

**Ministry of Energy and Mines
Department of Energy
ERTC**

**Wind and Solar Monitoring Network
Summary Report**

By

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1. Introduction, Motivation and Background

After independence, 1991, the most challenging task for the Eritrean people has been the reconstruction of a war torn drought ravaged economy. Especially the lack of energy has been one of the main barriers for the further development of the Eritrean economy and at the same time for people's overall living standard.

Sustainable energy provides a basis for vision and sense of direction for the future in the energy sector. At the heart of sustainable energy is energy security for the majority of the population. Energy security implies having access by the population to an affordable, suitable, and reliable supply of energy at anytime. Affordability ensures that the poor, who need energy most, are not excluded from the supply and issues of energy equity are addressed in the formulation of energy policies. Suitability ensures that the energy supply system does not damage the integrity of the ecosystem. It also implies that the form of energy is appropriate for various end-uses and convenient to use.

Currently almost all electricity in Eritrea is provided *via* fuel oil and diesel generation, which imposes costs both to the country in fuel oil and to the global environment in carbon emissions. The present trend of increasing oil costs, along with Eritrea's growing demand for electricity mean that Eritrea's energy burden will continue to grow unless it can find economically sound and sustainable energy solutions. Noticing these problems, the ministry of Energy and Mines has been working in reducing these burdens. One of these efforts is to study Eritrea's potential of Renewable Energies.

This report provides a summary of the meteorological data collected from the Department of Energy's Wind and Solar Monitoring Network. In this chapter, the history of wind and solar assessment in Eritrea, the need of this report, and the previous reports related to wind and solar potential in Eritrea are presented.

1.1 History/Background

Thorough assessment of wind and solar potential was started in 1999 by launching 25 stations across the country. This initiative came true due to the project launched by the collaboration of Ministry of Energy and Mines and SWECO International in late 1998. The project was a step in expanding the technical and human capabilities in order to facilitate renewable energy development in Eritrea.

The project included two components with the following main objectives;

- Creation of guidelines and routines for the Wind and Solar Energy Information System, increase technical resources and the experience of human resources to develop and sustain the information system (WSIS).
- Formulation and implementation of a Wind Turbine Pilot Project (WTPP), which in addition to increasing the energy production, should provide transfer of knowledge in wind energy technology and in operation and maintenance of wind turbines.

The over all objective of the WSIS component was to develop the technical infrastructure and human skill necessary for monitoring, analyzing and reporting on wind and solar energy resources of Eritrea on a continuous basis. This has been achieved by the installation of twenty-five (25) Wind and Solar Monitoring Network (WSMN), provision of hardware and software resources, development of a database system and by building up the required competence level of the staff at the Eritrean Research and Training Center (ERTC) to develop, operate and maintain the Wind and Solar Energy Information System. The Department of Energy (DoE) and other energy service institutions in Eritrea have now access to an information base necessary to plan for the development of solar and wind energy projects throughout Eritrea. In particularly,

the information, base is useful for the planning of small scale community projects. It will also be of great value for short and long term planning in Mater Plan studies, where the potential of future use of solar and wind energy should be considered.

This Wind and Solar Monitoring Network (WSMN) is maintained and operated by the Energy Research and Training Center (ERTC) of the Department of Energy of the Ministry of Energy and Mines. The ERTC is responsible for renewable energy technology in Eritrea and is active in studying assessing and developing renewable energy resources in Eritrea while promoting the efficient use of all energy sources.

1.2 Purpose/Objective

The objective of this summary report is to provide a quick reference for meteorological data from the Wind and Solar Monitoring Network. As part of the project, the data collected from WSMN should be analyzed and reported periodically to the department of Energy. Periodically, the monthly mean of wind speeds have being reported for every year to the Department of Energy. But these reports haven't been convenient for use because they were not well organized. Beside that they only gave the monthly mean of the wind speeds only. This report is meant to display summary statistics which were calculated for each month and for the year. Specifically the statistics that were calculated are:

- *Wind Speed:* Average amplitude, 10-minute standard deviation, and direction
- *Air Temperature:* Average daily minimum and maximum, and average temperature.
- *Solar Irradiance:* Average Daily diffuse and global.
- *Relative Humidity:* Average daily minimum and maximum, and average humidity.
- *Atmospheric Pressure:* Average daily minimum and maximum, and average atmospheric pressure.
- *Rainfall:* total rainfall for the period.

1.3 Previous Reports

Meteorological report based on the network was published with in the “*FINAL PROJECT REPORT*” reported by SWECO International to the Ministry of Energy and Mines in July 2002. This report shows the wind speed and direction frequency diagrams, mean temperature and wind speed diagrams ,wind energy contour maps, maps of monthly mean daily global Irradiance, and tables on meteorological and solar Irradiance parameters for the data collected up to December 2001 .Summary report about the monthly mean wind speed based from the data of 2000 was also included in “*Renewable Energy Development in Eritrea: Challenges and Opportunities*” by Dr Semere Habtetsion. This paper was published in *AFREPREN Occasional Paper* in 2002. Beside those, many interested people have used the data for doing different research for their respective organizations. In addition; internal reports of monthly average wind speed have been produced for use within the Ministry.

2. Methods

The Wind and Solar Monitoring Network (WSMN) has 25 meteorological stations located in different parts of Eritrea. Depending on the type of equipment attached on them and their height they are classified into three groups. In this chapter, the types of stations and their locations, equipment and procedures used, data format and meteorological variables, and data analysis method are detailed.

2.1 Station Location and Elevation

Eritrea consists of two distinct lowland areas dissected by a central range of mountains. The eastern lowlands are relatively flat desert areas bordering the Red Sea where elevations range from 100 m below sea level to 500 m above sea level. There also exists along the southeast coast a separate range of mountains that

vary in elevation between 1000 and 2000 m. The western lowlands consist of desert, hills, and savanna approximately 500–1500 m in elevation. The central highlands consist of mountains and plateaus that run northwest–southeast. The highlands range from 1500 to 3000 m in elevation and are incised by canyons and valleys that may be as low as 1000 m. Putting this topology into account, the meteorological stations were put in various parts of Eritrea so as to cover the different topologies of the country. Nine stations are located in the eastern and south eastern part of Eritrea. Another 12 stations are located in the highlands of the country while 4 stations are placed in the western lowlands. The location, altitude and distance from sea of the meteorological stations are given in the table below.

	NAME	LAT	LONG	ALTITUDE(m)	SEADIST(m)
Eastern and South Eastern Lowland Stations					
1	Massawa	15° 39.30' N	39° 28.35' E	5	1
2	Ingel	15° 28.15' N	39° 51.86' E	60	1
3	Dahlak	15° 44.70' N	39° 59.55' E	3	1
4	Bada	14° 33.25' N	40° 7.92' E	-90	27
5	Tio	14° 40.75' N	40° 57.70' E	0	1
6	Idi	13° 55.78' N	41° 41.27' E	10	1
7	Assab Airport	13° 1.60' N	42° 38.94' E	20	1
8	Gahro	12° 47.47' N	43° 4.24' E	30	1
9	Hashmet	17° 44.15' N	38° 44.14' E	10	1
Central Highland Stations					
1	Asmara ERTC	15° 21.48' N	38° 53.46' E	2230	65
2	Asmara Airport	15° 17.52' N	38° 54.23' E	2325	65
3	Embatkala	15° 23.83' N	39° 4.37' E	1361	42
4	Decemhare	15° 4.82' N	39° 3.12' E	1030	63
5	Hadish Adi	15° 1.19' N	39° 19.18' E	2700	37
6	Kohaito	14° 53.97' N	39° 24.58' E	2600	37
7	Maileham	14° 41.86' N	38° 43.42' E	1980	112
8	Areza	14° 54.79' N	38° 33.83' E	2029	122
9	Debresina	15° 45.28' N	38° 42.29' E	2210	63
10	Gizgza	16° 0.24' N	38° 30.71' E	1180	77
11	Nakfa	16° 39.00' N	38° 24.00' E	2690	64
12	Adobha	17° 7.42' N	38° 14.03' E	1870	73
Western Lowland Stations					
1	Keren	15° 46.64' N	38° 28.27' E	1400	86
2	Agordet	15° 33.12' N	37° 52.55' E	633	155
3	Kerkebet	16° 3.53' N	37° 25.89' E	450	187
4	Aligedir	15° 7.32' N	36° 34.73' E	758	297

2.2 Equipment and Procedures

The meteorological stations in the WSMN are categorized into three groups depending on their height and the types of equipment attached on them. These groups are solar stations, Wind stations, and Wind recorders. The types of meteorological equipment attached on each group are given below:-

2.2.1 Solar Stations (SS – stations)

These stations are 10m high above the ground. There are five of them in the network .They have the following meteorological equipment attached on every one of them.

- 1Pyranometer Skye SK1110. (for measuring global Irradiance)
- 2 Pyranometer Kipp & Zonen CM 11 (for measuring diffused and global Irradiances)
- Wind sensor RM Young 05103
- Temperature/Relative Humidity Sensor Vaisala 50Y
- Barometric Sensor Vaisala PTB220
- and Rain gauge ARG100

2.2.2 Wind Stations (WS – stations)

These are 30 meter high above the ground. There are five stations of this type in the network. The meteorological equipment on each of these stations is:-

- 2 Wind sensor RM Young 05103
- 1 Pyranometer Skye SK1110.
- Temperature/Relative Humidity Sensor Vaisala 50Y
- Barometer
- and Rain gauge ARG100

2.2.3 Wind Recording Stations (WR – Stations)

The rest 15 stations in the network are of wind recording stations type. The wind recording stations are stations with a tower 10 meters high and one wind sensor (RM Young 05103) mounted on top.

2.2.4. Data Storage

Every data sensed from all instruments on the three types of stations is stored in a Data logger. Data logger is a fully programmable controller with non-volatile memory and battery backed clock in a small, rugged module. Data acquisition and processing functions are controlled by user -entered instructions contained in program tables. So based on the instruction given by the user, data is collected in the data logger on the frequency given in the instruction.

There are two types of data loggers used in the Wind and Solar Monitoring Network. These are:

- Data logger Campbell Scientific CR10X-IM
- and Data logger Campbell Scientific CR510

The first type is used in the solar stations and Wind stations while the second one is used by the wind recording stations. The storing capacity of both types depends on the instruction given to them. When CR10X are used in the wind station, they can store data of 150 days. But when they are used in the solar station they can store data of 165 days. In general, if they are programmed to load many meteorological variables, the number of days they can store will decrease and vice versa. The CR510 data loggers load data of 89 days when it is used in the WSMN.

When the storage capacity of data logger is full, the data logger starts deleting the oldest character and loads the latest read character. So to avoid deleting of data, data should be copied from data loggers into some other device according to the storage capacity mentioned above.

2.3 Data Format and Meteorological Variables

The three types of stations, mentioned above, measure their meteorological variables in different format. The type of meteorological variables, the frequency they are taken and the formats for the three groups of stations are given below:

The Solar Stations are designated by SSx, where x = 1 - 5 (the stations of this type have ID which goes from 1 to 5) .The data collected from these stations have the following format:

Every 10 minute the following meteorological variables:

10x, Year, Day, HourMinute, WindSpeed(WS), WindDirection(WD), StdWD, StdWS, MaxWS

While every Hour:

x, Year, Day, HourMinute, Temp, RH, Rain, Pressure, Skye_glob, Skye_Std, Skye_max, CM11_shaded, Shaded_Std, Shaded_max, CM11_unshaded, Unshaded_std, Unshaded_max, CM21_calib, Batt_volt, T_inter, Unshaded_1 - Unshaded_60 (60 minute values)

Where the full description of the abbreviations of meteorological variables taken every hour are given in the following table:

Abbreviation	Full Description	unit
x	Station ID	
year		
Day		
HourMinute	Time measurement taken(HHMM)	
Temp	Air temperature	degree celcius (⁰ c)
RH	Air Relative Humidity	%
Rain	Rain fall	Mm
Pressure	Barometric pressure	hPa (hecto Pascal)
Skye_glob	Direct Irradiance	W/m ²
Skye_Std	Standard Deviation of Direct Irradiance	
Skye_max	Maximum of Direct Irradiance	W/m ²
CM11_shaded	Diffused Irradiance	W/m ²
Shaded_Std	Standard Deviation of Diffused Irradiance	
Shaded_max	Maximum of Diffused Irradiance	W/m ²
CM11_Unshaded	Global Irradiance	W/m ²
Unshaded_Std	Standard Deviation Global Irradiance	
Unshaded_max	Maximum of Global Irradiance	W/m ²
CM21_calib		
Batt_volt	Battery Voltage	Volt
T_inter	Internal Temperature	degree celcius (⁰ c)
Unshaded_1- Unshaded_60(60 minute values	Global Irradiance of every minute in each hour.	W/m ²

The Wind Stations designated by WS_x, x = 1 – 5 have the following data format:

Data is collected by data loggers every 10 minutes. The data collected have the following format:

(x+5), Year, Day, HourMinute, Speed_10m, WDirection_10m, StdWD_10m, WSpeed_30m, WDirection_30m, StdWD_30m, StdWS_10m, StdWS_30m, MaxWS_10m, MaxWS_30m, Temp, RH, Pressure, Rain, Skye, Skye_Std, Skye_max, Batt_volt, T_inter

Where the abbreviation of these variables are detailed in the table below:

Quantity	Full description	Unit
ID		
Year		
Day		
HourMinute	Time measurement taken(HHMM)	
WSpeed_10m	Wind Speed at 10m height integrated full 10 minute interval.	m/s
WDirection_10m	Wind Direction at 10m integrated full 10 minute interval.	Degrees
StdWD_10m	Standard Deviation of WD integrated full 10 minute interval.	
WSpeed_30m	Wind Speed at 30m integrated full 10 minute interval.	m/s
WDirection_30m	Wind Direction at 30m integrated full 10 minute interval.	Degrees
StdWD_30m	Standard Deviation of WD integrated full 10 minute interval.	
StdWS_10m	Standard Speed of WS at 10m calculated on all values during 10 min.	
StdWS_30m	Standard Speed of WS at 30m calculated on all values during 10 min.	
MaxWS_10m	Maximum WS at 10m max. 10 sec value.	m/s
MaxWS_30m	Maximum WS at 30m max. 10 sec value.	m/s
Temp	Air temperature integrated 60 sec before 10 minute.	degree celcius (°c)
RH	Air Relative Humidity integrated 60 sec before 10 minute.	%
Pressure	Barometric Pressure integrated 1 sec before 10 minute.	hPa (hecto Pascal)
Rain	Totalized every 10 minutes	Mm
Skye	Global Irradiance integrated 10 minute.	W/m ²
Skye_Std	Standard deviation of Skye calculated all value during full 10 min.	
Skye_max	Max. Global Irradiance max. momentarily value during 10 min.	W/m ²
Batt_volt	Battery Voltage	Volt
T_inter	internal temperature	degree celcius(°c)

Wind Recording stations designated by ID type “WRyy”, where yy means 11 - 25 and they have the following data format:

Every hour: yy, WSpeed, WDirection, StdWS, MaxWS, Year, Year, Day, HourMinute, Batt_volt

Every 10 min: yy, WSpeed, WDirection, StdWS

2.4 Data Analysis

The Six meteorological variables are considered in preparing these summary statistics. The summary statistics were calculated for each month and for the year. Specifically the statistics that were calculated are:

- *Wind Speed*: Average amplitude, and direction
- *Air Temperature*: Average daily minimum and maximum, and average temperature.
- *Solar Irradiance*: Average daily diffuse and global.
- *Relative Humidity*: Average daily minimum and maximum, and average humidity.
- *Atmospheric Pressure*: Average daily minimum and maximum, and average atmospheric pressure.
- *Rainfall*: total rainfall for the period.

For calculating the above summary statistics, software called “PC208W 3.0” (developed by Campbell Scientific) was used.

3. Results

The summary statistic presented here are results found from the data collected over the past 6 years. Unfortunately, the availability of data is not the same for all of the stations in the network. While some stations have all of the data that was expected to be collected (with few gaps), others have data as few as 30% of the expected data. There are three reasons for this.

1. Closing of stations because of collecting enough data or some other technical problems.
2. In ability of reaching the station due to lack of transporting facility.
3. Finishing of replacement equipment at store.

Beside of the above mention reasons that caused permanent termination of data collections, there are some other reasons which cause loss of data for short period of times. These short period of time gaps are represented by “N/A” (for not available) in the following table. The reasons for the gaps can be summarized in the following statements:-

- Deleting of data from data logger due to the failure of collecting data on time from the meteorological stations.
- Breaking or malfunctioning of measuring or sensing equipment.
- Failing of data logger or corrupting of its program.

3.1 Wind Speeds and Direction

Wind is the result of thermal heating of the earth by the sun, and has global patterns of a semi-continuous nature. It is significantly affected by topography and weather, with seasonal, daily, and hourly variations. Much of the wind resource is located along coastlines (including offshore) and in mountain regions, but significant resources are also found on plains. The results found from the wind and solar monitoring network prove this global fact.

Areas are often described by their "wind class" ranking, rather than their range of Wind Power Densities (WPD) or mean wind speeds. Below is a table that shows ranges of mean wind speed for each class, at 10 meters height above ground (a typical wind speed measurement height and small turbine height). Note that it also gives the ranges of WPD and associated with classes.

Mean Speed Range(m/s)	Wind Power Density(W/m ²)	Wind Power Class
<4.4	<100	1
4.4 - 5.1	100 - 150	2
5.1 - 5.6	150 - 200	3
5.6 - 6.0	200 - 250	4
6.0 - 6.4	250 - 300	5
6.4 - 7.0	300 - 400	6
>7.0	>400	7

All of the stations in the network have wind sensing equipment. The wind sensors on the solar stations and wind recording stations are at the height of 10 m above ground level. While wind stations (only 5 stations in the network) have wind sensors at the height of 10m and 30m. The wind speeds are written in normal font color as the directions are displayed in italics font. Finally, the unit for the wind speeds is m/s as the unit of the directions is degrees clockwise.

Eastern and South Eastern Stations

Eritrea occupies the southernmost 1200 km of the western Red Sea shoreline, including hundreds of islands near the major ports of Mitsiwa'e (Massawa) in central Eritrea and Aseb (Assab) in the south. All of the nine stations mentioned in these group are either on the coast of the Red Sea or some how related to the Red Sea. They are well scattered so as to study the potential of wind along the entire Red Sea coast. The stations' results are arranged by starting station in the northern tip of Red sea (Hasmet) and then the station which follow along the Red Sea as you go south.

HASMET

Hasmet is a village located at the northern tip of Eritrea near the coast of the Red Sea. Looking at the table, the winds are stronger between November and March of a year. But even these best winds of a year are not that strong – they usually fall on class 1 or 2. The annual wind means show that Hasmet has poor wind resource. The winds are always northerly except between June and August during which the wind blows from south.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	N/A	5.42	5.71	3.59	3.55	3.25	4.50	4.10	2.48	3.47	4.22	4.52	4.11
	<i>N/A</i>	<i>55.47</i>	<i>57.40</i>	<i>50.62</i>	<i>45.89</i>	<i>200.54</i>	<i>196.92</i>	<i>194.26</i>	<i>26.10</i>	<i>32.96</i>	<i>46.93</i>	<i>50.68</i>	63.56
2001	5.24	5.02	3.80	3.40	3.59	N/A	4.08	3.79	2.77	3.69	4.09	4.48	3.49
	<i>54.23</i>	<i>46.54</i>	<i>45.31</i>	<i>45.77</i>	<i>40.88</i>	<i>N/A</i>	<i>196.25</i>	<i>192.40</i>	<i>43.57</i>	<i>29.47</i>	<i>44.64</i>	<i>47.49</i>	55.64
2002	4.96	4.57	4.47	4.56	4.03	3.44	3.59	3.23	3.00	4.03	4.29	4.25	4.03
	<i>52.35</i>	<i>47.65</i>	<i>48.26</i>	<i>50.16</i>	<i>45.78</i>	<i>200.56</i>	<i>197.36</i>	<i>187.64</i>	<i>47.96</i>	<i>44.17</i>	<i>42.70</i>	<i>49.17</i>	57.93

MASSAWA

Massawa, a coastal city, has the next station after Hasmet as you go south along the Red sea. Massawa has class 1 type of wind speed. There is similar wind speed through out the year. The annual averages of wind directions show that the winds usually blow from the north. This table shows that Massawa has poor wind resource that seems enough only for wind water pumping. Extrapolating the average of annual means (3.69) to 50m height, the wind speed would be 4.85m/s. Even this speed, which falls in class 2 type, doesn't seem encouraging.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	3.68	3.79	4.06	3.97	3.69	3.35	3.78	3.50	3.37	3.68	3.57	3.48	3.66
	346.63	31.38	6.68	12.91	10.06	356.99	94.79	76.55	23.46	10.95	25.55	349.47	19.30
2001	3.63	3.64	3.84	N/A	3.73	3.64	3.60	3.55	3.50	3.83	2.86	3.59	3.58
	346.92	348.22	349.20	N/A	355.17	335.70	41.18	87.92	32.21	78.55	77.79	24.23	26.64
2002	3.77	3.42	4.15	4.15	3.76	3.52	3.24	3.56	3.72	3.72	3.61	3.65	3.69
	332.66	354.60	11.03	359.83	354.71	343.98	40.41	68.41	29.62	62.18	64.01	340.74	7.59
2003	3.52	4.12	4.14	4.07	3.60	3.33	3.63	3.46	3.49	3.73	3.90	3.54	3.71
	347.44	342.14	2.97	8.24	40.59	346.18	345.08	86.21	18.23	63.40	47.42	3.27	17.40
2004	3.54	3.69	3.64	4.09	3.61	3.34	3.28	3.64	3.76	3.65	3.62	3.85	3.64
	343.82	343.34	357.63	23.62	0.99	346.24	44.82	43.80	5.36	63.95	5.18	350.87	6.71
2005	3.68	3.78	4.09	4.23	3.97	3.56	4.02	3.73	2.74	3.80	3.66	N/A	3.84
	335.55	353.38	356.53	23.56	345.85	356.03	15.13	70.26	356.25	57.94	65.58	N/A	10.08

INGEL

Ingel is a village located at the tip of Zulla peninsula. It's close to Massawa only separated by Sea. The highest annual mean wind speed (AMWS) recorded is in 2000 (3.86). All of the results and the trends are similar to Massawa's. It seems logical for these places to have similar results as they have identical geographical profile.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	3.80	3.43	4.65	4.06	4.43	4.26	3.99	3.64	3.47	3.66	3.89	3.13	3.86
	4.84	25.44	355.87	11.80	332.81	321.87	60.88	28.56	353.12	13.78	85.18	41.09	9.51
2001	3.11	3.61	3.72	4.14	4.08	4.19	3.74	3.65	3.39	3.49	3.37	3.93	3.70
	29.94	350.88	344.36	0.33	338.24	321.84	5.39	63.36	358.18	67.15	81.81	77.95	14.09
2002	3.76	2.54	N/A	N/A	4.14	4.48	N/A	3.60	3.71	3.62	3.70	3.54	3.70
	336.17	30.83	N/A	N/A	344.33	335.13	N/A	44.88	13.87	84.87	90.88	10.62	14.28
2003	3.44	4.15	4.10	4.36	3.28	4.31	3.87	3.59	2.70	2.32	3.77	2.97	3.56
	18.86	344.20	353.88	10.87	54.09	333.81	352.39	70.25	355.60	54.13	74.76	44.27	15.55

BADA

Bada is located about 100 km south of the main Eritrean port at Massawa, the coastal plain dips to 100 m below sea level at the Danakil Depression. Due to this special geographic feature a wind sensor was installed in Bada. The data shows that the annual mean wind speeds (AMWS) show significant increment from year to year. Leaving AMWS of the year 2000 (as it has missing data of three months), the AMWS goes from 4.37 in 2001 to 4.94 in 2004. The wind profile of Bada shows considerable increment from year to year. It seems Bada needs further and deeper study of data to figure out the reasons for this difference. The wind almost always comes from north. The data show that in August and November of some years the wind becomes easterly.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	4.25	4.02	5.11	4.58	N/A	N/A	N/A	3.73	3.53	3.27	5.19	4.33	4.22
	7.79	347.88	2.37	11.06	N/A	N/A	N/A	73.49	345.99	335.60	105.62	351.55	359.95
2001	3.87	4.17	5.09	5.01	4.31	4.14	4.03	4.02	3.63	3.94	4.64	5.53	4.37
	340.96	356.58	41.10	17.87	355.21	3.85	14.94	91.43	352.04	339.38	2.86	101.51	4.33
2002	4.21	6.11	5.78	5.29	3.96	4.49	4.15	3.92	3.67	4.31	5.27	4.16	4.59
	348.18	69.15	17.00	8.12	359.77	356.03	14.51	11.85	347.38	353.00	33.74	339.82	1.70
2003	4.38	4.56	4.98	5.16	4.19	4.59	4.02	4.26	3.88	3.93	6.76	5.65	4.69
	349.90	350.55	5.84	18.69	10.54	359.67	17.52	40.13	352.39	353.87	107.47	52.43	8.24
2004	4.89	5.14	5.44	5.21	4.29	4.67	4.08	5.12	4.21	4.79	5.83	6.09	4.94
	349.13	355.93	22.80	6.65	354.44	358.39	5.64	17.05	348.36	14.50	85.19	31.30	4.62

DAHLAK

The wind doesn't vary much through out the year. For example, the difference between the highest (4.92) and the lowest (3.60) wind speeds for 2000 is 1.32. The availability of similar wind speed through out the year, although the wind speeds are of class 1 type, makes the place suitable for utilizing the wind for mechanical water pumping.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	4.19	3.74	4.87	4.66	4.91	4.92	4.35	4.15	3.78	3.60	4.48	3.78	4.30
	47.17	45.89	15.86	344.16	335.18	322.58	55.16	358.32	349.79	21.29	106.34	72.42	18.77
2001	3.92	4.20	4.22	4.62	4.56	5.36	4.52	4.23	3.62	3.70	4.04	4.52	4.32
	8.04	27.79	0.82	11.01	337.64	323.08	325.07	65.57	349.22	84.64	102.64	105.79	24.86

TIO

Tio is one of the Wind stations which have two wind sensors. There is strong wind between November and April of a year. But in May the speed drops-off and stays that way until November. Looking on the AMWS's, Tio has class two wind speed which turn into class three at the height of 30m.

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	10 m	5.07	5.16	5.47	4.45	4.14	3.42	3.70	3.64	3.74	4.15	5.90	4.78	4.45
	30 m	90.47	70.66	49.39	49.91	14.20	313.52	74.83	15.89	41.76	76.73	98.53	78.63	63.63
2001	10 m	5.72	5.65	6.20	5.16	4.70	3.95	4.15	4.18	4.15	4.59	6.65	5.53	5.03
	30 m	94.43	76.85	56.26	55.28	22.09	325.29	79.07	25.88	50.33	81.98	104.73	84.05	69.45
2002	10 m	N/A	N/A	4.78	4.87	3.89	3.14	3.46	3.49	3.86	5.52	5.66	5.70	4.44
	30 m	N/A	N/A	66.73	63.07	10.25	305.19	11.49	51.24	49.94	86.75	91.13	94.68	67.20
2003	10 m	N/A	N/A	5.50	5.56	4.45	3.72	4.07	4.06	4.37	6.15	6.53	6.79	5.12
	30 m	N/A	N/A	79.98	71.80	18.92	297.13	268.77	133.79	316.17	324.07	229.47	292.88	335.82
2004	10 m	3.21	5.13	5.27	5.01	2.94	2.35	2.09	2.49	3.29	5.22	5.13	4.09	3.84
	30 m	31.07	75.67	63.19	47.67	355.15	328.89	6.34	24.80	39.45	87.20	85.82	55.38	47.35
2005	10 m	5.01	6.40	6.55	6.38	4.22	4.10	3.90	3.83	4.39	6.47	6.73	5.33	5.27
	30 m	51.87	97.41	80.47	59.80	0.05	319.84	20.43	53.70	313.56	193.38	342.04	327.71	32.75

IDI

Idi has similar wind speed trend as Tio. There are stronger winds between November (in 2002 and 2004 it starts in October) and April. Although the annual mean wind speeds are almost equal (see 2002 and 2004 data as they are complete), the values of the same month show big difference from year to year. For 2002's February the mean wind speed was 7.05 but the value for the same month in 2004 was 5.66. In December, the wind speed is 4.86 in 2002 but 6.26 in 2004. There is great inconsistency of data value of a given month from year to year. This makes it difficult to conclude how the winds vary through out a year in Idi.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	4.92	4.79	6.14	N/A	4.05	4.07	3.46	3.77	3.86	3.60	5.90	5.56	4.60
	106.92	96.46	85.07	N/A	6.98	0.48	10.93	352.38	35.79	64.91	117.85	113.63	72.13
2001	4.96	5.03	5.87	N/A	N/A	3.78	3.64	3.79	3.85	4.43	5.38	6.42	4.14
	103.75	99.21	99.67	N/A	N/A	323.81	350.36	353.77	52.74	96.66	118.78	123.20	85.60
2002	4.77	7.05	6.68	6.52	3.57	4.14	3.46	3.59	3.79	5.22	5.71	4.86	4.93
	85.21	116.14	96.76	93.77	352.88	333.40	0.73	8.29	48.34	107.14	116.70	109.63	76.76
2003	5.23	5.32	5.52	6.01	4.75	3.73	3.76	3.51	3.77	N/A	N/A	N/A	4.68
	106.09	70.16	54.76	89.11	90.54	346.60	332.30	1.64	349.29	N/A	N/A	N/A	51.71
2004	5.72	5.66	5.72	4.91	3.49	3.86	3.71	4.03	3.70	5.26	6.24	6.26	4.90
	101.17	88.46	89.30	85.67	2.25	339.91	342.39	334.85	17.37	108.93	119.09	118.56	72.27

ASSAB

Assab has class seven winds at the height of 10m from October until April. The data show Assab has class 7 wind on the Annual mean wind speed in 2001 and 2002 but class six in 2000. At 30m, Assab has class 7 winds in the three years data available. There are, relatively, weaker winds between May and September.

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	10 m	8.26	7.53	8.82	6.62	5.91	5.28	5.15	5.05	5.27	5.16	9.28	8.38	6.72
	30 m	134.57	132.56	134.03	121.05	11.06	352.32	341.95	336.67	56.33	106.19	140.36	138.58	118.40
2001	10 m	9.14	8.40	9.70	7.38	6.78	6.09	5.89	5.76	5.82	5.73	10.17	9.26	7.51
	30 m	132.76	131.13	133.39	121.81	2.56	345.24	334.40	331.34	51.91	105.23	138.32	136.65	118.32
2002	10 m	8.32	8.49	9.27	7.94	5.39	5.58	5.59	5.37	5.65	7.15	8.87	9.65	7.27
	30 m	134.95	132.55	135.38	131.67	34.51	327.58	326.93	336.30	96.56	128.49	139.62	143.26	123.05
2003	10 m	9.15	9.31	10.14	8.75	6.07	6.57	6.52	6.09	6.20	7.84	9.80	10.61	8.08
	30 m	133.15	130.48	133.88	129.76	31.08	322.70	322.04	330.38	94.52	125.87	137.17	140.82	122.39
2004	10 m	7.57	10.64	9.66	8.86	4.62	5.47	5.17	5.11	5.32	8.50	8.74	7.46	7.32
	30 m	136.09	140.30	139.56	138.73	349.44	336.53	21.24	344.23	64.83	135.87	140.06	136.22	126.03
2005	10 m	8.37	11.65	10.64	9.75	5.32	6.37	5.84	5.80	5.86	9.36	9.70	8.28	8.14
	30 m	133.89	138.04	137.68	137.16	344.49	331.52	12.48	338.23	60.63	133.45	137.45	133.43	124.74

GAHRO

Gahro has the best wind resource of all stations. The annual mean wind speed goes as high as 7.94 (2003). There are strong winds from October to April then the wind speeds drop sharply which stays that way until September. The following shows that there are some irregularities in July's data. There are two cases (2003 and 2005) where the wind speed is registered with amplitude of as high as the strong winds season. This finding may require special attention to find out why such result was found and what it really means.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	8.70	7.97	8.94	7.23	5.40	5.79	6.02	6.06	5.83	5.68	7.95	N/A	6.91
	<i>139.63</i>	<i>140.34</i>	<i>140.87</i>	<i>138.79</i>	<i>332.69</i>	<i>358.66</i>	<i>335.63</i>	<i>328.09</i>	<i>76.95</i>	<i>130.44</i>	<i>354.70</i>	<i>N/A</i>	129.14
2001	8.01	8.66	N/A	N/A	5.60	6.34	6.77	6.28	6.18	7.45	N/A	N/A	7.14
	<i>171.71</i>	<i>168.41</i>	<i>N/A</i>	<i>N/A</i>	<i>354.72</i>	<i>354.74</i>	<i>354.76</i>	<i>354.73</i>	<i>354.71</i>	<i>354.72</i>	<i>N/A</i>	<i>N/A</i>	357.05
2002	N/A	10.38	9.77	8.56	5.25	6.17	5.51	6.17	5.43	8.63	8.95	8.01	7.45
	<i>N/A</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>
2003	8.62	8.59	8.55	8.61	7.76	5.86	8.18	6.19	5.37	8.15	9.68	8.31	7.94
	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>
2004	9.13	8.82	8.65	7.92	5.20	5.67	6.60	6.95	5.31	8.45	9.09	8.77	7.58
	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>	<i>Bad</i>
2005	8.69	8.78	8.98	9.77	5.77	5.54	7.43	5.58	5.20	7.75	9.19	N/A	7.64
	<i>Bad</i>	<i>3.78</i>	<i>125.95</i>	<i>128.91</i>	<i>7.92</i>	<i>333.19</i>	<i>308.50</i>	<i>326.05</i>	<i>340.73</i>	<i>126.97</i>	<i>129.82</i>	<i>N/A</i>	66.52

Central Highland Stations

Central highland is a high plateau that bisects Eritrea into two with elevation usually over 2000m .To the right of this highland lies a wide arid coastal plain that stretches the entire length of Eritrea (bordering the Red Sea). On the other side there are western lowlands which have a semiarid climate and consist chiefly of desert hills and savanna. In this group, there are 12 stations scattered all over the highland. The results from these stations are presented as follows:

ADOBHA

The winds that blow in Adobha are always northerly (except in few cases). The speeds do not show considerable variation through out the year. For example, in 2002, the lowest wind speed recorded was 4.24 which the highest was 5.35. Based on the annual mean wind speed, the wind in Adobha can be categorized as class 2 type wind.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	N/A	4.52	5.39	5.00	5.26	5.36	4.67	4.95	4.11	3.96	4.14	4.69	4.74
	N/A	17.23	359.20	355.45	346.74	347.59	86.88	22.31	12.13	29.15	107.40	152.60	18.17
2001	5.19	5.02	4.16	N/A	N/A	N/A	4.04	0.47	3.09	4.55	N/A	4.60	3.87
	328.92	346.67	19.05	N/A	N/A	N/A	65.12	4.33	358.15	30.94	N/A	146.58	20.50
2002	4.89	5.04	5.31	5.35	4.98	5.24	5.12	4.24	4.67	4.72	4.61	4.96	4.93
	326.02	79.95	20.71	34.64	326.24	333.17	11.11	41.56	349.83	134.93	145.63	321.18	6.55

NAKFA

The annual mean wind speeds show that Nakfa has class 2 type of wind. But the month to month results show that the winds vary from wind speeds as low as 2.69(2004) to wind speeds as high as 10.10(2000) – at 10 meter. The wind speeds between January and May do not vary much although they show continuous increment. In June the wind speed shows abrupt increment which can reach 7.71(2001). The wind speed reaches it peak in July. Similar wind blows in August. Soon after, the wind speed drops off suddenly in September. During the rest of the year, the wind speed keeps decreasing.

With the exception Jun, July and August - during which the wind blow from north – the winds in Nakfa are easterly or south easterly.

The unique thing about this station is the difference between the result from 10m and 30m wind sensors. There is no difference between these two results. For example, in 2000, the annual mean wind speeds of both heights are the same. This result is far from expectation. It needs further study to find out the reason of these similarities.

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	10 m	2.96	2.87	3.00	3.79	4.35	6.61	10.10	9.26	4.77	3.38	3.19	2.85	4.87
	30 m	125.41	122.05	119.94	128.34	69.48	318.90	289.30	296.75	334.59	124.30	139.28	125.52	146.96
2001	10 m	2.86	2.80	2.90	3.69	4.25	6.81	10.38	9.60	4.68	3.17	3.15	2.75	4.87
	30 m	122.33	116.93	114.86	124.46	79.68	317.05	284.80	292.92	342.00	121.33	133.45	120.75	117.45
2002	10 m	3.01	2.76	3.23	3.72	4.43	7.71	8.65	8.73	4.31	3.75	3.40	3.02	4.74
	30 m	122.51	124.49	129.45	134.16	348.49	286.57	286.15	296.23	9.56	117.39	139.04	137.90	183.93
2003	10 m	2.91	2.64	3.09	3.60	4.28	8.02	9.01	9.12	4.24	3.67	3.35	3.00	4.76
	30 m	117.97	121.32	125.59	127.62	13.12	281.68	281.54	292.34	16.96	112.77	131.20	132.33	145.83
2004	10 m	2.73	2.98	3.28	4.26	3.86	N/A	8.95	8.75	4.36	3.72	3.27	3.04	4.37
	30 m	124.70	131.43	124.71	123.83	72.42	N/A	296.08	297.88	21.36	135.58	137.72	128.12	126.61
2005	10 m	2.67	2.93	3.14	4.24	3.62	N/A	9.35	9.13	4.33	3.63	3.22	2.99	4.37
	30 m	121.18	126.84	121.01	119.39	91.57	N/A	291.65	294.25	28.56	131.33	131.11	124.20	121.76

2	10	2.93	2.85	3.16	3.72	3.92	6.80	9.92	7.91	5.30	3.68	3.42	3.10	4.74
0	m	<i>124.80</i>	<i>118.75</i>	<i>117.42</i>	<i>122.47</i>	<i>98.95</i>	<i>307.86</i>	<i>286.47</i>	<i>298.29</i>	<i>326.50</i>	<i>139.97</i>	<i>138.97</i>	<i>132.91</i>	162.85
0	30	2.84	2.68	2.98	3.61	3.78	7.06	10.19	8.20	5.29	3.61	3.34	3.02	4.73
3	m	<i>120.10</i>	<i>115.13</i>	<i>115.67</i>	<i>116.85</i>	<i>99.61</i>	<i>304.40</i>	<i>281.13</i>	<i>294.37</i>	<i>328.23</i>	<i>132.40</i>	<i>133.33</i>	<i>128.58</i>	136.41
2	10	2.69	2.95	3.49	3.74	4.15	5.61	N/A	7.84	4.68	3.76	3.14	2.92	3.90
0	m	<i>123.23</i>	<i>126.69</i>	<i>132.44</i>	<i>130.37</i>	<i>38.52</i>	<i>353.98</i>	<i>N/A</i>	<i>295.74</i>	<i>351.05</i>	<i>142.25</i>	<i>132.64</i>	<i>122.02</i>	120.00
0	30	2.56	2.17	3.36	3.59	3.88	5.89	N/A	7.51	4.14	3.24	2.48	2.14	3.50
4	m	<i>120.72</i>	<i>92.24</i>	<i>124.97</i>	<i>125.13</i>	<i>51.37</i>	<i>354.35</i>	<i>N/A</i>	<i>289.51</i>	<i>357.18</i>	<i>127.49</i>	<i>115.19</i>	<i>103.99</i>	101.99

GIZGIZA

Gizgiza has good wind resource. The annual mean wind speed reaches as high as 6.14. There is no easily recognizable trend of variation of wind speed from month to month. September scores the lowest wind speed of all months (4.26).

The winds in gizgiza are south westerly between June and September while they come from north east during the rest of a year.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	6.42	7.07	6.98	5.46	5.65	5.37	5.14	6.26	6.36	5.08	4.43	2.19	6.14
	<i>48.54</i>	<i>47.88</i>	<i>49.72</i>	<i>48.88</i>	<i>43.59</i>	<i>242.77</i>	<i>40.11</i>	<i>40.36</i>	<i>41.68</i>	<i>37.37</i>	<i>30.23</i>	<i>328.98</i>	41.83
2001	6.47	6.78	5.01	6.26	5.21	5.83	7.11	N/A	N/A	5.44	6.01	6.18	6.05
	<i>46.62</i>	<i>50.06</i>	<i>57.31</i>	<i>51.27</i>	<i>44.93</i>	<i>242.59</i>	<i>238.20</i>	<i>N/A</i>	<i>N/A</i>	<i>52.72</i>	<i>56.60</i>	<i>55.39</i>	50.40
2002	6.17	6.11	5.49	6.88	5.10	N/A	6.72	6.96	4.26	5.87	6.01	5.89	5.96
	<i>50.92</i>	<i>55.90</i>	<i>58.84</i>	<i>54.71</i>	<i>54.82</i>	<i>N/A</i>	<i>244.97</i>	<i>242.51</i>	<i>49.39</i>	<i>55.46</i>	<i>57.57</i>	<i>54.08</i>	51.52
2003	6.12	5.93	5.67	6.15	5.11	5.98	7.59	6.76	4.40	5.87	5.80	5.88	5.94
	<i>56.52</i>	<i>55.45</i>	<i>56.20</i>	<i>56.88</i>	<i>54.79</i>	<i>252.22</i>	<i>241.96</i>	<i>242.64</i>	<i>283.57</i>	<i>34.97</i>	<i>38.11</i>	<i>38.30</i>	36.05

DEBRESINA

In general, this site doesn't have promising wind resource. Through out the year, except between June and August, there are similar winds which usually blow from east. But between June and August, the wind speed and direction change. The wind speed reaches as high as 8.48(2003) while the direction changes to west.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	3.16	2.97	2.38	4.35	4.73	4.60	4.40	4.03	4.34	4.54	3.93	3.97	3.98
	<i>74.30</i>	<i>78.01</i>	<i>38.34</i>	<i>84.25</i>	<i>51.05</i>	<i>350.22</i>	<i>265.43</i>	<i>293.42</i>	<i>41.37</i>	<i>59.90</i>	<i>63.52</i>	<i>66.68</i>	48.36
2001	2.64	3.02	N/A	4.00	3.68	6.53	7.46	N/A	N/A	3.54	3.93	3.13	4.14
	<i>69.50</i>	<i>80.63</i>	<i>N/A</i>	<i>72.45</i>	<i>53.52</i>	<i>256.93</i>	<i>256.49</i>	<i>N/A</i>	<i>N/A</i>	<i>83.11</i>	<i>77.39</i>	<i>79.82</i>	75.65
2002	2.52	2.19	N/A	N/A	3.15	5.85	6.13	6.02	2.82	4.31	3.03	3.36	3.97
	<i>71.04</i>	<i>52.82</i>	<i>N/A</i>	<i>N/A</i>	<i>55.54</i>	<i>267.98</i>	<i>257.73</i>	<i>259.16</i>	<i>39.81</i>	<i>71.43</i>	<i>71.36</i>	<i>81.17</i>	13.42
2003	3.52	2.57	N/A	N/A	N/A	5.79	8.48	6.01	2.89	4.56	3.73	2.67	4.53
	<i>89.43</i>	<i>76.21</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>	<i>259.71</i>	<i>254.45</i>	<i>257.89</i>	<i>272.63</i>	<i>68.78</i>	<i>73.05</i>	<i>73.18</i>	270.37
2004	3.08	3.22	3.36	3.28	3.44	4.46	7.52	6.01	2.65	4.03	3.27	2.54	3.92
	<i>266.04</i>	<i>84.74</i>	<i>83.40</i>	<i>60.75</i>	<i>60.12</i>	<i>263.29</i>	<i>253.65</i>	<i>258.23</i>	<i>316.78</i>	<i>65.51</i>	<i>77.14</i>	<i>71.58</i>	20.27

EMBATKALA

Although annual averages of this stations fall on class 1 wind power class, this station has months when the wind reaches as high as class 7 winds (7.0 to 9.4). The wind speed increases steadily until July (where it reaches the pick) then it shows continuous decrement until the end of the year. The annual wind directions show considerable variation although in 5 out of 6 years, the data says that, the wind blows from the north-east.

N.B. the data for jan 2005 was removed and designated by “bad” because 80.8% of the data was filled with zeros.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	2.31	2.18	2.23	3.38	3.69	5.12	7.13	7.06	4.54	3.35	2.87	2.40	3.86
	58.95	50.22	57.32	46.77	62.99	193.88	207.31	194.41	150.90	103.12	56.96	61.17	83.51
2001	2.58	2.30	3.23	3.43	4.08	6.46	6.98	6.95	4.39	3.18	2.96	2.79	4.12
	51.07	43.63	61.82	41.92	64.01	198.11	195.23	185.88	149.15	67.16	56.60	51.66	96.03
2002	2.39	2.55	2.90	3.80	3.77	4.95	N/A	6.89	4.23.03	3.33	2.80	2.49	3.68
	42.55	48.97	55.33	45.85	50.81	212.14	N/A	192.77	156.57	76.71	53.10	44.53	60.19
2003	2.59	2.25	2.65	3.21	3.56	5.03	6.76	6.71	4.64	3.27	2.86	2.54	3.85
	48.35	44.20	43.99	48.63	65.03	153.08	208.33	179.11	132.58	71.22	50.39	49.01	70.64
2004	2.38	2.29	2.06	3.32	3.81	5.21	6.48	6.31	3.58	3.07	2.52	1.63	3.60
	49.66	41.32	24.12	41.73	55.30	177.57	205.65	193.22	55.11	45.23	30.90	21.19	43.52
2005	Bad	1.93	1.75	2.39	2.74	3.89	7.34	6.69	4.58	3.43	2.72	N/A	3.77
	Bad	35.32	24.18	22.64	19.88	328.40	189.15	174.38	114.40	56.29	37.88	N/A	47.71

ASMARA (ERTC)

Looking in the table, the highest annual averaged wind speed was recorded in 2000 (3.26) while the lowest was in 2005 (2.78). The average of the annual averages is 2.99. The annual averages of wind speed show continuous decrement as the years go up. The annual average of wind directions show that the winds usually blow from the north-east direction. Based in the wind power class, Asmara station has class one wind.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	3.09	2.96	3.06	3.10	3.43	3.69	4.26	4.21	2.73	3.14	2.82	2.69	3.26
	85.30	91.36	93.54	94.07	64.54	354.35	307.09	313.57	50.64	78.23	87.12	88.97	60.58
2001	2.93	2.94	2.95	3.42	3.24	3.10	3.50	3.51	2.75	3.02	2.98	2.56	3.07
	77.07	83.21	99.00	88.48	56.65	309.95	304.60	315.50	52.30	75.22	75.39	84.10	52.28
2002	2.86	2.74	2.73	3.69	2.95	3.42	2.92	2.97	3.00	3.13	2.64	2.91	3.00
	87.86	80.92	94.71	86.44	67.06	330.36	324.09	327.94	55.17	79.08	84.47	91.26	59.25
2003	2.80	2.62	2.71	3.11	2.81	3.21	3.88	2.90	2.78	3.48	2.92	2.50	2.98
	77.22	87.55	83.43	88.58	76.59	339.34	295.35	314.04	35.03	77.51	81.02	84.30	53.98
2004	N/A	2.69	2.79	2.74	3.23	2.76	3.18	2.78	2.70	3.11	2.65	2.39	2.82
	N/A	85.15	89.05	91.99	66.40	346.09	311.77	326.87	44.28	79.49	83.94	77.22	53.14
2005	2.60	2.78	2.44	3.14	2.72	2.97	2.88	2.46	2.72	3.23	2.64	N/A	2.78
	100.11	77.26	95.62	89.85	72.09	0.28	304.00	333.99	35.19	76.23	83.18	N/A	47.22

ASMARA AIRPORT

The results from the station, which was located in the Asmara Airport, are very similar to results found from ERTC. For example, in 2000, the AMWS of Asmara ERTC is 3.26 while Asmara airport's is 3.31. But the AMWS of 2002 shows there is some difference between both sites. The month-to-month data show Airport is windier than ERTC.

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2	10	3.41	3.29	3.27	3.29	3.54	3.60	3.90	3.88	2.75	3.26	2.84	2.74	3.31
0	m	78.52	87.06	87.81	88.22	53.65	344.25	308.10	311.81	34.56	70.06	80.81	80.01	47.11
0	30	4.97	4.72	4.73	4.68	5.34	5.45	5.48	5.39	4.39	4.92	4.27	4.25	4.89
0	m	83.44	92.47	92.50	95.11	55.47	341.47	303.91	308.11	34.72	72.95	86.83	88.29	50.43
2	10	2.87	2.98	2.87	3.55	3.28	3.26	3.46	N/A	N/A	3.49	3.27	2.86	3.20
0	m	67.83	74.48	86.00	81.87	46.67	309.00	306.22	N/A	N/A	67.32	68.41	81.29	50.84
0	30	4.44	4.55	4.17	5.11	5.01	4.84	5.03	N/A	N/A	4.89	4.77	4.19	4.71
1	m	74.21	81.08	122.92	86.07	49.75	304.18	302.63	N/A	N/A	71.25	73.09	88.08	56.74
2	10	3.19	2.96	3.00	4.18	3.32	3.65	3.19	3.33	3.70	4.31	2.40	3.20	3.36
0	m	82.31	69.73	92.27	82.06	55.89	327.02	321.45	323.03	46.51	72.74	84.40	83.87	40.89
0	30	4.68	4.41	4.23	5.72	4.76	5.47	4.82	4.87	5.33	5.97	3.58	4.62	4.87
2	m	86.89	78.70	112.94	88.07	59.50	323.33	316.45	320.69	48.46	76.76	94.00	93.51	44.15
2	10	2.99	2.94	3.10	3.89	3.49	3.62	3.97	3.26	3.46	N/A	N/A	N/A	3.40
0	m	53.34	82.24	72.94	83.82	70.55	333.82	296.85	313.18	21.42	N/A	N/A	N/A	9.51
0	30	4.57	4.31	4.40	5.38	4.82	5.31	5.69	4.47	4.95	N/A	N/A	N/A	4.87
3	m	64.23	96.58	82.96	91.56	75.34	330.60	295.28	311.24	21.86	N/A	N/A	N/A	7.53
2	10	N/A	N/A	3.24	3.23	4.03	3.30	3.71	3.39	3.49	3.75	3.13	2.70	3.40
0	m	N/A	N/A	84.19	88.02	57.56	335.15	308.35	323.67	30.78	74.99	80.35	66.20	37.17
0	30	N/A	N/A	4.66	4.57	5.69	4.75	5.32	4.80	5.03	5.31	4.49	4.09	4.87
4	m	N/A	N/A	95.70	95.82	58.90	332.78	305.34	321.46	31.53	77.85	84.19	78.03	39.88

DEKEMHARE

Dekemhare is one of the places, which have good wind resources. It has class 4 type wind. There is good wind through out the year. There is no easily recognizable trend of variation of wind speeds through the months of a year. But the wind directions are similar for all months except for July and August.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	6.37	6.24	5.98	5.38	6.43	6.19	6.15	5.93	5.38	6.05	5.71	5.78	5.97
	30.47	30.15	30.99	40.66	37.57	22.54	231.59	236.16	43.07	33.79	31.97	29.69	27.82
2001	6.62	6.04	5.09	N/A	5.86	6.03	5.77	N/A	N/A	N/A	N/A	N/A	5.87
	29.16	30.52	31.01	N/A	30.58	221.85	220.35	N/A	N/A	N/A	N/A	N/A	22.33
2002	N/A	N/A	N/A	N/A	N/A	5.37	5.72	5.81	5.80	6.00	5.71	6.00	5.81
	N/A	N/A	N/A	N/A	N/A	230.96	226.60	223.84	37.36	34.25	31.46	30.32	27.49
2003	5.92	5.53	5.67	5.52	5.38	6.22	6.01	5.37	5.81	6.48	5.96	6.31	5.82
	29.19	31.22	31.08	32.94	37.98	309.58	230.92	219.98	43.25	33.21	34.08	31.29	28.27
2004	4.98	5.70	5.67	5.50	6.41	N/A	6.23	5.61	N/A	5.79	6.02	6.24	5.87
	25.17	30.59	34.49	33.91	35.31	N/A	233.23	221.94	N/A	34.55	32.30	29.25	29.65
2005	5.16	6.04	5.56	5.92	5.64	5.98	5.84	5.50	6.00	6.72	6.49	6.15	5.90
	26.05	29.78	33.00	33.69	31.92	25.69	229.20	218.07	39.11	32.82	32.30	31.87	29.06

HADISH ADI (HALAY)

This place has similar wind speed through out the year. All wind speeds are not far from the mean of the annual averages 4.35. The directions are always from the east except in June, July and August when the wind blows from North Western.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	4.41	4.45	4.21	4.33	4.73	4.60	4.40	4.03	4.34	4.54	3.93	3.94	4.33
	68.44	75.35	78.19	84.25	51.05	350.20	265.43	293.42	43.32	59.90	63.52	66.67	52.40
2001	3.92	4.11	3.83	4.23	4.56	4.49	4.76	3.77	4.23	4.60	4.32	3.85	4.16
	12.33	64.74	75.12	49.32	50.10	262.36	277.50	304.98	44.01	58.93	50.22	68.66	40.46
2002	4.25	4.00	4.03	5.08	4.48	5.10	4.01	3.92	4.94	4.76	4.03	4.53	4.42
	62.66	60.97	86.64	62.58	50.87	312.97	318.65	326.23	46.03	62.67	64.88	56.00	46.71
2003	4.67	3.95	4.26	4.12	4.34	4.33	4.67	3.57	4.49	5.09	4.31	3.97	4.34
	358.21	70.88	76.37	63.32	65.05	338.33	252.27	331.10	33.73	58.22	63.15	61.62	47.37
2004	4.18	4.52	4.15	4.22	5.11	5.45	4.41	3.97	4.82	5.04	4.33	3.66	4.39
	261.47	78.11	70.44	71.30	49.08	340.07	283.89	325.53	47.61	59.93	61.91	37.84	44.11
2005	4.58	4.38	3.93	5.06	4.02	4.62	4.00	4.01	4.55	5.17	4.48	4.46	4.43
	305.38	58.17	81.88	62.71	55.35	9.42	263.14	350.80	36.90	56.91	60.31	66.14	46.29

KOHAITO

Kohaito has good wind resource. The annual means show that kohaito has class three type of wind. Some months show wind speeds as high as 6.98. The month October seems the best month as it almost always has class six wind.

The annual means don't show considerable variation but the year-to-year data of a single month do not show consistency. For example, April has 5.29 in 2000 but this goes to 6.98 in 2005.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	5.16	5.84	5.25	5.29	5.51	4.81	4.83	4.83	N/A	N/A	N/A	N/A	5.11
	104.88	101.95	107.80	108.27	67.64	336.32	258.25	273.24	N/A	N/A	N/A	N/A	91.04
2001	N/A	4.88	4.42	5.92	5.41	4.60	4.58	4.29	5.20	5.85	5.61	4.89	5.04
	N/A	103.44	123.86	99.44	71.99	258.33	267.57	287.07	55.55	84.87	93.16	106.30	87.79
2002	5.06	4.81	4.54	5.36	5.11	5.30	4.14	4.35	6.01	6.42	5.18	5.39	5.18
	105.39	97.70	131.29	104.38	70.69	294.41	296.05	299.77	55.32	90.26	99.29	123.39	89.21
2003	5.19	4.57	4.94	5.55	5.30	4.73	5.26	3.84	4.96	6.81	5.48	4.80	5.12
	166.36	111.01	103.33	107.10	89.20	321.14	251.50	300.68	39.99	89.90	101.50	103.44	90.93
2004	4.62	5.54	5.39	4.99	6.04	4.67	4.66	4.20	5.18	6.60	5.84	4.17	5.14
	231.27	114.43	111.29	104.48	64.38	343.57	272.85	312.51	46.75	88.87	96.81	106.90	78.91
2005	5.04	5.46	4.52	6.98	4.59	4.84	4.43	4.34	4.94	6.62	5.72	5.76	5.25
	217.83	89.47	124.21	96.57	83.40	1.30	256.55	334.65	34.31	84.46	94.70	101.27	79.54

MAILEHAM

Maileham has class 2 type of wind. June, July and August are the months in which lower winds recorded. The highest monthly wind speed recorded in the station is 7.59m/s in May of 2004. The winds are easterly between September and May. But between June and August the winds become westerly.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	5.99	5.77	5.41	5.54	6.00	4.36	3.58	3.41	4.59	5.70	5.48	5.11	5.07
	86.31	95.38	113.15	112.09	52.12	281.66	260.87	271.90	32.27	64.18	89.99	87.11	53.66
2001	4.92	5.41	N/A	N/A	5.41	4.07	3.26	3.19	4.90	5.64	5.80	5.45	4.78
	58.20	68.52	N/A	N/A	35.16	255.85	259.90	276.36	36.52	66.79	70.10	95.44	24.90
2002	5.40	5.25	4.90	7.09	5.65	4.75	3.44	3.19	6.01	N/A	N/A	N/A	5.09
	85.73	87.04	193.72	90.57	55.97	273.88	266.70	265.88	47.62	N/A	N/A	N/A	341.85
2003	4.93	3.51	1.98	N/A	N/A	N/A	3.67	3.03	4.09	6.67	5.80	5.57	4.34
	123.49	20.05	350.24	N/A	N/A	N/A	259.69	269.11	327.05	71.51	89.04	81.86	348.68
2004	4.34	5.22	5.72	5.38	7.59	4.65	3.51	3.11	6.21	6.18	6.02	4.14	5.37
	216.53	109.27	101.34	107.86	53.39	282.71	261.00	269.34	45.71	82.87	74.99	38.38	70.35

AREZA

The annual average wind speeds for this station fall on class 3. The good thing of this station is that the monthly wind speeds don't show considerable variation through out the year. This makes Areza comfortable for harnessing wind through out the year.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	5.18	5.38	5.64	5.81	5.29	5.56	5.52	5.33	4.23	4.52	4.80	4.63	5.16
	80.16	79.30	72.41	100.48	51.03	321.38	311.49	315.71	15.81	85.26	84.31	60.84	31.28
2001	4.92	5.09	5.09	5.95	5.21	4.77	4.73	5.13	4.77	4.54	5.04	4.83	5.00
	37.04	56.58	24.27	81.58	24.89	314.78	307.14	317.29	18.61	90.46	88.58	88.95	25.17
2002	4.79	5.29	4.92	6.50	4.96	5.67	5.24	4.88	5.43	5.11	5.32	4.91	5.25
	72.54	57.98	38.62	91.10	48.12	317.10	317.76	318.88	47.91	96.33	84.24	73.99	35.76

Western Lowland Stations

There are four stations in this part of Eritrea. Agordat, Aligdir and Kerkebet have similar weather and they are at similar altitude. Keren is at an altitude almost double of the other 3 places. Despite of Keren's high altitude, it's Kerkebet which usually scores higher annual wind speed.

KEREN

There is no specific trend of wind speed as you look through the values of every month. The annual means show that Keren doesn't have impressive wind resource. With the exception of June, July and August, during which the wind blows from south west, the winds are always northerly.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	5.01	5.47	5.51	4.36	4.54	4.20	4.47	4.24	N/A	4.30	4.56	4.32	4.60
	10.39	9.28	8.54	28.94	31.98	240.64	225.13	225.34	N/A	35.60	8.89	4.03	4.27
2001	N/A	N/A	N/A	5.40	4.20	4.31	3.96	3.72	2.99	4.18	4.67	4.77	4.19
	N/A	N/A	N/A	21.81	27.62	231.41	223.01	222.84	85.74	41.16	21.03	11.52	8.68
2002	4.72	4.77	4.39	5.56	4.20	4.46	3.39	3.53	3.41	4.78	4.77	4.23	4.35
	8.98	8.57	3.90	23.13	24.32	237.09	226.92	220.61	63.27	34.16	17.35	8.52	9.48
2003	4.71	4.63	4.53	4.87	4.39	4.13	4.98	3.67	2.97	4.91	4.80	4.76	4.45
	8.23	8.91	11.71	13.42	37.00	232.13	232.29	225.52	171.14	41.85	16.30	11.04	6.43
2004	3.83	5.11	5.12	4.46	4.50	3.86	3.75	1.89	2.95	2.80	1.17	4.51	3.67
	7.41	9.20	12.56	14.81	36.29	239.21	228.97	300.34	54.97	24.12	0.88	6.74	5.76

AGORDAT

This station scores the lowest wind speeds of all the stations. The year-to-year values of annual wind speeds don't vary much from the average of the annual averages (2.47). Even the annual averages of wind directions are very similar to each other which indicate that the winds are, usually, westerly.

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	2.59	2.77	3.12	2.87	2.72	2.39	2.42	2.14	1.92	2.25	2.45	2.20	2.49
	247.3	254.4	249.3	184.4	192	211.7	215.7	214.8	182.1	183.8	230.4	240.9	267.7
2001	2.33	2.69	2.56	3.20	2.69	2.55	2.18	1.65	1.71	2.27	2.46	2.21	2.37
	245.9	251.4	242.4	198.4	210.7	212	195.3	180.3	189.7	178.9	186.1	236.6	269.6
2002	2.40	2.53	2.76	3.38	2.66	2.60	2.28	1.92	1.98	2.68	2.56	2.31	2.50
	249	251.4	247.5	192.7	221.1	222.4	190.4	191.0	177.6	152.2	197.9	239.3	267.1
2003	2.21	2.73	2.96	2.99	2.78	2.56	2.41	N/A	N/A	N/A	2.13	N/A	2.53
	232.3	251.7	250.4	218.8	182.4	220.7	216.7	N/A	N/A	N/A	229.3	N/A	263.8

KERKEBET

There are usually strong winds between November and April. But in the rest six months (May to October) the wind speed gets weaker. In general, Kerekebet has northerly class 2 type of wind.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
2000	6.02	6.60	7.08	5.12	4.69	4.08	N/A	4.31	3.77	4.58	5.17	5.24	5.20
	320.50	321.17	318.72	315.77	306.38	270.69	N/A	189.88	242.58	297.49	313.23	315.36	306.74
2001	5.78	6.32	4.96	5.59	4.93	4.65	4.42	3.75	3.42	4.32	4.78	5.04	4.82
	321.03	318.39	310.90	309.99	303.69	206.77	184.36	178.69	280.74	306.31	312.80	316.33	300.05
2002	5.92	5.92	5.86	5.85	4.94	4.69	4.82	4.56	3.63	4.38	5.01	5.31	5.07
	319.72	318.71	312.93	308.95	307.06	257.04	190.34	181.65	274.87	308.88	315.53	317.82	301.90
2003	5.29	6.38	6.55	5.72	4.67	4.91	4.48	3.70	3.46	3.88	4.64	5.08	4.89
	318.56	318.37	315.16	308.82	302.59	244.27	202.22	166.41	240.12	308.76	311.15	317.62	299.88
2004	5.24	6.43	6.06	5.25	4.74	4.50	4.59	4.30	3.84	3.91	5.43	5.65	4.99
	318.04	318.53	315.00	307.53	308.15	244.23	199.09	173.88	257.45	306.84	312.16	317.72	300.42
2005	5.46	6.40	6.44	5.85	5.26	4.98	4.47	4.17	3.68	N/A	N/A	N/A	5.13
	315.47	318.51	315.00	308.07	312.76	246.04	186.59	189.88	205.12	N/A	N/A	N/A	295.29

ALIGDIR

The annual mean wind speeds show that Aligdir has class 1 type of wind at 10m. This result barely changes to class 2 at the height of 30m. The highest wind speeds recorded are 4.64m/s for 10m and 6.04 for 30m heights. The annual resultants' direction of these winds show to be easterly in 2001 while northerly in 2002 and 2003.

y	h	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
20	10	2.82	3.14	3.26	4.24	3.99	4.53	4.21	3.48	2.83	2.62	3.23	2.99	3.45
	30	12.75	15.89	359.78	26.48	264.88	201.87	188.28	176.72	172.01	146.96	32.10	15.22	89.72
12	10	3.69	4.01	4.16	5.19	4.88	5.49	5.10	4.46	3.73	3.37	4.25	3.91	4.35
	30	13.94	16.60	359.98	26.44	283.97	204.97	190.98	180.70	178.38	163.93	30.80	16.04	61.30
20	10	3.02	3.29	3.41	4.54	3.44	4.33	4.64	3.88	2.87	2.89	3.50	2.98	3.57
	30	3.62	12.59	0.03	22.27	3.24	208.71	189.05	179.07	172.74	121.63	26.90	355.87	21.94
03	10	3.95	4.21	4.27	5.50	4.19	5.20	5.54	4.75	3.53	3.56	4.47	3.92	4.42
	30	5.74	12.17	0.93	23.28	1.41	214.74	191.98	182.03	178.23	121.05	27.16	359.85	13.50
20	10	3.05	3.29	3.63	3.85	3.88	4.31	4.29	3.37	2.89	3.15	3.29	3.12	3.51
	30	17.14	13.57	9.33	1.79	328.29	204.66	193.87	180.10	190.46	77.08	26.34	19.78	25.40
03	10	3.87	4.13	4.41	4.61	4.74	5.33	5.51	4.55	4.03	4.29	4.67	4.40	4.55
	30	17.31	14.34	10.49	2.83	330.53	208.04	196.07	184.04	196.53	75.39	26.13	19.86	18.17
20	10	2.89	3.36	3.66	3.69	3.85	4.31	4.61	4.00	3.30	2.93	N/A	N/A	3.71
	30	2.18	5.07	18.53	5.73	48.70	197.84	198.98	184.43	188.58	165.81	N/A	N/A	196.36
04	10	3.99	4.51	4.78	4.92	5.06	5.61	6.04	5.25	4.46	4.04	N/A	N/A	4.92
	30	4.30	8.00	18.38	6.85	39.94	201.17	200.92	186.38	192.90	168.34	N/A	N/A	214.18

Solar Irradiance

Solar Irradiance is the rate at which radiant energy is incident on a surface, per unit area of surface. Solar Irradiance data are used in several forms and for a variety of purposes. In Wind and Solar Monitoring Network, two types of Irradiance data are collected. These are:-

- *Total (Global) Solar Irradiance*: - are the sum of the direct (beam) and the diffused solar Irradiances on a surface. The ten irradiance measuring stations use “Skye SK1110” pyranometers to recorder global Irradiances. In addition, global Irradiances are also measured by another “Kipp and Zonen CM 11” pyranometers (with out shadowing rings) in these solar stations.
- *Diffused Irradiance*: - solar irradiance received from the sun after scattering by the atmosphere and has changed its direction. There are 5 stations which measure diffused irradiances. These stations use “Kipp and Zonen CM 11” pyranometers with shadowing rings to measure only the diffused irradiance. cumulative

Solar stations measure two types of Irradiances. The data loggers of these stations are programmed to collect the diffused and total irradiances at every full hour. The cumulative solar irradiances over a day were averaged monthly to find the mean daily solar irradiance of a place.

The other types of stations, which measure irradiance, are the wind stations. Unlike the solar stations, these stations have instrument only for measuring direct Irradiance. These stations record global irradiance every 10 minute. The amount of irradiances measured every 10 minute were summed to find the amount of global irradiance received everyday. These values were then averaged to find the average daily global irradiance in a month.

There are three tables for each of the solar stations namely, Asmara, Emabtkala, Agordat, Areza, and Dahlak. These three tables consist of average daily global irradiances (measured by two types of pyranometers) and average daily diffused irradiances. The last 5 tables in this category are average daily global irradiances processed from stations located in Asmara airport, Tio, Assab, Nakfa and Aligdir.

The results found from the irradiance measuring devices show that the Eritrea has good solar energy resource. The data show that Eritrea has daily mean solar irradiances, in most places, of around 6.5kWh/m²/day which is among the best solar resources in the world. Even the lowest scored annual daily averaged solar irradiance 5.28 Wh/m²/day is a good solar resource. The data show that Eritrea has a huge potential of solar energy.

Average Daily Solar Irradiance (kWh/m²/day) -ASMARA

Global Irradiance (Skye SK 1110)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	5.702	6.019	6.453	5.773	6.930	6.316	5.237	5.114	6.387	5.772	5.331	5.123	5.846
2001	5.751	6.021	5.640	7.116	6.657	5.911	5.107	4.802	6.543	5.971	5.729	4.998	5.854
2002	5.263	6.068	6.249	7.639	7.633	6.816	5.376	5.451	6.890	6.326	5.156	5.225	6.174
2003	5.537	6.082	6.835	7.204	6.565	6.301	5.491	4.946	6.919	6.328	5.521	5.274	6.084
2004	N/A	5.803	6.926	6.585	7.909	6.469	5.521	5.269	6.757	6.161	5.422	5.217	6.185
2005	5.182	6.140	6.214	6.852	7.110	6.379	4.725	4.957	6.158	5.784	N/A	N/A	5.950

Global Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	5.826	6.187	6.605	5.924	7.095	6.410	5.450	5.273	6.592	6.089	5.584	5.369	6.034
2001	5.912	6.144	5.711	7.413	6.825	6.109	5.250	4.861	6.754	6.163	5.818	5.077	6.003
2002	5.441	6.139	6.333	7.683	7.605	6.749	5.346	5.358	6.791	6.278	5.132	5.307	6.180
2003	5.709	5.980	6.667	7.128	6.445	6.152	5.628	4.396	6.844	6.372	5.501	5.331	6.013
2004	N/A	5.750	6.554	6.585	7.635	6.147	5.414	5.246	6.754	6.201	5.471	5.441	6.109
2005	5.417	6.309	6.182	7.119	7.279	6.451	4.648	5.035	5.938	5.710	N/A	N/A	6.009

Diffused Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	1.188	2.788	2.540	5.610	4.136	2.545	2.865	4.737	5.269	2.504	4.026	1.166	3.281
2001	0.969	1.514	4.875	5.514	2.874	2.281	2.792	4.944	7.452	4.032	1.514	4.144	3.576
2002	2.217	1.352	5.321	3.323	1.664	2.458	3.170	4.716	6.026	2.399	2.058	3.842	3.212
2003	0.783	1.945	2.224	6.840	2.610	3.324	3.282	4.663	5.117	2.330	5.518	2.194	3.402
2004	N/A	4.043	2.147	5.589	6.355	4.063	3.305	3.556	7.257	5.288	3.851	1.246	4.246
2005	2.089	2.192	2.658	2.016	4.125	2.703	2.709	4.939	3.997	6.556	N/A	N/A	3.398

Average Daily Solar Irradiance (kWh/m²/day) - EMBATKALA*Global Irradiance (Skye SK 1110)*

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	3.680	3.912	3.242	5.780	6.777	6.922	5.906	6.067	6.681	5.454	5.014	3.971	5.284
2001	3.743	3.626	5.284	6.375	7.217	5.912	5.314	5.675	6.533	5.603	5.515	4.659	5.455
2002	2.764	4.177	4.767	7.706	7.596	6.894	N/A	5.819	6.693	6.088	5.011	3.282	5.527
2003	4.200	3.177	4.739	5.941	6.826	6.343	5.649	5.733	6.891	6.260	5.577	4.519	5.488
2004	3.353	3.881	4.821	5.244	7.716	6.783	5.794	5.623	6.774	6.212	5.267	3.648	5.426
2005	3.168	4.968	4.575	6.030	6.649	6.617	5.242	5.523	6.595	6.157	5.108	N/A	5.512

Global Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	3.745	3.945	3.286	5.704	6.607	6.546	5.501	5.709	6.328	5.268	4.864	3.875	5.115
2001	3.710	3.653	5.190	6.283	7.035	5.742	5.076	5.474	6.356	5.474	5.339	4.594	5.327
2002	2.850	4.222	4.791	7.637	7.507	6.705	N/A	5.470	6.439	5.857	4.803	3.249	5.412
2003	4.133	3.189	4.715	5.901	6.645	5.987	5.309	5.411	6.589	6.018	5.317	4.376	5.299
2004	3.298	3.874	4.843	5.254	7.418	6.357	5.483	5.266	6.376	5.881	4.909	3.518	5.206
2005	3.150	4.913	4.586	6.095	6.524	6.315	5.012	5.247	6.336	5.874	4.749	N/A	5.346

Diffused Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	2.160	2.392	2.736	2.189	2.242	2.954	2.987	3.051	2.498	2.037	1.801	1.772	2.402
2001	1.798	2.062	2.797	2.486	2.135	2.448	2.714	2.766	2.128	2.062	1.941	1.734	2.256
2002	1.785	1.880	1.929	1.664	1.728	2.549	N/A	2.980	1.997	1.689	1.837	1.655	1.972
2003	1.594	2.079	2.548	2.306	2.260	2.829	2.937	2.859	2.138	1.661	1.539	1.530	2.190
2004	1.592	1.840	1.966	2.420	2.002	2.525	2.843	2.606	2.247	1.507	1.486	1.770	2.067
2005	1.707	1.716	2.388	2.267	2.164	2.930	2.711	4.922	3.949	4.777	4.999	N/A	3.139

Average Daily Solar Irradiance (kWh/m²/day) - AGORDAT*Global Irradiance (Skye SK 1110)*

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	5.394	5.623	6.233	6.211	7.087	6.694	6.237	5.734	6.308	6.349	5.814	5.341	6.085
2001	5.683	5.897	6.189	7.328	7.016	6.785	5.522	5.194	6.372	6.363	5.856	5.317	6.127
2002	5.571	5.996	6.678	7.437	7.179	6.772	6.213	6.284	6.506	6.424	5.710	5.485	6.354
2003	5.543	6.125	6.782	7.502	7.014	6.620	6.157	N/A	N/A	N/A	5.778	N/A	6.440

Global Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	5.272	5.482	6.179	6.171	7.076	6.599	6.174	5.656	6.298	6.275	5.540	5.031	5.979
2001	5.405	5.538	5.830	7.261	6.983	6.811	5.497	5.229	6.386	6.193	5.606	5.005	5.979
2002	5.083	5.399	6.309	7.174	7.371	6.639	6.064	6.120	6.448	6.224	5.376	5.186	6.116
2003	5.345	5.981	6.768	7.371	7.043	6.585	5.886	N/A	N/A	N/A	5.463	N/A	6.305

Diffused Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	1.855	4.349	1.735	2.746	7.066	5.011	3.199	3.136	2.533	1.919	3.639	1.141	3.194
2001	0.993	1.919	2.653	2.106	2.336	2.408	2.834	3.786	3.258	6.056	1.495	1.114	2.580
2002	1.153	2.535	2.009	3.364	4.104	2.493	2.870	3.017	2.208	1.836	1.653	2.485	2.477
2003	1.220	1.466	2.041	2.753	2.959	2.862	3.247	N/A	N/A	N/A	1.215	N/A	2.221

Average Daily Solar Irradiance (kWh/m²/day) - AREZA*Global Irradiance (Skye SK 1110)*

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	6.311	6.838	7.432	5.929	6.557	6.467	5.138	4.341	5.834	6.111	6.316	5.965	6.103
2001	6.490	6.828	6.618	7.378	6.727	6.641	4.553	4.546	6.611	6.869	7.206	6.820	6.441
2002	7.212	7.853	7.903	8.869	8.343	7.301	6.034	5.370	6.917	7.180	6.754	6.836	7.214

Global Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	6.133	6.652	7.273	5.815	6.445	6.345	5.051	4.330	5.679	5.933	6.106	5.722	5.957
2001	6.273	6.594	6.193	7.230	6.545	6.497	4.447	4.037	6.034	6.113	6.199	5.683	5.987
2002	5.927	6.522	6.787	7.832	7.443	6.427	5.266	4.679	5.973	6.118	5.659	5.596	6.186

Diffused Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	0.954	6.285	4.786	2.913	2.716	6.372	4.424	2.746	2.421	1.668	0.975	1.088	3.112
2001	0.748	1.316	2.194	1.902	2.578	3.951	3.732	2.919	2.141	1.662	0.907	0.889	2.078
2002	1.017	1.292	1.860	1.441	2.119	4.055	3.039	2.687	2.240	1.884	1.230	0.869	1.978

Average Daily Solar Irradiance (kWh/m²/day) - DAHLAK*Global Irradiance (Skye SK 1110)*

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	4.787	5.031	5.157	6.492	6.878	6.548	6.503	6.544	6.849	6.397	5.903	5.483	6.048
2001	2.737	4.392	6.026	7.021	7.177	6.762	6.481	6.544	6.843	6.424	5.926	5.484	5.985

Global Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	4.592	4.880	5.096	6.288	6.562	6.054	6.095	6.125	6.472	6.105	5.590	5.134	5.749
2001	2.616	4.227	5.780	6.747	7.055	6.428	6.074	6.125	6.460	6.129	5.616	5.136	5.699

Diffused Irradiance (Kipp & Zonen CM 11)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	N/A	N/A	5.191	6.900	7.281	6.718	3.143	4.722	4.497	4.455	2.812	1.551	4.727
2001	2.182	3.836	6.292	7.498	7.760	7.045	3.211	4.722	4.427	4.639	2.822	1.545	4.665

Average Daily Solar Irradiance (kWh/m²/day) - ASMARA AIRPORT*Global Irradiance (Skye SK 1110)*

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	6.532	6.820	7.304	6.606	7.536	7.008	5.811	5.865	6.961	6.815	6.288	6.062	6.634
2001	6.566	6.823	6.359	7.977	7.484	6.744	5.676	N/A	N/A	6.667	6.271	5.519	6.609
2002	5.997	6.769	7.366	8.665	8.343	7.591	5.994	5.987	7.698	N/A	N/A	6.168	7.058
2003	6.763	7.003	7.573	8.488	7.128	6.798	5.839	5.162	7.44172	N/A	N/A	N/A	6.911
2004	N/A	N/A	7.683	7.155	8.463	7.172	5.908	5.677	7.553	7.209	6.350	6.349	6.952

Average Daily Solar Irradiance (kWh/m²/day) - TIO*Global Irradiance (Skye SK 1110)*

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	5.386	6.100	6.435	6.651	6.956	6.758	5.816	6.260	6.012	5.608	5.415	4.983	6.032
2001	N/A	N/A	6.091	7.271	6.959	6.502	5.896	6.498	6.798	6.305	5.788	5.303	6.341
2002	4.456	6.194	6.178	6.840	7.668	6.902	6.088	6.290	7.022	6.842	6.004	4.374	6.238
2004	4.669	N/A	6.981	7.035	7.911	7.134	5.962	6.152	N/A	4.570	4.066	4.886	5.937

Average Daily Solar Irradiance (kWh/m²/day) - ASSAB
Global Irradiance (Skye SK 1110)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	6.107	6.496	7.097	6.903	7.078	6.867	5.864	6.061	6.097	6.384	6.461	6.081	6.458
2001	6.172	6.956	6.443	7.600	7.340	6.973	6.099	6.353	6.918	6.698	6.235	5.813	6.633
2002	5.490	6.848	6.933	7.584	7.600	6.990	6.060	6.104	6.176	6.466	5.8136	4.947	6.418

Average Daily Solar Irradiance (kWh/m²/day) - NAKFA
Global Irradiance (Skye SK 1110)

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	5.116	5.562	5.681	6.633	7.329	6.855	6.126	6.279	6.140	6.059	5.532	4.864	6.015
2001	4.526	5.306	6.128	7.152	7.120	6.399	5.880	6.152	7.192	6.211	5.783	5.016	6.072
2002	3.677	5.402	6.592	7.687	7.695	N/A	5.651	6.279	6.952	6.758	5.736	4.453	6.080
2003	5.185	4.848	6.756	7.409	7.030	6.445	6.073	5.560	6.776	6.900	6.006	5.016	6.167
2004	4.603	4.923	6.864	6.684	7.936	N/A	N/A	6.305	6.987	6.821	5.847	4.849	6.182

Average Daily Solar Irradiance (kWh/m²/day) - ALIGDIR
Global Irradiance (Skye SK 1110)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2001	6.263	6.548	6.666	7.464	7.148	6.975	6.110	5.903	6.862	6.670	6.174	5.605	6.532
2002	5.663	6.074	6.722	7.156	7.090	7.130	6.646	6.552	6.933	6.610	6.202	5.903	6.557
2003	6.012	6.631	7.249	7.625	6.971	7.138	6.605	6.043	6.983	6.833	6.284	5.911	6.690
2004	5.663	6.282	6.908	7.370	7.516	7.130	7.151	6.776	7.104	N/A	N/A	N/A	6.878

Air Temperature

Ten stations in WSMN have temperature-sensing equipment. The five stations of these are solar stations while the rest are wind stations. In solar stations, temperature measurements are taken every full hour. On the other hand, wind stations take temperature measurement every 10-minute.

Here the average daily minimum and maximum temperature for 10 stations are presented. To do so, the minimum and maximum temperatures of every day were extracted. Then they were averaged on a monthly basis, which they were averaged annually later. The temperatures are on a degree Celsius scale.

Air Temperature (c⁰) - ASMARA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	T _{min}	8.56	10.31	12.52	12.64	14.21	14.36	13.41	13.36	11.35	11.26	10.29	8.95	11.77
	T _{max}	21.63	23.32	25.14	23.17	24.86	25.22	22.35	21.51	22.84	20.65	21.49	21.60	22.81
2001	T _{min}	7.03	10.24	11.47	13.88	14.19	12.72	13.22	13.51	11.52	11.47	9.39	9.24	11.49
	T _{max}	21.17	23.65	23.54	25.06	25.26	22.86	21.28	21.07	23.06	21.57	20.24	21.52	22.52
2002	T _{min}	6.45	7.52	8.81	6.18	10.86	12.17	10.19	11.01	9.86	10.09	8.67	5.19	8.92
	T _{max}	23.25	26.42	27.58	27.93	27.68	27.26	27.11	24.76	24.38	23.57	24.35	23.6	25.66
2003	T _{min}	8.07	11.09	12.51	13.46	8.28	11.60	13.81	13.70	11.99	12.05	10.24	8.78	11.30
	T _{max}	22.48	24.52	25.33	25.48	22.87	24.91	21.36	21.50	23.75	21.34	21.75	22.06	23.11
2004	T _{min}	N/A	10.57	11.41	12.92	14.44	13.40	13.43	13.44	12.21	11.52	11.13	8.60	12.10
	T _{max}	N/A	22.95	24.74	24.29	25.69	24.32	22.70	22.00	23.69	21.92	22.57	22.25	23.37
2005	T _{min}	8.24	11.56	11.92	13.91	13.36	14.61	13.22	13.13	12.70	11.74	N/A	N/A	12.44

	T _{max}	22.29	24.86	25.17	24.95	24.53	25.29	21.28	22.46	23.44	21.32	N/A	N/A	23.56
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Air Temperature (c⁰) - EMBATKALA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	T _{min}	14.87	15.36	15.79	19.36	22.37	24.45	23.27	22.78	22.40	18.41	17.23	15.56	19.32
	T _{max}	18.74	18.98	19.54	25.96	29.78	31.86	31.39	30.28	29.33	24.46	21.89	19.58	25.15
2001	T _{min}	13.69	14.57	17.54	19.34	22.43	23.33	22.41	22.48	21.90	19.47	17.23	17.92	19.36
	T _{max}	17.90	18.42	23.22	25.95	29.81	31.00	30.33	29.94	29.31	26.02	23.01	25.85	25.90
2002	T _{min}	13.69	14.57	17.11	N/A	22.43	23.33	N/A	22.00	21.25	19.81	18.53	16.43	18.92
	T _{max}	17.90	18.42	22.79	N/A	29.81	31.00	N/A	30.53	29.07	26.35	24.73	21.80	25.24
2003	T _{min}	14.48	15.73	15.83	19.14	23.04	23.49	22.60	22.73	22.82	19.04	17.84	16.26	19.42
	T _{max}	18.91	19.56	20.99	25.16	29.78	30.95	30.39	29.69	29.79	25.75	23.64	22.30	25.57
2004	T _{min}	15.88	14.80	16.81	19.65	23.01	25.37	23.83	22.91	22.65	19.64	18.22	15.46	19.85
	T _{max}	22.03	21.82	22.17	25.10	30.78	35.19	31.62	30.37	29.59	26.69	24.29	20.40	26.67
2005	T _{min}	14.58	17.06	19.23	19.91	20.62	25.23	22.92	23.66	22.75	18.95	17.61	N/A	20.23
	T _{max}	20.95	23.75	27.61	27.32	27.01	32.91	31.66	31.61	29.97	25.67	23.43	N/A	27.44

Air Temperature (c⁰) - AGORDAT

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	T _{min}	17.32	17.64	18.25	23.85	26.01	24.77	24.64	23.62	22.66	21.99	21.63	18.34	21.73
	T _{max}	33.11	34.34	35.90	38.42	40.19	38.21	35.60	33.87	36.42	36.40	36.43	33.92	36.07
2001	T _{min}	16.13	16.83	20.84	24.71	25.52	25.05	24.82	22.75	22.34	23.39	20.85	19.85	21.92
	T _{max}	32.21	33.48	36.90	40.50	40.49	37.40	34.43	32.10	36.39	38.16	36.50	35.15	36.14
2002	T _{min}	16.22	18.80	20.06	22.88	23.97	25.90	24.59	22.94	22.42	23.96	22.24	17.30	21.77
	T _{max}	31.47	35.32	37.31	39.86	41.08	39.14	36.77	33.90	37.27	38.75	37.14	32.94	36.74
2003	T _{min}	16.21	17.61	18.15	23.02	26.70	25.31	24.37	N/A	N/A	N/A	N/A	N/A	21.62
	T _{max}	33.63	34.74	36.69	40.09	41.72	38.12	34.31	N/A	N/A	N/A	N/A	N/A	37.04

Air Temperature (c⁰) - AREZA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	T _{min}	15.18	16.52	17.66	17.41	18.89	17.85	15.68	15.22	16.73	15.64	15.69	15.14	16.47
	T _{max}	25.65	26.98	28.41	26.69	27.79	26.12	22.73	20.81	24.12	24.55	25.35	24.81	25.33
2001	T _{min}	14.09	16.67	17.46	18.56	19.25	16.09	15.11	15.18	17.29	17.05	15.12	15.58	16.46
	T _{max}	24.46	26.97	26.77	29.13	28.50	24.72	21.18	20.36	24.40	25.59	25.03	25.44	25.21
2002	T _{min}	14.43	16.74	17.77	17.97	20.12	17.84	16.42	15.26	17.25	17.31	16.09	14.40	16.80
	T _{max}	24.73	27.03	27.56	28.67	29.31	26.47	24.65	21.93	24.79	26.54	25.66	24.31	25.97

Air Temperature (c⁰) - DAHLAK

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	T _{min}	22.96	23.17	24.46	26.91	28.08	29.08	32.12	32.04	29.89	28.09	26.26	24.08	27.26
	T _{max}	29.56	29.34	30.27	34.46	36.42	37.91	40.84	39.12	37.33	34.78	33.25	30.35	34.47
2001	T _{min}	22.71	23.29	25.47	26.88	28.28	29.89	31.50	31.02	30.43	29.05	25.06	24.37	27.33
	T _{max}	27.07	28.80	32.02	34.40	36.30	38.81	40.20	39.03	37.15	35.99	33.44	31.86	34.59

Air Temperature (c⁰) - ASMARA AIRPORT

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	T _{min}	5.11	6.53	8.60	9.99	11.55	12.50	12.73	13.10	8.85	9.03	7.42	5.75	9.26
	T _{max}	22.32	24.13	25.92	23.87	25.21	25.46	22.17	21.33	23.04	21.67	22.81	22.53	23.37
2001	T _{min}	3.68	6.75	7.94	10.57	11.11	11.85	12.95	N/A	N/A	9.44	7.17	6.39	8.79
	T _{max}	22.07	24.57	24.39	25.80	25.93	23.30	21.59	N/A	N/A	22.20	21.32	22.35	23.35
2002	T _{min}	5.36	7.10	8.81	9.74	10.55	12.77	12.55	12.24	10.49	N/A	N/A	6.04	9.57
	T _{max}	22.20	24.76	25.55	25.32	26.40	25.26	23.81	21.79	22.88	N/A	N/A	22.56	24.05
2003	T _{min}	4.81	7.93	9.05	10.27	12.38	13.03	13.18	12.98	9.98	N/A	N/A	N/A	10.40
	T _{max}	23.46	25.45	26.10	26.97	26.20	24.32	21.51	21.14	23.66	N/A	N/A	N/A	24.31
2004	T _{min}	N/A	N/A	8.39	10.03	11.18	11.49	12.33	12.69	10.15	9.45	8.25	5.41	9.94
	T _{max}	N/A	N/A	25.40	25.03	25.85	24.60	23.13	21.99	23.78	22.29	23.33	23.13	23.85

Air Temperature (c⁰) - TIO

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	T _{min}	20.81	22.30	24.00	25.17	26.86	27.39	30.66	30.86	28.82	26.81	24.38	N/A	26.19
	T _{max}	28.79	28.61	30.28	32.12	34.25	35.75	37.52	37.10	35.71	33.53	32.04	N/A	33.25
2001	T _{min}	N/A	N/A	25.02	25.38	27.02	27.53	29.95	30.43	29.26	27.26	22.52	22.20	26.66
	T _{max}	N/A	N/A	31.49	32.35	33.75	36.98	37.30	36.53	35.36	33.85	30.48	30.46	33.86
2002	T _{min}	22.74	22.59	24.41	25.66	24.67	27.99	30.88	30.92	28.71	25.90	23.67	24.13	26.02
	T _{max}	27.64	30.06	31.20	33.31	32.62	36.08	37.33	37.23	35.95	64.91	31.13	29.06	35.54

Air Temperature (c⁰) - ASSAB

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	T _{min}	21.99	22.02	24.54	26.66	27.90	29.38	31.75	31.32	30.01	27.49	25.55	23.44	26.84
	T _{max}	30.27	31.10	32.85	34.97	35.70	36.21	38.85	68.84	36.30	34.02	33.24	31.00	36.95
2001	T _{min}	22.08	22.40	25.49	26.56	28.79	30.59	31.35	30.84	29.70	27.26	24.17	23.98	26.93
	T _{max}	29.16	30.05	32.89	35.23	35.31	38.04	39.25	37.60	35.61	35.07	33.08	31.76	34.42
2002	T _{min}	23.22	23.31	24.84	26.54	27.11	30.28	31.66	32.11	30.04	26.96	24.60	24.13	27.07
	T _{max}	29.69	30.92	32.60	34.47	34.57	36.92	38.33	38.16	35.89	35.50	33.25	30.71	34.25

Air Temperature (c⁰) - NAKFA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	T _{min}	N/A	12.84	13.62	17.04	19.32	22.10	21.01	20.30	18.74	15.01	14.41	12.38	16.98
	T _{max}	N/A	20.75	21.09	26.21	29.44	31.42	29.48	28.23	28.58	24.38	22.61	20.58	25.71
2001	T _{min}	10.94	12.11	15.16	17.21	19.30	20.58	19.42	19.09	18.54	16.75	14.14	13.58	16.40
	T _{max}	18.55	20.24	23.93	26.42	29.75	29.15	27.45	27.20	28.90	26.27	22.69	22.28	25.24
2002	T _{min}	11.61	13.98	15.18	16.99	18.98	N/A	20.69	19.66	19.02	16.35	14.81	12.63	16.35
	T _{max}	18.39	21.90	24.64	26.39	29.33	N/A	29.58	28.65	29.74	26.51	23.62	20.13	25.35
2003	T _{min}	11.39	13.59	14.97	17.38	19.93	21.59	20.50	19.36	18.74	15.79	14.68	13.10	16.75
	T _{max}	20.12	21.02	23.32	26.11	29.87	30.27	28.07	27.59	28.76	25.09	23.74	21.24	25.43
2004	T _{min}	12.57	12.42	14.59	16.60	19.22	N/A	N/A	19.78	18.75	15.61	15.13	12.32	15.70
	T _{max}	19.94	19.77	23.38	25.35	29.96	N/A	N/A	28.37	28.84	25.27	23.87	20.38	24.51

Air Temperature (c⁰) - ALIGDIR

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2001	T _{min}	15.86	17.37	21.11	25.58	25.96	24.20	23.03	21.44	21.50	21.88	20.71	19.10	21.48
	T _{max}	32.75	35.06	37.62	41.02	40.22	37.01	33.27	30.83	35.25	37.17	36.04	35.28	35.96
2002	T _{min}	15.07	18.80	21.45	24.99	25.04	25.55	23.68	21.86	22.36	23.62	22.95	16.63	21.83
	T _{max}	32.23	36.23	38.16	40.28	41.23	38.75	36.09	33.54	35.76	37.98	37.21	33.04	36.71
2003	T _{min}	17.31	19.02	20.95	24.62	26.76	24.50	22.36	21.59	21.32	23.47	21.42	18.01	21.78
	T _{max}	34.55	36.28	37.88	40.61	41.15	37.17	33.22	31.30	34.21	37.68	36.83	34.86	36.31
2004	T _{min}	17.13	17.90	21.68	24.42	26.22	24.08	22.80	22.05	22.25	N/A	N/A	N/A	22.06
	T _{max}	33.78	34.76	38.47	40.01	41.19	37.32	35.42	33.76	35.58	N/A	N/A	N/A	36.70

Relative Humidity

Humidity is moisture content of the atmosphere. The atmosphere always contains some moisture in the form of water vapor; the maximum amount depends on the temperature. The amount of vapor that will saturate the air increases with a rise in temperature. At 4.4° C (40° F), 454 kg of moist air contains a maximum of 2 kg of water vapor; at 37.8° C (100° F), the same amount of moist air contains a maximum of 18 kg of water vapor. When the atmosphere is saturated with water, the level of discomfort is high because the evaporation of perspiration, with its attendant cooling effect, is impossible. Humidity is measured with a hygrometer.

Humidity is specified in several different ways. The weight of water vapor contained in a volume of air is known as the *absolute humidity* and is expressed in grams of water vapor per cubic meter. The ratio of the weight of water vapor to the total weight of air (including the water vapor) is known as the *specific humidity*. The ratio of the weight of water vapor to the weight of dry air (with the water vapor removed) is known as the *mixing ratio*. Both the specific humidity and the mixing ratio are expressed in grams of water vapor per kilogram of air. If air expands or contracts, its absolute humidity changes but its specific humidity and mixing ratio do not.

Relative humidity, given in weather reports, is the ratio between the actual vapor content of the air and the vapor content of air at the same temperature saturated with water vapor. If the temperature of air rises and no change occurs in its vapor content, then the absolute humidity remains the same but the relative humidity is lowered. A fall in temperature increases the relative humidity.

If air cools to the point that its relative humidity reaches 100 percent, then the air is saturated and can not hold any more water vapor. The air is said to have reached its *dew point*. If the air cools any farther, then some of the water vapor will condense. If the air is adjacent to the ground, the extra moisture will condense as dew or frost. Above the ground, the extra moisture will condense into cloud droplets or ice crystals and form clouds or fog. Under the proper conditions, rain, snow, sleet, or hail may fall from clouds.

In the wind solar monitoring network, the wind and solar stations have relative humidity sensors. The wind stations take relative humidity measurement every 10-minute as the solar stations take only full hour measurements. Following the monthly and yearly average daily minimum and maximum relative humidity are presented.

Relative Humidity (%) - ASMARA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	27.91	19.81	19.36	30.12	26.23	24.92	57.65	67.85	35.81	46.85	37.80	28.40	35.23
	max	86.57	82.01	66.87	83.66	66.93	65.47	100.0	100.0	91.07	99.63	99.14	89.93	86.76
2001	min	21.30	16.80	20.98	26.87	21.90	40.96	64.90	75.78	39.18	45.29	40.85	34.83	37.47
	max	85.52	77.69	71.45	80.67	62.07	91.42	106.1	100.0	100.0	99.78	99.76	100.0	90.47
2002	min	15.57	10.63	9.30	8.16	11.70	14.52	20.71	33.63	22.08	24.02	22.33	12.33	17.08
	max	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2003	min	19.91	24.12	20.30	24.07	18.20	24.49	65.13	71.55	36.41	41.47	36.31	28.82	34.23
	max	85.53	80.98	70.52	79.62	82.60	78.27	100.0	100.0	94.34	95.38	96.51	95.63	89.57
2004	min	N/A	30.46	21.20	32.28	18.88	31.80	54.74	65.84	33.77	39.75	35.89	29.02	35.78
	max	N/A	87.35	81.38	92.88	46.52	76.62	100.0	100.0	91.31	94.20	100.0	100.0	89.50
2005	min	23.25	18.50	26.23	30.06	33.87	33.18	70.37	65.79	38.51	39.55	N/A	N/A	37.93
	max	86.23	65.79	85.96	83.94	80.16	79.52	100.0	100.0	96.42	95.61	N/A	N/A	89.22

Relative Humidity (%) - EMBATKALA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	81.52	84.48	84.73	40.72	29.06	19.09	29.21	36.86	28.39	59.80	74.52	80.40	54.06
	max	100.0	100.0	100.0	87.54	63.18	44.80	61.90	69.84	62.58	97.02	100.0	100.0	85.13
2001	min	85.64	91.77	49.26	55.40	26.81	26.03	35.34	42.59	33.58	50.51	62.06	75.30	52.86
	max	100.0	100.0	100.0	98.30	72.38	55.09	73.91	77.96	79.28	94.67	95.10	100.0	89.89
2002	min	85.64	91.77	51.23	N/A	26.81	26.03	N/A	35.85	31.39	50.96	69.43	91.65	56.08
	max	100.0	100.0	100.0	N/A	72.38	55.09	N/A	79.25	87.37	89.37	100.0	100.0	92.87
2003	min	83.70	93.34	69.26	58.88	42.11	26.16	38.85	46.48	32.14	49.60	64.05	81.52	57.17
	max	100.0	100.0	100.0	100.0	74.17	58.25	76.56	80.74	72.92	90.48	93.45	100.0	91.91
2004	min	85.44	94.78	74.56	67.22	24.53	26.68	35.00	42.47	33.87	53.87	70.58	91.61	58.39
	max	100.0	100.0	100.0	100.0	56.95	61.24	72.05	78.96	78.37	93.86	99.66	100.0	92.91
2005	min	93.84	78.74	82.89	60.21	48.88	29.97	41.02	43.21	34.10	50.13	76.10	N/A	58.10
	max	100.0	100.0	100.0	100.0	92.16	64.65	81.37	84.82	80.23	91.12	100.0	N/A	97.38

Relative Humidity (%) - AGORDAT

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	25.30	24.71	21.38	14.80	14.71	20.96	30.22	39.54	28.30	24.70	21.01	24.12	24.15
	max	91.49	92.52	88.86	56.52	45.46	58.15	75.87	88.42	84.43	88.09	88.61	92.40	79.23
2001	min	26.45	27.34	14.68	13.17	13.88	22.78	37.68	54.57	33.29	21.44	18.84	26.96	25.92
	max	95.82	95.49	75.36	58.65	46.38	63.07	80.82	100.0	94.26	79.35	89.96	100.0	82.16
2002	min	32.96	24.68	18.76	12.97	12.59	19.23	32.39	45.12	28.99	18.18	21.92	29.25	24.75
	max	97.58	100.0	84.27	65.28	43.94	49.91	82.24	100.0	80.97	65.57	88.28	98.22	79.77

Relative Humidity (%) - AREZA

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	17.46	14.60	15.51	22.33	20.35	30.77	55.50	74.90	38.11	34.96	25.38	22.65	31.04
	max	57.54	51.50	49.00	57.93	56.25	67.25	94.68	100.0	77.89	79.91	67.97	62.15	69.07
2001	min	18.35	16.39	17.34	17.98	18.93	38.98	71.27	83.94	42.90	28.86	24.84	21.66	33.45
	max	57.55	50.50	45.95	56.12	49.51	84.37	100.0	100.0	80.44	71.70	67.87	66.08	70.51
2002	min	24.01	18.42	21.12	15.82	17.15	30.43	52.49	69.42	36.66	25.92	27.80	26.74	30.50
	max	65.52	52.64	55.08	50.03	40.39	72.61	92.37	100.0	77.89	67.41	70.84	71.41	68.63

Relative Humidity (%) - DAHLAK

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	51.66	56.21	58.44	43.02	38.62	31.23	26.19	36.22	39.71	51.79	49.87	60.49	45.29
	max	91.22	90.74	91.74	91.47	92.17	90.40	84.64	82.20	87.42	90.26	94.62	99.29	90.51
2001	min	79.59	65.35	56.92	48.62	43.70	30.71	29.95	40.90	49.42	49.11	42.08	51.76	49.01
	max	100.0	100.0	97.96	94.55	95.27	88.30	87.02	91.17	90.05	91.01	95.65	99.86	94.73

Relative Humidity (%) - ASMARA AIRPORT

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	26.67	19.26	18.69	28.43	25.74	24.82	56.70	65.52	33.88	42.91	33.86	26.23	33.56
	max	98.08	92.88	77.73	91.67	74.06	71.66	100.0	100.0	96.71	100.0	100.0	97.40	93.51
2001	min	20.08	16.92	21.01	25.72	20.47	40.27	61.61	N/A	N/A	40.28	36.15	32.34	31.49
	max	96.88	86.13	78.71	87.21	69.10	95.60	100.0	N/A	N/A	100.0	100.0	100.0	93.38
2002	min	29.41	22.21	23.57	20.69	19.99	29.72	48.05	60.49	35.48	N/A	N/A	29.79	31.94
	max	100.0	90.85	87.77	80.84	63.88	75.12	100.0	100.0	95.40	N/A	N/A	100.0	91.71
2003	min	20.23	23.61	20.09	19.08	27.83	37.05	65.74	70.48	33.93	N/A	N/A	N/A	35.34
	max	95.75	91.19	78.81	71.56	81.84	83.07	100.0	100.0	99.34	N/A	N/A	N/A	91.43
2004	min	N/A	N/A	22.03	31.27	18.99	30.49	53.10	62.73	30.22	36.31	34.24	27.60	34.70
	max	N/A	N/A	86.45	99.08	53.35	82.64	100.0	100.0	95.68	96.24	100.0	100.0	94.45

Relative Humidity (%) - TIO

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	54.79	60.21	56.75	51.39	47.65	40.63	37.69	42.51	49.79	54.19	46.74	N/A	49.30
	max	86.66	91.51	89.59	90.26	89.41	83.25	76.68	76.45	85.20	90.05	84.17	N/A	85.75
2001	min	N/A	N/A	54.90	55.71	57.35	34.02	37.62	48.92	56.14	51.64	51.81	53.15	50.13
	max	N/A	N/A	91.37	89.82	92.74	78.45	76.80	85.66	86.46	89.37	86.34	87.65	86.46
2002	min	75.59	57.03	56.96	52.57	58.63	43.28	42.61	47.42	55.25	47.50	54.47	72.16	55.29
	max	100.0	92.19	88.89	89.70	97.09	83.05	80.43	81.18	89.13	87.50	90.02	96.56	89.66

Relative Humidity (%) - ASSAB

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	41.32	37.24	31.80	36.38	36.46	35.08	31.46	35.85	45.78	53.50	46.89	53.41	40.43
	max	78.37	72.43	69.35	73.92	81.63	81.75	77.88	80.43	86.74	91.15	86.71	93.03	81.12
2001	min	56.40	51.97	46.12	40.77	52.23	29.41	34.17	50.55	60.59	53.66	45.39	55.34	48.05
	max	88.84	91.69	88.41	85.89	98.65	86.31	85.83	92.80	98.90	96.58	90.32	93.49	91.48
2002	min	70.33	56.57	51.64	50.28	54.41	42.29	44.19	48.96	65.45	50.04	53.58	73.60	55.11
	max	100.0	97.07	95.44	96.22	100.0	95.70	93.98	94.21	100.0	100.0	99.55	100.0	99.04

Relative Humidity (%) - NAKFA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	N/A	54.31	50.26	29.48	23.87	17.07	29.09	36.33	26.62	46.38	56.38	62.71	39.32
	max	N/A	100.0	100.0	80.36	60.01	44.23	62.91	73.77	73.75	99.34	100.0	100.0	83.77
2001	min	68.78	58.61	37.44	36.01	21.05	24.58	41.04	49.68	27.60	42.21	52.82	56.49	43.03
	max	100.0	100.0	99.48	92.33	68.49	60.30	80.21	88.66	88.89	97.90	100.0	100.0	92.47
2002	min	77.63	55.83	41.76	31.76	19.98	N/A	34.89	38.09	24.34	36.08	53.78	68.68	43.89
	max	100.0	100.0	100.0	82.74	57.50	N/A	72.36	83.80	81.97	87.05	100.0	100.0	91.22
2003	min	58.13	50.62	39.79	37.48	28.64	25.63	41.20	48.98	31.05	40.23	46.30	58.94	42.25
	max	100.0	100.0	100.0	91.96	75.27	57.99	74.71	92.07	85.16	88.23	100.0	100.0	92.19
2004	min	65.99	68.03	48.11	49.80	20.51	N/A	N/A	44.37	29.71	39.21	54.39	72.98	49.31
	max	100.0	100.07	96.57	100.0	54.06	N/A	N/A	83.17	79.39	91.79	100.00	100.0	95.77

Relative Humidity (%) - ALIGDIR

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2001	min	19.07	17.57	9.98	10.29	14.29	23.30	42.11	58.72	38.67	26.44	19.78	22.59	25.23
	max	76.63	72.83	42.66	37.59	42.30	71.52	89.73	100.0	100.0	88.12	77.41	82.89	73.79
2002	min	23.62	15.94	12.57	11.10	11.26	19.79	32.44	44.02	34.38	22.36	18.32	21.05	22.24
	max	80.66	71.30	47.97	39.49	30.97	60.13	83.57	98.43	90.67	70.68	67.76	71.01	67.72
2003	min	18.22	19.09	13.33	10.92	12.75	28.44	45.70	58.71	44.77	24.82	19.75	20.72	26.44
	max	72.18	67.74	52.43	37.55	35.98	74.92	97.55	100.0	100.0	75.99	71.72	81.79	73.13
2004	min	23.45	22.66	14.04	13.97	13.95	26.53	36.16	47.57	38.76	N/A	N/A	N/A	26.34
	max	77.33	72.92	54.76	48.89	37.47	73.24	89.92	100.0	96.97	N/A	N/A	N/A	72.46

Atmospheric Pressure

Pressure is the force per unit area exerted by a liquid or gas on a body or surface, with the force acting at right angles to the surface uniformly in all directions.

Air pressure is the force exerted by the weight of a column of air above a particular location. Since there's a lot of "empty" space between air molecules, air can be compressed to fit in a smaller volume. When it's compressed, air is said to be "under high pressure". Barometers are used to measure the current air pressure at a particular location in "inches of mercury" or in "millibars" (mb).

There are ten stations within the wind and solar network in which barometric sensors are attached at. Five of them, the solar stations, collect atmospheric pressure reading every full hour. The rest five stations, the wind stations, take pressure reading every 10 minute.

The tables present the monthly and annual average daily minimum and maximum of the 10 stations mentioned above. All units are in *hecto* Pascal. The unit *hecto* Pascal is defined as a pressure of 1.02 g/sq cm, which, in terms of the conventional mercury barometer, corresponds to 0.760 mm of mercury.

Atmospheric Pressure (hPa) - ASMARA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	771.9	772.5	771.3	772.2	772.7	772.3	771.5	771.7	772.3	773.1	772.2	772.8	772.2
	max	774.4	775.0	773.7	774.6	774.9	774.5	773.8	774.1	774.7	775.5	774.6	775.1	774.6
2001	min	772.1	771.8	771.5	772.0	772.6	772.8	772.4	772.6	772.7	773.2	773.3	773.2	772.5
	max	774.4	774.2	774.2	774.6	775.1	775.0	774.5	774.9	775.1	775.6	775.7	775.7	774.9
2002	min	771.4	770.4	769.3	767.1	771.2	771.3	771.9	771.3	772.7	771.7	772.2	771.4	771.0
	max	776.7	776.8	775.9	775.7	776.2	777.2	776.4	776.9	778.1	776.9	777.1	777.5	776.8
2003	min	773.3	772.5	772.0	771.9	773.0	772.3	772.8	772.4	773.2	773.4	772.8	773.2	772.7
	max	775.7	775.0	774.7	774.4	775.4	774.9	774.8	774.7	775.5	775.8	775.3	775.6	775.2
2004	min	N/A	772.8	772.0	771.8	773.3	773.9	772.3	773.0	772.8	773.4	773.0	772.4	772.8
	max	N/A	775.4	774.6	774.6	775.5	776.1	774.4	775.2	775.2	775.9	775.3	774.8	775.2
2005	min	772.5	772.3	772.4	772.1	773.0	772.8	773.2	772.5	773.0	773.5	N/A	N/A	772.7
	max	775.0	774.9	774.9	774.6	775.3	775.0	775.5	774.9	775.5	775.8	N/A	N/A	775.1

Atmospheric Pressure (hPa) - EMBATKALA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	860.6	861.2	859.5	859.2	859.3	858.1	856.7	857.3	858.8	860.8	860.3	861.4	859.4
	max	863.5	864.1	862.4	862.1	861.7	860.3	859.5	860.2	861.6	863.7	863.1	864.1	862.2
2001	min	861.3	860.3	859.2	859.1	858.9	858.6	858.0	858.2	859.2	860.6	861.6	861.6	859.7
	max	864.1	863.3	861.9	862.1	861.6	861.0	860.6	861.3	862.0	863.6	864.6	864.5	862.5
2002	min	861.3	860.3	859.4	N/A	858.9	858.6	N/A	858.5	860.3	860.5	861.4	862.0	860.1
	max	864.1	863.3	862.1	N/A	861.6	861.0	N/A	861.4	863.1	863.3	864.2	864.9	862.9
2003	min	862.0	860.6	859.9	858.9	859.6	858.4	858.4	858.2	859.5	861.0	860.7	861.9	859.9
	max	864.9	863.5	862.8	861.8	862.1	860.7	860.9	861.0	862.3	863.9	863.7	864.7	862.7
2004	min	859.9	861.6	860.0	858.7	859.8	860.0	857.7	858.7	859.3	861.2	861.1	861.0	859.9
	max	862.9	864.5	862.9	862.0	862.4	862.5	860.3	861.4	862.0	864.0	863.7	863.8	862.7

2005	min	861.2	860.3	860.1	859.2	859.9	858.7	858.9	858.2	859.4	861.2	861.6	N/A	859.9
	max	864.1	863.3	862.9	862.1	862.6	861.0	861.6	861.0	862.2	864.1	864.4	N/A	862.7

Atmospheric Pressure (hPa) - AGORDAT

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	940.8	940.2	938.0	937.8	937.5	938.5	939.0	940.0	938.8	940.1	939.7	941.6	939.3
	max	945.8	945.6	943.4	943.4	942.9	943.4	943.7	944.6	944.2	945.2	944.4	946.4	944.4
2001	min	941.7	940.0	938.7	936.8	937.5	939.4	940.5	941.4	939.1	939.2	940.9	941.1	939.7
	max	946.6	945.0	943.7	942.4	943.0	944.4	944.8	945.9	944.4	944.6	945.7	946.0	944.7
2002	min	942.6	940.4	938.1	936.5	937.2	938.9	940.2	940.7	940.0	938.9	940.3	942.7	939.7
	max	947.6	945.6	943.6	942.0	942.6	944.1	944.9	945.5	945.3	943.9	945.3	947.5	944.8

Atmospheric Pressure (hPa) - AREZA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	797.3	797.7	796.2	797.0	797.4	797.4	796.9	797.3	797.3	798.1	797.6	798.3	797.4
	max	800.0	800.5	799.1	800.0	800.3	800.1	799.6	800.0	800.3	801.0	800.2	800.9	800.2
2001	min	797.7	797.1	796.9	796.8	797.4	798.1	797.9	798.1	797.6	798.1	798.6	798.6	797.7
	max	800.2	799.9	799.9	800.0	800.5	800.8	800.4	800.9	800.7	801.2	801.3	801.3	800.6
2002	min	798.4	798.1	796.7	796.2	797.3	798.0	798.5	798.2	798.5	797.9	798.5	798.8	797.9
	max	801.1	800.9	799.8	799.3	800.2	801.0	801.2	801.0	801.5	800.8	801.2	801.4	800.8

Atmospheric Pressure (hPa) - DAHLAK

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	1006.0	1007.1	1004.0	1001.5	1000.0	997.9	995.4	996.8	999.5	1003.4	1003.9	1006.5	1001.8
	max	1010.1	1011.3	1008.6	1005.8	1003.7	1001.0	999.4	1000.7	1003.4	1007.5	1007.9	1010.5	1005.8
2001	min	1008.1	1005.8	1002.8	1001.5	999.9	998.2	997.5	998.1	999.9	1002.7	1005.6	1006.0	1002.2
	max	1011.8	1010.0	1007.0	1006.0	1003.7	1001.5	1001.2	1002.1	1003.9	1007.0	1009.9	1010.3	1006.2

Atmospheric Pressure (hPa) - ASMARA AIRPORT

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	772.7	773.0	771.8	772.7	773.2	772.9	772.0	772.3	772.9	773.6	772.8	773.3	772.8
	max	775.3	775.6	774.4	775.3	775.6	775.1	774.5	775.0	775.4	776.2	775.3	775.8	775.3
2001	min	772.6	772.3	772.1	772.5	773.0	773.4	772.9	N/A	N/A	773.8	773.8	773.7	773.0
	max	775.1	774.9	774.9	775.3	775.6	775.6	775.3	N/A	N/A	776.3	776.4	776.4	775.6
2002	min	773.5	773.3	772.0	771.8	773.0	773.5	773.7	773.4	774.2	N/A	N/A	773.8	773.2
	max	776.1	775.9	774.9	774.6	775.4	775.8	776.1	775.9	776.7	N/A	N/A	776.3	775.8
2003	min	773.9	773.0	772.5	772.3	773.8	773.0	773.3	773.0	773.7	N/A	N/A	N/A	773.2
	max	776.3	775.6	775.3	775.0	776.2	775.3	775.6	775.5	776.2	N/A	N/A	N/A	775.7
2004	min	N/A	N/A	772.5	772.2	773.8	774.4	772.8	773.5	773.2	773.9	773.5	772.9	773.3
	max	N/A	N/A	775.2	775.3	776.1	776.8	775.1	776.0	775.8	776.5	775.9	775.4	775.8

Atmospheric Pressure (hPa) - TIO

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	1009.2	1009.6	1007.2	1004.6	1003.5	1001.4	999.2	1000.4	1002.7	1006.7	1007.4	N/A	1004.7
	max	1013.9	1014.2	1012.4	1009.4	1007.5	1004.7	1003.0	1004.5	1006.8	1011.0	1011.6	N/A	1009.0
2001	min	N/A	N/A	1005.7	1004.8	1003.1	1002.0	1001.3	1001.7	1003.3	1006.1	1009.0	1009.6	1004.7
	max	N/A	N/A	1010.7	1009.6	1007.3	1005.2	1004.9	1005.8	1007.5	1010.4	1013.5	1014.1	1008.9
2002	min	1011.3	1009.0	1006.0	1004.3	1004.0	1002.2	1001.6	1001.6	1004.6	973.7	1008.3	1010.4	1003.1
	max	1015.7	1013.9	1011.2	1009.4	1007.9	1005.9	1005.1	1005.4	1008.9	1010.4	1012.9	1014.7	1010.1

Atmospheric Pressure (hPa) - ASSAB

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	1009.5	1009.2	1006.8	1003.9	1002.1	999.6	997.8	978.0	1000.9	1005.0	1007.0	1009.2	1002.4
	max	1014.2	1014.2	1012.1	1009.0	1006.6	1003.9	1002.1	1003.4	1005.9	1009.9	1011.4	1013.7	1008.9
2001	min	1009.5	1008.1	1005.0	1003.6	1000.9	999.4	998.8	999.4	1001.0	1004.2	1007.9	1009.0	1003.9
	max	1014.2	1013.0	1010.5	1008.7	1005.6	1003.0	1002.8	1004.2	1005.9	1009.2	1012.7	1013.7	1008.6
2002	min	1009.6	1008.5	1004.9	1002.9	1001.1	999.1	998.7	999.1	1001.7	1004.0	1006.8	1008.5	1003.7
	max	1014.2	1013.6	1010.2	1008.2	1005.6	1003.2	1002.9	1003.7	1006.8	1009.0	1011.8	1013.1	1008.5

Atmospheric Pressure (hPa) - NAKFA

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2000	min	N/A	827.4	825.9	826.0	826.2	825.0	823.4	824.0	825.8	827.4	826.9	827.7	825.9
	max	N/A	830.1	828.5	828.9	828.7	827.4	826.3	827.1	828.5	830.3	829.5	830.2	828.7
2001	min	827.2	826.6	825.7	825.9	825.9	825.2	824.7	825.1	826.3	827.4	828.0	828.1	826.3
	max	829.8	829.2	828.4	828.8	828.6	827.9	827.4	828.1	829.0	830.3	831.0	830.8	829.1
2002	min	828.0	827.3	825.7	825.4	825.9	N/A	825.5	825.3	827.4	827.3	827.9	828.2	826.7
	max	830.7	830.1	828.6	828.4	828.5	N/A	828.1	828.2	830.1	830.1	830.7	830.9	829.5
2003	min	828.1	827.0	826.4	825.8	826.7	825.2	824.9	825.2	826.6	827.9	827.3	828.2	826.6
	max	830.9	829.6	829.1	828.7	829.4	827.7	827.6	828.0	829.3	830.7	830.3	830.9	829.4
2004	min	826.2	827.8	826.6	825.6	826.8	N/A	N/A	825.8	826.4	827.9	827.6	827.2	826.8
	max	829.0	830.5	829.4	828.8	829.4	N/A	N/A	828.6	829.0	830.8	830.3	829.8	829.6

Atmospheric Pressure (hPa) - ALIGDIR

		Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	A _{mean}
2001	min	942.5	940.8	939.6	937.6	938.6	940.7	942.0	942.7	940.6	940.5	941.8	941.9	940.8
	max	946.6	945.0	944.1	942.6	943.9	945.8	946.3	947.3	945.7	945.6	945.9	946.1	945.4
2002	min	943.4	941.1	939.2	937.3	938.3	940.1	941.3	942.0	941.3	939.9	941.0	943.5	940.7
	max	947.6	945.5	943.8	942.0	942.9	945.3	946.4	947.0	946.5	944.6	945.4	947.6	945.4
2003	min	942.8	940.7	939.7	937.9	938.5	939.8	942.2	942.3	941.8	940.2	940.6	942.4	940.7
	max	946.9	945.1	944.3	942.6	943.5	945.2	946.9	946.6	946.5	944.8	944.7	946.4	945.3
2004	min	941.3	941.9	939.2	937.9	938.6	941.6	940.7	942.2	940.5	N/A	N/A	N/A	940.4
	max	945.4	946.3	943.6	943.0	943.6	946.8	945.6	946.8	945.9	N/A	N/A	N/A	945.2

Rainfall

Rain means precipitation of liquid drops of water. Raindrops generally have a diameter greater than 0.5 mm (0.02 in). They range in size up to about 3 mm (about 0.13 in) in diameter, and their rate of fall increases, up to 7.6 m (25 ft) per sec with their size. Larger drops tend to be flattened and broken into smaller drops by rapid fall through the air. The precipitation of smaller drops, called drizzle, often severely restricts visibility but usually does not produce significant accumulations of water.

Amount or volume of rainfall is expressed as the depth of water that collects on a flat surface, and is measured in a rain gauge to the nearest 0.25 mm (0.01 in). Rainfall is classified as light if not more than 2.5 mm (0.10 in) per hr, heavy if more than 7.50 mm (more than 0.30 in) per hr, and moderate if between these limits.

Rainfall (mm) - ASMARA

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	1.83	0.81	0.61	44.76	658.41	17.70	242.14	168.07	30.73	17.70	12.61	1.42	1196.79
2001	2.23	1.63	1.02	33.17	20.55	74.47	248.66	323.55	19.32	8.75	3.05	13.42	749.81
2002	3.45	1.42	7.93	4.88	9.77	18.11	130.64	245.60	25.03	6.51	17.50	3.05	473.89

2003	1.42	13.83	10.38	9.36	31.34	26.65	108.05	181.28	3.25	6.92	0.61	2.64	395.72
2004	N/A	7.93	1.83	68.98	3.66	53.32	122.51	136.13	8.75	17.71	10.58	3.45	434.84
2005	1.02	0.00	40.29	64.71	80.59	19.94	36.62	26.40	3.25	0.20	N/A	N/A	273.01

Rainfall (mm) - EMBATKALA

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	81.38	29.70	19.91	13.63	6.10	3.46	67.35	97.69	8.54	126.56	82.41	44.55	581.28
2001	32.95	30.70	18.51	20.34	2.85	42.73	87.50	45.38	7.53	46.19	0.61	7.52	342.81
2002	70.37	31.32	13.22	0.00	6.72	0.00	N/A	695.19	40.70	35.00	6.71	86.67	985.88
2003	51.46	54.70	18.30	1.63	0.41	19.53	102.56	33.58	3.05	89.34	16.88	26.85	418.28
2004	45.75	52.26	10.97	21.97	17.91	0.41	3.46	1.22	1.22	9.15	9.56	34.37	208.24
2005	26.02	11.38	30.50	7.31	0.00	12.21	0.00	1471.90	69.59	1.63	0.20	N/A	1630.74

Rainfall (mm) - AGORDAT

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	0.00	0.00	0.00	6.10	1.63	928.64	55.36	113.96	49.65	54.34	0.00	0.20	100.82
2001	0.00	0.20	0.20	9.77	4.48	28.49	65.12	215.71	26.66	0.00	0.00	0.00	29.22
2002	0.00	0.00	22.79	12.21	7.12	0.41	105.41	191.70	26.45	0.81	0.81	5.70	31.12
2003	0.00	2.44	23.40	14.45	16.28	49.45	136.53	N/A	N/A	N/A	8.55	N/A	31.39

Rainfall (mm) - AREZA

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	0.00	0.00	4.27	25.23	33.57	68.79	72.85	134.09	39.47	92.58	0.41	0.61	471.86
2001	0.00	0.41	17.50	19.33	7.73	72.04	151.18	144.66	58.81	20.55	9.77	0.61	502.58
2002	0.00	1.83	7.32	8.55	27.27	18.51	41.50	91.56	41.30	7.12	8.55	4.88	258.40

Rainfall (mm) - DAHLAK

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	25.23	12.21	10.78	0.00	0.00	0.00	0.00	1.22	10.18	147.73	59.83	7.53	274.71
2001	3.05	5.49	0.00	0.20	0.00	0.00	1.42	55.15	14.04	0.00	0.00	0.00	79.36

Rainfall (mm) - ASMARA AIRPORT

	Jan	Feb	Mar	Apr	may	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	0	0	0.4	0.4	23.6	20.8	97.4	184.4	43	15.2	0	0.6	385.8
2001	0	0	0.6	2.2	0.6	6.6	59.2	98.4	36	6.2	0.4	3.6	213.8
2002	0	0.2	1	0	23	22	195.8	155.2	32	2.4	0	0.4	432
2003	0.2	0.4	0	6.6	0.6	0.6	0	0.4	0.2	3.6	N/A	N/A	12.6

Rainfall (mm) - TIO

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	56.8	4.6	16	0	0	0	0	0	1	0	0.6	0	79
2001	N/A	N/A	24	0	0	0	0.2	22.2	0	0	0	0	46.4
2002	138.6	14.6	1	1	0	0	0	0	0	0	0	1.4	156.6

Rainfall (mm) - ASSAB

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	0.4	6.8	1.2	0	0.4	0	0	0.4	0	4.4	0.8	19.6	34
2001	0	0	0	3.8	0.2	0	0	1.6	0	0	0	1.6	7.2
2002	39.4	0	0	4	0	0	0	0	0.8	0.4	0	25.4	70

Rainfall (mm) - NAKFA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	18	9	17.4	3.2	1.6	0	15	17.2	13.4	9.2	13.2	98.6	215.8
2001	14.2	5.8	17	17.6	9.8	8.2	3.2	0	0	0	0	0	75.8
2002	0	0.2	26	10.4	2	N/A	0.6	3.6	0.2	2.2	6.4	9	60.6
2003	7.4	13.8	24.2	5.8	6	5.4	23.6	79.2	1.6	3.6	6.6	4.6	181.8
2004	15	17.2	13.4	9.2	13.2	98.6	N/A	45	14	25.8	7.8	5	264.2

Rainfall (mm) - ALIGDIR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2000	0	0	0.4	0.4	23.6	20.8	97.4	184.4	43	15.2	0	0.6	385.8
2001	0	0	0.6	2.2	0.6	6.6	59.2	98.4	36	6.2	0.4	3.6	213.8
2002	0	0.2	1	0	23	22	195.8	155.2	32	2.4	0	0.4	432
2003	0.2	0.4	0	6.6	0.6	0.6	0	0.4	0.2	3.6	N/A	N/A	12.6
2004	0	0	0.4	0.4	23.6	20.8	97.4	184.4	43	15.2	0	0.6	385.8

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