

Meteorological Pursuit a case study of Hafiz Hayat Campus, University of Gujrat, Pakistan

Umeed Maalik

Abstract— Being an important phenomenon “Weather Observation” or “Meteorology” is not only interesting for Meteorologists but also for environmentalists and geologists as well. So for this an internship program was held at University of Gujrat Hafiz Hayat Campus, in a newly maintained Met Office, where appointed Official Weather Observers supervised this work. So in this way this is a wonderful chance to become a part of Starting Weather observation at UOG, being the students of Environmental Sciences. A group of students worked as internees. Observation under certain parameters, by taking scheduled readings of outdoor installed instruments, then accordingly filling of Pocket Register, by consulting Hydrometric table, Aeronautical Code book 1995, & Surface Weather code book 1995 of Pakistan Meteorological Department 2008. Making Metar (after 1 hour reporting) and Synaptic (after 3 hours reporting), then reporting it to the Regional Meteorological headquarter Lahore through cell phone message sending or directly uploading it to their website. Discussion sections on different weather changes as shown by readings, along with instruments working accordingly, are the different steps of Starting of Weather Observation at UOG. The cell phone message send to headquarter is uploaded there to the official website of Meteorological Department. This internet updating of weather is also a part of our discussion to check how important working of our station, other Regional stations and the World over. Dealing with all these tasks increases our interest, skills, observation, experience and worth to take weather observation officially and understand its practical application and importance in the various fields of Science, Technology, Hydrology, Aviation, Agriculture, and Defense for the saving, wellbeing, and development of mankind and life on the Planet Earth.

Keywords— Meteorology, Weather Observation, Meteorology and Climate, Urban Meteorology, Hydrogeology, Meteorological observation at H.H. Campus UOG PK.

1 INTRODUCTION

SUN's energy is an ultimate source of heat and light for our Planet Earth from millions of years. The face of Earth, as it appears today, was not like that from the time of its beginning, but series of gradual changes affect its appearance, finally it becomes able to sustain life. This sustaining of life demands mainly food, shelter, growth, and reproduction facilitated by the earth and its surroundings, which still undergo continuous changing. The change which is constant, actually brighten the color of life.

On the Planet earth, its surrounding possesses air,

essential for life, and Sun is major source of energy. **Weather** is created by Sun's energy that is somewhere more and less on the other, while air in which all the weather processes occur. As changing in the Weather patterns are responsible for life style, food or crop yield, and construction designs at any place. So the information about weather conditions became essential. The raise of knowledge of weather inspires to know about it more and more, although human access limits. Weather is observed, to update and forecast that refers as **Meteorology**.

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METEROLOGICAL PURSUIT IN UNIVERSITY OF GUJRAT

ABSTRACT

Being an important phenomenon “Weather Observation” or “Meteorology” is not only interesting for Meteorologists but also for environmentalists and geologists as well. So for this an internship program was held at University of Gujrat Hafiz Hayat Campus, in a newly maintained Met Office, where appointed Official Weather Observers supervised this work. So in this way this is a wonderful chance to become a part of Starting Weather observation at UOG, being the students of Environmental Sciences. A group of students worked as internees. Observation under certain parameters, by taking scheduled readings of outdoor installed instruments, then accordingly filling of Pocket Register, by consulting Hydrometric table, Aeronautical Code book 1995, & Surface Weather code book 1995 of Pakistan Meteorological Department 2008. Making Metar (after 1 hour reporting) and Synaptic (after 3 hours reporting), then reporting it to the Regional Meteorological headquarter Lahore through cell phone message sending or directly uploading it to their website. Discussion sections on different weather changes as shown by readings, along with instruments working accordingly, are the different steps of Starting of Weather Observation at UOG. The cell phone message send to headquarter is uploaded there to the official website of Meteorological Department. This internet updating of weather is also a part of our discussion to check how important working of our station, other Regional stations and the World over. Dealing with all these tasks increases our interest, skills, observation, experience and worth to take weather observation officially and understand its practical application and importance in the various fields of Science, Technology, Hydrology, Aviation, Agriculture, and Defense for the saving, wellbeing, and development of mankind and life on the Planet Earth.

Keywords: Meteorology, Weather Observation, Meteorology and Climate, Urban

Meteorology, Hydrogeology, Meteorological observation at H.H. Campus UOG PK.

CHAPTER ONE

1.0-INTRODUCTION

Sun's energy is an ultimate source of heat and light for our Planet Earth from millions of years. The face of Earth, as it appears today, was not like that from the time of its beginning, but series of gradual changes affect its appearance, finally it becomes able to sustain life. This sustaining of life demands mainly food, shelter, growth, and reproduction facilitated by the earth and its surroundings, which still undergo continuous changing. The change which is constant, actually brighten the color of life.

On the Planet earth, its surrounding possesses air, essential for life, and Sun is major source of energy. **Weather** is created by Sun's energy that is somewhere more and less on the other, while air in which all the weather processes occur. As changing in the Weather patterns are responsible for life style, food or crop yield, and construction designs at any place. So the information about weather conditions became essential. The raise of knowledge of weather inspires to know about it more and more, although human access limits. Weather is observed, to update and forecast that refers as **Meteorology**.

Set up of weather observation is a Met office /Met Station. A Met Station started working with one official observer in April 2013 at University Of Gujrat Hafiz Hayat Campus. This type of weather observation is termed as Surface Weather observation. Each Met Station has a Specific code however here with Station code used UOG, because it is a new set up so no code has allotted right now. At a certain place on Planet earth when weather variation is officially observed and reported. It is based on these Meteorological elements: Temperature (dry & wet), Wind, Visibility, Sky condition, Dew point, Time, Atmospheric pressure, and Relative humidity along with area's location that shows it's longitudinal and latitudinal position. Reporting is done in the form of coding. Meteorological Observation is

required for taking weather update; alert, and forecast that are important for various fields of agriculture, aviation, research, disaster management and of every day's life.

1.1-History of Weather Observation

In 350 BC, with the description of Hydrological cycle weather observation starts. So Muslim Scientists play very important role in developing of Meteorological Sciences. As weather is not only concerned with ground level changes, expect it is much more linked with atmosphere or air. Earlier observations of atmospheric conditions are limited like that is taken at the height of mountains, and then kites were used to measure temperature of higher altitudes. It was discovered by using kites, that lightening is an electrical discharge. Cameras were tied with the pigeons, during their flight pictures from altitude were captured in this way, that on their return were available to the observers, this provides the bases for Arial photography that leads to GIS, Geographical Information System, working.

Certain instruments like Thermometer, Barometer, and tools have developed for studying weather parameters and these are improved and standardized through experimentation. Taking the risk, dangerous manned balloons were used to study upper atmosphere. Later Unmanned balloons with instruments can go to more height, but there were no assurance of instrument's recovery.

Till 18th century no regular and official Weather observation is considered. So there were no Reporting and Record gathering, however ordinary forecasting was in practice that is limited to a local level. After Second World War airplanes were used to collect weather information from upper atmosphere. With the network developing in many countries from the 19th century onward weather forecasting, and other studies related to climate are introduced. From 1960's onward Environmental changes, Pollution, Hydrology, Climatology, studies have gained importance resulting to recognize Climate Change that emphasis study of Meteorology.

In this regard weather radar and satellites have developed. In 1960, "TIROS-I" the first meteorological satellite was send to space.

1.2-Worldover Weather Observations

National or state Weather Stations are serving in almost all over the world with their available resources and Instruments. In developed countries more advance ways are applied to observe weather alterations at all levels while under developing countries are relaying on manual working rather than Automated Weather Observation Systems. As Weather observation is in demand for certain routine matters and catastrophic conditions for serving Humanity. So weather Observations are shared on the websites both by manual and automated data collection systems. For Example almost 15,000 data collection points working for Hydro meteorological Automated Data System are in record that works for Office of Hydrologic development of The National Weather Service.

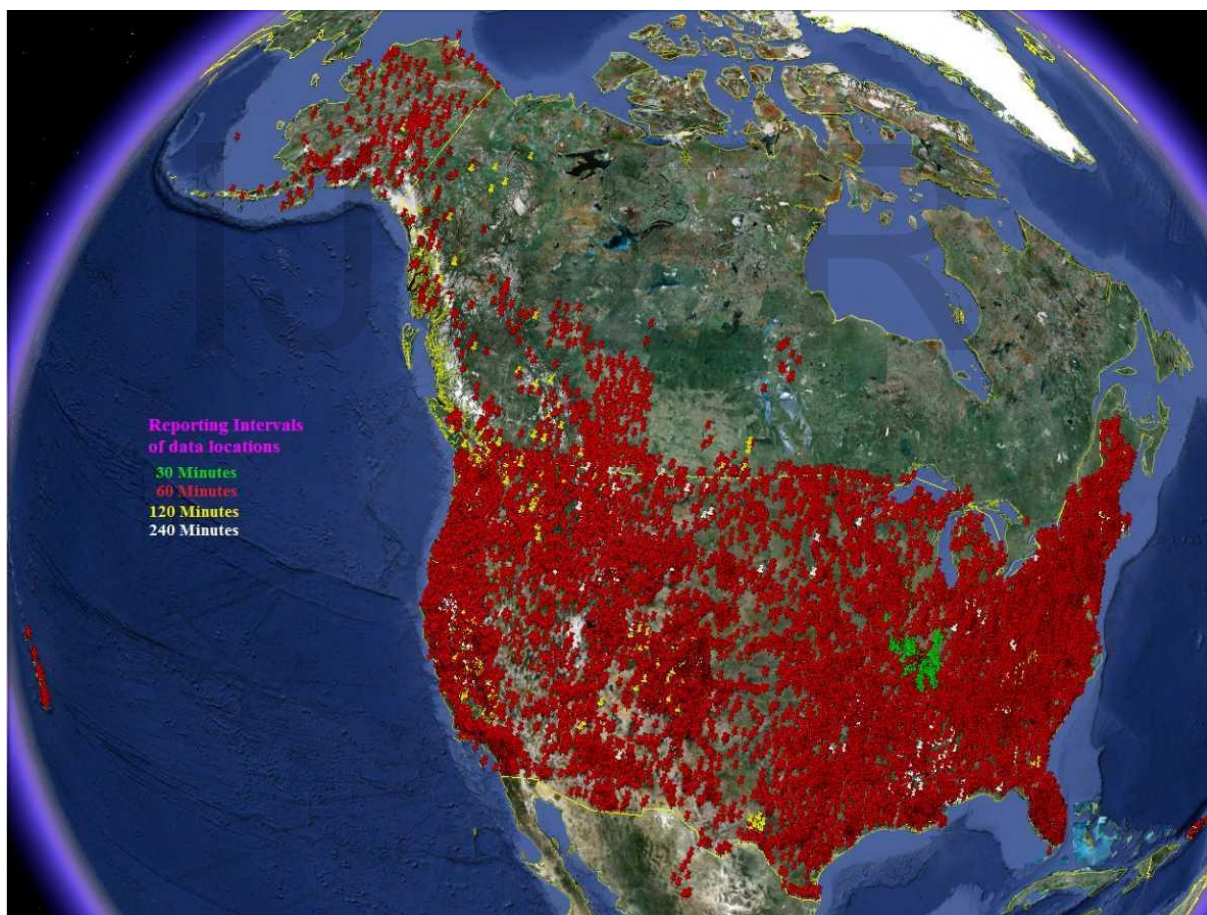


Figure1.1: More than 15,000 Data collection points of Hydro meteorological Automated Data System.
Source1.1: National Weather Service

hadstream@gateway2.nws.noaa.gov <http://www.nws.noaa.gov/oh/hads/> Accessed at 29-05-2021

Not only National and international weather observation is in demand also local level information is a matter of interest. But this information can only provide forecast of that specific location. In this regard Manual work where observer directly observes and takes readings from instruments to consider Meteorological elements is a common practice from long ago, the data collected in this way is urgently send to the headquarter where it is uploaded to the website so it become a part of main stream to predict weather conditions of that area. And is helping in scientific and research purposes to update, forecast, developing strategies, trade, irrigation, shipping, seismic warnings, construction of dams and buildings, flying, Tourism, Sports defense, and disaster management cells, according its demand in that area. Once a data of some area is uploaded it is now available to everyone on the internet that can be utilized.

However now, Local level Automated Observation Systems are also introduced, on all levels. Because people all over the world not only consider reliable, updates of mobile companies, television channels, and internet rather they are interested in taking direct weather observation even in their home stations, to enjoy knowing the variation of weather patterns and be alert to the drastic effects of weather. These observations are either part of official working or just for once own interest.

Anything that has a sensor and can give readout regarding weather is a part of Weather Station/ Weather Observatory. This sensor could be a single one that takes observation of one of the weather parameters at a time like only temperature or that one which could transmit readings of a set of other sensors, setup for taking readings of Meteorological elements, and this transmitter is connected to readout display like a computer screen. With the advancement in technology Weather Observation has become more convenient with outdoor setup of sensors and indoor readouts. The indoor readout displays are mostly connected with outdoor one /more sensors or a transmitter sensor that take observations of weather parameters/Meteorological parameters and are effective where weather conditions are tough to bear like: Extremely hot/cold weather areas.



Figure1.2: Local level outdoor sensor for Automated Weather Observation System
Source1.2: Weather Station Transmitter _IPJ,

<http://www.practicalarduino.com/sitebuilder/projects/knowledge/asset/medium/38/weather-station-transmitter-sml.jpg> , Accessed at 29-05-2013.



Figure1.3: Local level indoor readouts.

Source 1.3: Local Weather Observation, by MetEd,
<https://www.google.com.pk/search?hl=en&q=local+weather+observations&tbm=isch&tbs=simg:CAQSYgkNtWH6alxXlpxOCxCwjkClGjwKOggBEhSVA5kDgQOUA8UDpwOeA7sDqgOTAxogmnjlsEhosxTVaVO1u7XDAbUcaLuPp3aluQmOu2i6548MCxCOrv4IGgAMIUfXxEUj-ZYc&sa=X&ei=wX29Uaj9OMSn4AT324HoDQ&ved=0CCMQwg4oAA&biw=1280&bih=709> ,Accessed at 29-05-2013

1.3-Weather Observation in Pakistan

Pakistan is situated in a highly sensitive area of Asia with respect to weather conditions. In 1947 with 15 Weather observatories working in the entire country, **PMD**, Pakistan Meteorological Department was established. This is a National level entity that officially works to fulfill the technical weather observation responsibility to update, forecast and Monsoon Alert. At present in Pakistan a network of observing stations is operating, as a National Headquarter in the capital Islamabad, 4 Regional/Provincial headquarters at Lahore, Karachi, Peshawar, Quetta, and more than 20 local level officially operating Meteorological Stations. These are working for PMD under the Ministry of Defense. These stations are tried to equip with automatic instruments. However Manual working is in practice as a previous routine and is considered more reliable by the experienced observers. With the availability of Automated Observation Systems obtained data is compared with manually obtained data that helps to overcome deficiencies in manual work.

Overall Weather Observation in Pakistan has its practical application in the field of Agriculture as Pakistan is big Agricultural land area possessing country. Aviation, Shipping, Sports and irrigation requirements are second main purpose of Meteorological working in the country; however there are so many lacks of technology in this respect. Adaptations of precautionary measures for catastrophic conditions are also dependent on efficiency of Weather Observation Stations; this is a matter of special attention as due to lack of arranged resources and mismanagements in the political circle of country Weather updates are not followed accordingly to avoid big disasters. Working of PMD is also concerned with nuclear explosion detection system, radar, satellite, dam designing with respect of seismic effects,

information technology, science and Research work. PMD is a member of **WMO**, World Meteorological Organization.

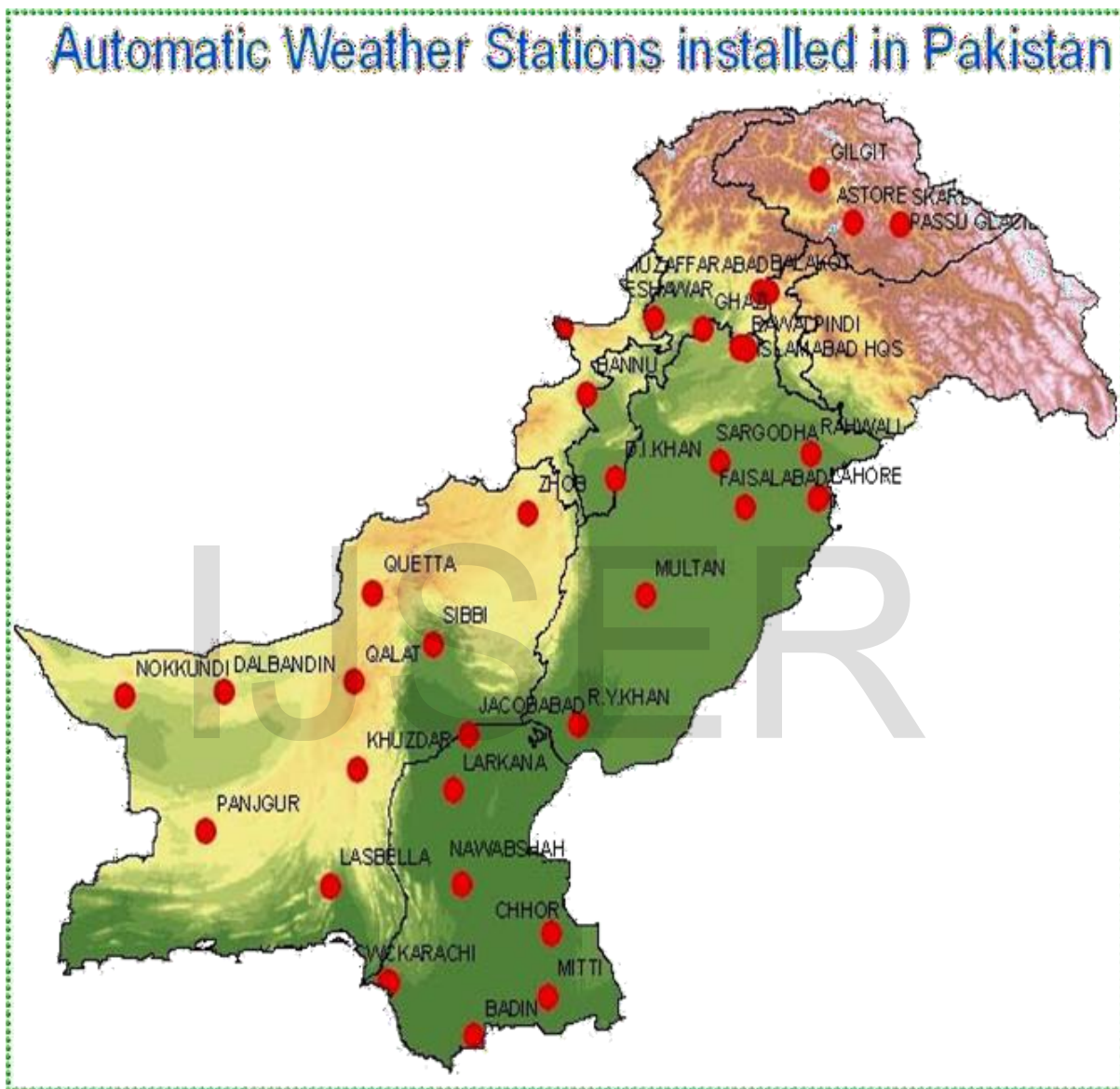


Figure1.4: Automatic Weather Stations in Pakistan.

Source1.4: PMD-WFP joint project Government of Pakistan,

<http://pmd.gov.pk/wfp/weather.html>, Accessed at 2-06-2021.

1.4-National Headquarter OF PMD Islamabad



Figure1.5: PMD, Pakistan Meteorological Department, Islamabad.

Source1.5: PMD, Islamabad

https://fbcdn-sphotos-d-a.akamaihd.net/hphotos-ak-prn1/947038_590408417657917_920706467_n.jpg

Accessed at 16-06-2013.

Organizational rank of PMD, Islamabad is National Agro met Centre (NAMC), Islamabad. Where it serves to coordinate National authorities of agriculture and water. Monthly “Agro met Bulletin of Pakistan”, in both Urdu and English is issued. Research and technological developments in the field of agriculture are published by computer data processing. Acknowledgment of various issues like: water requirements to major crops, plant and animal diseases, and soil moisture conditions. Weather Surveillance Radar is installed in Islamabad

with the help of Japan Government. This Radar is with an ability of Monitoring Weather Systems up to a radius of 400kms.

A study tour was arranged by our Instructor respected Dr. Mushahid Anwar to visit PMD, Islamabad on 30th May, 2013. That was a precious chance to meet Dr. Haneef the 1st PHD, degree holder of Pakistan in Meteorological Sciences. Also there is a chance to listen his lecture along with valuable discussion of Dr. Haneef and Dr. Mushahid, on visiting the Monitoring Radar & other Instruments working there.



Figure1.6: Lecture and discussion in PMD, Islamabad

Source1.6: PMD, Pakistan Meteorological Department, Islamabad.

https://www.facebook.com/photo.php?fbid=590408480991244&set=pcb.590409344324491&type=1&perm_page=%20Accessed%20at%2031-05-2013. Accessed at 15-06-2013.

1.5-Weather Observation at UOG

A Weather Observation Station /Meteorological Observatory / Met Office have started working in the month of March 2013, at University of Gujrat Hafiz Hayat Campus, under the supervision of Respected Sir Dr. Muhammad Mushahid Anwar Chairman of Department of Geosciences & Geography.

Respected Sir Abdul Ghani Gondal an Official Weather Observer appointed in this Met Office.



Figure1.7: Meteorological Observatory at UOG

Source1.7: Photos by Muhammad Mushahid Anwar, about Meteorological Observatory

<https://www.facebook.com/photo.php?fbid=590405850991507&set=pcb.590406947658064&type=1&perm%20Page=1%20A>

Accessed: 02 June, 2021.

1.6- Weather Observation in Meteorological Observatory UOG

Weather Observation is done by observing Numerical values, of certain parameters named as Meteorological Elements; this is through general observation calculation, use of instruments, and documentary tools.

Following steps are performed by a Weather Observer at UOG: **Intake of readings**, take the reading and check it (that is on the experience base and personal excellence) before note down to make sure that all instruments are in proper working condition, or anyone's maintenance is required. For example: Due to outdoor installation of Weather Instruments, their exposure to the surrounding needs care for their safe existence and proper working like: High speed wind can drop them if their position is not strongly fitted, and extreme weather conditions like NW & SW winds result experiencing an excessive dryness, that can cause wet thermometer's thread to become dry, as the moisture it sucks continuously from its water/moisture bottle evaporates with a rate comparatively very high than the previous less dry weather/wind condition. Recovery of it could be simple as reduce the distance of moisture bottle from the thermometer bulb so it experiences less exposure to the dry winds, drop some water on thread every time you come to take reading, so that it remains full of moisture, make sure don't take reading at once, after you dropped water on the thread, take at least 5 minutes time to remain close Stevenson Screen's door/opening side, then take reading, and in the long run to face and handle effects of these winds increase thread's amount so that its thick layer can maintains it to remain wet by retaining the amount of moisture it sucks, or to increase its moisture holding capacity, although rate of evaporation is a changing factor of weather that can be observed but can't be altered by will.

Filling of pocket Register: is actually based on general observation of some of the parameters and intake of Instrumental readings and making its note by using Meteorological coding from Hydrometric table, and weather code book. **Making Metar and Synoptic:** that is Official/Professional method of reporting from a Weather Observatory. **Sending its message:** to headquarter Lahore or uploading it to the internet. Usually reading observations are taken for 24 hours, but because of working with this newly set up Observatory, and University timing's restrictions, reading are taken for only 0300z to 1200z.

CHAPTER TWO

2.0-METHODOLOGY

Weather Observation is an outdoor lab work as the Instruments or sensors are installed in such a way that their exposure with outdoor environment is kept permanent, and indoor data collection is performed by manual work or via transmitters connected to the indoor readouts, for finding Meteorological Elements, with the use of relevant Instruments and tools in document form, intake of readings, making record in the Meteorological coding, interpreting data, and preparing its message for sending.

2.1- Tools in the Form of Documents

Necessary Documents used in manual Surface Observation are:

- A) – Hydrometric Table
- B) –Surface Weather Code Book
- C) – Aeronautical Code Book

– **Hydrometric Table:** Hydro means water, and meter is for measuring, Hydrometer is used to measure the density of liquids. While Hydrometric table is used for taking reading of such parameters which are relatively measured, that is these are measured with reference to certain other elements. These reference values, that are note down and published via this document, are calculated through a series of experimentation, under controlled conditions, by the expert, trained, and experienced technical staff.

These calculations after getting national & international approval are certified, for being authentic, and are considered as standards. These standards are then established.

In Meteorological Observation, Hyrometric Table is used for finding values of some parameters like: Dew Point & Relative Humidity, (these two considerations are indirectly measuring amount of water in the atmosphere). Values of D.P & R.H are picked by using the reference of dry & wet thermometer readings at a certain place for a specific time.

B) – Surface Weather Code Book: is a tool, used in Surface Meteorological Observation. This tool is in the form of a document that have a record of codes in it, these codes are actually the real requirement of an observer as Meteorological observation is reported in form of specific codes, these codes are highly specific for their relative considerations. Along with codes some symbols are also considered and used in weather reporting. Generally codes for Time, Cloud type, Cloud Cover and Rain are picked while symbols for visibility, thunder storm, and Rain are taken, by Met observer.

Surface Weather Code 1995, Pakistan Meteorological Department, 2008 is prepared for using in order to consult codes and symbols, required for surface weather observation. It is being consulted in more than 20 Local, 4 Provincial /Regional, and 1 National level, headquarters of Meteorological Observation / Met Stations.

C) – Aeronautical Code Book: Aeronautical Meteorological Codes, 1995 Edition that is revised in 2008 is used for Reporting Metar, as it have all the coding record for Metar.

Metar Reporting is rather simple and is with lesser use of codes; however it is also very specific for its application so codes given in book are carefully consulted. The more and more experience or even practice for Reporting Metar makes the observer so efficient that there is no need to consult this code book in each Reporting.

Aeronautical is for air navigation or related to aerial, as Metar Reporting is of much more importance in flight, so its codes possessing book is named Aeronautical Code Book.

2.2-Meteorological Elements

Weather Observation is carried out with the help of certain parameters that are measured either manually or automated observation systems. At UOG Meteorological Observatory, observation is through manual system. These parameters/ Meteorological Elements are:

- a) – Area
- b) – Location
- c) – Temperature
- d) – Time
- e) – Wind Direction
- f) – Wind Speed
- g) – Atmospheric Pressure
- h) – Cloud Type
- i) – Cloud Cover
- j) – Cloud Position / Cloud Height
- k) – Visibility
- l) – Rain / Precipitation
- m) – Dew Point
- n) – Relative Humidity

Description of these Meteorological Elements

a) – Area: Pakistan is one of Asian countries which are at less distance from Equator, and is

possessing a melt sea, so Pakistan has three types of Ecological Zones: Tropical, Sub

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Tropical, and Temperate. Area Geographically from Gujrat to Sibi is **Tropical**, where temperature can be more than 40 degree centigrade; Humidity 40%, height from sea level is about 0-200miles.

Hafiz Hayat Campus of University of Gujrat is in upper Punjab at the border of Azad Jammu and Kashmir, 10km from main Gujrat city. As Gujrat is in between two rivers Chenab and Jhelum so possess wet land and northern forest range that creates a variety of weather conditions to be experienced.

Areas are divided for Weather Observation, area division for UOG Meteorological Observatory; Surface Weather Observation is carried out. From four sections (111, 222, 333, and 444) of Weather Reporting Methodology, UOG Meteorological Observatory works for two sections (111 & 333), and other sections are concerned with Weather Reporting in Oceans etc.



Figure2.1: Gujrat location Map, shows Area of Gujrat, this city is situated between two rivers Chenab and Jhelum

**Source2.1: Weather Forecast location Gujrat, <https://www.weather-forecast.com/locations/Gujrat/forecasts/latest>
Accessed: 02 June, 2021.**

b) – Location: Pakistan’s latitude is 30° 00’ N (25° 00’ - N 35° 00’ N) and its longitude is 70° 00’ E (65° 00’ E -75° 00’ E), accordingly Gujrat city’s latitude is about 30° 00’ - N 35° 00’ N and its longitude 70° 00’ E -75° 00’ E.

For Meteorological Observatory UOG, latitude 32° 38’ N, longitude 74° 09’ E, and height above Sea level is 799feet.

c) – Temperature: is the major factor for weather considerations, temperature variations are basically the cause of creating different conditions of weather, Spring, Summer, Winter, Autumn, that is generated by the varying exposure Earth to the Sun. Measured by Stevenson Screen.

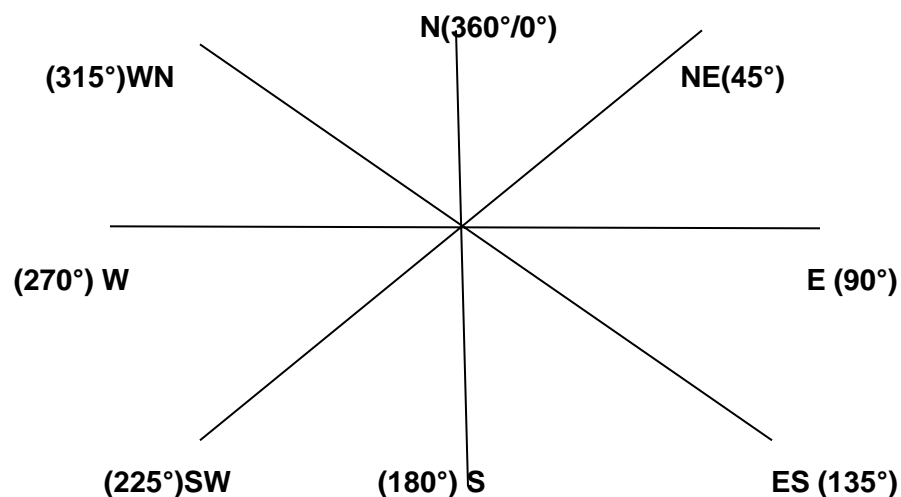
d) –Time: Official Weather Observation is very much concerned with time. In Meteorology GMT “Greenwich Mean Time” is taken as standard world over. “Pakistan’s Standard Time” PST is converted into GMT for Meteorological Observation.

Conversion Formula:

$$\text{GMT} + 5 = \text{PST}$$

Meteorological Observation deals with GMT as 0300z, 0600z, 0900z, 1200z, 1500z, 1800z, 2100z, 2400z / 0000z.

e) – Wind Direction: Is a special phenomenon in relation with weather alterations, and is measured by Wind Vane. For example: NW & SW Winds result excessive dryness.



Meteorological Observation is conveyed in the form of Reporting. This Reporting is done in the form of special coding. Wind Direction codes used in Weather Reporting, according Surface Weather Code Book 1995, Pakistan Meteorological Department, 2008 are as follows:

Table2.1: Codes for Wind Direction

Wind Direction	Code used for Reporting	Wind Direction	Code used for Reporting
NNE	02	SSW	20
NE	05	SW	23
ENE	07	WSW	25
E	09	W	27
ESE	11	WNW	29
SE	13	NW	31
SSE	16	NNW	34
S	18	N	36

Source2.2: Surface Weather Code book 1995, Pakistan Meteorological Department, 2008

f) – Wind Speed: is also an important parameter that plays a specific role in weather alteration like: winds move clouds that if retain can result shower at one place and where these clouds move they can result a rain spell over there, and so on...Wind Speed in manual observation can be measured by Wind Anemometer.

g) – Atmospheric Pressure: is essential to measure for an observer, because pressure difference can be caused due to heat variations on the earth surface. So the term, high pressure (more atmospheric mass above that very location), or low pressure (less atmospheric mass over that very location) is a relative term. Warmer air can hold more moisture than cooler air, and warm air is less dense than cold air. In Stormy weather barometric pressure will tends to be lower, as moist air is less dense than dry air.

Atmospheric Pressure is measured by Barometer.

IJSER

h) – Cloud Type: it is through General Observation & perceptions to notice what type of clouds are present at a time on the sky, here experience of observer is a remarkable factor. Clouds are divided into 3 major categories with respect to their height, as Low, Medium, & High. These are further divided into 10 types:

Table2.2: Cloud Types with their codes & Symbols used in Meteorological Observation

Code figure	Cloud type Name	Symbol(cloud type)	of 3 major categories
0	Cirrus	Ci	High
1	Cirrocumulus	CC	High
2	Cirrostratus	CS	High
3	Alto cumulus	AC	Medium
4	Altostratus	AS	Medium
5	Nimbostratus	NS	Medium
6	Stratocumulus	SC	Low
7	Stratus	St	Low
8	Cumulus	Cu	Low
9	Cumulonimbus	Cb	Low

Source2.3: Surface Weather Code book, 1995. Accessed at 07-05-2013

Also

Table2.3: Slash or Oblige as Cloud Symbol

Cloud measurement symbol	Its relative description
/ (slash or oblige)	Cloud not visible owing to darkness fog, storm, dust (sand), or other.

Source2.4: Surface Weather Code, 1995. Accessed at 07-05-2013



Figure2.2: Cloud Types

Source2.5: <http://nimbus.davelynch.net/wp-content/uploads/2012/08/endpapers.jpeg>, Accessed at 20-6-13
 Most common types of clouds experienced at UOG Meteorological Observatory are given below in _____ Table2.4: Generally experienced Cloud types & their Codes

CH (High Clouds)

Ci	1
----	---

CM (Medium Clouds)

AS	2
AC	3
AC + AS	7

CL (Low Clouds)

Cu	2
SC + Cu	4
SC	5
SC + Cu + Cb	9

Source2.6: Notes prepared by, Sir Abdul Ghani Gondal, Official Met Observer at UOG.

i)-Cloud Cover



Figure2.3: Cloud Cover on Sky at UOG

Source2.7: UOG's Face book page, <http://www.pakimag.com/tourism/beautiful-university-of-gujrat.html/attachment/university-of-gujrat-1>, Accessed at 2-06-2013.

Clouds are measured in **Octas**, the vale ranges from **0-8 Octas**, in Meteorological Observation, Sky fully covered with clouds is noted as **8 Octas**, half sky covered **4 Octas**, less than 2 parts Sky covered with clouds **6 Octas**, only 1 part of sky naked/empty from clouds **7 Octas**.

Table2.3: Cloud Cover range for # of Octas, their relative codes & symbols

Range for number of Octas	Their relative names or Meteorological codes	Symbols for names or codes
1 – 2	Few	few
3 – 4	Scatter	Sct
5 – 6	Broken	BKN
7 – 8	Overcast	Overcast

Source2.8: Surface Weather Code, 1995. Accessed at 08-05-2013.

j) – Cloud Position/Cloud Height: Clouds seen from ground level are at which level of height. This can be estimated manually with Temperature, & Humidity values, / in automated system with laser called ceilometers.

For Manual work Formula:

[Difference of {Surface Temperature (in °c) & Dew Point} × 400] = {Height (above Ground level)}

AGL in feet}

[{Height AGL (above ground level)} + Station Height in feet] = {Height (Above Sea level)}

ASL in feet}

Weather Balloons are in practice to measure Cloud Position from when they start flying to get enter into the cloud after how many kilometers, reading (Pilot message) is continuously being calculated, as after every 2 minutes, in this way Cloud Height can be calculated, also angular position (Horizontal & vertical) can be noted with **Theodolite**.

Table2.4: Codes for Cloud Height

Code Figure	Range of height in feet	Range of Height in meters
0	0 to 150 feet	0 to 50 meters
1	150 to 300 feet	50 to 100 meters
2	300 to 600 feet	100 to 200 meters
3	600 to 1000 feet	200 to 300 meters
4	1000 to 2000 feet	300 to 600 meters
5	2000 to 3000 feet	600 to 1000 meters
6	3000 to 5000 feet	1000 to 1500 meters
7	5000 to 6000 feet	1500 to 2000 meters
8	6000 to 8000 feet	2000 to 2500 meters
9	8000 feet or more of	2500 meters or more or No Clouds.

And

Code Figure	Description
/ (slash or oblige)	Height of base of cloud not known or base of clouds at 9 at a level lower and tops at a level higher than that of Station.

Source2.9: Surface Weather Code, 1995. Accessed at 09-05-2013.

k)-Visibility: refers for, up to what limit of horizontal distance sight is clear, it is considered as, at Surface for weather observation.

Visibility considered with respect to (R.H) Relative Humidity's vale:

Table2.7: Visibility with respect to R.H value

Range of values of R.H in %	Visibility's position (name)	Relative symbol
50% or less than 50% R.H	Less visibility present weather Haze	Hz
50% to 85/90% R.H	Smoke Haze	Fu
85% to 94% R.H	Mist	Br
95% and above R.H	Fog	Fog
100% R.H	Rain	RA

Source2.10: Surface Weather Code, 1995. Accessed at 10-05-2013.

Also consider

Table2.8: Horizontal Visibility at Surface

Code figure	Day light observation	Night observation (Distance at which the lamp of 100 candle power just disappearing)		
		A	B	C
90	Objects not visible at 50 meters(55yards)	130 m 140yards	150m 160yards	180m 200yards
91	Objects visible at 50 meters but not at 200 meters (220 yards)	340m 370yards	440m 480yards	
92	.	.	.	.
93	.	.	.	.
94	.	.	.	.
95	Objects visible at 2000 meters but not at 4000 meters	2750m.	..	..
96	// at 10,000 meters not at 20,000 meters	..	..	..
97	.	.	.	.
98	.	.	.	.
99	.	.	.	.

Source2.112: Surface Weather Code, 1995. Accessed at 11-05-2013.

Distance considered here is taken in meters other than kilometers, like 5000m except 5km. AT 96 that is 10,000meters/10km if (Cloud + Visibility) is ok then it is called as **CaVoK**.

I) – Rain: Rain, precipitation, or shower is a major factor regarding weather observation at some place. Rain is measured with Rain Gauge.



Figure2.4: Rain in UOG

Source2.12: Face Book page, University of Gujrat, PK.

<https://www.facebook.com/photo.php?fbid=649922575021911&set=pb.291931487487690.-2207520000.1371653947.&type=3&theater> , Accessed at 12-05-2013.

Rain is calculated for last 3hours, 6hours, 12hours, and 18hours.

Table2.5: Amount of Rain in mm & its codes used in Meteorological Observation

Code figure	Amount of Rain in millimeter(mm)	Code figure	Amount of Rain in millimeter (mm)
000	000 mm	990	Trace
001	1 mm	991	0.1 mm
002	2 mm	992	0.2 mm
....	.....	993	0.3 mm
....	.....	994	0.4 mm
....	.....	995	0.5 mm
....	.....	996	0.6 mm
....	.....	997	0.7 mm
988	988 mm	998	0.8 mm
989	989 mm / more	999	0.9 mm

Source2.13: Surface Weather Code, 1995. Accessed at 12-05-2013.

m) – Dew Point: is water to air saturation temperature. It is necessary to observe and note, as the dew point shows mole fraction of water vapor in the air. Its value is related with Temperature and Relative humidity.

n) – Relative Humidity: is that Humidity which is required and consumed that is available in the surrounding for a living one. Living bodies absorb moisture from their surroundings according to their needs, so it is not a constant rather differs for one entity to other. For Example: Relative Humidity of an individual's need with respect to Humidity of the room in which he/she lives.

The values of these two parameters of weather observation, Dew Point & Relative Humidity are together noted in the Hydrometric Table after calculation, available to the observer for almost every range of dry & wet thermometer readings.

***As 1st calculate** temperature difference from dry and wet thermometer readings:

dry thermometer reading:	21.0 °c (always big value)
–	
wet thermometer reading:	19.0 °c (always low value)
difference of readings:	
	2.0 °c(should not be zero)

**** 2nd notice** vales of Dew Point (D.P) & Relative Humidity (R.H) from Hydrometric Table concerning vales of dry thermometer reading and difference of readings.

Table2.6: How to pick values of D.P & R.H?

↓ Dry thermometer reading	Check diff.→ 0.0 D.P & R.H	0.5 D.P &R.H	1.0 D.P & R.H	1.5 D.P & R.H	2.0 D.P & R.H
20.0 & & & & &
20.5	... & & & & &
21.0	<u> </u> & <u> </u>	<u> </u> & <u> </u>	<u> </u> & <u> </u>	<u> </u> & <u> </u>	Values need
21.5 & & & & &

Source2.14: Hydrometric Table, PMD, PK. Accessed at 13-05-2013.

2.3- Instrumentation

Necessary outdoor Instruments installed in the UOG Meteorological Observatory, which generally used in manual Surface Weather Observation are:

- I) – Stevenson screen
- II) – Barometer
- III) – Wind Vane
- IV) – Anemometer
- V) – Rain Gauge
- VI) – Evaporation Tank

Handling and Working of these Instruments, to take reading in Met Observation:

I) – **Stevenson Screen:** from exterior is a wooden box, placed straight on an iron stand_



Figure8.5: Working with Stevenson Screen

Source3.15: Weather Observatory UOG

<https://www.facebook.com/photo.php?fbid=546505668714859&set=pb.100000662924245.-2207520000.1371707323.&type=3&theater>, Accessed at 15-06-2013.

___ in the outdoor environment. According standards of **WMO** (World Meteorological Organization), its stand is fitted tightly on the ground, at a proper distance from the buildings/trees in surrounding, the door of screen facing North (according to the Northern hemisphere). Its walls are of double-louvered design that is window blinds with horizontal slats, angled to admit air & light can pass through, but not direct exposure of rain, sunlight, and sound.

From its inside, 4 Thermometers are fitted there making a square, wet Thermometer on right, dry on left, Thermometer for measuring maximum temperature is above, and for minimum is below, these thermometers are at a height of 4 feet/2m above the ground.

Thermometer giving dry temperature reading is with naked bulb; while Thermometer that gives reading for wet, its bulb is wrapped with cloth with an extended thread that is dipped in the water bottle, so can continuously suck water. In order to avoid wet bulb from dryness, because it is essentially needed to keep it moist.

In other two thermometers that have to give maximum & minimum temperature readings, not only Mercury is filled in their bulbs, some other material totally or in combination with Mercury is used in their composition, to fulfill their work requirement.

Method of taking readings from Stevenson Screen: Screen door is opened carefully, notice & read (once, twice /thrice as you feel satisfied) with full concentration, position of Mercury (in general bulb filling material), in dry and wet Thermometers & others as needed, then close the screen door. And make note of these readings.

Precautions for taking reading

- > Don't keep the door of screen opened for long period of time.
- > Every time when reading is taken check water level in the wet thermometer bottle, pour water in it so sucking of thread don't disturb, and wet bulb refrains from drying.
- > Reading of dry Thermometer should always be greater than wet Thermometer's reading.

II) – Barometer: is used for measuring atmospheric pressure, sometimes Stevenson Screen also holds a Barometer/ is present alone, still not available at Meteorological Observatory University of Gujrat.

III) – Wind Vane: is fitted at the highest point of building, as its tail end is of large area so it allows the front end or arrow head to move in the direction of wind, taking a careful notice of its arrow head's rotation & stability once, twice or thrice to make sure your notice/observation. The wind is blowing in the direction, which the arrow head point out.



Figure2.6: Wind Vane & Anemometer at Meteorological observatory UOG, PK.

Source416: Meteorological Observatory University of Gujrat, PK.

<https://www.facebook.com/photo.php?fbid=546505608714865&set=pb.10000662924245.-2207520000.1371707527.&type=3&theater>, Accessed at 15-06-2013.

IV) – Anemometer: its $\frac{3}{4}$ cups spin with wind speed and its meter shows readings. Take 1st reading and after 3 to 4 minutes take 2nd reading, calculate the difference between 1st&2nd reading and multiply it with 2, to get value of Wind Speed in Knots. Wind speed & its pressure gradient are relative to measure.

Formula: Wind Speed in Knots = $[(1^{\text{st}} \text{ reading} - 2^{\text{nd}} \text{ reading}) \times 2]$

For Example: Wind Speed in Knots = $[(66673 - 66675) \times 2]$, so 0.4 Knots = $[(0.2) \times 2]$.

IV) - Rain Gauge: is an instrument, used to measure the amount of rainfall. It measures, for a certain amount of time, depth of precipitation, in millimeters (mm). The Gauge is fitted, in the open ground, with the copper funnel that is up to 30 cm above ground. The funnel is tapering with standard dimensions to allow rain-water to be collected in the calibrated cylinder.



Figure2.7: Rain Gauge & Evaporation Tank at Meteorological Observatory UOG.

Source5.17: Meteorological Observatory University of Gujrat, Hafiz Hayat Campus.

<https://www.facebook.com/photo.php?fbid=546505682048191&set=pb.100000662924245.-2207520000.1371707527.&type=3&theater>, Accessed at 15-06-2013.

VI) - Evaporation Tank: is a circular pane to determine the day-to-day amount of evaporation, at a certain location, where it is placed. This corrosion resistant pan with 47.5inches diameter & 10inches depth rests on a leveled wooden-frame. In the Start of measurement pan is filled 2inch from the top, after 24 hours the water amount required to refill it to 2inch is measured. In case of precipitation, anytime during the 24 evaporation measuring hours and if the rate of precipitation was more than evaporation, the increase in water from pan should exclude.

Precaution: Keep safe from animal drinking, splashing, and freezing of tank's water, for the accurate measurement.

CHAPTER THREE

3.0- FINDING

Weather Observation is presented in the form Reporting. Therefore after carefully taking readings from outdoor installed instruments, these readings are specifically note down in the Pocket Register, and then Sign up is formed.

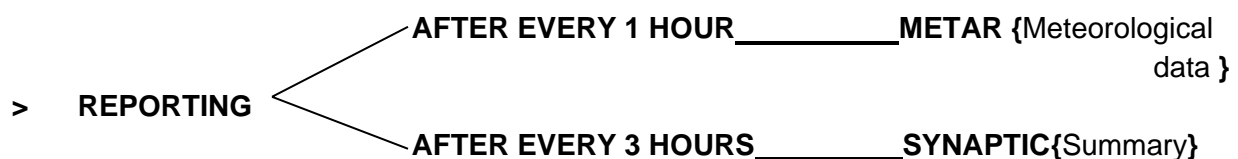
Filling of pocket register: is done in duty hours for each reading time, from directly measured readings of parameters like: Dry & Wet Temperature, Wind Direction & Speed, and Rain along with consulting of Hydrometric Table for picking values of parameters such as Dew Point & Relative Humidity, which are either directly measured or dependent on the directly measured parameter's values for their measurement. Also values of these relative parameters remains constant for a constant set of directly measured parameters. Filling Pocket Register is by using codes as given in the Surface Weather Code, 1995. In this way Observation is manually recorded for the whole month at one place.

3.1- Reporting

Weather Reporting is in the coding form, this coding is specific Meteorological coding, given in Aeronautical code book1995, and Surface Weather Code book1995, etc.

STATEMENT OF PROBLEM: **HOW TO SIGN UP_____?**

For Sign Up Reporting is in the form of Metar & Synaptic



Filling of Synaptic Sheet: Synaptic Sheet is filled for Reporting in the form of Sign up & Metar manually. This sheet is another form of data collection /making record of Met Observation at a station where there is no use of automated observation and digital data collection.

3.2- Metar

Metar is from Meteorological data. It is the way of Weather Reporting after every 1 hour. It is important for Aviation, Airplanes Root weather.

Table3.7: Model of Metar & its description

Parameters that are used to make Metar	Presentation in code/symbol	Model of Metar	# of figures & digits used
Station nam:Pakistan+UOG	Pak.code+station.code	OPUG	2 + 2 figures
Wind direction.+ Wind Speed	Code+ value (Knots)	13006Kt	3 +2 digit (unit)
Visibility	Value in kilometers	9999	4 digits
Thunder storm + Rain	Symbol + Symbol	TSRA	2+2 figures
# of Octas + Lower cloud	Symbol+code+name	Few 035CB	3f + 3d + 2f
# of Octas + Medium Cloud	Symbol + code	Sct 040	3f+ 3d
# of Octas + High Cloud	Symbol + code	BKN100	3f +3d
Dry temperature& Dew Point	Both Whole numbers	29 / 10	2d + 2d
Barometer reading	unavailable	Q ///	4d
Relative Humidity	Whole # in %	RH 31%	2f +2d(unit)

Source6.1: Class Work, by consulting Pocket Register's data. Accessed at 15-05-2013.

Description of Metar: Metar is formed by reporting following considerations, from above table of Metar Model:

OPUG: is the Station name from (Pakistan+ UOG), OP is the code figure of Pakistan used for Reporting of Metar, and UG is code figure for UOG Meteorological Observatory.

13006Kt: is the Wind Direction +Wind Speed in Knots, 130 is code in 3 digits form for SE (135°) Direction of Wind observed by Wind Vane, and 06 is Wind speed given in 2 digits, as calculated from the 2 readings of Anemometer in Knots(Unit of Wind Speed).

9999: is the code for Visibility, given in the 4digits form, from code 99, representing for day light observation of objects at a distance of more than 10,000meters/10km.

TSRA: is the code figure (2 +2) for Thunder storm & Rain, as note down in the Pocket Register.

Few 035 CB: is the number and type of Lower Clouds, where Few: from 1-2 Octas, 035: code for lower clouds, CB: type of lower clouds.

Sct 040: is for number of medium clouds, where Sct represents 3-4 Octas, and 040 is code of Medium clouds.

BKN 100: is for number of higher clouds, where BKN represents 5-6 Octas, and 100 is code of higher clouds.

29/10: is 2digits representation of Dry thermometer reading to show present temperature, along value of Dew Point in 2digits, here values of both parameters are given as whole numbers by rounding off.

Q////: is at a place where Barometer's reading is given, as for absence of Barometer Q with 4 obliques in written, whereas oblige is mostly showing absence of a reading or unavailability of taking an observation.

RH 31%: is the Relative Humidity 31 in %, where RH is for 2figure representation of Relative Humidity, 31 is for 2digits representation of vale of Relative Humidity in units of %age.

This model of Metar is a representation of Reporting Metar which changes as the weather changes that is with alterations in values of different Weather Elements, accordingly signs, symbols and codes.

Metar one after the other are showing slight differences among while any Metar of 1st day of month shows very clear distinction from the Metar of middle day of a month or from a Metar of the last day of month, that can be seen in given examples.

Table8.2 : Metar reporting models of 2-04-2013, 3-04-2013, & 12-04-2013, b/t 0300z-1200z.

OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG
31012Kt	00000Kt	00000Kt	31002Kt	31006Kt	31006Kt	31010Kt	31010Kt	31012Kt
9999	2000	4000	5000Hz	9999	9999	9999	9999	9999
Sct 040	TS	TS	TS	Sct 040	Sct 040	Sct 040	TS	TS
	Few 035 Cb	Few 035 Cb	Few035 Cb				Few035 Cb	Few 035 Cb
	Sct 040	Sct 040	Sct 040				Sct 040	Sct 040
Sct 100	BKN100	BKN100	Sct 100	Sct 100	Sct 100	Sct 100	Sct 100	BKN100
20 / 11	22 / 11	22 / 13	22 / 13	22 / 12	22 / 18	22 / 13	22 / 12	21 / 14
Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>
RH 56%	RH 50%	RH 58%	RH 58%	RH 54%	RH 54%	RH 58%	RH 58%	RH 65%

OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG
05006Kt	05006Kt	05004Kt	05004Kt	05006Kt	05006Kt	05006Kt	05006Kt	05006Kt
9999	9999	9999	9999	9999	9999	9999	9999	9999
Sct 100	Sct 100	Few040	Few035	Sct 040	SKC	SKC	Sct 040	Sct 040
		Sct 100	Few100					
25 / 10	27 / 11	28 / 11	29 / 10	29 / 11	30 / 9	30 / 9	29/10	29 / 10
Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>
RH 30%	RH 37%	RH 36%	RH 30%	RH 32%	RH 28%	RH 28%	RH 30%	RH 31%

OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG
31004Kt	31004Kt	31004Kt	31004Kt	31002Kt	31002Kt	31004Kt	31004Kt	31006Kt
CaVok	CaVok	CaVok	CaVok	CaVok	CaVok	CaVok	CaVok	CaVok
34 / 12	34 / 12	35 / 13	35 / 13	35 / 10	35 / 10	35 / 13	35 / 13	34 / 10
Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>
RH 27%	RH 27%	RH 28%	RH 26%	RH 22%	RH 22%	RH 26%	RH 28%	RH 29%

Source3.7: Pocket Register & Signup Sheets Data Record. From Meteorological Observatory University Of Gujrat, PK. Hafiz Hayat Campus, Accessed at 17-05-2013.

Table3.3: The Models of Metar Reporting of 21-04-2013 & 24-04-2013 showing the differences of closely taken Metar reporting i-e within one day & The Metar Reading of one day in comparison with the Metar Readings of 2 days later.

OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG
13006Kt	13006Kt	13008Kt	13008Kt	13008Kt	13010Kt	13010Kt	05012Kt
9999	9999	9999	9999	9999	9999	9999	9999
BKN 040	BKN040	BKN040	BKN 040	BKN040	Few 040	Few040	Sct 100
					Sct 100	Sct 100	
24 / 15	25 /15	25 / 13	25 / 13	26 / 11	27 / 12	28 / 12	30 / 12
Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>
RH 60%	RH 54%	RH 47%	RH 47%	RH 39%	RH 38%	RH 36%	RH 33%

OPUG	OPUG	OPUG	OPUG	.	OPUG	OPUG	OPUG
05012Kt	05008Kt	09004Kt	09008Kt	.	00000Kt	05002Kt	05004Kt
9999	9999	9999	9999	.	4000Fu	4000Fu	40000Fu
Sct 100	Sct 100	Sct 100	Few 100	.	Few 100	Few 100	Sct 100
30 / 12	31 / 12	33 / 9	31 / 8	.	32 / 13	27 / 16	22 / 17
Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	.	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>
RH 33%	RH 33%	RH 25%	RH 24%	.	RH 33%	RH 50%	RH 74%

OPUG	OPUG	OPUG	OPUG	OPUG	OPUG	OPUG
0000Kt	31002Kt	31002Kt	31004Kt	23002Kt	27004Kt	27004Kt
4000Fu	4000Fu	9999	9999	9999	9999	9999
SKC	SKC	Few 100	Few 040	Few 040	Few 040	Few 040
						Sct 100
33 / 14	34 / 14	35 / 14	35 / 13	35 / 10	36 / 11	35 / 13
Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>	Q <i>////</i>
RH 32%	RH 31%	RH 28%	RH 26%	RH 22%	RH 23%	RH 28%

Source3.3: Record of Data, at UOG Meteorological Observatory, collected in the form of filling Pocket Register and Synaptic Sheets. Accessed at 20-05-2013.

3.3- Synaptic

Synaptic is from “Synap” that is summary or average. Sign up or Synaptic Reporting is a way of reporting in which observer reports after every 3 hours. This main step of professional reporting is the key feature of any Meteorological Observatory, from which updates, forecasting and all other phenomena are derived.

Table3.4: Scheme for Reporting in the form of Synaptic for 0300z + 0900z

0300z + 0900z				
Date	Date	Time	Time	4
4	1	U	O	G
2	1 / 2	h	V	V
N	D	D	F	F
1	0	T	T	T
2	0	Td	Td	Td
3	/	/	/	/
	(This group is Reported in 0000z, 0300z, 0600z, 1200z, &1800z)			
4	/	/	/	/
7	W	W	W1	W2
8	Nh	CL	CM	CH
3		3		3
5	/	/	/	/
6	0	0	0	7
7	R24	R24	R24	R24
	(This group is Reported Only in 0300z)			
RH in %				

Source3.4: Class Notes prepared by Met Observer Sir Abdul Ghani, at UOG, PK. Accessed at 21-6-2013.

Table3.5: Scheme for Reporting in the form of Synaptic for 0600z + 1200z

0600z + 1200z				
Date	Date	Time	Time	4
4	1	U	O	G
0 / 1	1 / 2	h	V	V
N	D	D	F	F
1	0	T	T	T
2	0	Td	Td	Td
3	/	/	/	/
4	/	/	/	/
6	0	0	0	1 / 2 / 3
7	W	W	W1	W2
8	Nh	CL	CM	CH
	3	3	3	
Maximum (At 1200z) ¹	0	Tx	Tx	Tx
Minimum (At 0300z) ²	0	TN	TN	TN
5	/	/	/	/
6	0	0	0	7
RH in %				

Source3.5: Class Notes prepared by official Met Observer Sir Abdul Gani, at UOG, PK. Access at 25-05-2013.

These schemes made very clear & easy the Synaptic Reporting. Following this avoid from lot of confusions and difficulties that can raise to know about Synaptic Reporting by consulting large amount of data in code books, internet web sites, guide books, and Meteorological syllabus. It is a comprehensive approach to reach the demand of manual reporting at a Surface Weather station like that of Meteorological Observatory at UOG.

Table3.6: Scheme of sign up, Rain groups.

	Date	Date	Time	Time	4
	4	1	U	O	G
When Rain is Reported in both sections like: (0000+0600+1200+1800)	0	1			
When Rain is Reported in only one section i-e before 333	1		h	V	V
When Rain is Reported in just after 333	2	2			
	N	D	D	F	F
	1	0/1	T	T	T
	2	0/1	Td	Td	Td
This group is Reported in 0300z+0600z+1200z +1800z+0000z	3	P1	P1	P1	P1
	4	PPP	PPP	PPP	PPP
					1→0600z for 6hours Rain
0000z+0600z+1200z+1800z	6	0	0	0	2→1200z for 12hours Rain
					3→1800z for 18hours Rain
	7	W	W	W1	W2
	8	Nh	CL	CM	CH
	3		3		3
This is for Maximum temp. Reported in afternoon 1200z	1	0	Tx	Tx	Tx
This is for Minimum temp. Reported in Morning 0300z	2	0	TN	TN	TN
	5	/	/	/	/
Just for 3hours Rain Reported in every sign up.	6	0	0	0	7
Daily for 24hours Rain 0300z	7	R24	R24	R24	R24
RH in %					

Source3.6: Class notes prepared by Met Observer Sir Abdul Ghani, UOG PK. Accessed at 26-05-2013.

Here Models of Synaptic Reporting for 0300z,0600z,0900z, &1200z are given one by one along with their relevant description, according to the Weather Observations that are carried out at UOG Meteorological Observatory by following above given schemes(0300z-1200z).

Table3.7: Model of Synaptic Reporting for 0300z (02-04-2013)

0	2	0	3	4
4	1	U	O	G
2	1	6	9	7
6	3	1	1	2
1	0	2	0	0
2	0	1	0	9
3	/	/	/	/
4	/	/	/	/
7	2	9	9	2
8	3	4	7	0
3		3		3
2	0	1	9	9
5	/	/	/	/
6	0	0	0	7
7	0	0	5	2
RH 56%				

Source3.7: Pocket Register & Synaptic Sheet Data Records, at Met Observatory UOG, PK. Accessed at 29-05-2013.

Description of Synaptic Reporting Model for 0300z reading:

02034: This group represents date+date+time+time+code of Anemometer, as **02** is date+date that is 2digits date, **03** is time+time that is time given in 2digits, and **4** is code of Anemometer.

41UOG: This group represents Country code in 2digits + Station code in 2/3digits. As **41** is the country code for Pakistan, and **UOG** is timely used code, up to now for UOG Meteorological Observatory because this newly formed set up of weather station still has not got any code.

21697: Rain type + Specific phenomena + Height of lowest clouds from surface (h) + Visibility (V V) in 2digits. This is Rain Reporting group. Where **2** is for reporting Rain type I (type one), that is Rain of last 3hours. **1** is from 1 / 2, that is Special phenomena exists / No special phenomena exist, while **6** is code for height above surface of the base of the lowest clouds seen from surface. **97** is Visibility (V V) code in 2digits form that ranges from 00 to 96,97,98,99.

63112: This is NDDFF group, for No. of Octas (N) + Wind Direction (DD) +Wind Speed (FF), in 1+ 2+ 2 # of digits form respectively.Where for **N** (no. of Octas)/ total number of clouds is represented as 0-8, no visibility of sky by 9, and for no observation “/” is used. For **DD** (Wind Direction) 2digits code to represent direction.

Table3.8: Wind Direction codes which are common and mostly observed

Wind Direction	Code digits	Wind Direction	Code digits
NE	05	SW	23
E	09	W	27
SE	13	NW	31
S	18	N	36

Source88: Surface Weather Code, 1995. Accessed at 29-05-2013.

And for **FF** (Wind speed), reading taken by Anemometer, after calculation is taken in 2digit.

10200: This is dry temperature code + station specific temp.'s code + dry thermometer's reading in 1+1+3digits form respectively. Where **1** is code for dry temperature remains constant, **0** is from 0 / 1 that is a code representation, specific to area's temperature as for +ive reading of dry thermometer / -ive reading of dry thermometer, and **200** is actual reading of dry thermometer in 3digits form.

20109: This is Dew Point code (1digit) + station specific D.P's code (1digit) + Dew Point reading (3digits) from Hydrometric Table.

Where **2** is code for Dew Point remains constant, **0** is from 0 /1, code options according

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station specification as for +ive reading of Dew Point / -ive reading of Dew Point, while **109**: is for actual Dew Point reading.

3////: This group is for Barometer's reading. **3** is code digit, and **////** (4obliges) for no observation.

4////: This group is also for Barometer's reading. **4** is code digit, while **////** (4obliges) are for no observation.

72992: This is, 7 W W W₁W₂, group, where **7** is code to represent Specific phenomena exists, then Present Weather condition (**WW**), for which codes are from 00-99 that is 2digit codes, more experienced examples are:

Table3.9: Codes for present weather W W

Code in 2digits form ranges from 00-99	Present weather (W W)
29	Thunder present
17	Thunder was
97	..... and so on

**Source 9: Surface Weather Code, 1995. Page # 52-55.
Accessed at 29-05-2013**

Then **W₁** is for near past weather, of previous 3hours weather. And the last in this group is **W₂** that represents; far past weather, of previous 6, 12, Or 18hours

Code representation for W₁ & W₂ in more detail is available on page 51 of Surface Weather Code, 1995.Pakistan Meteorological Department, 2008.

83470: This is, 8 Nh CL CM CH, group. Where **8** is code digit, **3** is code for Nh and Nh is number of low clouds in Octas or number of medium clouds in Octas, **4** is code for CL (Lower cloud type), **7** is code for CM (Medium cloud type), and **0** is code for CH (Higher cloud type).

333: This is to show end of section 111 & start of section 333.

20199: This is the group to report Minimum temperature; this reading is taken from the thermometer of Stevenson Screen, which is present on the bottom side of Thermometer square. This group is reported only in the morning or in 0300z reporting.

Here **2** is code for Minimum Thermometer's reading,

0 is code from 0 / 1 that is code for -ive thermometer reading / +ive Thermometer reading, &

199 is the reading of minimum temperature showing thermometer, in 3digits form.

5////: This group is to report Barometer reading. 5 is code digit while **////** (4obliges) are showing no observation.

60007: This group is to show Rain, to represent just for 3hour's Rain, reported in every signup. Here **6** is code digit to show Rain, **000** is the code for amount of Rain, and **7** is code for 3hours Rain.

70052: This group is for reporting daily 24 hours Rain, at 0300z reporting, where **7** is the code digit, and

0+0+5+2 are codes for R24.

RH 56%: This group is reporting Relative Humidity's value in %age, from Hydrometric Table.

Table3.10: Model of Synaptic Reporting at 0600z (25-04-2013)

2	5	0	6	4
4	1	U	O	G
0	2	9	9	7
1	0	9	0	2
1	0	3	1	0
2	0	1	3	8
3	/	/	/	/
4	/	/	/	/
6	0	0	0	1
8	0	3	0	0
	3	3	3	
5	/	/	/	/
6	0	0	0	7
RH 35 %				

Source 10: Data Records of Pocket Register & Signup sheets. Met Observator UOG, PK. Accessed at 03-06-2013.

Description of 0600z Model of Synaptic Reporting:

25064: This group represents Date + Date + Time +Time + Anemometer and it is (2+2+1digits).

41UOG: This group represents Country code + Station Code (2+3digits).

02997: This group represents,

0→for both types of Rain type I: Rain for 3 hours & type II: Rain for 6 / 12 / 18hours

2→for No special phenomenon (when the condition of no special phenomena holds then group 7 W W W1 W2 is not reported).

9→code used for height of lowest clouds, and **97**→2 digits code for visibility (V V).

10902: This group represents:

1→ total number of Octas,

09→ Wind Direction code,

02→ Wind Speed.

10310: This group represents:

1→code for dry temperature,

0→code for +ive temperature reading, and

310→ Reading of dry thermometer.

20138: This group represents:

2→code for Dew point,

0→code for +ive reading of Dew Point, and

138→reading of Dew Point

3//// & 4////: These groups are for reporting Barometer reading.

60001: This group represents: **6000**→code and **1**→code for Rain of 6hours.

333: section 333 starts.

5////: This group is to report Barometer reading.

60007: This group is reported just for 3hours Rain.

RH 35%: Relative Humidity is 35 %.

Table3.11: Model of Sign up for 0900z (25-04-2013)

2	5	0	9	4
4	1	U	O	G
2	2	9	9	7
4	2	3	0	2
1	0	3	3	5
2	0	1	2	9
4	/	/	/	/
8	0	0	7	0
3		3		3
5	/	/	/	/
6	0	0	0	7
RH 29 %				

Source11: Data Records of Pocket Register & signup sheets. UOG, PK. Accessed at 4-6-2013.

Description of 0900z sign up Model:

25094: represents date+ date + time + time + Anemometer code.

41UOG: Country code + Station code

22997: Type I Rain (for 3 hours Rain) + No special phenomenon + code for cloud height+ vv.

42302: Total no. of Octas+ Wind Direction code + Wind speed.

10335: dry temp. Code+ code for +ive reading of dry temperature + dry thermometer's Reading

20129: Dew Point code+ code for +ive reading of D.P + reading of Dew Point in 3digits.

4////: Barometer's reporting group.

80070: 8→is code, 0→Nh (number of lowest clouds), 0→low cloud type CL, 7→medium cloud type's code (CM), 0→is code for High cloud type CH.

333: section 333 starts, **5////:** Barometer's reading is reported in this group.

60007: 3hours Rain reporting group in every sign up.

RH 29%: Relative Humidity is 29 in %age.

Table9.12: Model of sign up for 1200z (12-04-2013)

1	2	1	2	4
4	1	U	O	G
0	2	9	9	7
0	2	3	0	2
1	0	3	2	5
2	0	1	0	0
3	/	/	/	/
4	/	/	/	/
6	0	0	0	2
3		3		3
1	0	3	4	0
5	/	/	/	/
6	0	0	0	7
RH 27 %				

Source12: Data record of Meteorological Observatory UOG, PK. Accessed at 5-6-2013.

Description of 1200z sign up reporting:

12124: Date 12, and then time 1200z so it is also 12, and Anemometer code 4.
41UOG: Pakistan country code used for Meteorological Observation, & UOG Meteorological Observatory's code (for the time being it is UOG).

02997: code **0** to show both types I & II of Rain, Type I (3 hours Rain represented with code 1), and Type II (6/12/18hours Rain represented with code 2),

2 code to show no special phenomena,

9 code for height of lowest clouds,

97 code of visibility.

02302: code **0** for Total number of clouds, code **23** is for Wind Direction, **02** Wind speed.

10325: Code **1** for dry temperature, **0** is code for positive dry temperature (1 for negative dry temperature), **325** is temperature reading for dry thermometer in 3digits form.

20100: Code **2** for Dew Point, **0**code for positive D.P reading (here appears 1code for negative D.P reading), **&100** is Dew Point reading (3digit).

3//// & 4////: both the groups are for reporting Barometer readings.

60002: is Rain group where **6000** is code for Rain, while **2** is code for 12 hours Rain.

333: section 111 ends while 333 starts.

10340: Maximum temperature showing thermometer's reading is reported in this group where **1** is code for temperature maximum, **0** is code to show positive reading of maximum temperature showing thermometer, and **340:** is the reading of maximum temperature showing thermometer, in 3 digits form.

5////: is the group for reporting Barometer's reading.

RH 27 %: is the group reporting Relative Humidity's value in %age units.

Class Discussions: & Question Answer sections, often add information along with routine work like: Some symbolic representations and indications and their after effects, related to the Met observation are also a part of our work.

Table3.13: Class Discussions

Symbol / representation	Description of Symbol / Indication
SKC	Sky clear (it could be when visibility not clear i-e 4000Hz, but no clouds on sky)
SE ,SW wind	No clear visibility
NE	Almost clear visibility
W wind	Sand storm / Dust storm
RRR	Amount of rain fallen during the period proceeding time of observation.

000	No precipitation during reference period
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Some important Symbols used in Met Observation's Reporting are also considerable; mostly these are used in record forming of Reporting in Pocket Register.

<p>RAIN</p> <p>☐ ☐ Light</p> <p>☐ ☐ ☐ Moderate</p> <p>☐ ☐ ☐ ☐ Heavy</p> <p>☐ ▽ Light Shower</p> <p>☐ ▽ Moderate Shower</p> <p>⚡ Thunderstorm</p> <p>⚡ Heavy T-storm</p>	<p>SNOW</p> <p>X X Light</p> <p>X X X Moderate</p> <p>X X X X Heavy</p> <p>X ▽ Light Shower</p> <p>X ▽ Moderate Shower</p> <p>OTHER</p> <p>∞ Haze</p> <p>== Fog</p>	<p>DRIZZLE</p> <p>☐ ☐ Light</p> <p>☐ ☐ ☐ Moderate</p> <p>☐ ☐ ☐ ☐ Heavy</p> <p>FREEZING RAIN</p> <p>☐ ~ Light</p> <p>☐ ☐ ~ Moderate</p> <p>↔ Ice Crystals</p>
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Figure3.19: Weather position representing Symbols

Source13: Atmospheric Symbols from Google images

:[http://ww2010.atmos.uiuc.edu/\(Gh\)/wwhlpr/common_wx_symbols.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/wwhlpr/common_wx_symbols.rxml) Accessed at 06-06-2013.

Signup Reporting of a starting day of month are quite different from the sign up Reporting of last days of the same month, as the weather parameters show clear distinction of the weather patterns.

A model Reporting as done by **filling Signup Sheets**, involves Synaptic Reporting in the prescribed place on the sheet along with Metar Reporting on the blank portion, then adding signatures of the reporter / Observer.

Table3.14: Model to show a signup sheet's work (12-04-2013) for 0300z.

1	2	0	3	4	OPUG 13006Kt 9999 TSRA Few 035 CB Sct 040 BKN 100 27 / 15 Q /// RH 49 % Observer: XYZ
4	1	U	O	G	
2	1	6	9	9	
6	1	3	0	6	
1	0	2	7	0	
2	0	1	5	0	
3	/	/	/	/	
4	/	/	/	/	
7	1	7	9	2	
8	2	9	7	0	
	3	3	3		
2	0	2	2	0	
5	/	/	/	/	
6	0	0	0	7	
7	0	0	0	0	
	RH	49 %			

Source14: Meteorological Observatory UOG's manual Reporting record, Accessed at 10-6-2013.

At UOG Meteorological Observatory 0300z to 1200z Reporting is done to see all these signup reporting of one day consulting its record from Pocket Register and Signup sheets, there is a chance to compare the difference among 0300z, 0600z, 0900z, and

1200z for the same day. And the sign up reporting of one day of a month to the sign up reporting after 2 days in the same month, representing how wide range of changes occur in everyday's weather.

Table3.15: Models of Synaptic sheets for 0300z, 0600z, 0900z and 1200z (21-04-2013) showing weather observation reported from UOG Meteorological Observatory.

2	1	0	3	4	OPUG 13006Kt 9999 BKN040 24 / 15 Q /// RH 60%	2	1	0	6	4	OPUG 05012Kt 9999 Sct 100 30 / 12 Q /// RH 33%
4	1	U	O	G		4	1	U	O	G	
2	2	6	9	7		0	2	9	9	7	
5	1	3	0	6		4	0	5	1	2	
1	0	2	3	5		1	0	2	9	5	
2	0	1	5	2		2	0	1	1	5	
3	/	/	/	/		3	/	/	/	/	
4	/	/	/	/		4	/	/	/	/	
8	5	4	0	0		8	0	0	7	0	
3		3		3		3		3		3	
2	0	2	3	6	5	/	/	/	/		
5	/	/	/	/	6	0	0	0	7		
6	0	0	0	7	RH		33	%			
7	0	0	0	0	By : xyz						
RH		60		%							

2	1	0	9	4	OPUG 05012Kt 9999 Sct 100 30 / 12 Q /// RH 33%	2	1	1	2	4	OPUG 09008Kt 9999 Few100 31 / 8 Q /// RH 24%
4	1	U	O	G		4	1	U	O	G	
2	2	6	9	7		0	2	9	9	7	
4	0	9	1	2		2	0	9	0	8	
1	0	2	9	5		1	0	3	0	5	
2	0	1	1	5		2	0	7	9	0	
4	/	/	/	/		3	/	/	/	/	
8	0	0	7	0		4	/	/	/	/	
3		3		3		6	0	0	0	2	
3		3		3		8	0	0	3	0	
5	/	/	/	/	3		3		3		
6	0	0	0	7	1	0	2	9	5		
RH		33		%	5	/	/	/	/		
By: xyz					6	0	0	0	7		
					RH		24	%			
					BY: xyz						

Source 15: Meteorological Observatory UOG 'S Data collection. Accessed at 10-06-2013.

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Table3.16: Comparison Models of Sign up 0300z, 0600z, 0900z, &1200z (24-4-2013)

2	4	0	3	4	OPUG 05004Kt 4000Fu Sct 100 22 / 17 Q /// RH74% By :xyz	2	4	0	6	4	OPUG 00000Kt4 000Fu SKC 33 /14 Q /// RH 32% By: xyz	2	4	0	9	4	OPUG 31004Kt 9999 Few 040 35 / 13 Q /// RH26% By:xyz
4	1	U	O	G		4	1	U	O	G		4	1	U	O	G	
2	1	9	9	6		0	1	9	9	6		2	2	6	9	7	
3	0	5	0	4		0	0	0	0	0		2	3	1	0	4	
1	0	2	2	0		1	0	3	2	5		1	0	3	5	0	
2	0	1	7	2		2	0	1	3	7		2	0	1	2	9	
3	/	/	/	/		3	/	/	/	/		4	/	/	/	/	
4	/	/	/	/		4	/	/	/	/		8	2	4	0	0	
7	3	4	0	0		6	0	0	0	1		3	3	3			
8	0	0	3	0		7	0	5	0	0		5	/	/	/	/	
3	3	3				3	3	3				6	0	0	0	7	
2	0	1	6	5		5	/	/	/	/		RH 26%					
5	/	/	/	/		6	0	0	0	7							
6	0	0	0	7		RH 74%											
7	0	0	0	0													
RH 74 %																	

2	4	1	2	4	OPUG 27004Kt 9999 Few 040 Sct 100 36 / 13 Q /// RH 28% By: xyz
4	1	U	O	G	
0	2	6	9	7	
5	2	7	0	4	
1	0	3	4	5	
2	0	1	3	3	
3	/	/	/	/	
4	/	/	/	/	
6	0	0	0	0	
8	2	4	3	0	
3	3	3			
1	0	3	6	6	
5	/	/	/	/	
6	0	0	0	7	
RH 28 %					

Source 16: Record of Meteorological Observatory UOG's data, Accessed at 11-6-2013

3.4: Message Sending

Metar and Synaptic Reporting is manual recording of weather data, and this record is limited to the station. In order to convey this Meteorological Observation data, of Metar and Synaptic form, Reporting is conveyed to the Headquarter through cell phone message.

If internet facility is available then this Reporting is uploaded on the website to make it available on the internet, directly but if this is not the part of our job then the message send from the cell phone to the headquarter is the only source of distributing weather observation and reporting.

The sign up messages send from Meteorological Observatory UOG to Lahore Headquarter, from where it is uploaded to their official website, that can be then seen and utilize at anywhere regarding internet's availability.

The sign up Message which have to send, is in this form

23034, 41UOG, 21996, 30504, 10220, 20172, 3////, 4////, 70400, 80030, 333, 20165, 5////, 60007, 70000, RH 74%

OPUG, 05004Kt, 4000Fu, Sct100, 22 / 17, Q////, RH 74%

This message is just ready to press send.

When one sign up reporting is manually completed it is send to the Headquarter, the Regional Met Office Lahore. At Meteorological Observatory UOG sign up is made for 0300z, 0600z, 0900z and 1200z. So accordingly the message is prepared for sending and is conveyed.

This conveying of sign up message is the way to get entrance in the main stream to become a valuable part of Weather Observation carried out within the country and in the entire world.

CHAPTER FOUR

4.0-RECOMMENDATIONS

Surface Weather Observation is a main pillar for the worldwide weather observation, which works for all the basic demands to be fulfilled for which weather observation is officially carried out, like: Defense purposes, update establishment, forecast mechanism & disaster management etc.

Surface weather observation is mostly carried out by manual work involving outdoor instrument working and indoor recording of data captured. Weather observation can also be done by automated weather observation systems.

Considering the importance of surface weather observation, any local level station cannot be ignored. As local stations are reporting to the Regional headquarters, from where this Met reporting is conveyed to the internet via their official website. In this way it can circulate the whole world.

So for Meteorological Observatory UOG is also an important addition in this channel of weather observations, and it can be expanded as for demand of its work is much more irrespective of any other area's weather observation. Because its geographical location is in a sensitive area with respect to weather observation, Gujrat city is located between two rivers Chenab & Jhelum, of Punjab Pakistan. So weather concerning phenomenon can be helped by the observations of this local level station.

As already many professional weather observation steps are in work at UOG Met Observatory. But there are also few things that can be done for making this official work more successful. For making the Met observation more authentic and meeting the demands of interested students who want to learn this interesting and valuable task, and making it possible that this work can continue. Also this Observatory can be expanded to

meet the weather observation needs along with training of upcoming courageous students by making its performance worthy.

This observatory is a source of local weather data collection that can be promoted to give local weather updates, and forecasts, to be beneficial within university premises, &city etc.

4.1- A separate Met Office

The present working of this station is still on initial bases, like: availability of a professional room as office for indoor works, is insufficient to meet the demands of interested students, who ever feels a need for a separate room where they can consume their time for met observation work understanding, and general meteorological discussions with experienced official observers to gain the knowledge of practical application of these observations.

4.2- More Official Observers

Meteorological Observatory UOG is working with just one official observer, Sir Abdul Ghani, although he is so much experienced but he alone cannot meet exceeding duties of observatory. More official observers should be appointed.

One observer alone has to face all the responsibilities, that is difficult to handle for long ago. The chairman of Geo Sciences and Geography Department, an experienced person regarding met observation, is himself sharing these responsibilities but still there is a need for at least one or more fulltime observers.

4.3- Outdoor instrument's security

Outdoor Installed Instruments are not fully secured there is always a feeling of danger from nearby road's traffic load. As there is an ongoing construction work in this part of University so heavy traffic is continuously passing, that can result any unwanted situation like: equipment loss etc.

There is still not a complete precautionary step to avoid the instruments from animal exposure, as Evaporation tank can be used by cats and dogs for water drinking place

when there is a less hustle and bustle in the surroundings, especially on weekends, long weekends, or vacations.

Along with making better and secure outdoor installation of instruments so these can bear, for their normal working the extreme changes of weather conditions, there is a need felt for such instruments which are still unavailable the most important of which is Barometer.

4.4- Barometer

As Met Observatory UOG, is still in its primary stage of working so there is also a space for dealing with these primary needs of instruments, like; Barometer.

Barometer works for giving the understanding of rise and fall of atmospheric pressure. With reference of mercury Barometer's dial shows pressure in inches.



Figure3.2: Barometer

Source 17: <http://www.sciencecompany.com/How-a-Barometer-Works-W135.aspx>

Adjust the Screw, when facing the dial its indicator shows clockwise rotation. Use the center knob to set the barometer, at a time in a certain location. Barometer can show about pressure is it falling, rising or is constant.

Mercury Barometer is most commonly used in Meteorological Observation in Pakistan.

CHAPTER FIVE

5.0-RESULTS

Meteorological Observation at UOG is a great opportunity. Before this weather observation was a hidden fact, and was considered a matter of dealing with lot of difficult coding, handling with instruments outdoor, that demands wide range of precautionary measures and with many more this was a tough rout to walk on.

But on entering this was proved otherwise, there are many interesting things to pick rather than difficult. Everyday a new experience of weather conditions is so closely observed even than the weather is changing rapidly. As a rainy day passes a complete cycle of dryness covers and then there is again a rainy day, although it is a common experience but the fact working here is to know how this all happens.

What happens to the winds, clouds, temperature, humidity and dryness that results a complete change of weather pattern.

Weather observation's official work involves instruments handling which is not to difficult, and tools as documents for consulting and collecting weather data observed. These mainly include, like; code books, Hydrometric Table, Pocket Register and sign up sheets all are easy to handle and tackle if stepwise learning occurs in discussion form, because it is not the matter of one day to become a Meteorologist. It demands time to observe and understand certain phenomenon carried out there like: clouds are present at which height to know their type to use relevant code for filling Pocket Register and Reporting sign up.

At the end learning is as form of experience. How better the observation works from the starting day to the middle, and at the end. There is definitely a big difference not only in observation but also now this observation is with understanding that tells how some phenomenon could happen, what can be resulted from such readings of parameters and what its effect could be, better or otherwise, all this lead to weather updating, forecasting, hazard alert, and disaster prediction regarding weather alterations.

This work not only helps us to know the way of weather observation that is how it could be done but also it is a research work so it possess a much more worth than an ordinary course learning, it involves experimental work along with manual data collection that is not only developing an understanding rather it is skill creating, experience gaining and concentration improving work.

This data collection, interpretation, concluding inferences and eventually writing report has developed the knowledge of dealing with research work tasks. Interest of experimental work has been improved that makes it easy to move from theoretical to practical word.

Through this report, our addition to the starting of weather observation at UOG opens, a room for others to approach this practical task to get skill, training, and experience in the valuable Meteorological working.

Being **Environmentalists**, this Meteorological research is acknowledged, the relationship between these two fields of science that together and alone deals with climate change. The most famous and concerned subject to talk now-a-days. Also met information helps improving Hydrological data, so dealing with water scarcity, water reuse management, and water preservation. Air where all pollutants are diluted and dispersed is an important meteorological parameter. Weather patterns like; temperature, pressure, precipitation level, wind's directions & speed decide some where's flora and fauna, food webs, crop yields, and even ecosystem.

The various fields of life, dealing with environmental indicators, are also directly dependent on meteorological information. Like; Agriculture, Trading, Hydrodynamics, Sports, Acid Rain, and Glacier melting etc.

Declarations

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Conflicts of interest/Competing interests 'Not applicable'

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Consent for publication 'Not applicable'

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6.1-INDEX

No. in list	Names, places and topics along with the numbers of pages in Report.	Explanations
6.1.1	Alto cumulus Page no. 21 of Report	Alto cumulus is small mid-level layers or patches of clouds, also referred as, "cloudlets". These clouds are usually composed of droplets, but may also contain ice crystals.
6.1.2	Altostratus Page no.21 of Report	Altostratus is large mid-level thin grey clouds, usually composed of mixture of water droplets and crystals, thin clouds, Sun can weekly be seen through clouds.
6.1.3	Barometer mentioned on page no. 29, & 56. Of Report.	Barometer an air pressure measuring instrument, most commonly used weather barometer is a mercury barometer, in which a mercury filled column is inverted in mercury filled dish, mercury level in column moves up and down giving pressure reading.
6.1.4	Cirrocumulus page no.21 of Report	Cirrocumulus's are lot of small white, regularly spaced clouds, composed almost entirely from ice crystals, often arranged as ripples in the sky.
6.1.5	Cirrostratus Page no.21 of Report	Cirrostratus transparent high clouds, covering large areas of sky, forming thin arcs around moon.
6.1.6	Cirrus Page no.21 of Report	Cirrus, short, hair like clouds found at high altitudes. More white than other clouds in day, taking Sunrise or Sunset colors during rising & setting of Sun.
6.1.7	Clouds mentioned on page no.17, 21, 22, and others.	Clouds either composed of ice or water droplets, depending upon height of clouds and the temperature of atmosphere. At temperature -30°C small size droplets, remain as liquid, at extreme height become ice crystals.

6.1.8	Cumulonimbus Page no.21 of Report	Cumulonimbus heavy and dense low level cloud, high in the sky extending in towers, plumes or mountain shape peaks, with flat very dark base, commonly saying as, "Thunderclouds". These can be only a few hundred feet high from ground surface.
6.1.9	Cumulus Page no.21 of Report	Cumulus, low-level clumps or patches of cloud , bright white to dark grey in color appearance.
6.1.10	Dew Point, (D.P) Page no. 17, & 27 of Report.	The temperature and pressure are so that air must cool, and water vapors reach to saturation, that dew begins to form.
6.1.11	Meteorology Page 4, 5 of Report	Meteorology is the branch of science that deals with the study of processes and phenomena of the atmosphere, especially as a means of forecasting the weather.
6.1.12	Meteorological_ __Observation Page no.4 of Report	Recognizing and noticing the varying conditions of diff. weather parameters or Meteorological Elements, by using instruments or from general observation.
6.1.13	Met Office Page no. 4 & others of Report.	Met Office is Meteorological Office / Met station or it is a Weather Observatory. Where Weather parameters are measured, noticed, and recorded that can lead to update, and forecast weather.
6.1.14	Nimbostratus Page no. 21 of Report	Nimbostratus dark grey or bluish grey featureless layers of clouds, those are thick enough to block sun, and cover most of sky. The middle-level clouds that can result continuous heavy rain or snow.
6.1.15	Pressure Page no. 29 & 56.	The force exerted per unit area /surface by an object, that could be solid, liquid, or even gas or mixture of gases, like that of air.
6.1.16	PMD Page no. 9 & 11.	PMD, Pakistan Meteorological Department, working for weather update, monsoon alerts, and weather forecast.
6.1.17	Relative Humidity Page no. 17 &	Relative Humidity is the moisture available in the surrounding of an object for consumption need.
6.1.18	WMO Page no12 of Report.	WMO, World Meteorological Organization, which is working now under UN, United Nations.

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