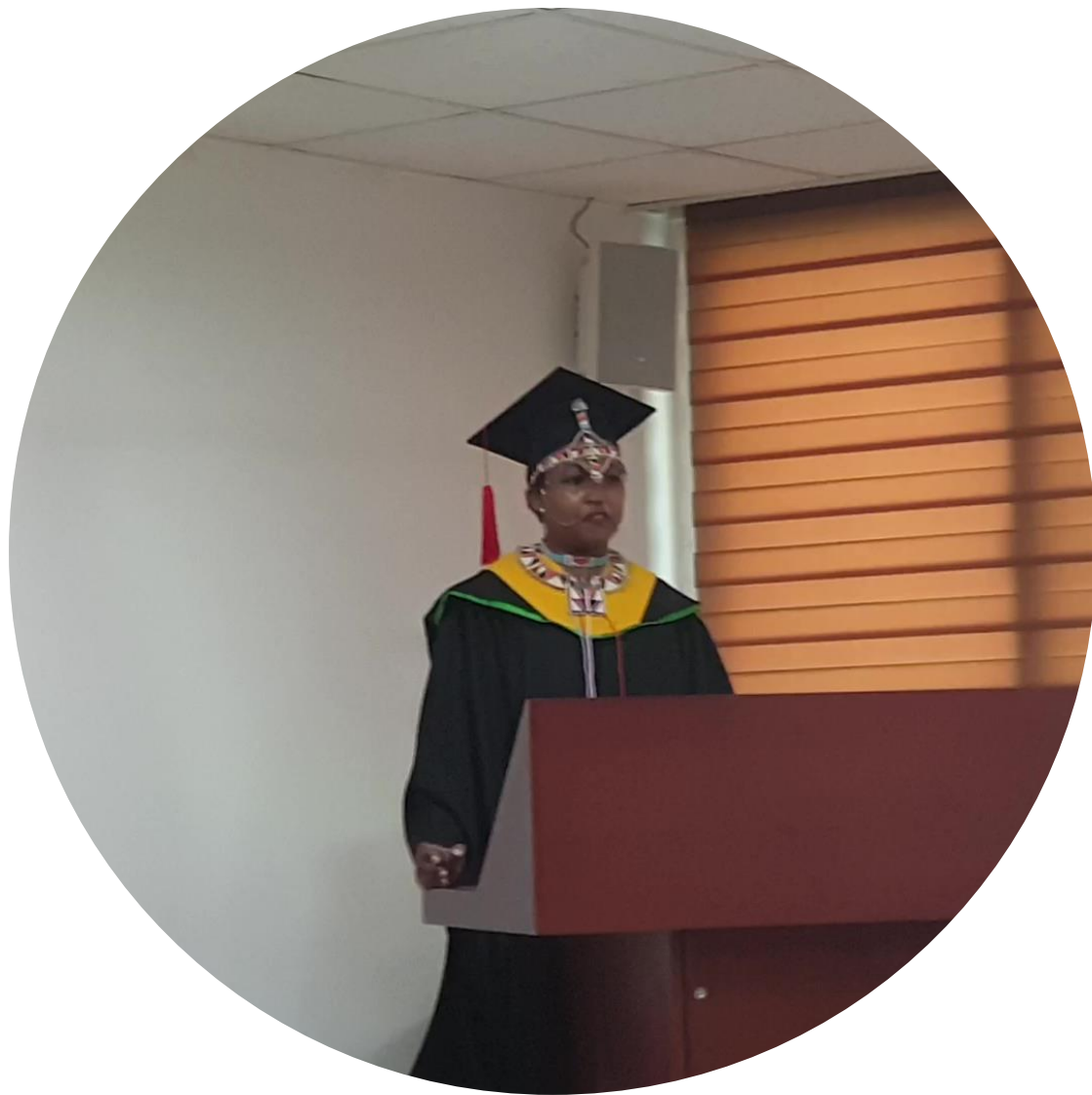
NASA program started in 1998

- To fill gaps in global observing network
- For satellite validation
- Trend analysis of ozone layer recovery
- Upper Troposphere - Lower Stratosphere (UTLS) dynamics and ozone exchange

DISSEMINATION

KMD disseminates her various products through:

- Press Releases
- Media: Digital (socio media, apps, SMS, YouTube); Traditional (Print and electronic media)
- Government Organs/Ministries
 - Public Weather Display Boards,
 - County Directors of Meteorological Services; and
 - Website : www.meteo.go.ke



THANK YOU