AGRO AUTOMATIC WEATHER STATION

Surface Instrument Division

Office of Climate Research and Services

भारत मौसम विज्ञान विभाग

INDIA METEOROLOGICAL DEPARTMENT

Definition of AWS

An automatic weather station (AWS) is defined as a "meteorological station at which observations are made and transmitted automatically" (WMO, 1992*a*).

[WMO Guide to Meteorological Instruments and Methods of Observation, No.8, 7th Edition Aug 2008]

World Meteorological Organization, 1992*a*: *International Meteorological Vocabulary. Second* edition, WMO-No. 182, Geneva.

History of AWS

- Background
- AWS in the international context
- AWS in IMD - since 1980s.. Earlier known as DCPs
- Upgradation during 1990s
- Proposal for installation of 125 AWS started in 2004. Commissioned during 2006-07.
- Proposal of 550 AWS in which 127 Agro AWS have been installed at AFMUs and some KVKs.

Conditions for AWS site selection

Meta data of AWS sites

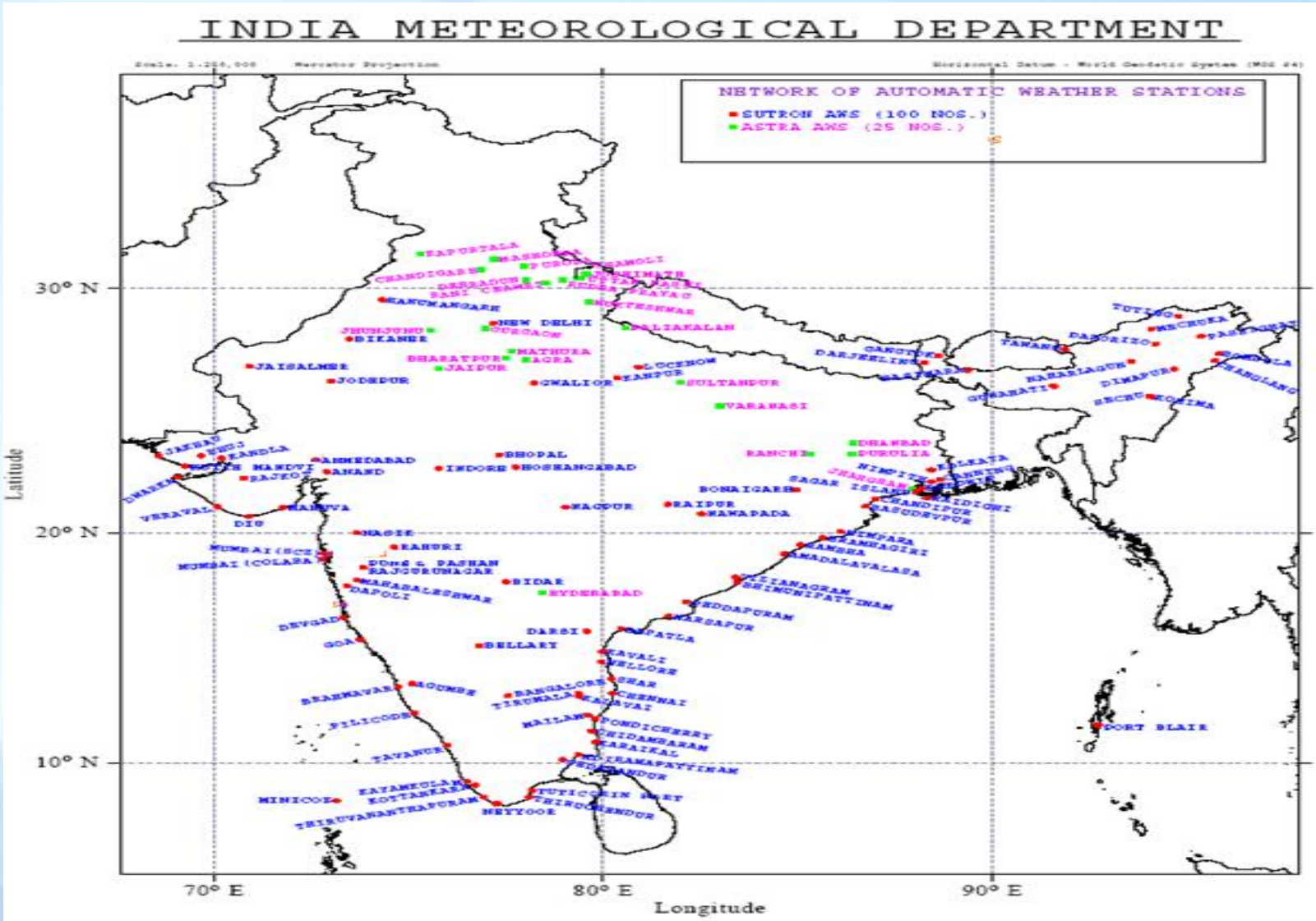
Selections of sensors as per AWS site requirement.

Guidelines on technical aspects followed in conformity with WMO CIMO Guide

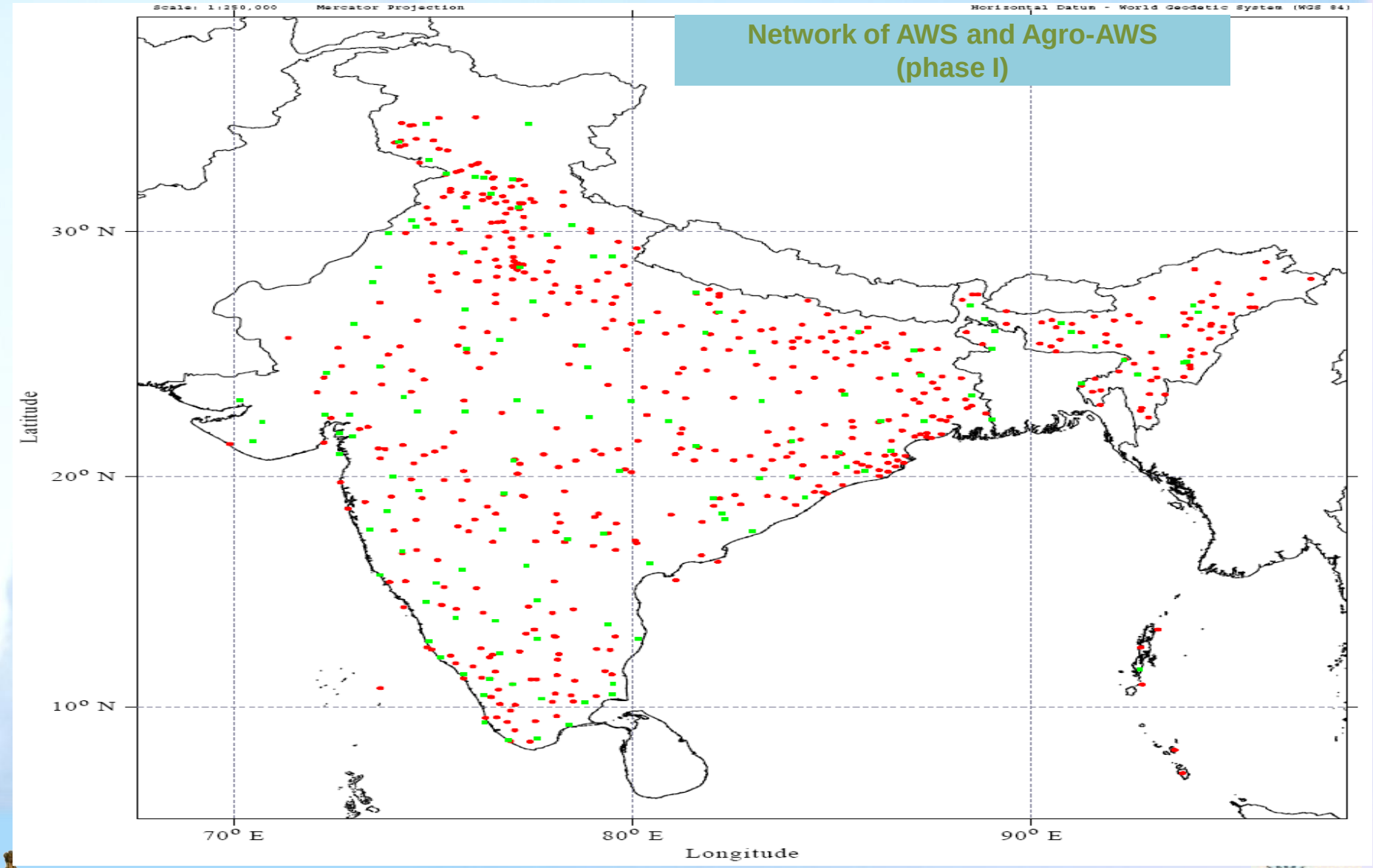
AWS network of IMD

- 100 AWS of Sutron, USA make – PRBS type installed during 2006 and 2007.
  - 5 are Agro based AWS- Anand, Dapoli, Kanpur, Pune and Rahuri
- 25 AWS of Astra, India make – PRBS type installed during 2006 and 2007.
- 550 AWS – (550 already installed) of Astra make – TDMA type installed all over India in 2009-2012.
  - 127 are Agro based AWS

NETWORK OF 125 AWS.



NETWORK OF 550 AWS

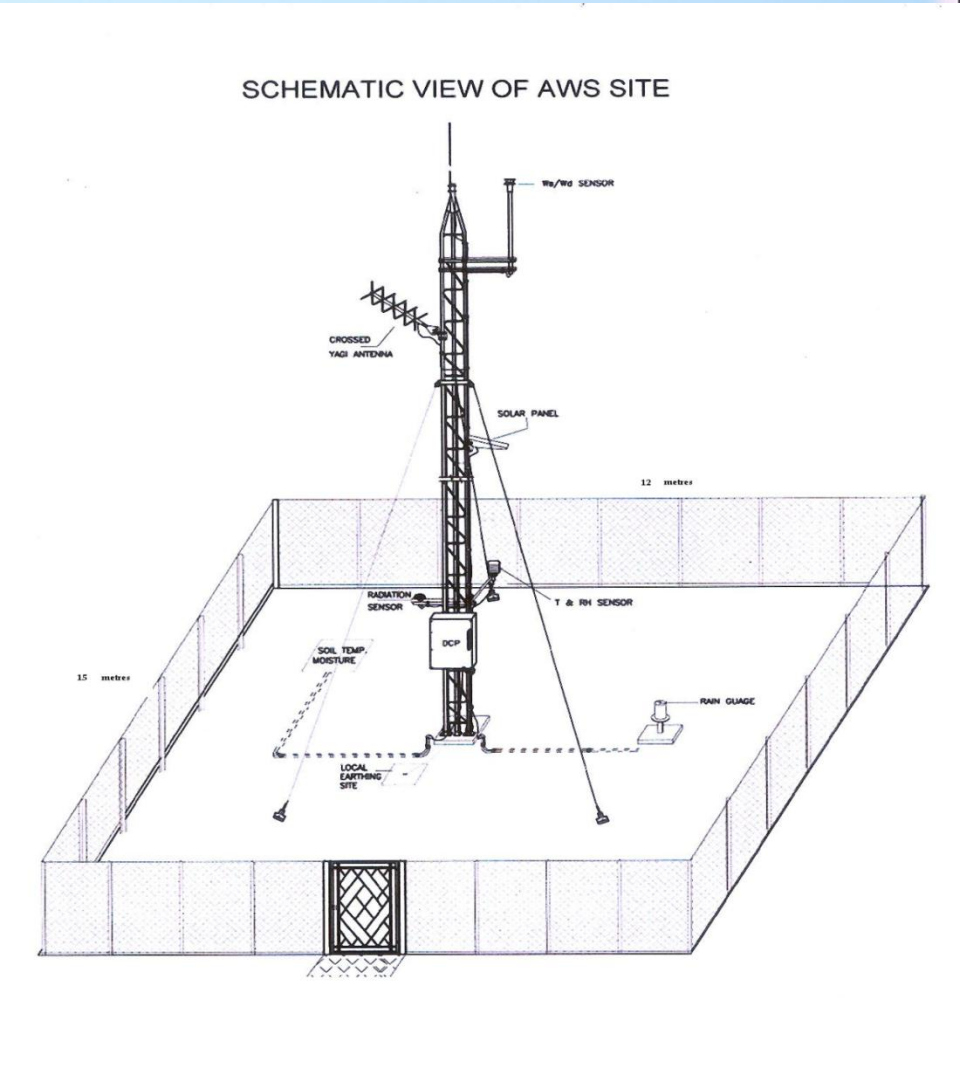


Features of Automatic Weather Stations

- Around 707 Automatic Weather stations and 1351 ARGs in IMD network
- State of art technology with 32 bit microprocessor
- TDMA type of transmission through satellite and GPRS based AWS
- Compatibility to INSAT satellites
- GPS – synchronized transmitter
- Accurate meteorological sensors
- Availability of hourly data
- Facility to configure user-defined time intervals
- Reception of data at Earth Station, Pune
- Possibility to display real time weather data at the site for general public
- Hourly data transfer in WMO format to RTH New Delhi through AMSS Mumbai
- Plotting of data and preparation of charts
- Availability of AWS charts in ftp server for use by forecaster

SATELLITE BASED AWS

- DATA LOGGER
- UHF TRANSMITTER
- BATTERY/CHARGER
- GPS
- SOLAR PANEL
- SENSORS
- YAGI ANTENNA



GPRS BASED AWS

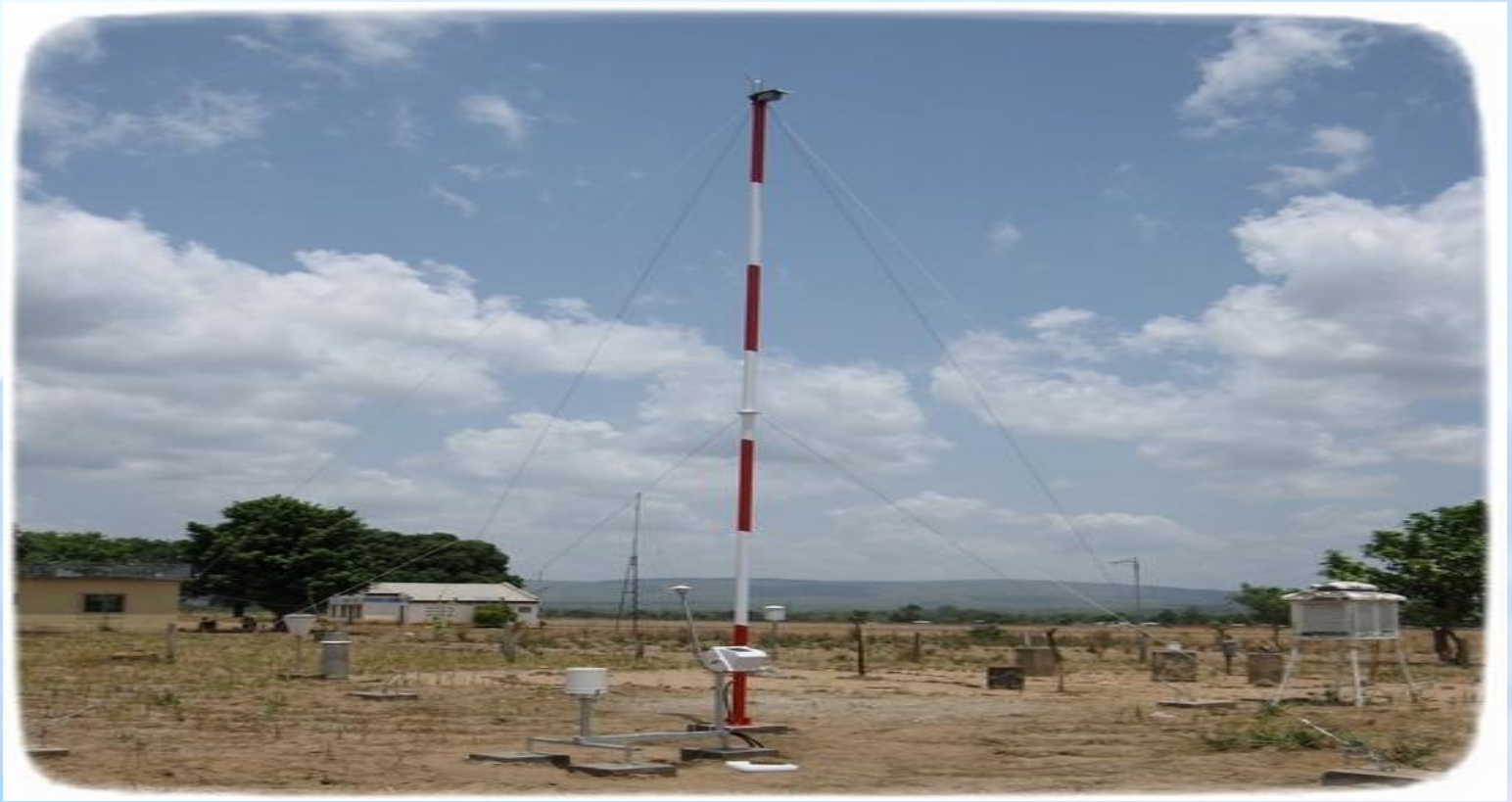
- GPRS based Data logger used for AWS.

Feature of GPRS Based Data Logger:

- GPRS based communication with 3G/4G MODEM.
- Dual way communication.
- Quality Control at field Level.
- Reception of AWS data through Email from AWS site.

NEW TYPE OF AWS

- 10 meter Mast should be foldable or tiltable to make easy maintenance of wind sensors installed at 10 m height.
- GPRS communication may be sued for communication from field site to central server.



AWS

An automatic weather station is an assembly of various sensors to monitor various environmental parameters coupled with a data logger and radio transmitter to record and transmit this data to some terminal equipment like **PC or Server**, where it may be stored, accessed and analyzed.

The four sensors is to be used for normal AWS – **Wind sensors, temperature humidity sensors, pressure sensors and rainfall sensors.**

AWS

Typical sensors used in a weather station are,

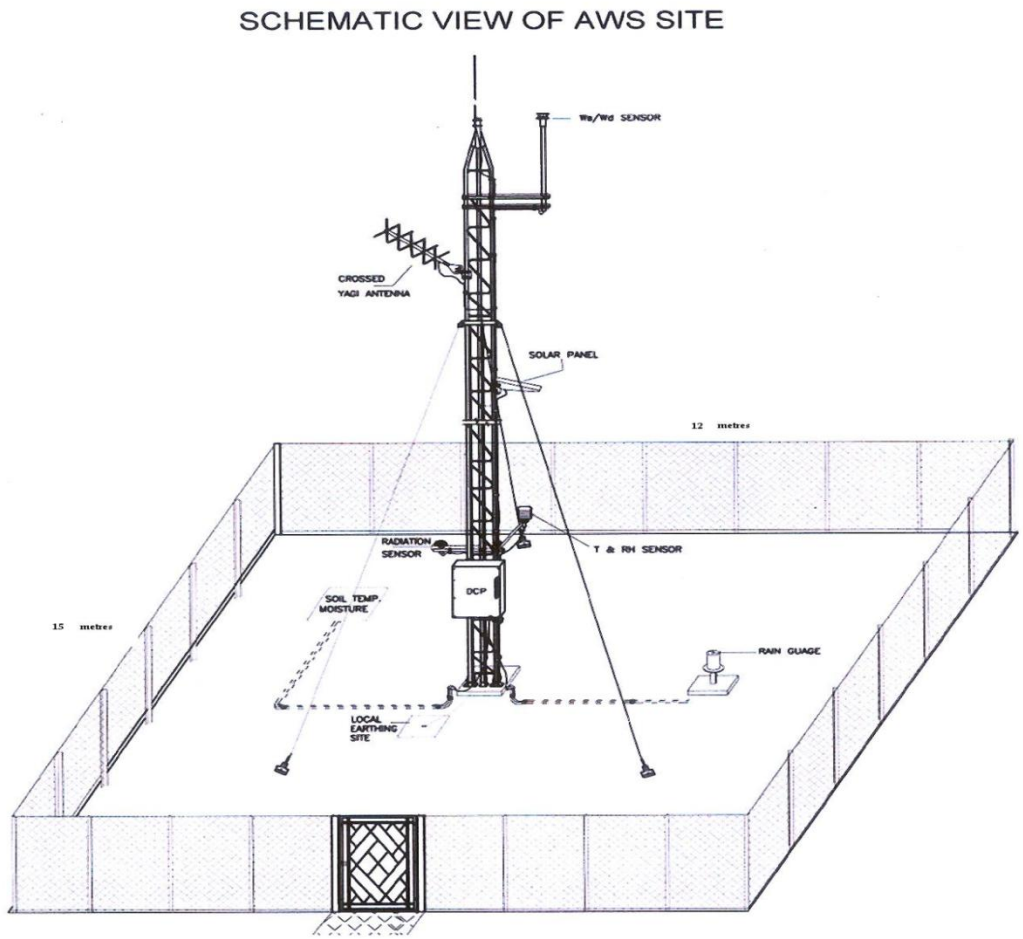
- **Air temperature**
- Humidity
- Wind direction and speed (Anemometer)
- Barometric pressure
- Precipitation / Rain

Agro AWS

An Agro automatic weather station is an assembly of various sensors to monitor various environmental parameters coupled with a data logger and radio transmitter to record and transmit this data to some terminal equipment like **PC or Server**, where it may be stored, accessed and analyzed.

The actual selection of sensors depends on the climatic conditions, soil conditions, and type of crop for which the weather station is to be used.

Continue..


SCHEMATIC VIEW OF AWS SITE
Ws/Wd SENSOR
CROSSED YAGI ANTENNA
SOLAR PANEL
12 metres
RADIATION SENSOR
T & RH SENSOR
DCP
SOIL TEMP, MOISTURE
15 metres
RAIN GUAGE
LOCAL EARTHING SITE

Agro AWS

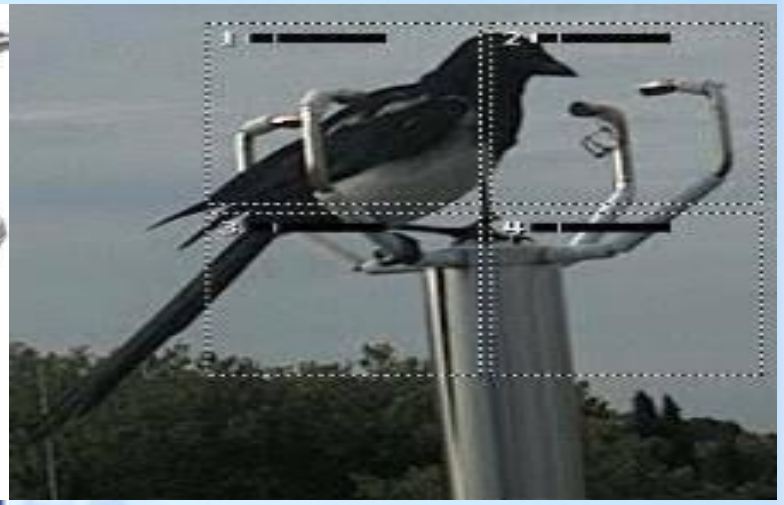
Typical sensors used in a weather station are,

- **Air temperature**
- Humidity
- Wind direction and speed (Anemometer)
- Barometric pressure
- Global radiation and radiation balance (Pyranometer)
- Precipitation / Rain
- Soil temperature
- Soil Moisture and evaporation

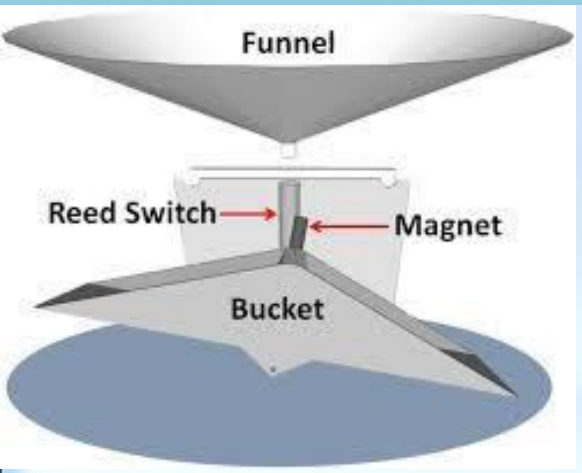
Portable AWS

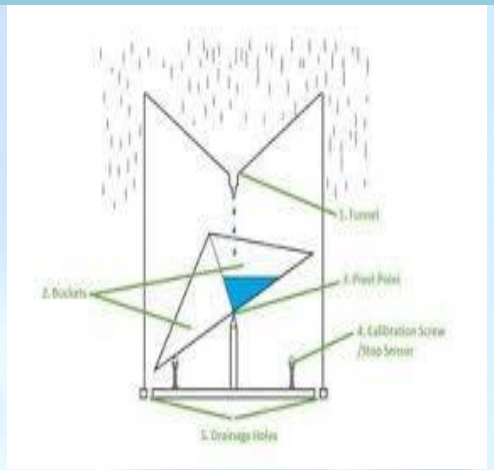
Temperature and Humidity sensors

Wind sensors



RAINFALL SENSORS





The Tipping Bucket performs a wide range of rainfall measurements. The receiver is 200 mm to 325 mm in diameter.

The Tipping Bucket measures each 0.1, 0.2, 0.5, 1mm of rainfall.

Once the rain is captured, the bucket tips and empties.

SOIL SENSORS


Soil moisture sensors (as volumetric water content sensors) measure the water content of soil.

These sensors can be used to estimate the amount of stored water in a profile or how much irrigation is required to reach a desired amount of water in the soil.

These sensors can be used for quick measurements or installed for long-term measurements

Soil electrical conductivity (EC), relative dielectric permittivity, volumetric water content (VWC), soil temperature

PYRANOMETER

A **pyranometer** is a type of actinometer used for measuring solar irradiance on a planar surface and it is designed to measure the solar radiation flux density (W/m^2) from the hemisphere above within a wavelength range 0.3 µm to 3 µm.

A pyranometer is a sensor that converts the global **solar radiation** it receives into an electrical signal that can be measured.
Pyranometers measure a portion of the solar spectrum.
As an example, the CMP21 Pyranometer measures wavelengths from 0.285 to 2.8 µm

Solar irradiance is the power per unit area (watt per square metre, W/m^2), received from the Sun in the form of electromagnetic **radiation** as reported in the wavelength range of the **measuring** instrument.

Global radiation is the total short-wave **radiation** from the sky falling onto a horizontal surface on the ground. It includes both the direct solar **radiation** and the diffuse **radiation** resulting from reflected or scattered sunlight.

PAR SENSORS

Photosynthetically active **radiation**, often abbreviated **PAR**, designates the spectral range (wave band) of solar **radiation** from 400 to 700 nanometers that photosynthetic organisms are able to use in the process of photosynthesis.

Photosynthetically active radiation (PAR) is light of wavelengths 400-700 nm and is the portion of the light spectrum utilised by plants for photosynthesis.

Photosynthetic photon flux density (PPFD) is defined as the photon flux density of PAR.
Modern instruments measure light as the rate at which moles (6.02×10^{23} quanta) of PAR land on a unit area (μmol quanta m^{-2} s^{-1}); however, it is sometimes necessary to convert between different units used for measuring light.

SUNSHINE DURATIONS

CSD3 measures sunshine duration. Sunshine duration is defined by WMO as the time during which the direct solar radiation exceeds the level of 120 W/m².

It has no moving parts and uses 3 photo-diodes with specially designed diffusers to make an analogue calculation of when it is sunny.

The output is switched high or low to indicate sunny or not sunny conditions. The calculated direct irradiance value is also available

Measurement is performed by instruments called sunshine recorders. For the specific purpose of sunshine duration recording, Campbell–Stokes recorders are used, which use a spherical glass lens to focus the sun rays on a specially designed tape. When the intensity exceeds a pre-determined threshold, the tape burns.

The total length of the burn trace is proportional to the number of bright hours

EVAPORATION SENSORS

Evaporation is the process by which water changes from a liquid to a gas or vapor. **Evaporation** is the primary pathway that water moves from the liquid state back into the water cycle as atmospheric water vapor.

An atmometer or evaporimeter is a scientific instrument used for measuring the rate of water evaporation from a wet surface to the atmosphere.
Atmometers are mainly used by farmers and growers to measure evapotranspiration rates of crops at any field location.

CHALLENGES FOR MAINTENANCE OF THE AWS NETWORK

- Accurate and reliable measurements from AWS are primarily possible with proper calibration of sensors and periodic maintenance schedules especially prior to the onset of monsoon.
- The tipping bucket rain gauge has an inherent limitation of missing of pulses during very heavy rainfall and may underestimate the actual rainfall recorded.
- Clogging of rain gauge due to leaves, twigs, fine mud deposits due to wind, bird droppings, may further lead to wrong readings.
- Regular upkeep of the AWS enclosure by clearing off the bushes and creepers is a must for reliable data.
- Theft of equipments like battery, solar panel and other components of an AWS leads to non-functional status of an AWS and hence loss of data.

CHALLENGES FOR MAINTENANCE OF THE AWS NETWORK

- **Awareness among the general public about the valuable nature of weather data in general, and of adverse weather in particular, is required**
- **Needs to be inculcated as part of the existing network management and in future implementation of the project of commissioning more AWS.**
- **Most developed countries having automatic weather stations in their network have realized these challenges and hence are not unique to Indian conditions.**
- **Efforts are being made to overcome the difficulties since modernization is inevitable in the changing technological scenario.**


Thank you