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Climatic field data including validation

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National foreword

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CLIMATIC FIELD DATA INCLUDING VALIDATION

FOREWORD

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IEC/TR 62130, which is a technical report, has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
104/572/DTR	104/577/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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CLIMATIC FIELD DATA INCLUDING VALIDATION

1 Scope

IEC/TR 62130, which is a technical report, provides traceable recommendations from validated field data for updating IEC 60721-2-1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60721-1:1982, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

IEC 60721-2-1:1982, *Classification of environmental conditions – Part 2-1: Environmental conditions appearing in nature – Temperature and humidity*
Amendment 1:1987

3 Current IEC 60721-2-1 standard dealing with temperature and humidity

IEC 60721-2-1:1982 and its Amendment 1 (1987) give maps of climatic types with the following parameters:

– mean value of the annual extreme daily mean values of temperature, humidity and highest temperature with RH $<$ 95 %;
– mean value of the annual extreme values of temperature, humidity and highest temperature with RH $\geq$ 95 %;
– absolute extreme values of temperature, humidity and highest temperature with RH $\geq$ 95 %.

Values of parameters and maps of statistical open-air climates in the geographical areas of the world are given in Tables 1 to 3, and in Figures 1 and 2, respectively.

Table 1 – Types of climate by extreme daily mean values from the current standard

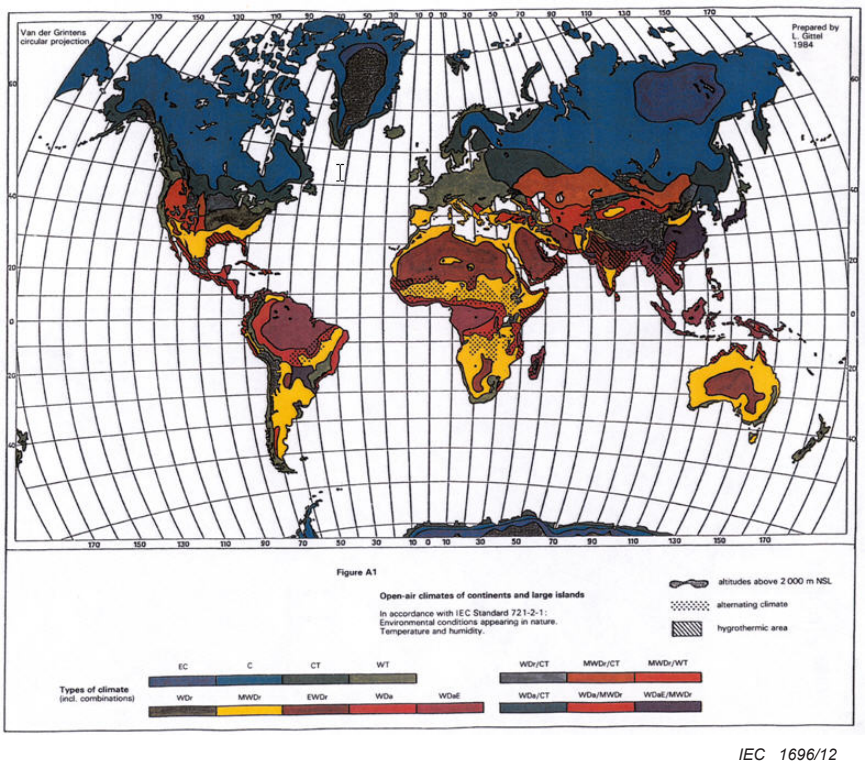
Type of climate	Mean value of the annual extreme daily mean values of temperature and humidity			
	Low temperature	High temperature	Highest temperature with RH ≥ 95 %	Highest absolute humidity
	°C	°C	°C	g × m^{-3}
Extremely cold (except Central Antarctic)	–55	+26	+18	14
Cold	–45	+25	+13	12
Cold temperate	–29	+29	+18	15
Warm temperate	–15	+30	+20	17
Warm dry	–10	+35	+23	20
Mild warm dry	0	+35	+24	22
Extremely warm dry	+8	+43	+26	24
Warm damp	+12	+35	+28	27
Warm damp, equable	+17	+33	+31	30

Table 2 – Types of climate by annual extreme values from the current standard

Type of climate	Mean value of the annual extreme values of temperature and humidity			
	Low temperature	High temperature	Highest temperature with RH ≥ 95 %	Highest absolute humidity
	°C	°C	°C	g × m^{-3}
Extremely cold (except Central Antarctic)	–65	+32	+20	17
Cold	–50	+32	+20	18
Cold temperate	–33	+34	+23	20
Warm temperate	–20	+35	+25	22
Warm dry	–20	+40	+27	24
Mild warm dry	–5	+40	+27	25
Extremely warm dry	+3	+55	+28	27
Warm damp	+5	+40	+31	30
Warm damp, equable	+13	+35	+33	36

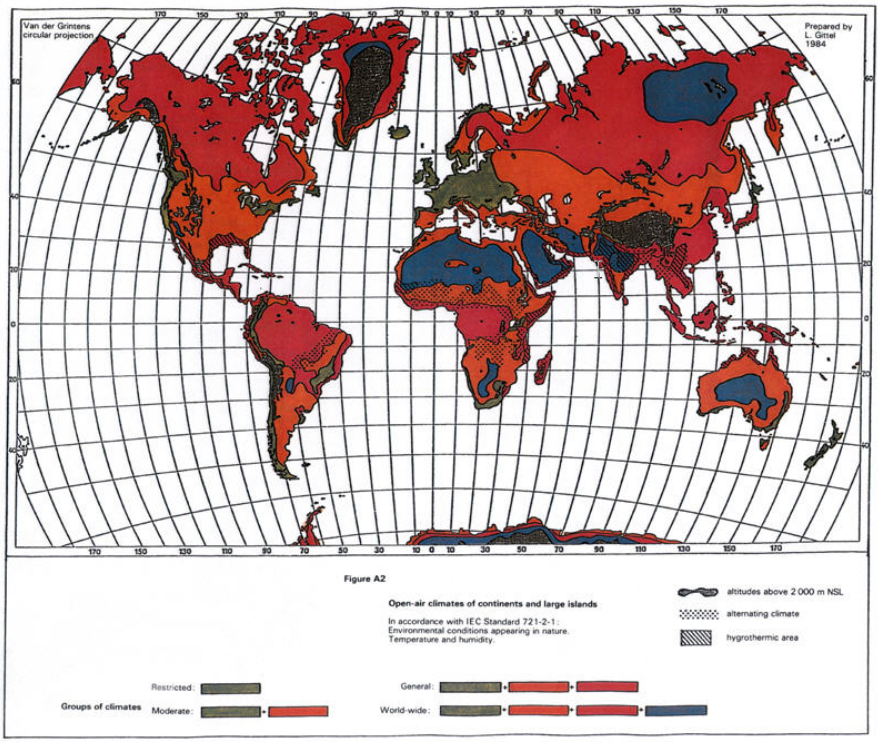
Table 3 – Types of climate by absolute extreme value from the current standard

Type of climate	Absolute extreme values of temperature and humidity			
	Low temperature °C	High temperature °C	Highest temperature with RH ≥ 95 % °C	Highest absolute humidity $g \times m^{-3}$
Extremely cold (except Central Antarctic)	–75	+40	+24	20
Cold	–60	+40	+27	22
Cold temperate	–45	+40	+28	25
Warm temperate	–30	+40	+28	25
Warm dry	–30	+45	+30	27
Mild warm dry	–15	+45	+31	30
Extremely warm dry	–10	+60	+31	30
Warm damp	0	+45	+35	36
Warm damp, equable	+4	+40	+37	40



IEC 1696/12

Figure 1 – Current map showing types of climate and their combinations



IEC 1697/12

Figure 2 – Current map showing the groups of climates

4 Task 1

The purpose of task 1 is to collect field data and to collate the validated data into a form suitable for comparison with IEC 60721-2-1.

The field data was collected from two independent main sources. The data was organized, arranged and analysed using a spreadsheet (Figure 3 and attachment). Annex A shows the graphical data based on the data in Annex B. The validation process is described in details in Clauses 5 and 6.

				Mean value of the annual extreme daily mean values of temperature and humidity			Mean value of the annual extreme values of temperature and humidity			Absolute extreme value of temperature and humidity				
	City or Locaton	Proposal	Type according the map by M.Kottek et al	Low temperature (°C)	High temperature (°C)	Highest absolute humid	Low temperature (°C)	High temperature (°C)	Highest absolute humid	Low temperature (°C)	High temperature (°C)	Highest absolute humid	Years on record	
4	Akureyri, IL	very low	polar	-11	19	13	-17	23	14	-19	27	21	1973-1992	Expert CD, 1997
5	Jan Mayen, No	very low	polar	-14	11	8	-19	12	8	-26	18	11	1973-1992	Expert CD, 1997
6	Godthab, GL	very low	polar	-14	14	9	-21	18	10	-28	21	13	1973-1992	Expert CD, 1997
7	Eureka, CN	very low	polar	-35	1	5	-50	15	7	-53	19	9	1973-1992	Expert CD, 1997
8	Mould Bay, airport, CN	very low	polar	-34	2	5	-47	13	8	-53	19	11	1973-1992	Expert CD, 1997
9	Resolute airport, CN	very low	polar	-32	2	7	-45	13	9	-51	16	25	1973-1992	Expert CD, 1997
10	Sondre Stromfjord	very low	polar	-26	15	8	-40	21	9	-46	22	11	1973-1992	Expert CD, 1997
11	Forbisher, CN	very low	polar	-26	10	8	-42	23	10	-45	25	32	1973-1992	Expert CD, 1997
12	Thule, CN	very low	polar	-26	8	6	-39	15	7	-44	20	9	1973-1992	Expert CD, 1997
13	Fort Reliance, CN	very low	polar	-27	16	10	-45	28	14	-52	33	21	1973-1992	Expert CD, 1997
14		very low	Polar	-40	25	15	-50	30	20	-60	35	25		
15	Harbin,China	Low	snow	-14	24	14	-33	33	23	-37	37	29	1973-1992	Expert CD, 1997
16	Nome, AK, US	very low	snow	-24	16	9	-37	25	12	-47	28	16	1973-1992	Expert CD, 1997
17	Chibougamau-Chapais, CN	very low	snow	-21	21	13	-40	31	17	-44	35	20	1973-1992	Expert CD, 1997
18	Mountain Home, ID, US	Intermediate	Snow	-13	31	13	-20	40	14	-30	43	23	1973-1992	Expert CD, 1997
19	Renner, KS, US	Intermediate	Snow	-12	33	14	-24	37	18	-32	40	21	1973-1992	Expert CD, 1997
20	Jinzhou,China	Intermediate	snow	-6	29	15	-19	34	27	-23	37	37	1973-1992	Expert CD, 1997
21	Yulin,China	Intermediate	snow	-10	27	13	-23	35	19	-29	39	26	1973-1992	Expert CD, 1997
22	Pyongynag,N.Korea	Intermediate	snow	-5	25	17	-20	33	24	-25	35	29	1973-1992	Expert CD, 1997
23	Beijing,China	Intermediate	snow	-1	28	16	-14	37	26	-17	39	29	1973-1992	Expert CD, 1997
24	Griffiss AFB/Rome, NY, US	Low	snow	-13	28	17	-27	34	22	-34	36	24	1973-1992	Expert CD, 1997
25	Winnipeg Intl Airport, CN	Low	snow	-18	25	13	-35	35	20	-38	38	24	1973-1992	Expert CD, 1997
26	Huron Regional, SD, US	Low	snow	-16	31	16	-31	39	22	-38	42	25	1973-1992	Expert CD, 1997
27	Andoya NORWAY	Intermediate	snow	-11	16	10	-16	23	12	-20	26	16	1973-1992	Expert CD, 1997
28	Oslo NORWAY	Intermediate	snow	-10	22	12	-19	30	15	-26	35	17	1973-1992	Expert CD, 1997
29	Shengyang,China	Low	snow	-8	26	15	-25	34	24	-28	38	27	1973-1992	Expert CD, 1997
30	Jyvaskyla FINLAND	Low	snow	-18	19	12	-31	28	16	-38	34	23	1973-1992	Expert CD, 1997
31	Kajaani FINLAND	Low	snow	-21	18	11	-34	27	15	-41	30	19	1973-1992	Expert CD, 1997
32		Low	Snow	-25	35	25	-45	45	25	-50	45	30		
33	Gibraltor	High	WT	9	31	17	5	36	18	-1	39	20	1973-1992	Expert CD, 1997
34	Palma Mallorca SPAIN	High	WT	2	30	19	-3	36	24	-6	40	29	1973-1992	Expert CD, 1997
35	Rabat, Morocco	High	WT	13	23		5	38		0	48		1973-1992	Expert CD, 1997
36	Naples ITALY	High	WT	3	30	19	-2	36	25	-5	40	32	1973-1992	Expert CD, 1997
37	Posadas airport, AG	High	WT	6	37	25	1	39	27	-2	41	36	1973-1992	Expert CD, 1997
38	Buenos Aires, AG	High	WT	1	33	21	-3	37	24	-4	40	29	1973-1992	Expert CD, 1997
39	Shanghai,China	High	WT	3	31	22	-6	37	28	-9	39	30	1973-1992	Expert CD, 1997
40	Fukuoka,Japan	High	WT	4	29	20	-4	35	25	-7	38	29	1973-1992	Expert CD, 1997
41	Palermo ITALY	High	WT	10	33	21	5	37	26	2	43	34	1973-1992	Expert CD, 1997
42	Athens GREECE	High	WT	6	30	17	0	37	21	-3	41	26	1973-1992	Expert CD, 1997
43	Osaka(Itami),Japan	High	WT	4	28	19	-4	36	24	-7	38	27	1973-1992	Expert CD, 1997
44	Tokyo,Japan	High	WT	5	28	19	-3	34	25	-5	37	27	1973-1992	Expert CD, 1997

IEC 1698/12

Figure 3 – Screenshot from data analysis spreadsheet

5 Task 2

5.1 General

The purpose of task 2 is to ensure traceability of the comparison process.

5.2 Description of the comparison process

The high level process for updating IEC 60721-2 standards [1][1] is given in Figure 4. The process has four main phases. The traceability between measured field data and values given in the standard can be achieved by following this process. Detailed actions that were carried out in each phase are given in Table 4. To ensure full traceability, it is crucial that all process phases are documented and that the sources used can be found in the future.

In Phase 1, it is decided what standards will be reviewed and possibly updated. In Phase 2, data sources are identified and data is collected with certain attributes. Analysis of data and comparison to current values in the particular standard takes place in Phase 3. The data comparison process is a key phase to ensure traceability of data and it can vary depending on which parameters are in question. This phase is described in detail in Clause 6. The output of the process (Phase 4) helps the maintenance team decide how a standard should be updated and/or modified. The decision can also be a proposal to leave the parameters in the standard as they are.

1 References in square brackets refer to the Bibliography.

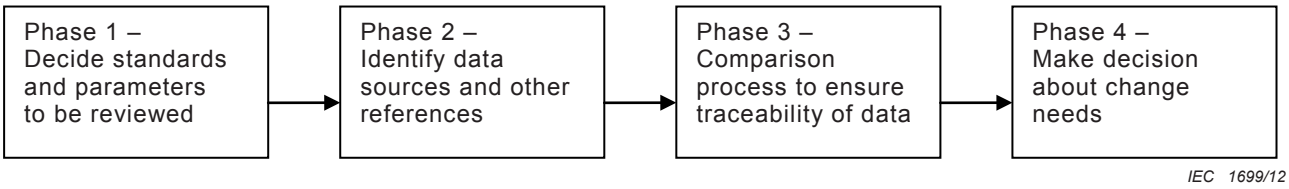


Figure 4 – High level comparison process to ensure traceability of data

Table 4 – Process phases and actions in the each phase

Process phase	Actions
Phase 1. Decide what standard and what parameters will be reviewed	Decide what standard will be reviewed Decide what parameters will be reviewed Document decisions
Phase 2. Identify data sources	Identify data and other input sources of parameters Identify the name of data source organization (universities, meteorological offices or corresponding organization) Ensure that data sources are independent from each other i.e. no same data Identify date and period of data collection Identify the location of measurement set-up Document the uncertainty of data Document all of the above attributes
Phase 3. Make comparison	Arrange data in a format so that it can be compared to data given in the standard Make comparison, evaluate whether there is a need to make changes Analyze impact of possible change Document the comparison process
Phase 4. Make decision	Make decision about proposal for possible changes Make decision whether changes are needed Document decisions with rationale Deliver decision to relevant maintenance team

5.3 Traceability of temperature and humidity parameters by using the main process

5.3.1 General

This subclause describes each process phase and the actions taken in each phase.

5.3.2 Process phase 1 – Decide what standard and what parameters to review

Temperature and humidity parameters in IEC 60721-2-1 to be reviewed. The decision can be found in the IEC TC 104 and WG14 meeting minutes from June 2006.

5.3.3 Process phase 2 – Identify data sources and other references

Two data sources [2], [3] were identified and used as input sources in the TC104 WG14 working group meeting in Stockholm, June 2006 (see the unconfirmed meeting minutes [4]). References [5] and [6] give maps of climatic classification which were identified after the Stockholm meeting:

a) MIL210 ExPERT database (Version 1.0 July 1997) [2]

Data is provided by ACFFF/SYS AFRL, 88 WS. Daily temperature and humidity data were collected during the years 1973 – 1992. Measurement locations are mainly airports and major cities worldwide. The total amount of sites/stations is 289. The uncertainty of measurement is not documented in the CD. The data source contained no data about the highest temperature with RH > 95 %.

b) The Hutchinson World Weather Guide by E.A. Pearce and C.G. Smith (ISBN 1-85986-342-6, 2000, Helicon Publishing Ltd) [3]

Data in this book was provided by the British Meteorological Office. The length of the measured period differs from location to location. The measurement span in years varies from 2 years up to 105 (Toronto, Ontario in Canada). The years express time when measurements were published. Detailed locations and uncertainty of measurement are not documented in the book. The data source contained no data about highest temperature with RH > 95 %.

c) M. Kottek, J. Grieser, C. Beck, B. Rudolf, and F. Rubel, 2006: World Map of the Köppen-Geiger climate classification updated. *Meteorol. Z.*, **15**, 259-263 [5]

Data sets (1951 – 2000) are from the Climatic Research Unit (CRU) of the University of East Anglia and from the Global Precipitation Climatology Centre (GPCC) at the German Weather Service. Detailed data analysis methods are given in the publication. Reference. 3 contained no data about highest temperature with RH > 95 %. IEC recognizes the work in the reference but has changed the description of "Snow" to "Cold", “Warm temperate” to “Temperate” and Equatorial” to “Tropical”.

d) Christoph Beck, Jürgen Grieser, Markus Kottek, Franz Rubel and Bruno Rudolf, Characterizing Global Climate Change By Means Of Köppen Climate Classification, *Klimastatusbericht*, **2005**, 139-149 [6]

Data sets (1951 – 2000) are from the Climatic Research Unit (CRU) of the University of East Anglia and from the Global Precipitation Climatology Centre (GPCC) at the German Weather Service. Detailed data analysis methods are given in the publication including a more detailed climatic map. Reference [6] contained no data about highest temperature with RH > 95 %.

References [2] and [3] were used to compare temperature and humidity values. The data for these references are independent from each other. References [5] and [6] were used for comparison purposes and the map of the climatic classes.

5.3.4 Process phase 3 – Comparison process to ensure traceability of data

The process phase 3 is given in detail in Clause 6 “to describe acceptable data comparison processes”

5.3.5 Process phase 4 – Make decision about change needs

Four different change recommendations were identified regarding climatic types, definitions, values and maps. Recommendations with rationale are given in Clause 7.

6 Task 3

6.1 General

The purpose of task 3 is to describe acceptable data comparison processes.

The purpose of the data comparison process is to ensure the traceability of data. This process is one part of the main comparison process (Phase 3).

At the October 2006 meeting, WG14 discussed how collected data should be compared to the tables and how to update the map of world climatic types given in IEC 60721-2-1 and as shown in Annex A (see also Figures 1 and 2). In order to make comparison of data it was decided to first validate the map (Figure 1).

6.2 Process for analysing the map

The process for analysing the map was as follows:

a) Making of a spreadsheet containing all temperature and humidity data points (location and/or city) from different sources.
b) Finding of current IEC 60721-2-1 climate types from the map for each data point. Only main climatic types were used.
c) Sorting of data points according to the current IEC 60721-2-1 type of climates
d) Comparing values given in Tables 1 to 3 IEC 60721-2-1:1982 to each data points in the spreadsheet
e) Finding of data points which don't fall under the particular climatic type
f) Analysing of the existing map in IEC 60721-1. How many data points fall under each particular climatic type?

As a result of analysis work it was noticed that about 35 % of data points didn't fall under climatic types where they were supposed to be. Based on this finding and further discussion it was concluded that the map was not up-to- date and it could be used only as reference. Adding a disclaimer was discussed.

The current map in IEC 60721-2-1 contains 9 main climatic types and 6 different combinations of the main climatic types. It was discussed by WG14 that the map could be too difficult to use due to number of detailed types of climates. It was decided to have a map with better readability. The proposal includes five new main climatic types. At the October 2006 meeting the working group discussed names of new categories such as: Very low, Low, Intermediate, High and High humid. After the October 2006 meeting, references [5] and [6] were found and a new proposal was made by the convener to use same main categories as in references [5] and [6] for several beneficial reasons. These are given in 7.1.

The process for analysing climatic types, maps and temperature and humidity parameters was as follows:

1) Formation of five new climatic types by combing IEC 60721-2-1 types:

IEC 60721-2-1 types	**Proposed new climatic types**
Warm damp and Warm damp, Equable	Tropical
Mild warm dry, Extremely warm dry	Arid
Warm temperate and Warm dry	Temperate
Cold temperate	Cold
Extremely cold and cold	Polar

2) Add new data points and review these using the spreadsheet in order to find possible errors.
3) Arrange data points (measurement location) under the proposed climatic types from References [5] and [6] .
4) Analysis of temperature and humidity values for new climatic types. Analysis results for each climatic type are given in Annex A. Some values were rounded and adjusted to correspond better with the experimental data points (location /city).
5) Propose new climatic types and values for temperature and humidity (Clause 7).

6.3 Impact analysis

Keeping in mind the goals of WG14 and the results of the comparison process, it is evident that some parameters, values and maps in the standard should be updated based on the results found.

Main impacts of the update compared to the current standard are as follows:

– background, analysis process and sources of values would be known;
– easier to use due to reduced amount of main climatic types (one target of WG14 work);
– about 50 % temperature and humidity values are changing due to reduced amount of categories;
– wider ranges are needed;
– removal of one parameter due to traceability reasons (no data found);
– simple and detailed up-to-date maps correspond with temperature and humidity values.

7 Task 4 – To make traceable recommendations for updating IEC 60721-2-1

7.1 General

There are four different recommendations on how to update IEC 60721-2-1. Recommendations and reasons are given below.

7.2 Recommendation 1 – Naming of new climatic types

WG14 proposes to the maintenance team to combine and rename existing climatic types in IEC 60721-2-1 according to Table 5. Names of climatic types are based on references [5] and [6]. Justifications for a change proposal are as follows:

– to enable easier usage of standard due to reduced number of categories of main climatic types;
– to drive convergence “standardization” thinking by using the most widely used and well known published climatic types;
– to give readers, when needed, a possibility to for further details of climatic types by referring to the already published climatic types. This is especially needed when designing or acquiring products to the certain environments;
– to enable easier access to data behind the map by referring to the publications and web references.

Table 5 – Recommended climatic types

Recommendation for new classes	Current IEC 60721-2-1 classes when combined
Tropical	Warm damp and Warm damp, Equable
Arid	Mild warm dry and Extremely warm dry
Temperate	Warm temperate and Warm dry
Cold	Cold temperate
Polar	Extremely cold and Cold

7.3 Recommendation 2 – Definitions for new climatic types

Definitions for new climatic types are given in Table 6. Definitions were taken from reference [6].

Table 6 – Definitions for proposed climatic types (reference [6])

Climate type	Definition
Tropical	Tropical rain climates where the mean temperature of the coldest month exceeds +18, 0 °C
Arid	Arid climates, rainfall less than 500 mm
Temperate	Temperate rain climates where the mean temperature of the coldest month is between –3,0 °C and +18,0 °C
Cold	Boreal forest and snow climates. Mean temperature of the warmest month exceeding 10,0 °C and a mean temperature of the coldest month below –3,0 °C
Polar	Cold snow climates. Mean temperature of the warmest month below 10,0 °C

7.4 Recommendation 3 – Values for new climatic types

Proposed new climatic categories and corresponding values are shown in Tables 7 to 9. Values are based on the data given in references [2] and [3]. Due to the traceability requirement of data, and no found data, it is proposed to remove "Highest temperature with RH ≥ 95 %" from this technical report. The reason for proposing this is the traceable requirements for data. All data sources which have been used in preparation of this technical report are now well known and adequate traceability is achieved. Also parameters can be updated more easily when new independent information is received.

Table 7 – Types of climate by extreme daily mean values

Type of climate	Mean value of the annual extreme daily mean values of temperature and humidity		
	Low temperature °C	High temperature °C	Highest absolute humidity $g \times m^{-3}$
Tropical	10	40	30
Arid	0	45	25
Temperate	–15	40	25
Cold	–25	35	25
Polar	–40	25	15

Table 8 – Types of climate by annual extreme values

Type of climate	Mean value of the annual extreme values of temperature and humidity		
	Low temperature °C	High temperature °C	Highest absolute humidity $g \times m^{-3}$
	°C	°C	$G \times m^{-3}$
Tropical	5	45	35
Arid	–10	50	30
Temperate	–20	40	30
Cold	–45	45	25
Polar	–50	30	20

Table 9 – Types of climate by absolute extreme value

Type of climate	Absolute extreme values of temperature and humidity		
	Low temperature °C	High temperature °C	Highest absolute humidity $g \times m^{-3}$
Tropical	0	50	40
Arid	–20	55	35
Temperate	–30	50	35
Cold	–50	45	30
Polar	–60	35	25

7.5 Recommendation 4 – Update of the map of climatic classes

There are three options on how to update climatic maps in IEC 60721-2-1:

a) **Option 1 –** Use the latest existing maps which are available in the scientific articles. IEC TC104/WG14 has permission from the authors to use the map such as that in Figure 5 in reference [5], on the condition that reference to the authors and journal is added to the standard[2]. In this case, the maps and data in Tables 7 to 9 correspond directly to each other.

b) **Option 2 –** Draw a new map with 181 locations from the spreadsheet and using references [2] and [3]. Reason: the map would be easy to update by adding new locations (city, country). In this case, the map and recommended data in Tables 7 to 9 correspond with each other.

c) **Option 3 –** Keep the existing map and add a disclaimer that the map(s) can be used only for reference purposes. Correspondence of data and maps is about 65 %.

WG14 recommends the use of Option 1.

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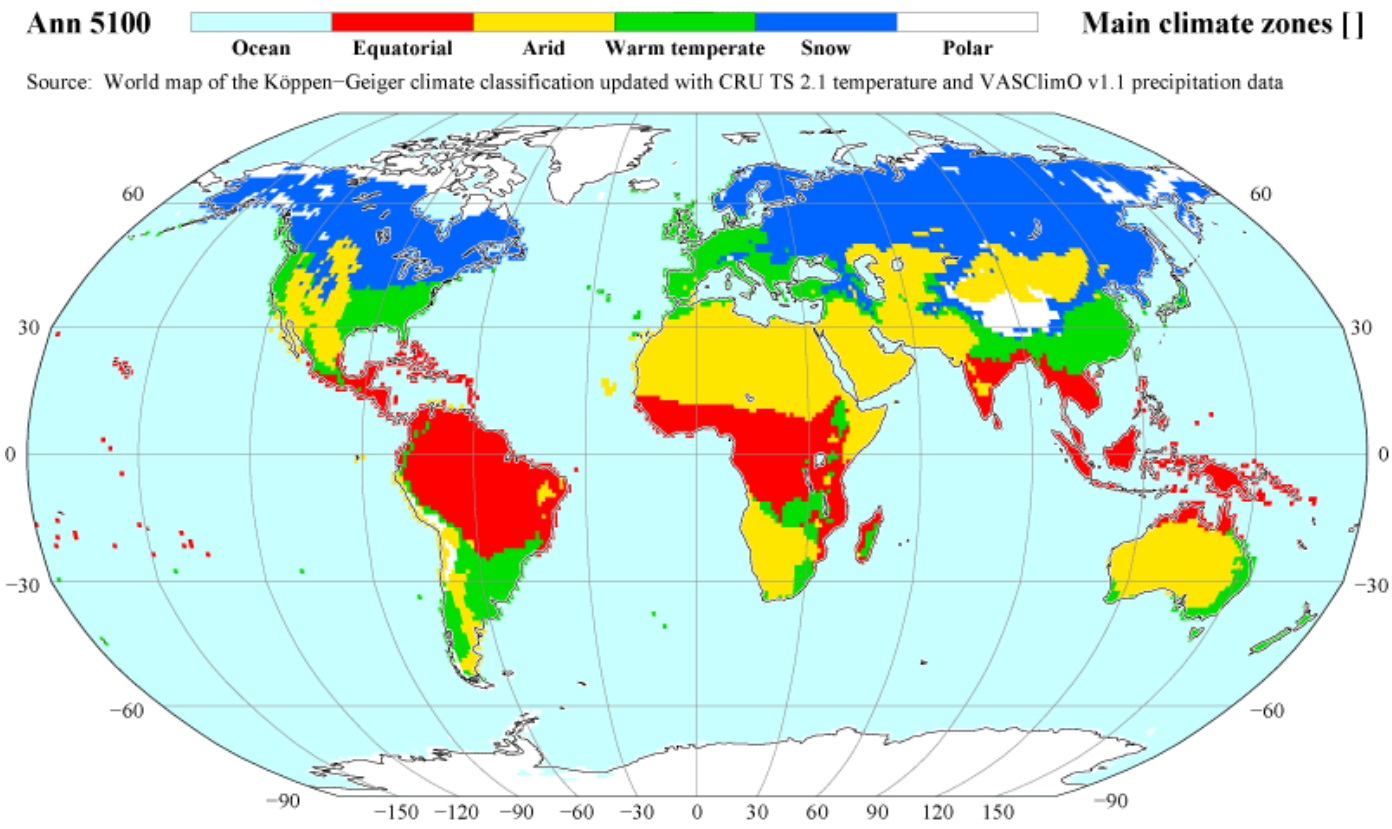
2 Discussions with Kyösti Väkeväinen and Markus Kottek, Department of Natural Sciences, University of Veterinary Medicine Vienna Veterinärplatz 1 A-1210, University of Vienna, 11th December 2006 and 5th January 2007.



NOTE WG14 received a new version of the map in February 2007 (see footnote 2).

Figure 5 – Main climatic types from reference [5]

Table 10 – Cross reference table between different climatic types

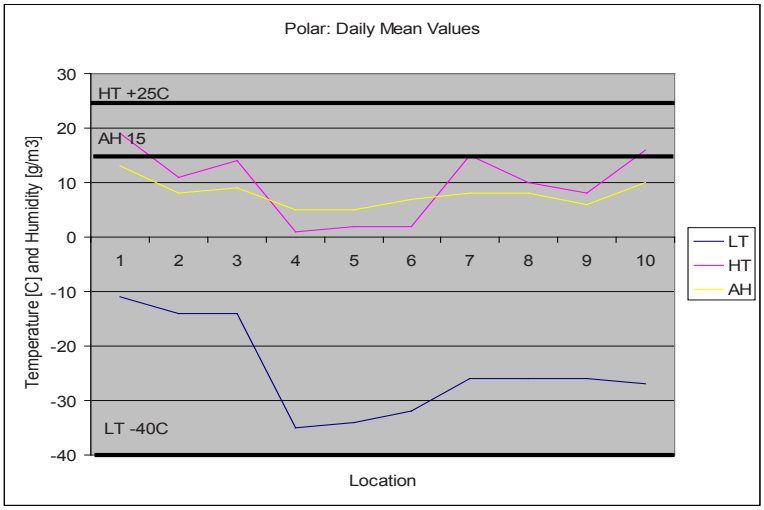
New proposed climatic types	Earlier proposed climatic types	Köppen-Geiger climate types	IEC 60721-2-1 types
Tropical	Equatorial	Equatorial	Warm damp and Warm damp, equable
Arid	Arid	Arid	Mild warm dry, Extremely warm dry
Temperate	Warm temperate	Warm temperate	Warm temperate and Warm dry
Cold	Cold	Snow	Cold Temperate
Polar	Polar	Polar	Extremely cold and cold

Annex A
(informative)

Analysis of temperature and absolute humidity

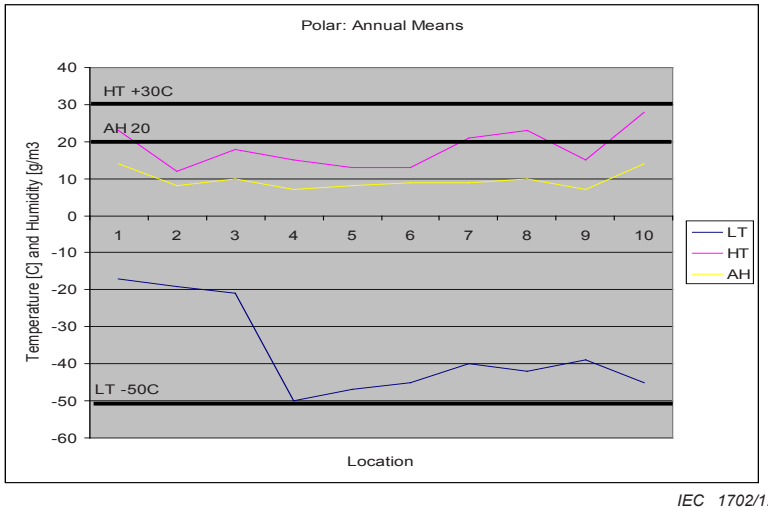
Annex A shows, for each location from Annex B, high and low temperature and high absolute humidity. The figures are divided into each proposed climate type. In each figure, the proposed limits for high temperature (HT), low temperature (LT) and high absolute humidity (AH) are shown. The limits were chosen to find the limit that covers most locations.

Figures A.1, A.2 and A.3 describe temperature and absolute humidity for polar climatic type regions.



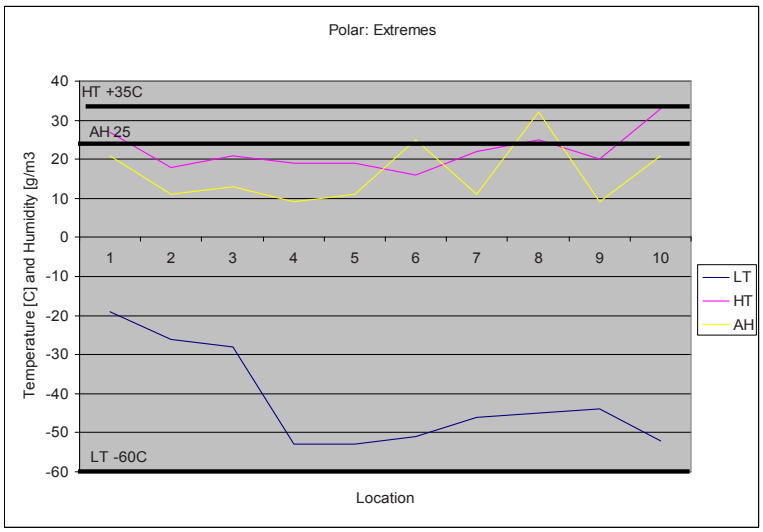
IEC 1701/12

Figure A.1 – Polar: Daily mean values



IEC 1702/12

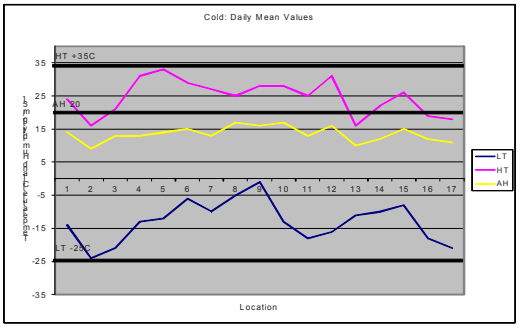
Figure A.2 – Polar: Annual means



IEC 1703/12

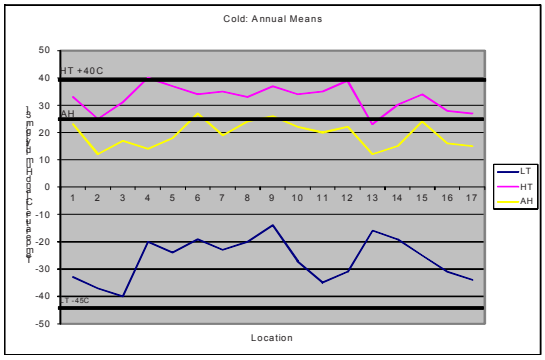
Figure A.3 – Polar – Extremes

Figures A.4, A.5 and A.6 describe temperature and absolute humidity for cold climatic type regions.



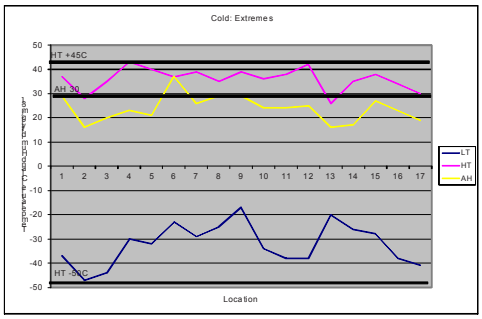
IEC 1704/12

Figure A.4 – Cold: Daily mean values



IEC 1705/12

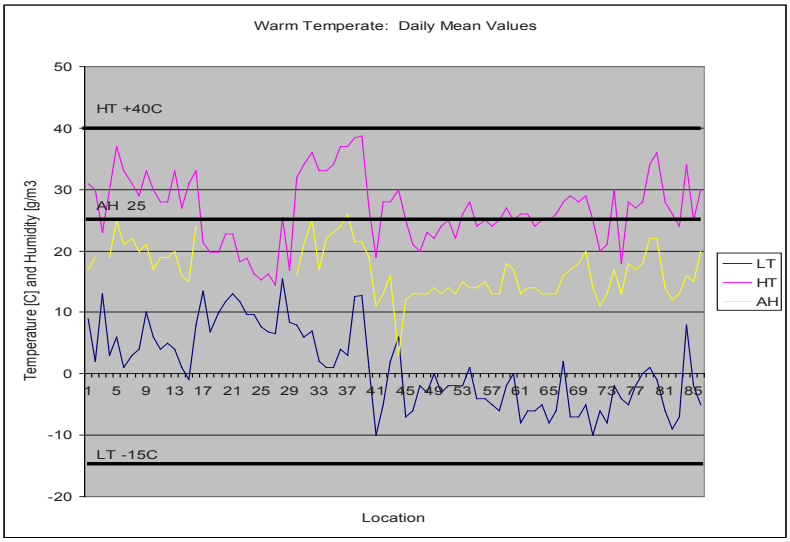
Figure A.5 – Cold: Annual means



IEC 1706/12

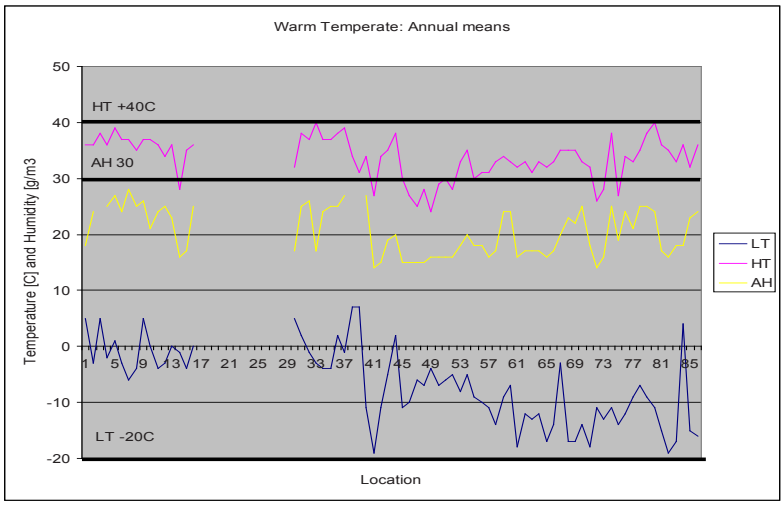
Figure A.6 – Cold: Extremes

Figures A.7, A.8 and A.9 describe temperature and absolute humidity for temperate climatic type regions



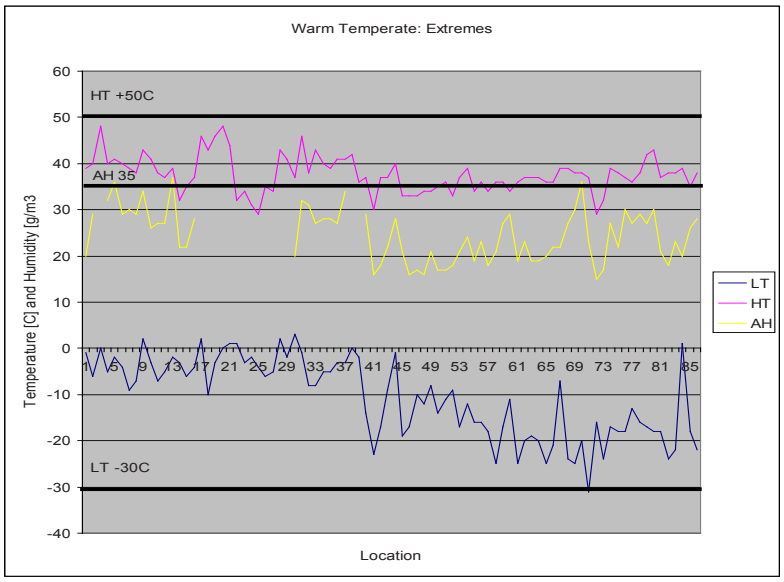
IEC 1707/12

Figure A.7 – Warm temperate: Daily mean values



IEC 1708/12

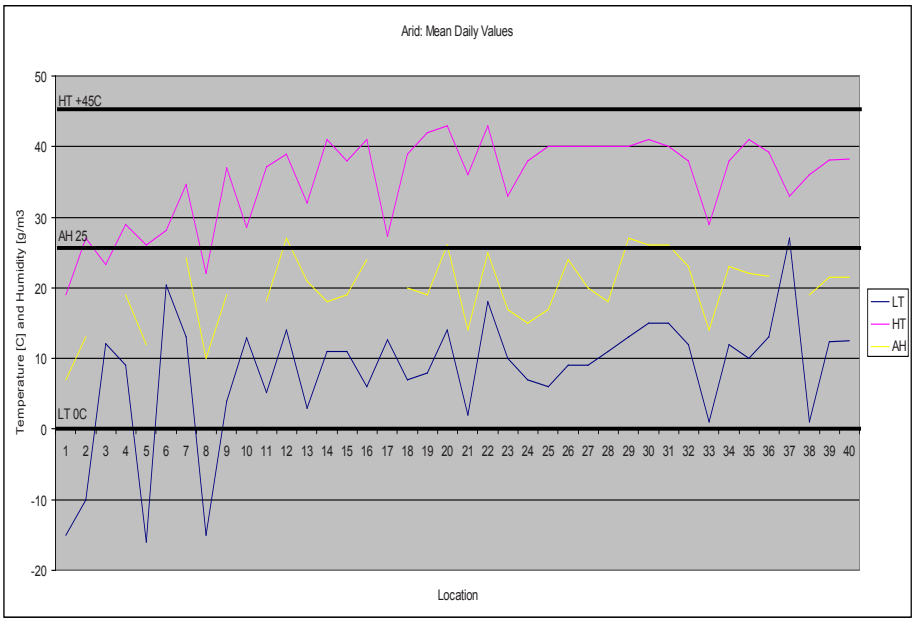
Figure A.8 – Warm temperate: Annual means



IEC 1709/12

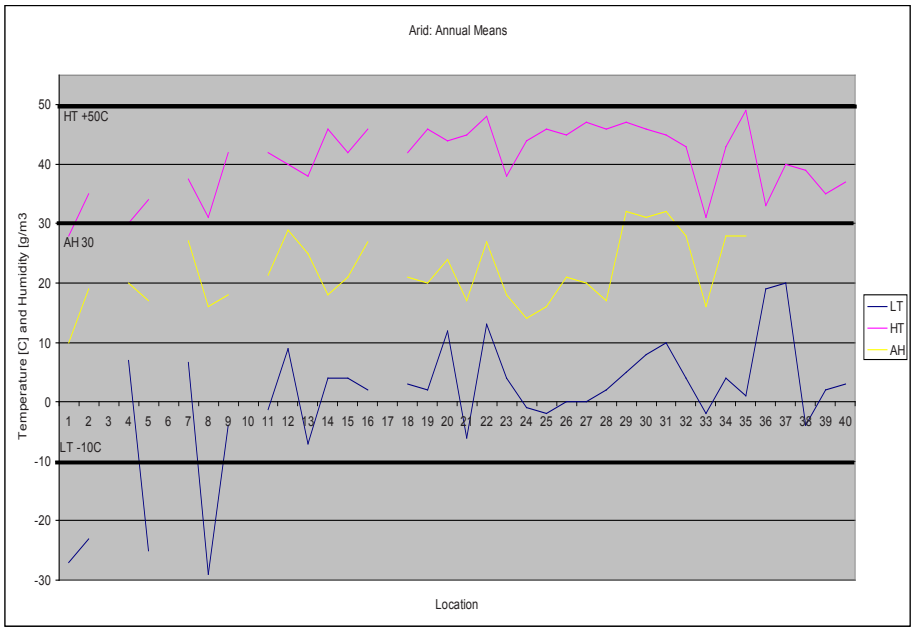
Figure A.9 – Warm temperate: Extremes

Figures A.10, A.11 and A:12 describe temperature and absolute humidity for arid climatic type regions.



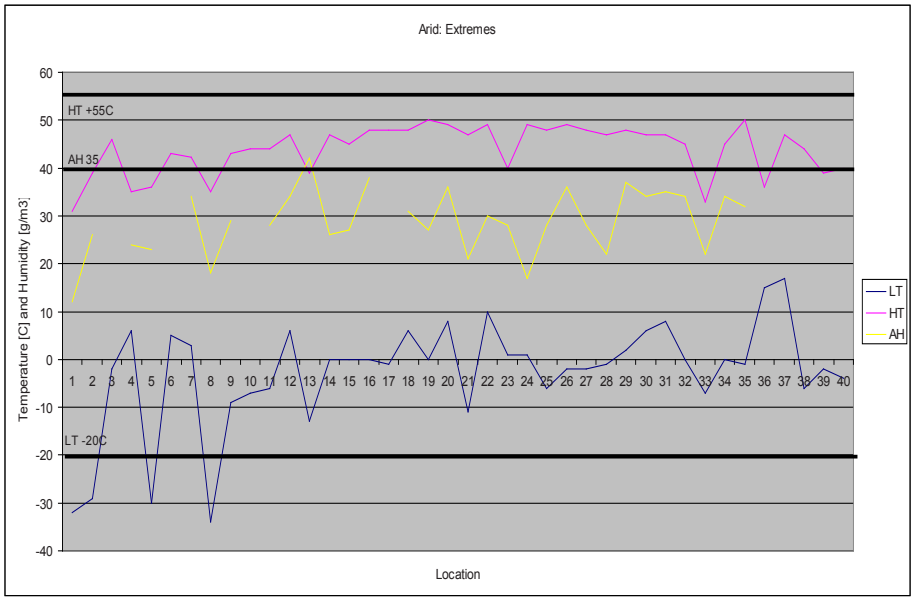
IEC 1710/12

Figure A.10 – Arid: Mean daily values



IEC 1711/12

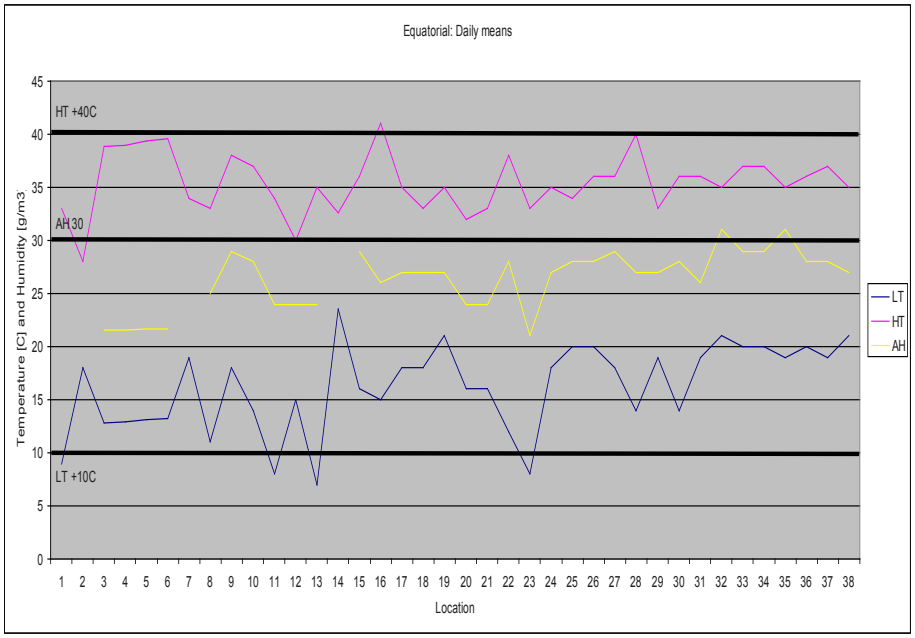
Figure A.11 – Arid: Annual means



IEC 1712/12

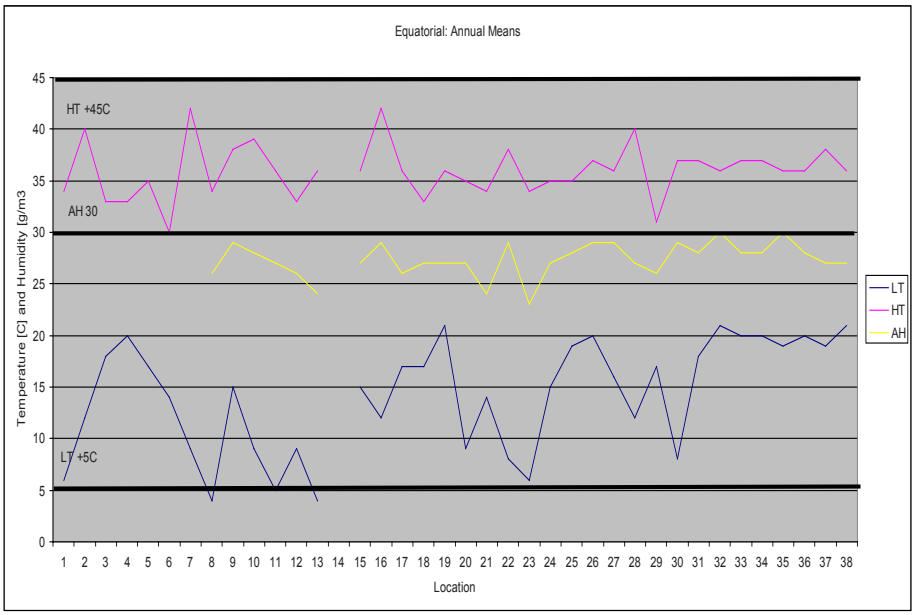
Figure A.12 – Arid: Extremes

Figures A.13, A.14 and A.15 describe temperature and absolute humidity for tropical climatic type regions.



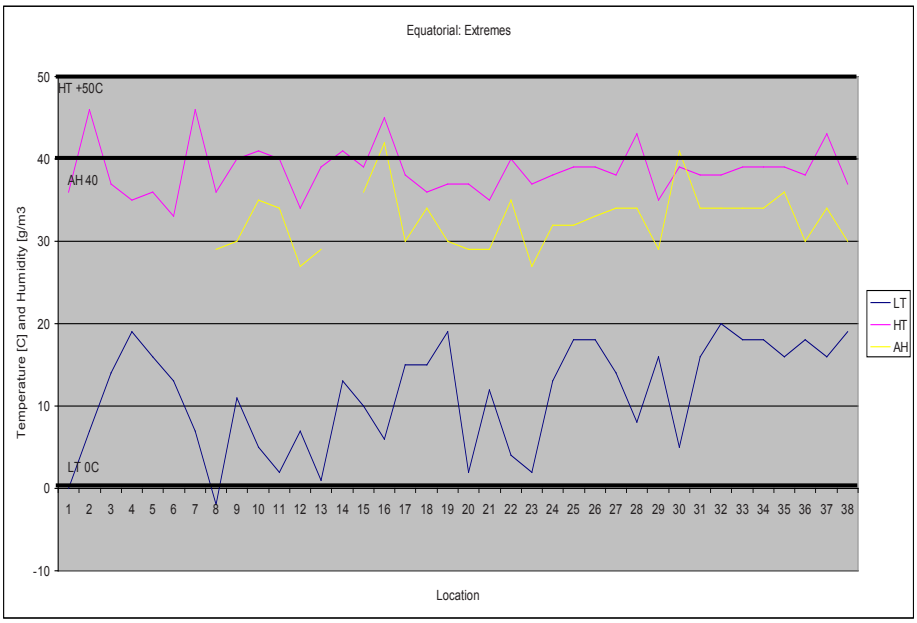
IEC 1713/12

Figure A.13 – Arid: Daily means



IEC 1714/12

Figure A.14 – Arid: Annual means



IEC 1715/12

Figure A.15 – Arid: Extremes

Annex B
(informative)

Climatic data from various locations

The following tables provide data from different locations for polar, cold, temperate, arid and tropical climatic types from reference 1 and 2.

Table B.1 – Data for polar climatic type

		Mean value of the annual extreme daily mean values of temperature and humidity			Mean value of the annual extreme values of temperature and humidity			Absolute extreme value of temperature and humidity				
City or Locaton	Climate type	Low temperature (°C)	High temperature (°C)	Highest absolute humidit	Low temperature (°C)	High temperature (°C)	Highest absolute humidit	Low temperature (°C)	High temperature (°C)	Highest absolute humidit	Years on record	
Akureyri, IL	polar	-11	19	13	-17	23	14	-19	27	21	1973-1992	Expert CD, 1997
Jan Mayen, No	polar	-14	11	8	-19	12	8	-26	18	11	1973-1992	Expert CD, 1997
Godthab, GL	polar	-14	14	9	-21	18	10	-28	21	13	1973-1992	Expert CD, 1997
Eureka, CN	polar	-35	1	5	-50	15	7	-53	19	9	1973-1992	Expert CD, 1997
Mould Bay, airport, CN	polar	-34	2	5	-47	13	8	-53	19	11	1973-1992	Expert CD, 1997
Resolute airport, CN	polar	-32	2	7	-45	13	9	-51	16	25	1973-1992	Expert CD, 1997
Sondre Stromfjord	polar	-26	15	8	-40	21	9	-46	22	11	1973-1992	Expert CD, 1997
Forbisher, CN	polar	-26	10	8	-42	23	10	-45	25	32	1973-1992	Expert CD, 1997
Thule, CN	polar	-26	8	6	-39	15	7	-44	20	9	1973-1992	Expert CD, 1997
Fort Reliance, CN	polar	-27	16	10	-45	28	14	-52	33	21	1973-1992	Expert CD, 1997
	Polar	-40	25	15	-50	30	20	-60	35	25		

Table B.2 – Data for cold climatic type

		Mean value of the annual extreme daily mean values of temperature and humidity				Mean value of the annual extreme values of temperature and humidity				Absolute extreme value of temperature and humidity				
City or Locaton	Climate type	Low temperature (°C)	High temperature (°C)	Highest absolute humidit		Low temperature (°C)	High temperature (°C)	Highest absolute humidit		Low temperature (°C)	High temperature (°C)	Highest absolute humidit	Years on record	
Harbin,China	Cold	-14	24	14		-33	33	23		-37	37	29	1973-1992	Expert CD, 1997
Nome, AK, US	Cold	-24	16	9		-37	25	12		-47	28	16	1973-1992	Expert CD, 1997
Chibougamau-Chapais, CI	Cold	-21	21	13		-40	31	17		-44	35	20	1973-1992	Expert CD, 1997
Mountain Home, ID, US	Cold	-13	31	13		-20	40	14		-30	43	23	1973-1992	Expert CD, 1997
Renner, KS, US	Cold	-12	33	14		-24	37	18		-32	40	21	1973-1992	Expert CD, 1997
Jinzhou,China	Cold	-6	29	15		-19	34	27		-23	37	37	1973-1992	Expert CD, 1997
Yulin,China	Cold	-10	27	13		-23	35	19		-29	39	26	1973-1992	Expert CD, 1997
Pyongynag,N.Korea	Cold	-5	25	17		-20	33	24		-25	35	29	1973-1992	Expert CD, 1997
Beijing,China	Cold	-1	28	16		-14	37	26		-17	39	29	1973-1992	Expert CD, 1997
Griffiss AFB/Rome, NY, US	Cold	-13	28	17		-27	34	22		-34	36	24	1973-1992	Expert CD, 1997
Winnipeg Intl Airport, CN	Cold	-18	25	13		-35	35	20		-38	38	24	1973-1992	Expert CD, 1997
Huron Regional, SD, US	Cold	-16	31	16		-31	39	22		-38	42	25	1973-1992	Expert CD, 1997
Andoya NORWAY	Cold	-11	16	10		-16	23	12		-20	26	16	1973-1992	Expert CD, 1997
Oslo NORWAY	Cold	-10	22	12		-19	30	15		-26	35	17	1973-1992	Expert CD, 1997
Shengyang,China	Cold	-8	26	15		-25	34	24		-28	38	27	1973-1992	Expert CD, 1997
Jyvaskyla FINLAND	Cold	-18	19	12		-31	28	16		-38	34	23	1973-1992	Expert CD, 1997
Kajaani FINLAND	Cold	-21	18	11		-34	27	15		-41	30	19	1973-1992	Expert CD, 1997
	Cold	-25	35	25		-45	45	25		-50	45	30		

Table B.3 – Data for temperate climatic type

City or Locaton	Climate type	Mean value of the annual extreme daily mean values of temperature and humidity: Low temperature (°C)	Mean value of the annual extreme daily mean values of temperature and humidity: High temperature (°C)	Mean value of the annual extreme daily mean values of temperature and humidity: Highest absolute humidit	Mean value of the annual extreme values of temperature and humidity: Low temperature (°C)	Mean value of the annual extreme values of temperature and humidity: High temperature (°C)	Mean value of the annual extreme values of temperature and humidity: Highest absolute humidit	Absolute extreme value of temperature and humidity: Low temperature (°C)	Absolute extreme value of temperature and humidity: High temperature (°C)	Absolute extreme value of temperature and humidity: Highest absolute humidit	Years on record	
Gibraltor	WT	9	31	17	5	36	18	-1	39	20	1973-1992	Expert CD, 1997
Palma Mallorca SPAIN	WT	2	30	19	-3	36	24	-6	40	29	1973-1992	Expert CD, 1997
Rabat, Morocco	WT	13	23		5	38		0	48		1973-1992	Expert CD, 1997
Naples ITALY	WT	3	30	19	-2	36	25	-5	40	32	1973-1992	Expert CD, 1997
Posadas airport, AG	WT	6	37	25	1	39	27	-2	41	36	1973-1992	Expert CD, 1997
Buenos Aires, AG	WT	1	33	21	-3	37	24	-4	40	29	1973-1992	Expert CD, 1997
Shanghai,China	WT	3	31	22	-6	37	28	-9	39	30	1973-1992	Expert CD, 1997
Fukuoka,Japan	WT	4	29	20	-4	35	25	-7	38	29	1973-1992	Expert CD, 1997
Palermo ITALY	WT	10	33	21	5	37	26	2	43	34	1973-1992	Expert CD, 1997
Athens GREECE	WT	6	30	17	0	37	21	-3	41	26	1973-1992	Expert CD, 1997
Osaka(Itami),Japan	WT	4	28	19	-4	36	24	-7	38	27	1973-1992	Expert CD, 1997
Tokyo,Japan	WT	5	28	19	-3	34	25	-5	37	27	1973-1992	Expert CD, 1997
Carrasco, UY	WT	4	33	20	0	36	23	-2	39	37	1973-1992	Expert CD, 1997
Concepcion/Carriel,CH	WT	1	27	16	-1	28	16	-3	32	22	1973-1992	Expert CD, 1997
Pudahuel/Arturo,CH	WT	-1	31	15	-4	35	17	-6	35	22	1973-1992	Expert CD, 1997
Tampa, FL, US	WT	8	33	24	0	36	25	-4	37	28	1973-1992	Expert CD, 1997
Sydney	WT	13	*21*					2	46		see ref	Hutchinson, 2000
Canberra	WT	7	*20*					-10	43		see ref	Hutchinson, 2000
Melbourne	WT	10	*20*					-3	46		see ref	Hutchinson, 2000
Adalade	WT	12	*23*					0	48		see ref	Hutchinson, 2000
Perth	WT	13	*23*					1	44		see ref	Hutchinson, 2000
Aukland	WT	12	*18*					1	32		see ref	Hutchinson, 2000
Napier, NZ	WT	10	*19*					-3	34		see ref	Hutchinson, 2000
Wellington, NZ	WT	10	*16*					-2	31		see ref	Hutchinson, 2000
Hoktika, NZ??	WT	8	*15*					-4	29		see ref	Hutchinson, 2000
Christchurch, nz	WT	7	*16*					-6	35		see ref	Hutchinson, 2000
Dunedin, NZ	WT	7	*15*					-5	34		see ref	Hutchinson, 2000
Brisbane, Australia	WT	15	*26*					2	43		see ref	Hutchinson, 2000
Hobart, tasmania	WT	8	*17*					-2	41		see ref	Hutchinson, 2000
Harare, Zimbabwe	WT	8	32	16	5	32	17	3	37	20	1973-1992	Expert CD, 1997
Tunis, Tunisia	WT	6	34	21	2	38	25	-1	46	32	1973-1992	Expert CD, 1997
Brownsville, TX, US	WT	7	36	25	-1	37	26	-8	38	31	1973-1992	Expert CD, 1997
Fairfield, CA, US	WT	2	33	17	-3	40	17	-8	43	27	1973-1992	Expert CD, 1997
Junin, Airport, AG	WT	1	33	22	-4	37	24	-5	40	28	1973-1992	Expert CD, 1997
Rosario Airport, AG	WT	1	34	23	-4	37	25	-5	39	28	1973-1992	Expert CD, 1997
Porto Alegre/Salgad, BZ	WT	4	37	24	2	38	25	-3	41	27	1973-1992	Expert CD, 1997
Resistencia Airport,AG	WT	3	37	26	-1	39	27	-3	41	34	1973-1992	Expert CD, 1997
Algiers, Algeria	WT	13	38	22	7	34		0	42		see ref	Hutchinson, 2000
Ndola, Zambia	WT	13	39	22	7	31		-2	36		see ref	Hutchinson, 2000
Kunsan,S.Korea	WT	1	27	19	-11	34	27	-14	37	29	1973-1992	Expert CD, 1997
Juneau Intl Airport, AK, US	WT	-10	19	11	-19	27	14	-23	30	16	1973-1992	Expert CD, 1997
Tacoma, WA, US	WT	-5	28	13	-11	34	15	-17	37	18	1973-1992	Expert CD, 1997
Istanbul,TU	WT	2	28	16	-5	35	19	-9	37	22	1973-1992	Expert CD, 1997
Lisbon PORTUGAL	WT	6	30	3	2	38	20	-1	40	28	1973-1992	Expert CD, 1997
Rio Gallegos airport, AG	WT	-7	25	12	-11	30	15	-19	33	21	1973-1992	Expert CD, 1997
Glasgow UK	WT	-6	21	13	-10	27	15	-17	33	16	1973-1992	Expert CD, 1997
Belfast UK	WT	-2	20	13	-6	25	15	-10	33	17	1973-1992	Expert CD, 1997
Manchester UK	WT	-3	23	13	-7	28	15	-12	34	16	1973-1992	Expert CD, 1997
Shannon UK	WT	0	22	14	-4	24	16	-8	34	21	1973-1992	Expert CD, 1997
Stanstead UK	WT	-3	24	13	-7	29	16	-14	35	17	1973-1992	Expert CD, 1997
London UK	WT	-2	25	14	-6	30	16	-11	36	17	1973-1992	Expert CD, 1997
Cardiff UK	WT	-2	22	13	-5	28	16	-9	33	18	1973-1992	Expert CD, 1997
Paris FRANCE	WT	-2	26	15	-8	33	18	-17	37	21	1973-1992	Expert CD, 1997
Marseille FRANCE	WT	1	28	14	-5	35	20	-12	39	24	1973-1992	Expert CD, 1997
Amsterdam HOLLAND	WT	-4	24	14	-9	30	18	-16	34	19	1973-1992	Expert CD, 1997
Brussels BELGIUM	WT	-4	25	15	-10	31	18	-16	36	23	1973-1992	Expert CD, 1997
Luxembourg	WT	-5	24	13	-11	31	16	-18	34	18	1973-1992	Expert CD, 1997
Zurich SWITZERLAND	WT	-6	25	13	-14	33	17	-25	36	21	1973-1992	Expert CD, 1997
Villafranca ITALY	WT	-2	27	18	-9	34	24	-17	36	27	1973-1992	Expert CD, 1997
Venice ITALY	WT	0	25	17	-7	33	24	-11	34	29	1973-1992	Expert CD, 1997
Munich GERMANY	WT	-8	26	13	-18	32	16	-25	36	19	1973-1992	Expert CD, 1997
Frankfurt GERMANY	WT	-6	26	14	-12	33	17	-20	37	23	1973-1992	Expert CD, 1997
Hamburg GERMANY	WT	-6	24	14	-13	31	17	-19	37	19	1973-1992	Expert CD, 1997
Berlin GERMANY	WT	-5	25	13	-12	33	17	-20	37	19	1973-1992	Expert CD, 1997
Prague	WT	-8	25	13	-17	32	16	-25	36	20	1973-1992	Expert CD, 1997
Vienna AUSTRIA	WT	-6	26	13	-14	33	17	-21	36	22	1973-1992	Expert CD, 1997
Split	WT	2	28	16	-3	35	20	-7	39	22	1973-1992	Expert CD, 1997
Bucharest ROMANIA	WT	-7	29	17	-17	35	23	-24	39	27	1973-1992	Expert CD, 1997
Arad Romania	WT	-7	28	18	-17	35	22	-25	38	30	1973-1992	Expert CD, 1997
Kogalniceanu ROMANIA	WT	-5	29	20	-14	33	25	-20	38	36	1973-1992	Expert CD, 1997
Warsaw POLAND	WT	-10	25	14	-18	32	18	-31	37	23	1973-1992	Expert CD, 1997
Bergen NORWAY	WT	-6	20	11	-11	26	14	-16	29	15	1973-1992	Expert CD, 1997
Alborg DENMARK	WT	-8	21	13	-13	28	16	-24	32	17	1973-1992	Expert CD, 1997
Xi'an,China	WT	-2	30	17	-11	38	25	-17	39	27	1973-1992	Expert CD, 1997
Wakkanai,Japan	WT	-4	18	13	-14	27	19	-18	38	22	1973-1992	Expert CD, 1997
Milan ITALY	WT	-5	28	18	-12	34	24	-18	37	30	1973-1992	Expert CD, 1997
Aviano ITALY	WT	-2	27	17	-9	33	21	-13	36	27	1973-1992	Expert CD, 1997
Rimini ITALY	WT	0	28	18	-7	35	25	-16	38	29	1973-1992	Expert CD, 1997
Warner Robbins, GA, US	WT	1	34	22	-9	38	25	-17	42	27	1973-1992	Expert CD, 1997
Dallas, TX, US	WT	-1	36	22	-11	40	24	-18	43	30	1973-1992	Expert CD, 1997
Eskisehir,TU	WT	-6	28	14	-15	36	17	-18	37	21	1973-1992	Expert CD, 1997
Ankara,TU	WT	-9	26	12	-19	35	16	-24	38	18	1973-1992	Expert CD, 1997
Van,TU	WT	-7	24	13	-17	33	18	-22	38	23	1973-1992	Expert CD, 1997
Los Angeles, CA, US	WT	8	34	16	4	36	18	1	39	20	1973-1992	Expert CD, 1997
Dailin,China	WT	-2	25	15	-15	32	23	-18	35	26	1973-1992	Expert CD, 1997
Mcquire, NJ, US	WT	-5	30	20	-16	36	24	-22	38	28	1973-1992	Expert CD, 1997
	Warm Temperate	-15	40	25	-20	40	30	-30	50	35		

Table B.4 – Data for arid climatic type

		Mean value of the annual extreme daily mean values of temperature and humidity			Mean value of the annual extreme values of temperature and humidity			Absolute extreme value of temperature and humidity				
City or Locaton	Climate type	Low temperature (°C)	High temperature (°C)	Highest absolute humidit	Low temperature (°C)	High temperature (°C)	Highest absolute humidit	Low temperature (°C)	High temperature (°C)	Highest absolute humidit	Years on record	
Da-Qaidam,China	Arid	-15	19	7	-27	28	10	-32	31	12	1973-1992	Expert CD, 1997
Jiuquan,Suzhou,China	Arid	-10	27	13	-23	35	19	-29	39	26	1973-1992	Expert CD, 1997
Kalgoorie, australia	Arid	12	*23*					-2	46		see ref	Hutchinson, 2000
Arica/Chacalluta,CH	Arid	9	29	19	7	30	20	6	35	24	1973-1992	Expert CD, 1997
Otog.Ql,Ulan,China	Arid	-16	26	12	-25	34	17	-30	36	23	1973-1992	Expert CD, 1997
Townsville, australia	Arid	20	*28*					5	43		see ref	Hutchinson, 2000
Townsville, australia	Arid	13	*35*	24	7	37	27	3	42	34	1973-1992	Expert CD, 1997
Huade,China	Arid	-15	22	10	-29	31	16	-34	35	18	1973-1992	Expert CD, 1997
Hail,SD	Arid	4	37	19	-4	42	18	-9	43	29	1973-1992	Expert CD, 1997
Alice Springs	Arid	13	29					-7	44		see ref	Hutchinson, 2000
Alice Springs	Arid	5	37	18	-1	42	21	-6	44	28	1973-1992	Expert CD, 1997
Wejh,SD	Arid	14	39	27	9	40	29	6	47	34	1973-1992	Expert CD, 1997
Wuhan/Nanhu,China	Arid	3	32	21	-7	38	25	-13	39	42	1973-1992	Expert CD, 1997
Madinah,SD	Arid	11	41	18	4	46	18	0	47	26	1973-1992	Expert CD, 1997
Cairo, Egypt	Arid	11	38	19	4	42	21	0	45	27	1973-1992	Expert CD, 1997
Tripoli, Libya	Arid	6	41	24	2	46	27	0	48	38	1973-1992	Expert CD, 1997
Bourke, australia	Arid	13	27					-1	48		see ref	Hutchinson, 2000
Agadir, Morocco	Arid	7	39	20	3	42	21	6	48	31	1973-1992	Expert CD, 1997
Luxor/Aswan, Egypt	Arid	8	42	19	2	46	20	0	50	27	1973-1992	Expert CD, 1997
Niamey, Niger	Arid	14	43	26	12	44	24	8	49	36	1973-1992	Expert CD, 1997
Nellis, NV, US	Arid	2	36	14	-6	45	17	-11	47	21	1973-1992	Expert CD, 1997
Makkah,SD	Arid	18	43	25	13	48	27	10	49	30	1973-1992	Expert CD, 1997
Al Baha,SD	Arid	10	33	17	4	38	18	1	40	28	1973-1992	Expert CD, 1997
Al Jouf,SD	Arid	7	38	15	-1	44	14	1	49	17	1973-1992	Expert CD, 1997
Rafha,SD	Arid	6	40	17	-2	46	16	-6	48	28	1973-1992	Expert CD, 1997
Gassim,SD	Arid	9	40	24	0	45	21	-2	49	36	1973-1992	Expert CD, 1997
Hafr al,SD	Arid	9	40	20	0	47	20	-2	48	28	1973-1992	Expert CD, 1997
Riyadah,Saudi	Arid	11	40	18	2	46	17	-1	47	22	1973-1992	Expert CD, 1997
Dhahran,SD	Arid	13	40	27	5	47	32	2	48	37	1973-1992	Expert CD, 1997
Abu Dhabi	Arid	15	41	26	8	46	31	6	47	34	1973-1992	Expert CD, 1997
Dubai,ER	Arid	15	40	26	10	45	32	8	47	35	1973-1992	Expert CD, 1997
Sharjah,ER	Arid	12	38	23	4	43	28	0	45	34	1973-1992	Expert CD, 1997
Johannesburg,/Jan Smuts	Arid	1	29	14	-2	31	16	-7	33	22	1973-1992	Expert CD, 1997
Delhi,India	Arid	12	38	23	4	43	28	0	45	34	1973-1992	Expert CD, 1997
Kuwait,KW	Arid	10	41	22	1	49	28	-1	50	32	1973-1992	Expert CD, 1997
Mogadishu, Somalia	Arid	13	39	22	19	33		15	36		see ref	Hutchinson, 2000
Djibouti, Djibouti	Arid	27	33		20	40		17	47		see ref	Hutchinson, 2000
Mendoza/EL Plumeril,AG	Arid	1	36	19	-4	39	20	-6	44	27	1973-1992	Expert CD, 1997
Cape Town, South Africa	Arid	12	38	21	2	35		-2	39		see ref	Hutchinson, 2000
Walvis Bay, Namibia	Arid	13	38	22	3	37		-4	40		see ref	Hutchinson, 2000
	Arid	0	45	25	-10	50	30	-20	55	35		

Table B.5 – Data for tropical climatic type

		Mean value of the annual extreme daily mean values of temperature and humidity				Mean value of the annual extreme values of temperature and humidity				Absolute extreme value of temperature and humidity				
City or Locaton	Climate type	Low temperature (°C)	High temperature (°C)	Highest absolute humidit		Low temperature (°C)	High temperature (°C)	Highest absolute humidit		Low temperature (°C)	High temperature (°C)	Highest absolute humidit	Years on record	
Brasilia, BZ	Equatorial	9	33	22		6	34	23		0	36	27	1973-1992	Expert CD, 1997
Maputo, Mozambique	Equatorial	18	28			12	40			7	46		see ref	Hutchinson, 2000
Luanda, Angola	Equatorial	13	39	22		18	33			14	37		see ref	Hutchinson, 2000
Freetown, Sierra Leone	Equatorial	13	39	22		20	33			19	35		see ref	Hutchinson, 2000
Kisangani, Congo Dem Re	Equatorial	13	39	22		17	35			16	36		see ref	Hutchinson, 2000
Entebbe, Uganda	Equatorial	13	40	22		14	30			13	33		see ref	Hutchinson, 2000
Tete, Mozambique	Equatorial	19	34			9	42			7	46		see ref	Hutchinson, 2000
Homestead, FL, US	Equatorial	11	33	25		4	34	26		-2	36	29	1973-1992	Expert CD, 1997
Bangkok,Thailand	Equatorial	18	38	29		15	38	29		11	40	30	1973-1992	Expert CD, 1997
Chiang Mai, Thailand	Equatorial	14	37	28		9	39	28		5	41	35	1973-1992	Expert CD, 1997
Taipei,Taiwan	Equatorial	8	34	24		5	36	27		2	40	34	1973-1992	Expert CD, 1997
Naha,Japan	Equatorial	15	30	24		9	33	26		7	34	27	1973-1992	Expert CD, 1997
Campinas/Viracopos,BZ	Equatorial	7	35	24		4	36	24		1	39	29	1973-1992	Expert CD, 1997
Darwin	Equatorial	24	33							13	41		see ref	Hutchinson, 2000
Brazzaville, Rep Congo	Equatorial	16	36	29		15	36	27		10	39	36	1973-1992	Expert CD, 1997
Bamako, Mali	Equatorial	15	41	26		12	42	29		6	45	42	1973-1992	Expert CD, 1997
Managua, NK	Equatorial	18	35	27		17	36	26		15	38	30	1973-1992	Expert CD, 1997
Guadeloupe	Equatorial	18	33	27		17	33	27		15	36	34	1973-1992	Expert CD, 1997
Panama	Equatorial	21	35	27		21	36	27		19	37	30	1973-1992	Expert CD, 1997
Hongkong,China	Equatorial	16	32	24		9	35	27		2	37	29	1973-1992	Expert CD, 1997
Talara/Capt Montes, PR	Equatorial	16	33	24		14	34	24		12	35	29	1973-1992	Expert CD, 1997
Trinidad/Jorge Henr,BO	Equatorial	12	38	28		8	38	29		4	40	35	1973-1992	Expert CD, 1997
Sao Paulo/Congonhas, BZ	Equatorial	8	33	21		6	34	23		2	37	27	1973-1992	Expert CD, 1997
Salvador/Dois Julho, BZ	Equatorial	18	35	27		15	35	27		13	38	32	1973-1992	Expert CD, 1997
Recife/Quararapes, BZ	Equatorial	20	34	28		19	35	28		18	39	32	1973-1992	Expert CD, 1997
Fortaleza/Pintomar, BZ	Equatorial	20	36	28		20	37	29		18	39	33	1973-1992	Expert CD, 1997
Iquitos/Seceda, PR	Equatorial	18	36	29		16	36	29		14	38	34	1973-1992	Expert CD, 1997
Galeao/Rio, BZ	Equatorial	14	40	27		12	40	27		8	43	34	1973-1992	Expert CD, 1997
Piarco intl airport, TD	Equatorial	19	33	27		17	31	26		16	35	29	1973-1992	Expert CD, 1997
Haikou,China	Equatorial	14	36	28		8	37	29		5	39	41	1973-1992	Expert CD, 1997
Luzon island,Philipines	Equatorial	19	36	26		18	37	28		16	38	34	1973-1992	Expert CD, 1997
Mactan,Philipines	Equatorial	21	35	31		21	36	30		20	38	34	1973-1992	Expert CD, 1997
Kuala Lumpur,Malaysia	Equatorial	20	37	29		20	37	28		18	39	34	1973-1992	Expert CD, 1997
Phuket,Thailand	Equatorial	20	37	29		20	37	28		18	39	34	1973-1992	Expert CD, 1997
Caracas/S.Bolivar, VN	Equatorial	19	35	31		19	36	30		16	39	36	1973-1992	Expert CD, 1997
Barranquilla/Ernest,CO	Equatorial	20	36	28		20	36	28		18	38	30	1973-1992	Expert CD, 1997
Zandery/Paramaribo, SM	Equatorial	19	37	28		19	38	27		16	43	34	1973-1992	Expert CD, 1997
Howard AFB, PM	Equatorial	21	35	27		21	36	27		19	37	30	1973-1992	Expert CD, 1997
	Equatorial	10	40	30		5	45	30		0	50	40		

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