JMA/WMO Workshop on Quality Management in Surface, Climate and Upper-air Observations in RA II (Asia)

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Geography and climate

Kuwait consists mostly of desert and little difference in elevation. It has nine islands, the largest of which is Bubiyan, which is linked to the mainland by a concrete bridge.

Summers (April to October) are extremely hot and dry with temperatures exceeding 51 ° C (124 ° F) in Kuwait City several times during the hottest months of June, July and August. April and October are more moderate with temperatures over 40 ° C uncommon . Winters (November through February) are cool with some precipitation and average temperatures around 13 ° C (56 ° F) with extremes from -2 ° C to 27 ° C. The spring season (March) is warm and pleasant with occasional thunderstorms. Surface coastal water temperatures range from 15 ° C (59 ° F) in February to 35 ° C (95 ° F) in August.

The driest months are June through September, while the wettest are January through March. Thunderstorms and hailstorms are common in November, March and April when warm and moist Arabian Gulf air collides with cold air masses from Europe. One such thunderstorm in November 1997 dumped more than ten inches of rain on Kuwait.

Kuwait
Meteorology Department

Meteorological Department

- Forecasting Supervision
- Climates Supervision

  Stations & Upper Air Supervision
- Communications Supervision
- Maintenance Supervision

Stations and Upper air Supervision

1- Surface manned Stations & AWOS

2- upper air Stations & Ozone

Kuwait Int. Airport Station

In December 1962 one manned synoptic, climate, agro stations started to report on 24 hour basis and sending data to WMO

Kuwait Int. Airport Station

Kuwait started to observe and report meteorological data in the early 1940 with Kuwait Britsh oil company but most of the report were very limited.

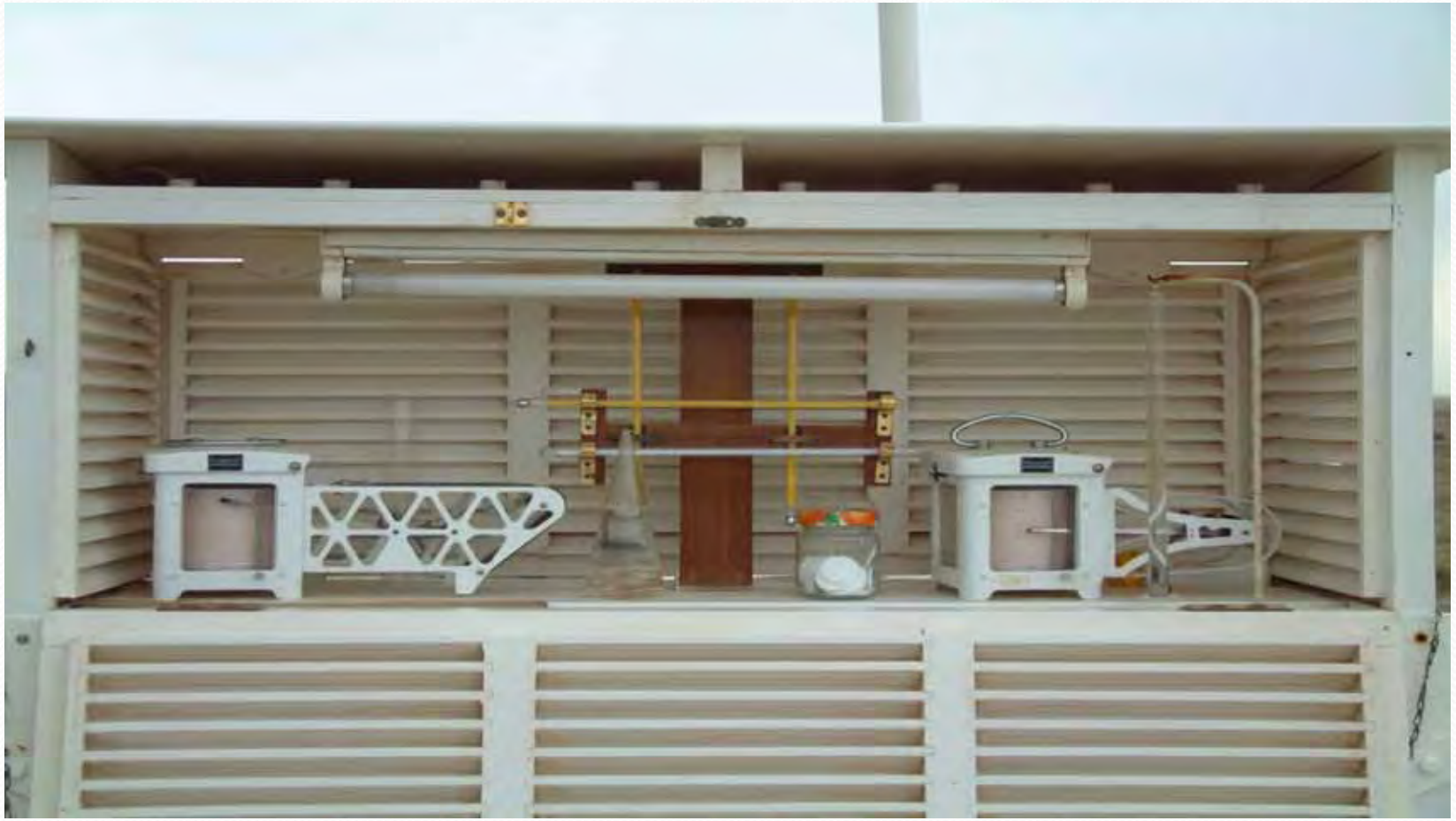
In December 1962 one manned synoptic, climate, agro stations started to report on 24 hour basis and sending data to WMO

Surface Stations

- one manned station :
- Metar reports every 30 min 24 hrs a day.
- Synop report every one hour and send to GTS every 3 hrs 0000, 0300, 0600, 0900, 1200, 1500, 1800, 2100.
- Data send automaticlly after the reports to AFTN & GTS and to MDP archiving system and checked by the Climate section for QC.

Manual manned WX observing Station

Stevenson Screen

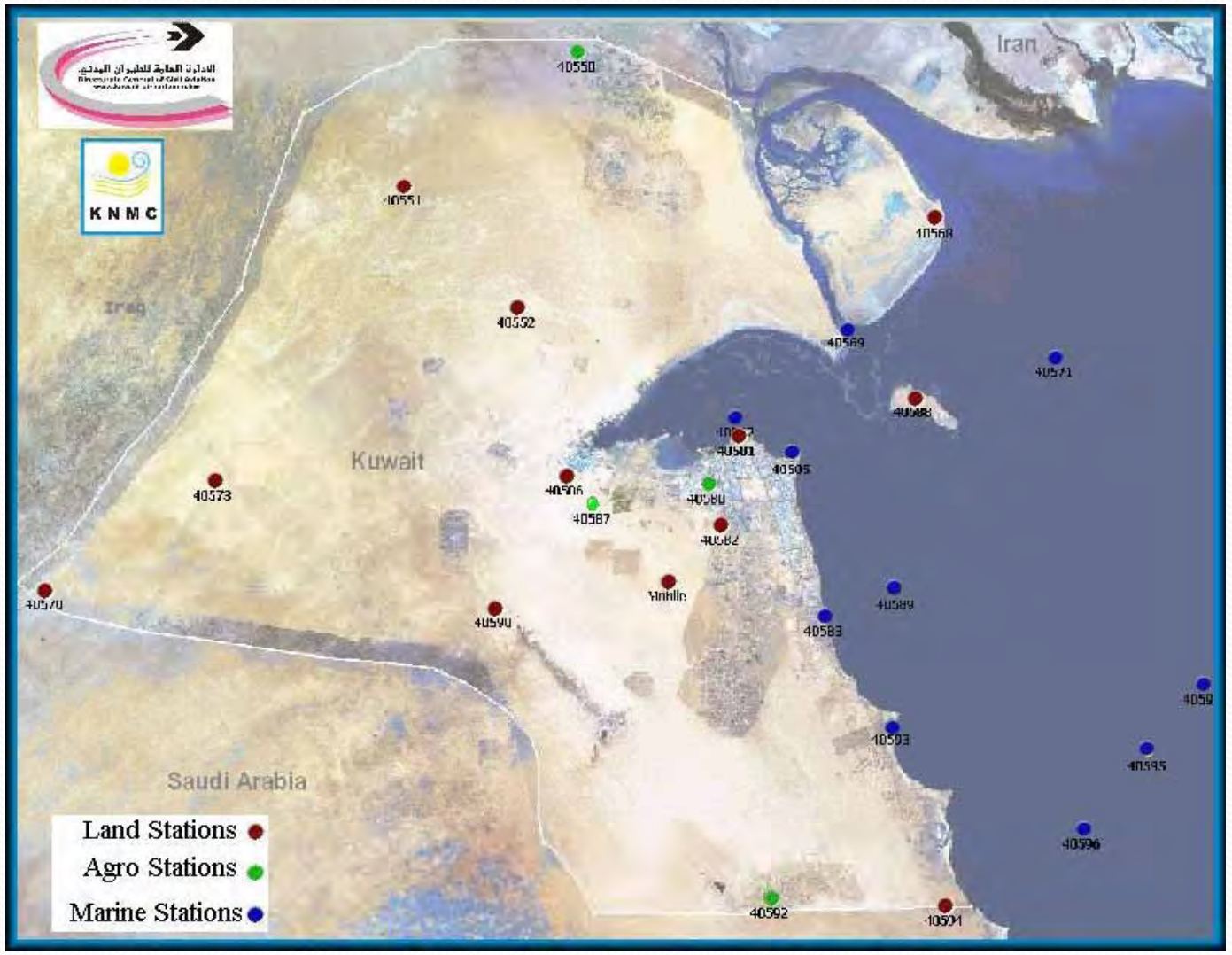


AWOS
Automatic Weather Observing System

We Have 26 stations

- 11 land stations
- 10 Marine stations
- 4 Agriculture stations
- 1 Mobile station

AWOS-Kuwait


KNMC
Iran
Iraq
Kuwait
Saudi Arabia
40550
40551
40552
40568
40569
40571
40573
40587
40589
40590
40592
40593
40595
40596
Land Stations
Agro Stations
Marine Stations

Kuwait Weather observing System

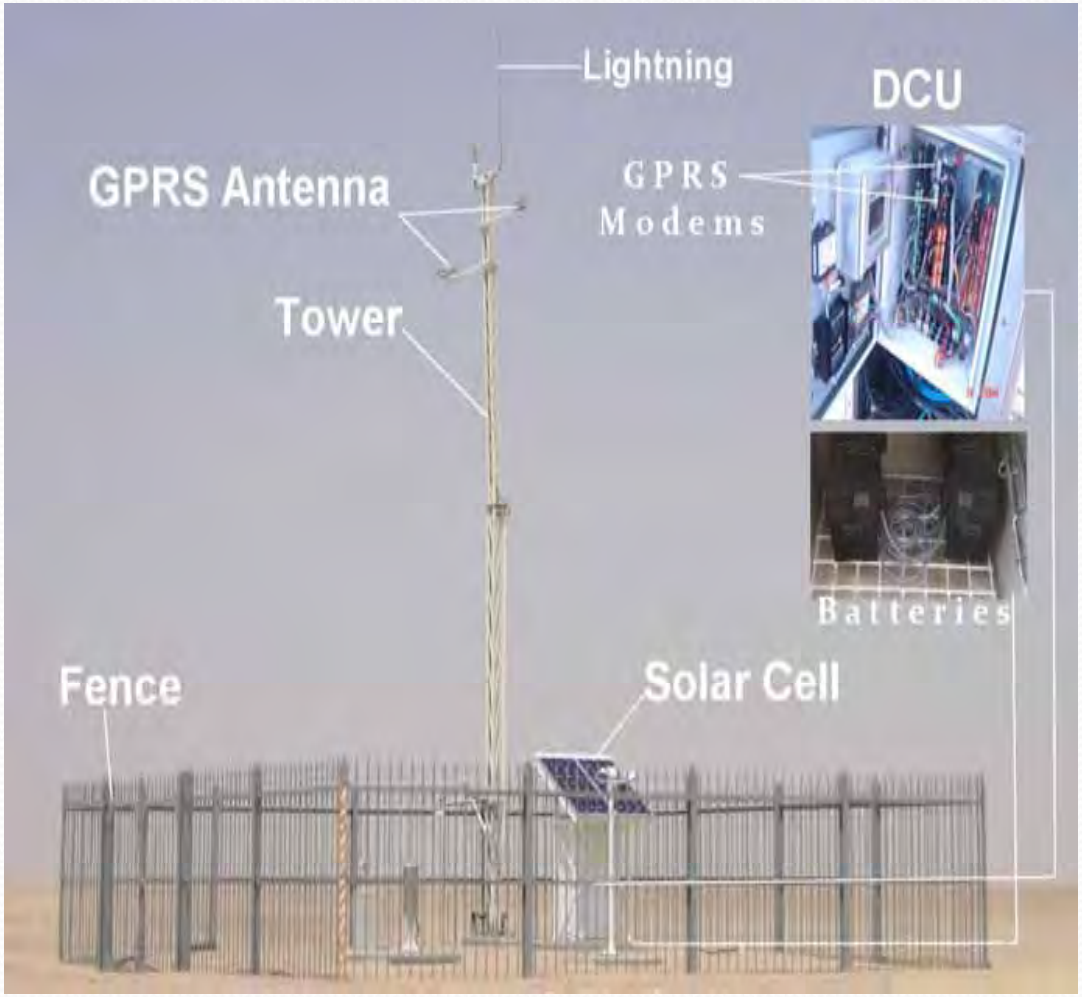
AWOS

Station	No.	Type
Abdaly	40550	Agro
Mitribah	40551	Synoptic
Jal Allyah	40552	Synoptic
Bubyan Islan	40568	Synoptic
Beacon N6	40569	Marine
ALsalmy	40570	Synoptic
Beacon M28	40571	Marine
South Dolphin	40572	Marine
Abraq AlHabari	40573	Synoptic
Rabyah	40580	Agro
Kuwait City	40581	Synoptic
Kuwait International Airport	40582	Synoptic
Ahmadi Oil Peir	40583	Marine
Salmiyah	40585	Marine
Jahra	40586	Synoptic
Sulibiyah	40587	Agro
Faylaka Island	40588	Synoptic
Sea Island Buoy	40589	Marine
Managish	40590	Synoptic
Ahmadi Light Vessel	40591	Marine
Wafra	40592	Agro
Julia Port	40593	Marine

Surface Land Station:

Basic &Land Station Equipments:

- Tower
- Solar cells
- Batteries
- DCU
- GPRS Modem
- GPRS Antenna
- Lightning protection
- Sensors



Basic & Land Station Sensors:

- Wind Direction/speed

The WAS425 Ultrasonic Wind Sensor

Basic & Land Station Sensors:

- Temperature / Relative Humidity

Rimco SHLD1 Radiation Shield

HMP45D Temperature and Humidity Sensor

Basic & Land Station Sensors:

- Air Pressure

The PTB220 Barometric Pressure Sensor

Basic Station Sensors

- Rain Gauges

Balance Type Rain Gauge

OTT Pluvio Rain Gauge

Rimco 8500 Tipping Bucket Rain Gauge

Agro. Stations sensors:

- 2 M wind mast sensors
- Soil Temperatures
- Soil Heat Flux
- Soil moister device
- Soil Water Content
- Leaf Wetness
- Grass Temperatures
- Incoming & Reflected Shortwave & Long wave Radiation
- Ultra Violate Radiation
- Sunshine Duration
- Evaporation Pan

Agro. Stations sensors:

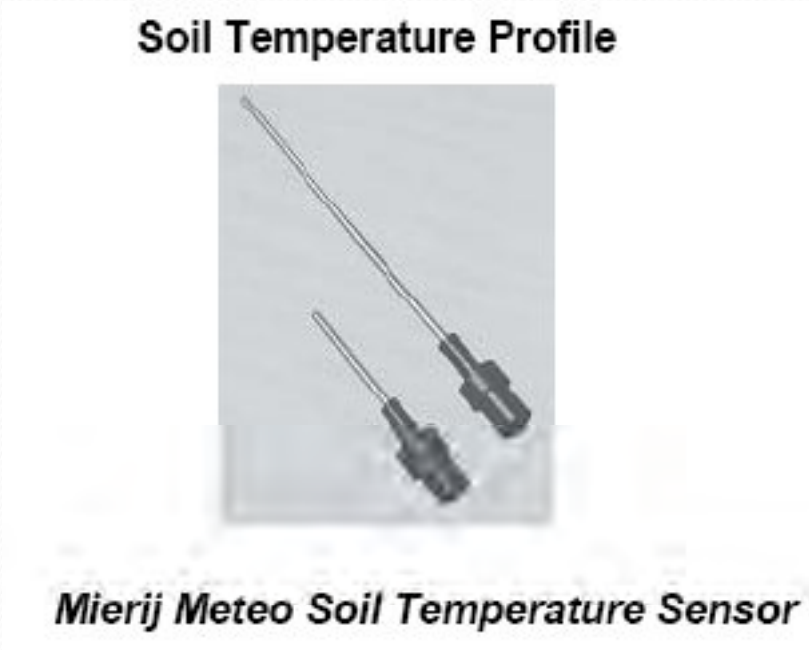
- **2** M Wind Direction/speed

The WAS425 Ultrasonic Wind Sensor

Agro. Stations sensors:

- Soil Temperature

5 CM ,10 CM,20CM,50CM & 1M



Mierij Meteo Soil Temperature Sensor

Agro. Stations sensors:

- Soil Heat Flux

Middleton CN3 Soil Heat Flux Sensor

Agro. Stations sensors:

- Soil Moister PH Device:

Hanna 89240 Soil pH Meter

Agro. Stations sensors:

- Soil Water content:

Sentek EasyAg Soil Water Content Sensor

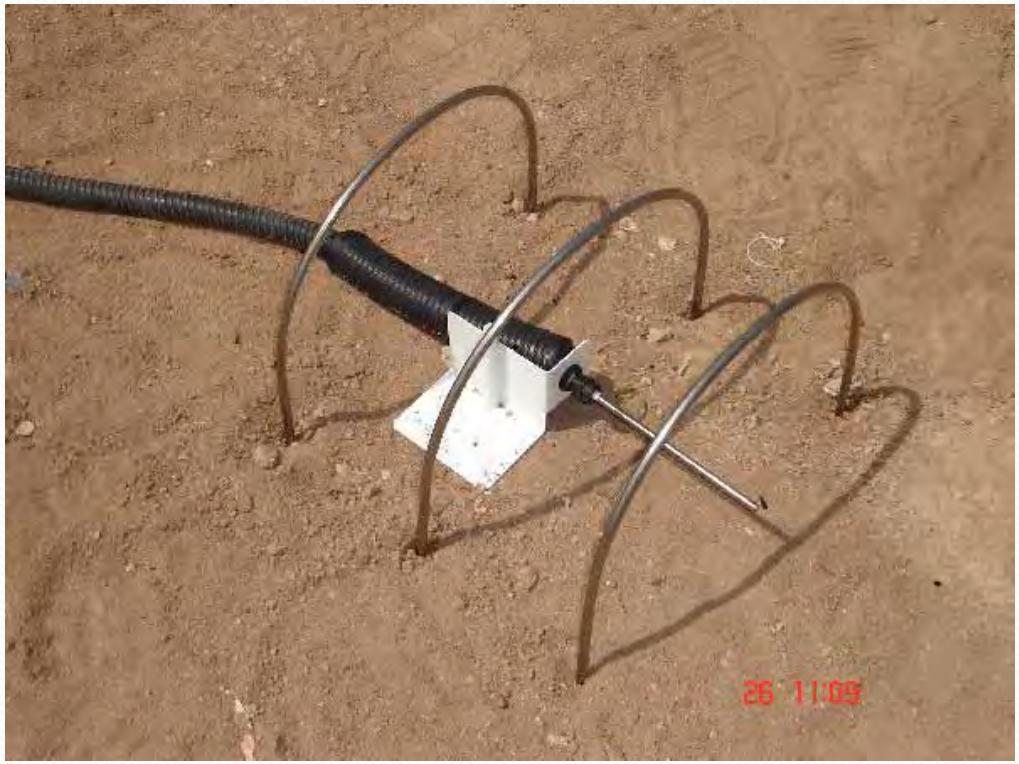
Agro. Stations sensors:

- Leaf Wetness

Davis 6420 Leaf Wetness Sensor

Agro. Stations sensors:

- Grass Temperature



Agro. Stations sensors:

- Reflected Shortwave & Longwave Radiation

Figure 2-22 Kipp & Zonen CG4 Pyrgeometer

Incoming and Reflected Shortwave Radiation

Figure 2-23 Kipp & Zonen CM14 Albedometer

Agro. Stations sensors:

- Ultra Violate Radiation
- Sunshine Duration

UV-B Radiation Sensor

UVR1-B UV-B Radiation Sensor

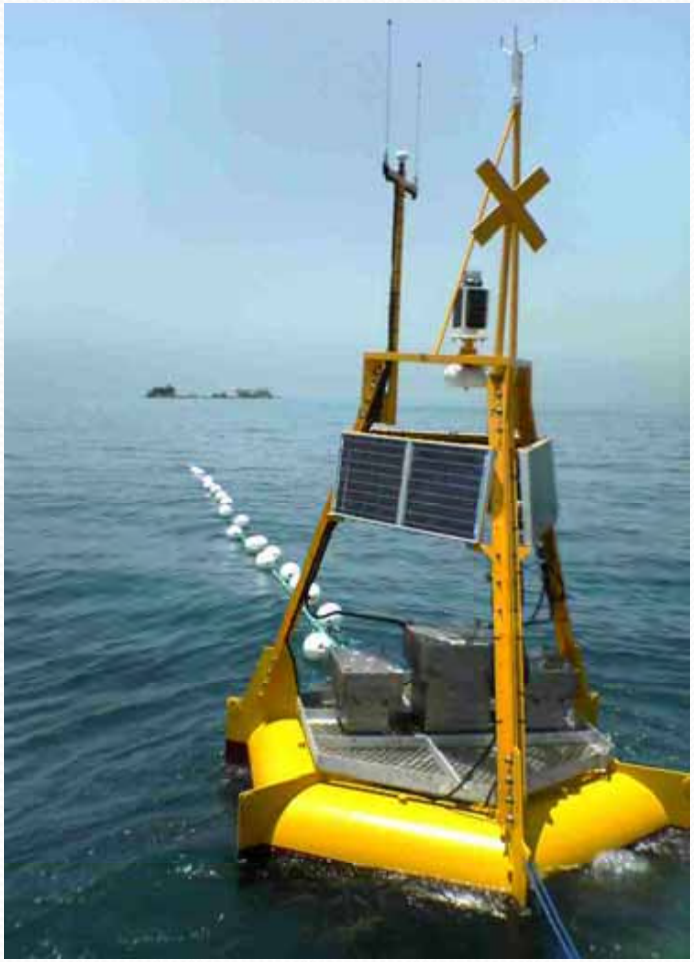
Middleton SD4 Sunshine Duration Sensor

Agro. Stations sensors:

- Evaporation Pan

Marine Stations Sensors

- Wave & Tide Recorder
- Sea Water Temperature Record
- CTD (water Temp ,pressure , Conductivity, salinity) Record
- ADCP (Acoustic Doppler Current profiler)



Marine Stations Sensors

- Wave & Tide Record

Seabird SBE 26 Plus Wave & Tide Recorder

Marine Stations Sensors

- Sea Water Temperature Recorder

Sea Water *Seabird SBE 39 Temperature recorder*

Sea water temperature after 7 weeks.

Marine Stations Sensors

- CTD

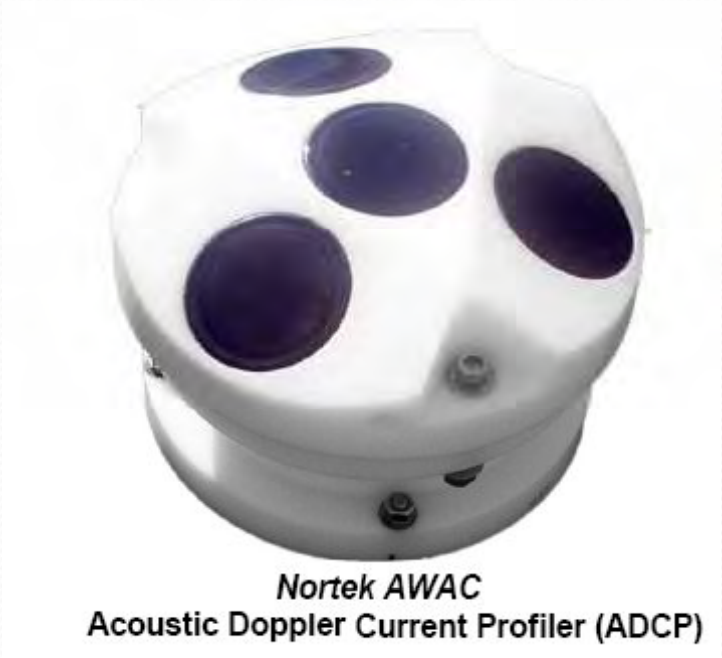
Integrated CT Probe (Seabird SBE37-IM, SBE37-SMP)

The CTD Applied Microsystems shall be used to measure

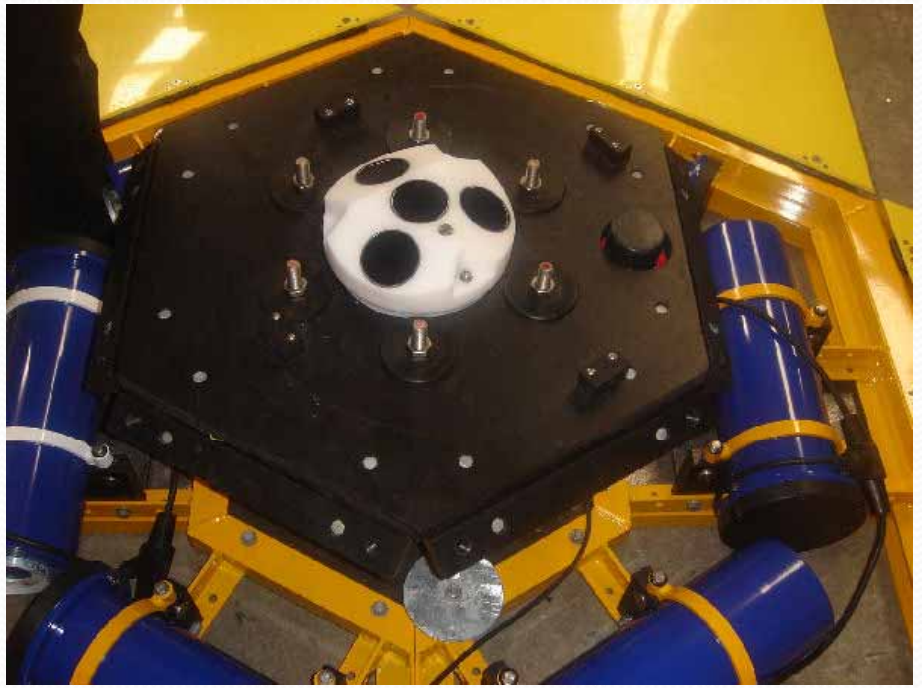
- Sea Water Temperature
- Water Pressure
- Conductivity
- Salinity

Marine Stations Sensors

- ADCP



Nortek AWAC
Acoustic Doppler Current Profiler (ADCP)



Special Sensors:

- FD12 visibility Sensor
- FD20 Visibility Senor
- Sampler Rain Gauge
- Nuclear Radiation

Special Sensors:

- FD12 visibility Sensor:

FD12 Forward Scatter Visibility Sensor

Special Sensors:

- PWD20 Visibility Sensors:

We use this type in marine stations.

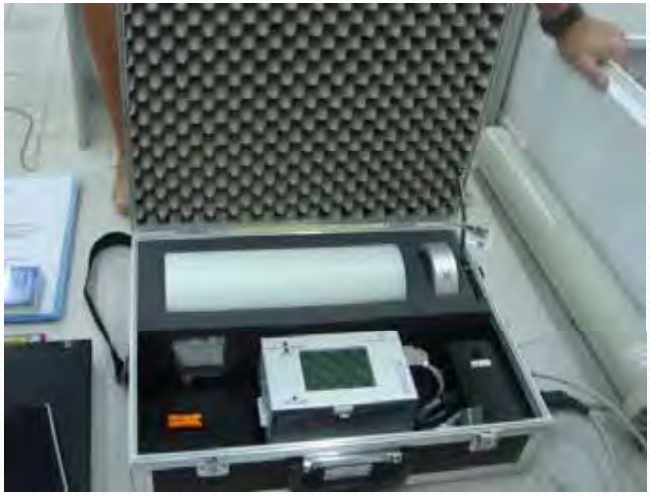
PWD20 Forward Scatter Visibility Sensor

Special Sensors:

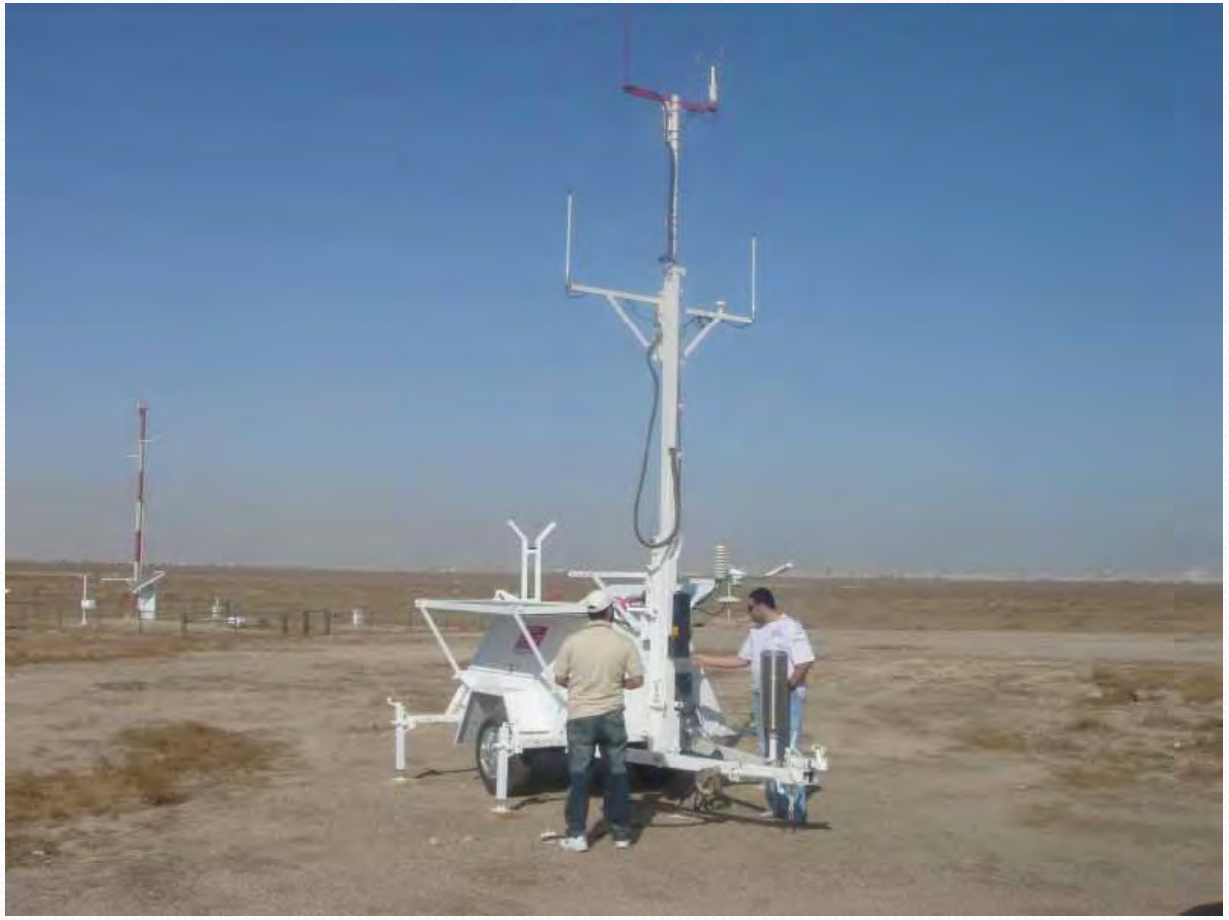
- Sampler Rain Gauge

Special Sensors:

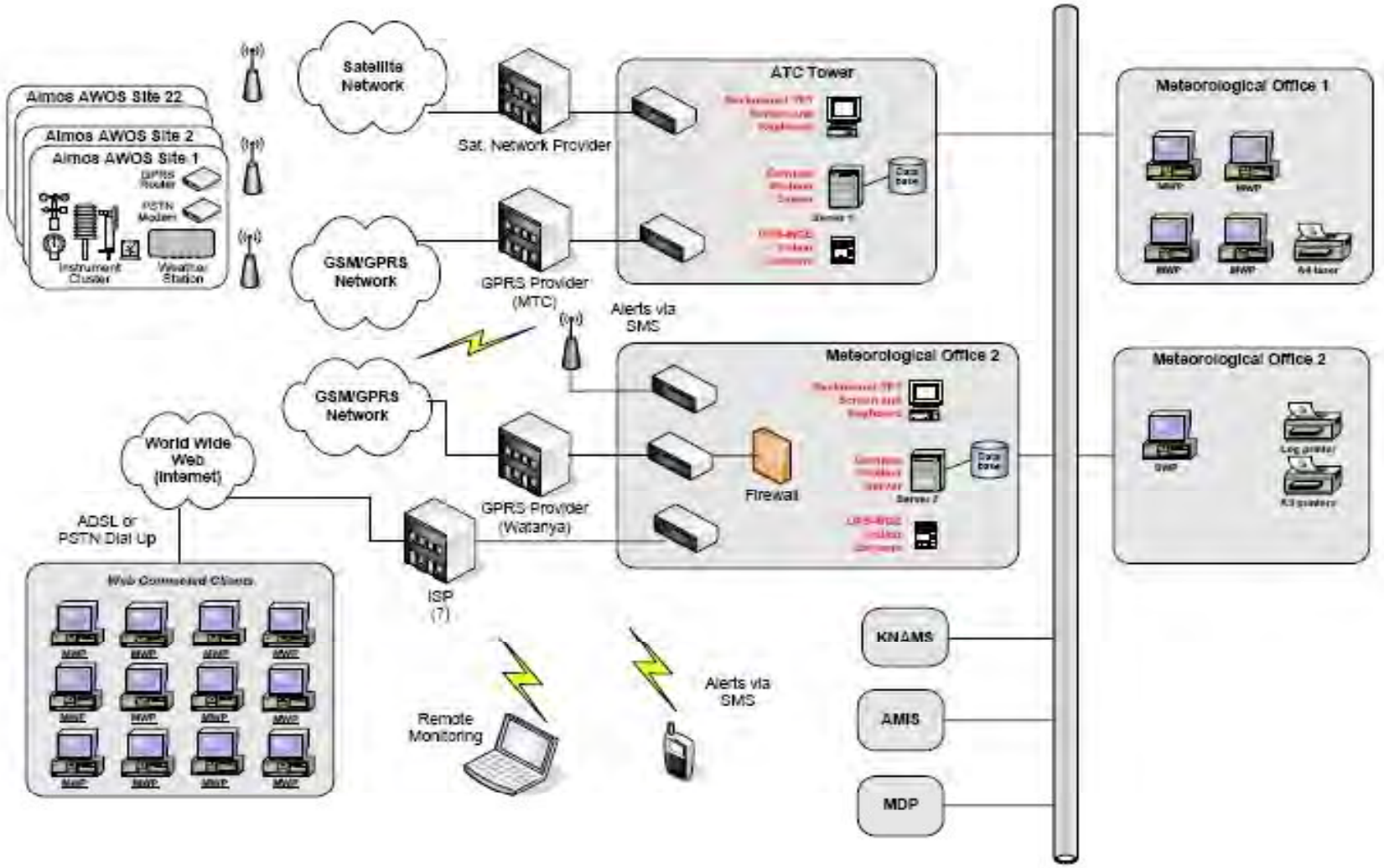
- Nuclear Gama Radiation



Mobile Station:



AWOS Network



Upper Air DIVISION

In 1963 one radiosonde and two radio teletype (RTT) receivers were purchased. Pilot ballon release increased from one to two per day

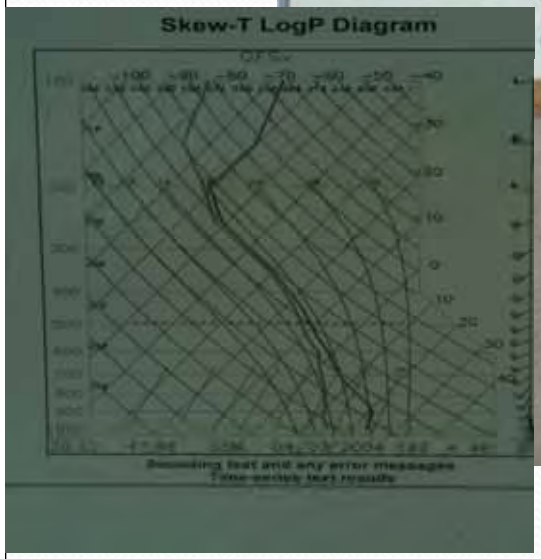
- 24 hrs 5 shifts all manned station
- One upper air station no. (40582)
- TEMP at 00 UTC and 12 UTC
- PILOT at 06 UTC and 18 UTC
- OZONE Sonde EVERY TWO WEEKS

Instruments:

- (Vaisala) Digicora III SPS 311 using RS 92 radiosonde.
- (Gematronik R 300 WFX) Wind finding radar using target reflector (CIRRA).
- (Science Pump Corporation) Ozonesonde.
- (TOTEX) Balloons 350 gm & 1000 gm.
- Hydrogen and Helium gas for filling.

Radio sonde RS 92

Upper air station



Ozone Lab

QMS

Quality Management System

Meteorologists at KMD

Monitor/Manage quality of AWOS data

Monitor/Manage quality and distribution of AWOS Products

Monitoring of alarms and alerting responsible maintenance personnel

Create/Manage Calibration/Test schedules

Organise day-to-day sensor cleaning and visual checks.

Manage Site Configuration (what sensors are where)

Fill role of “Inspector” at AWOS sites

Engineers at KMD

- Manage Maintenance/Inspection schedule
- Monitor/report on system performance (site availability, communications faults)
- Respond to alarms
- Diagnose/ repair faults as needed
- Undertake preventative maintenance
- Assist with sensor tests and calibrations
- Manage Site Configuration (what sensors are where, serial numbers)
- Keep records (Faults - Remedies, Configuration, records of visits etc)

On-Site People

Take soil samples for analysis

Take rain samples for analysis

Check correct operation of evaporation pans

Clean solar radiation sensors

Etc as needed

Calibration of the sensors

Calibration for all sensors are done as required through the manufacturer requirement and WMO regulation, every six months and one year basis.

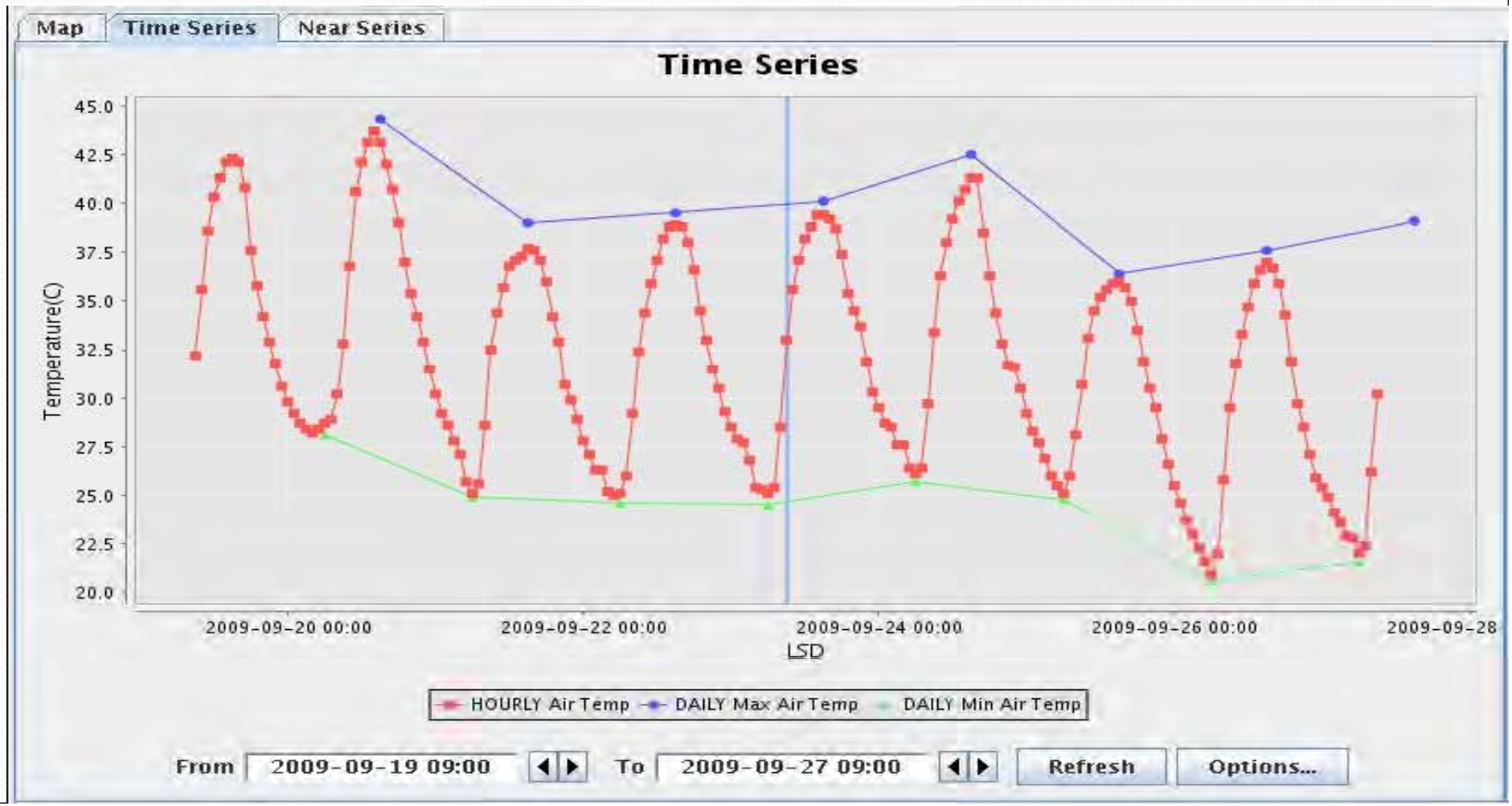
Most of the sensors are send abroad to be calibrated or compared and tested with calibrated one.

Example on AWOS Sensors and Testing

Category	Sensor	Make/Model	Test	Equipment	Regular cleaning	Regular calibration
Agronomy	Leaf Wetness	Davis 6420	Dry = 0, wet = 100%	None	Yes	
Agronomy	Soil pH	HI 98240	Standard test solutions	Kit with sensors		Yes
Agronomy	Soil Heat Flux	Middleton CN3	Apply heat/cold to top surface	Lamp or ice		
Agronomy	Soil Mositure Content	Sentek EasyAg	Visual inspection			
Meteorology	Rain - Sampling Bucket	Ecotech 200	Cause door to open	None	Yes	
Meteorology	LW Radiation	Kipp & Zonen CG4	Visual inspection None	None	Yes	
Meteorology	SW Radiation	Kipp & Zonen CM11	Visual inspection	None	Yes	
Meteorology	Sunshine Duration	Middleton SD4	Visual inspection	None	Yes	
Meteorology	UV Radiation	Middleton UVR1	Visual inspection	None	Yes	
Meteorology	Grass Temp	Mierij Meteo PT100	Apply know temp (Ice or boiling water)	None		
Meteorology	Soil Temp	Mierij Meteo PT100	Visual inspection	None		
Meteorology	Rain - Weighing	OTT Pluvio	Add 5 cc of water	None		

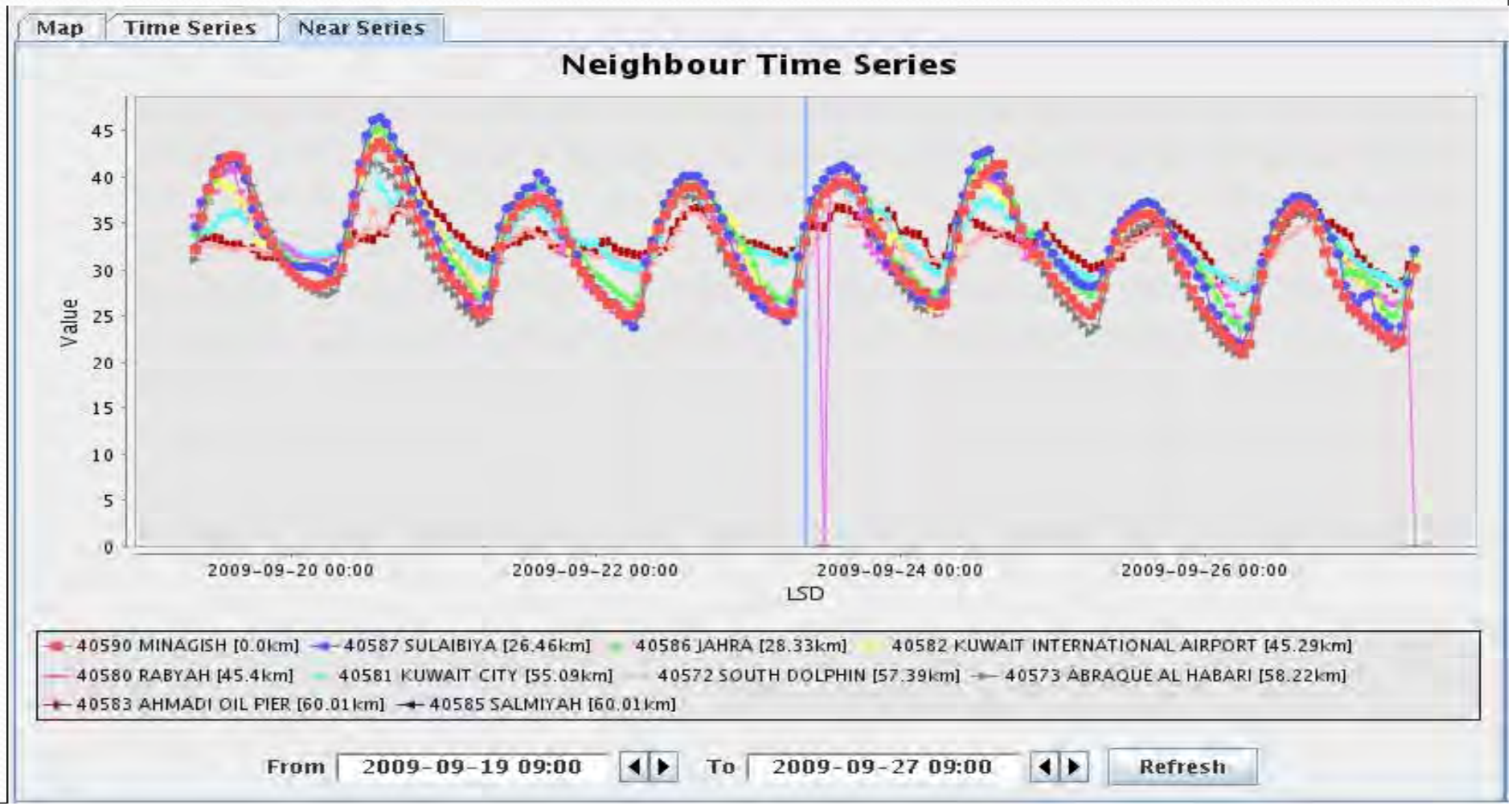
Time Series

- الوقت مع المعلومة وأقل أعلى مقارنة .



Near Series

- منها القريبة المحطات مع المحطة معلومة مقارنة.



Training for the Met. Staff

The Kuwait Meteorological Department had conducted several training activities and workshop in Kuwait and abroad.

- Upper air training for engineers and forecasters in Finland for the digicora radiosonde and Ozone releases.
- Surface AWOS by ALMOS in Australia.
- Manned station training for observers conducted in WMO regional training Center in Egypt.
- Need more frequent training courses on yearly basis.

Current issues and future plan

Current:

- Staff need to have more experience and to transfer new technologies and training to them.
- Lack in the Kuwaiti human resources in this field is one of the most challenging issue to the future of Kuwait Met. Department.

Future plan:

- To improve the QC/QM and get the ISO for Kuwait Met department.
-More training strategies for future challenges.

Thank You !

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