

Manual on Codes

International Codes

VOLUME I.1

PART A – Alphanumeric Codes



**World
Meteorological
Organization**

Weather • Climate • Water

WMO-No. 306

Weather • Climate • Water

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International Codes

Volume I.1

(Annex II to WMO Technical Regulations)

Part A –Alphanumeric Codes

WMO-No. 306

2009 edition



**World
Meteorological
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Weather • Climate • Water

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PREFACE

Coded messages are used for the international exchange of meteorological information comprising observational data provided by the WWW Global Observing System and processed data provided by the WWW Global Data-processing and Forecasting System. Coded messages are also used for the international exchange of observed and processed data required in specific applications of meteorology to various human activities and for exchanges of information related to meteorology.

The codes are composed of a set of CODE FORMS and BINARY CODES made up of SYMBOLIC LETTERS (or groups of letters) representing meteorological or, as the case may be, other geophysical elements. In messages, these symbolic letters (or groups of letters) are transcribed into figures indicating the value or the state of the elements described. SPECIFICATIONS have been defined for the various symbolic letters to permit their transcription into figures. In some cases, the specification of the symbolic letter is sufficient to permit a direct transcription into figures. In other cases, it requires the use of CODE FIGURES, the specifications of which are given in CODE TABLES. Furthermore, a certain number of SYMBOLIC WORDS and SYMBOLIC FIGURE GROUPS have been developed for use as code names, code words, symbolic prefixes or indicator groups.

Rules concerning the selection of code forms to be exchanged *for international purposes*, and the selection of their symbolic words, figure groups and letters, are laid down in the WMO *Technical Regulations*, Volume I, Chapter A.2.3 (1988 edition). These code forms are contained in Volume I of the *Manual on Codes*, issued as Volume I.1 – Part A, and Volume I.2 – Part B and Part C.

Apart from these international codes, several sets of *regional codes* exist which are intended only for exchanges within a given WMO Region. These codes are contained in Volume II of the *Manual on Codes*. This volume also contains descriptions of:

- Regional coding procedures for the use of international code forms;
- National coding practices in the use of international or regional codes of which the Secretariat has been informed;
- National code forms.

A number of special codes which are used in messages exchanged over the WWW Global Telecommunication System circuits, and which comprise ice and satellite ephemeris codes, are included in Volume II as an Appendix.

This edition of Volume I.1 of the *Manual on Codes* replaces the 1995 edition.

EDITORIAL NOTE

As a general rule, **standard coding practices** are printed in semi-bold roman in order to distinguish them from explanations.

Section A: **Regulations** are printed in semi-bold roman; explanatory notes relating to these regulations are printed in smaller type and preceded by the indication: Note.

Sections B and C: **Specifications** of symbolic letters and **standard coding procedures** relating to the specification concerned are printed in semi-bold roman. Definitions and explanations relating to these specifications are printed in light-face roman.

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INTRODUCTION

Volume I of the *Manual on Codes* contains WMO international codes for meteorological data and other geophysical data relating to meteorology; it constitutes Annex II of the WMO *Technical Regulations* and has therefore the status of a Technical Regulation. It is issued in two volumes: Volume I.1, containing PART A, and Volume I.2, containing PART B and PART C.

VOLUME I.1:

Part A – Alphanumeric Codes consists of five sections.

Section A contains lists of international code forms and corresponding standard coding procedures. The format and wording conventions used in this section are as follows:

Code forms: Groups in brackets are drop-out items and may or may not be included, depending on specified conditions. The absence of round brackets means that the inclusion of the group concerned is determined by international decision; these decisions are indicated in the regulations appearing under each code form.

Parts and sections of code forms: Code forms may have been built up from a number of well-defined components, each comprising a different type of coded information. Components which can be transmitted as a separate report are called *parts* and carry special identification groups. Code forms, or their parts, can be divided into *sections* which may be omitted from the report under certain conditions and therefore carry a symbolic indicator figure or group.

Notes: Brief explanations of the code form are included in a number of notes under the code form.

Regulations: The regulations, which follow the notes, contain standard coding procedures in the sense given to these procedures in the *Technical Regulations*. The standard coding procedures are distinguished by the use of the term “shall” in the English text, and by suitable equivalent terms in the French, Russian and Spanish texts. Where national practices do not conform with these regulations, Members concerned shall formally notify the Secretary-General of WMO for the benefit of other Members. Explanatory notes are sometimes added to regulations.

Section B contains the list of symbolic letters which are to be replaced, generally by figures in coded reports, analyses or forecasts with their specifications. Definitions and standard coding procedures relating to the specification concerned are added, where appropriate, to the specifications in the form of notes. Notes indicating standard coding procedures are distinguished from notes containing a definition by a difference in typographical practice and by the use of the word “shall” in the English text, and by suitable equivalents in the French, Russian and Spanish texts. Where symbolic letters represent coded information, i.e. not just the scale of values as measured, the reference to the tables containing specifications of the code figures is added between brackets.

Section C contains the specifications of code figures in the form of code tables. The tables are preceded by a description of the numbering system of international code tables included in the part concerned.

Section D contains a description of the system of station index numbers.

Section E contains the Beaufort scale of wind for ease of reference and in order to provide the equivalent wind speeds for Beaufort numbers used in some codes.

Attachments II and III (yellow background) to Volume I.1 do not have the status of WMO *Technical Regulations* and are given for information only.

VOLUME 1.2:

Part B – Binary Codes consists of the list of binary codes with their specifications and associated code tables.

Part C – Common Features to Binary and Alphanumeric Codes consists of table-driven alphanumeric codes and of common code tables to binary and alphanumeric codes.

PROCEDURES FOR AMENDING THE *MANUAL ON CODES***1. General validation and implementation procedures**

- 1.1 Amendments to the *Manual on Codes* must be proposed in writing to the WMO Secretariat. The proposal shall specify the needs, purposes and requirements and include information on a contact point for technical matters.
- 1.2 The Expert Team on Data Representation and Codes (ET-DRC),¹ supported by the Secretariat, shall validate the stated requirements (unless it is consequential to an amendment to the WMO Technical Regulations) and develop a draft recommendation to respond to the requirements, as appropriate.
- 1.3 A draft recommendation of the ET-DRC must be validated. A draft recommendation of the ET-DRC must be endorsed by the Implementation/Coordination Team on Information Systems and Services (ICT-ISS) of the Open Programme Area Group on Information Systems and Services (OPAG-ISS). The ET-DRC should define a date of implementation in order to give sufficient time to the WMO Members to implement the amendments after the date of notification; the ET-DRC should document the reasons to propose a time span of less than six months.
- 1.4 Depending on the type of amendments, the ET-DRC may select one of the following procedures for the approval of the amendments:
 - Fast track procedure (see section 2 below);
 - Procedure for the adoption of amendments between CBS sessions (see section 3 below);
 - Procedure for the adoption of amendments during CBS sessions (see section 4 below).
- 1.5 Once amendments to the *Manual on Codes* are adopted, an updated version of the relevant part of the Manual shall be issued in the four languages: English, French, Russian and Spanish. The Secretariat will inform all WMO Members of the availability of a new updated version of that part at the date of notification mentioned in 1.3.

2. Fast-track procedure

- 2.1 The fast-track procedure can be used for additions to BUFR or CREX Tables A, B, and D with associated code tables or flag tables, to code tables or templates in GRIB and to common tables C.
- 2.2 An ET-DRC draft recommendation must be validated in accordance with the procedures given in section 6 below. Draft recommendations developed by the ET-DRC must be endorsed by the Chair of OPAG-ISS. The filling of reserved and unused entries in the existing code and flag tables is considered as minor adjustments, and will be done by the Secretary-General in consultation with the president of CBS. For other types of amendments, the English version of the draft recommendation, including a date of implementation, should be distributed to the focal points for codes and data representation matters for comments, with a deadline of two months for the reply. It should then be submitted to the president of CBS for adoption on behalf of the Executive Council (EC).

¹ The ET-DRC, the ICT-ISS and the OPAG-ISS are the current bodies dealing with data representation and codes within CBS. If they were replaced by other bodies performing the same function, the same rules would apply, by replacing the names of the entities appropriately.

- 2.3 The implementation of amendments approved through the fast track procedure shall normally be limited to one per year. If the Chair/co-Chair of ET-DRC and OPAG-ISS agree that an exceptional situation exists, a second fast track implementation can be initiated.

3. Procedures for the adoption of amendments between CBS sessions

For the direct adoption of amendments between CBS sessions, as a first step, the ET-DRC submits its recommendation, including a date of implementation of the amendments, to the Chair of OPAG-ISS and president and vice-president of CBS. In a second step, upon approval of the president of CBS, the Secretariat sends the recommendation in the four languages (English, French, Russian and Spanish), including a date of implementation of the amendments, to all WMO Members for comments to be submitted within two months; WMO Members are invited to designate a focal point responsible to discuss any comments/disagreements with the ET-DRC. If the discussion between the ET-DRC and the focal point cannot result in an agreement on a specific amendment by a WMO Member, this amendment will be reconsidered by the ET DRC. Those WMO Members not having replied within the two months following the dispatch of the amendments are implicitly considered as having agreed with the amendments. In a third step, once amendments are agreed by WMO Members, and after consultation with the Chair and co-Chair of the OPAG-ISS and the president and vice-president of CBS, the Secretariat notifies at the same time the WMO Members and the members of the Executive Council of the approved amendments and of the date of their implementation.

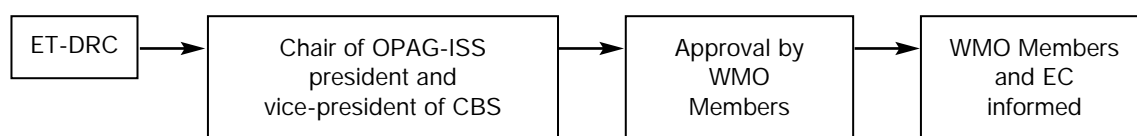


Figure 1. Adoption of amendments between CBS sessions

4. Procedures for the adoption of amendments during CBS sessions

For the adoption of amendments during CBS sessions, the ET-DRC submits its recommendation, including a date of implementation of the amendments, to the ICT-ISS. The recommendation is then submitted to a CBS session and then to an EC session.

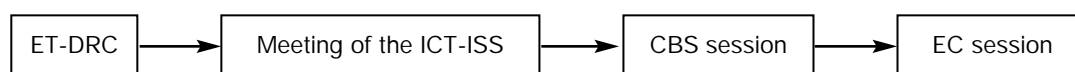


Figure 2. Adoption of the amendments through a CBS session

5. Procedures for the correction of existing entries in the BUFR and CREX tables

- 5.1 If an erroneous specification of an entry is found in an operational BUFR or CREX Element descriptor or Sequence descriptor, a new descriptor should preferably be added to the appropriate table through the fast track procedure or the procedure for adoption of amendments between CBS sessions. The new descriptor should be used instead of the old one for encoding (especially if it concerns data width). An appropriate explanation shall be added to the notes of the table to clarify the practice along with the date of the change. This situation is considered a minor adjustment according to 2.2 above.
- 5.2 As an exceptional measure for erroneous entries in Table B, if it is found absolutely necessary to correct an erroneous specification of an existing entry by changing its specification, the following rules shall apply:
- 5.2.1 The name and unit of an element descriptor shall remain unchanged except for minor clarifications.
- 5.2.2 Scale, reference value and bit width may be corrected to required values.
- 5.2.3 Such a change will be submitted through the fast-track procedure.
- 5.2.4 The version number of the master will be incremented.

6. Validation procedures

- 6.1 The need for, and the purpose of, the proposal for changes should be documented.

- 6.2 This documentation must include the results of validation testing of the proposal as described below.
- 6.3 For new or modified WMO code and data representation forms, proposed changes should be tested by the use of at least two independently developed encoders and two independently developed decoders which incorporated the proposed change. Where the data originated from a necessarily unique source (for example, the data stream from an experimental satellite), the successful testing of a single encoder with at least two independent decoders would be considered adequate. Results should be made available to the ET-DRC with a view to verifying the technical specifications.

7. Urgent introduction of new descriptors or entries in BUFR, CREX and GRIB edition 2 tables

As agreed by CBS (see the *Abridged Final Report with Resolutions and Recommendations of the Extraordinary Session (2002) of the Commission for Basic Systems* (WMO-No. 955), 6.2.66 of the general summary), a three-step mechanism for the introduction of new descriptors or entries in BUFR, CREX and GRIB edition 2 tables accommodates urgent user needs, as follows:

- (a) Approval (by the chairperson of ET-DRC, the chairperson of OPAG-ISS and the president of CBS) of allocated entries after an expression of requirements. The list of allocated entries awaiting validation is kept on-line on the WMO web server;
- (b) After validation (according to 6.1, 6.2 and 6.3 above), declaration of pre-operational use (after approval by the chairperson of ET-DRC, the chairperson of OPAG-ISS and the president of CBS). The list of pre-operational entries is kept on-line on the WMO web server;
- (c) Finally, adoption of the amendments in accordance with the procedures detailed in sections 2, 3 or 4 above.
-

DEFINITIONS

Actual time of observation

- (1) In the case of a surface synoptic observation, the time at which the barometer is read.
- (2) In the case of upper-air observations, the time at which the balloon, parachute or rocket is actually released.

Alpine glow

Pink or yellow colouring assumed by mountain tops opposite the Sun when it is only just below the horizon before it rises and after it sets. This phenomenon vanishes after a brief interval of blue colouring, when the Earth's shadow reaches these summits.

Anomalous propagation

Propagation of radio energy in abnormal conditions of vertical distribution of refractive index, in association with abnormal distribution of atmospheric temperature and humidity. Use of the term is mainly confined to conditions in which abnormally large distances of propagation are attained.

Atmospheric – Sferic

Electromagnetic wave resulting from an electric discharge (lightning) in the atmosphere.

Automatic station

Meteorological station at which instruments make and transmit observations, the conversion to code form for international exchange being made either directly or at an editing station.

Aviation routine weather report

A statement of the observed meteorological conditions related to a specified time and location, issued on a routine basis for use in international air navigation.

BUFR – Binary universal form for the representation of meteorological data

BUFR is the name of a binary code for the exchange and storage of data.

BUFR message

A single complete BUFR entity.

Category

The lists of sequence descriptors tabulated in BUFR or CREX Table D are categorized according to their application; categories are provided for non-meteorological sequences, for various types of meteorological sequences, and for sequences which define reports, or major subsets of reports.

Class

A set of elements tabulated together in BUFR/CREX Table B.

Condensation trails (contrails)

Clouds which form in the wake of an aircraft when the atmosphere at flying level is sufficiently cold and humid.

Coordinate class

Classes 0–9 inclusive in BUFR/CREX Table B define elements which assist in the definition of elements from subsequent classes; each of these classes is referred to as a coordinate class.

CREX – Character form for the representation and exchange of data

CREX is the name of a table-driven alphanumeric code for the exchange and storage of data.

Data description operator

Operators which define replication or the operations listed in BUFR or CREX Table C.

Data entity

A single data item.

Data subset

A set of data corresponding to the data description in a BUFR or CREX message; for observational data, a data subset usually corresponds to one observation.

Day darkness

Sky covered with clouds with very strong optical thickness (dark clouds) having a threatening appearance.

Descriptor

An entity entered within the Data description section to describe or define data; a descriptor may take the form of an element descriptor, a replication operator, an operator descriptor, or a sequence descriptor.

Dry thunderstorm

A thunderstorm without precipitation reaching the ground (distinct from a nearby thunderstorm with precipitation reaching the ground but not at the station at the time of observation).

Dust wall or sand wall

Front of a duststorm or sandstorm, having the appearance of a gigantic high wall which moves more or less rapidly.

Element descriptor

A descriptor containing a code figure reference to BUFR/CREX Table B; the referenced entry defines an element, together with the units, scale factor, reference value and data width to be used to represent that element as data.

Equatorial regions

For the purpose of the analysis codes, the region between 30°N and 30°S latitudes.

Geometric altitude

Vertical distance (Z) of a level, a point or an object considered as a point, measured from mean sea level.

Geopotential

That potential with which the Earth's gravitational field is associated. It is equivalent to the potential energy of unit mass relative to a standard level (mean sea level by convention) and is numerically equal to the work which would be done against gravity in raising the unit mass from sea level to the level at which the mass is located.

Geopotential ϕ at geometric height z is given by

$$\phi = \int_0^z g \, dz$$

where g is the acceleration of gravity.

Geopotential height

Height of a point in the atmosphere expressed in units (geopotential metres) proportional to the geopotential at that height. Geopotential height expressed in geopotential metres is approximately equal to $\frac{g}{9.8}$ times the geometric height expressed in (geometric) metres, g being the local acceleration of gravity.

Haboob

A strong wind and duststorm or sandstorm in the northern and central Sudan. Its average duration is three hours; the average maximum wind velocity is over 15 m s^{-1} . The dust or sand forms a dense whirling wall which may be 1 000 m high; it is often preceded by isolated dust whirls. Haboobs usually occur after a few days of rising temperature and falling pressure.

Ice crust (ice slick)

- (1) A type of snow crust; a layer of ice, thicker than a film crust, upon a snow surface. It is formed by the freezing of melt water or rain water which has flowed into it.
- (2) See *Ice rind*.

Ice rind

A thin but hard layer of sea ice, river ice or lake ice. Apparently this term is used in at least two ways: (a) for a new encrustation upon old ice; and (b) for a single layer of ice usually found in bays and fjords where fresh water freezes on top of slightly colder sea water.

Instrumental wave data

Data on measured characteristics relating to period and height of the wave motion of the sea surface.

Inversion (layer)

Atmospheric layer, horizontal or approximately so, in which the temperature increases with increasing height.

Isothermal layer

Atmospheric layer through which there is no change of temperature with height.

Jet stream

Flat tubular current of air, quasi-horizontal, whose axis is along a line of maximum speed and which is characterized not only by great speeds but also by strong transverse gradients of speed.

Line squall

Squall which occurs along a squall line.

Lithometeor

Meteor consisting of an ensemble of particles most of which are solid and non-aqueous. The particles are more or less suspended in the air, or lifted by the wind from the ground.

Mountain waves

Oscillatory motions of the atmosphere induced by flow over a mountain; such waves are formed over and to the lee of the mountain or mountain chain.

Normals

Period averages computed for over a uniform and relatively long period comprising at least three consecutive 10-year periods.

Obscured sky

Occasions of hydrometeors or lithometeors which are so dense as to make it impossible to tell whether there is cloud above or not.

Ocean weather station

A station aboard a suitably equipped and staffed ship that endeavours to remain at a fixed sea position and that makes and reports surface and upper-air observations and may also make and report subsurface observations.

Operator descriptor

A descriptor containing a code figure reference to BUFR or CREX Table C, together with data to be used as an operand.

Past weather

Predominant characteristic of weather which had existed at the station during a given period of time.

Persistent condensation trail

Long-lived condensation trails which have spread to form clouds having the appearance of Cirrus or patches of Cirrocumulus or Cirrostratus. It is sometimes impossible to distinguish such clouds from other Cirrus, Cirrocumulus or Cirrostratus.

Present weather

Weather existing at the time of observation, or under certain conditions, during the hour preceding the time of observation.

Prevailing visibility

The greatest visibility value, observed in accordance with the definition of "visibility", which is reached within at least half the horizon circle or within at least half of the surface of the aerodrome. These areas could comprise contiguous or non-contiguous sectors.

Note: This value may be assessed by human observation and/or instrumented systems. When instruments are installed, they are used to obtain the best estimate of the prevailing visibility.

Purple light

Glow with a hue varying between pink and red, which is to be seen in the direction of the Sun before it rises and after it sets and is about 3° to 6° below the horizon. It takes the form of a segment of a more or less large luminous disc which appears above the horizon.

Reference value

All data are represented within a BUFR or CREX message by positive integers; to enable negative values to be represented, suitable negative base values are specified as reference values. The true value is obtained by addition of the reference value and the data as represented.

Replication descriptor

A special descriptor is reserved to define the replication operation; it is used to enable a given number of subsequent descriptors to be replicated a given number of times.

Runway visual range

The range over which the pilot of an aircraft on the centre line of the runway can see the runway markings or the lights delineating the runway or identifying its centre line.

Sea station

An observing station situated at sea. Sea stations include ships, ocean weather stations and stations on fixed or drifting platforms (rigs, platforms, lightships and buoys).

Section

A logical subdivision of a BUFR or CREX message, to aid description and definition.

Sequence descriptor

A descriptor used as a code figure to reference a single entry in BUFR or CREX Table D; the referenced entry contains a list of descriptors to be substituted for the sequence descriptor.

Severe line squall

Severe squall which occurs along squall line (see Line squall).

Snow haze

A suspension in the air of numerous minute snow particles, considerably reducing the visibility at the Earth's surface (visibility in snow haze often decreases to 50 m). Snow haze is observed most frequently in Arctic regions, before or after a snow storm.

Squall

Atmospheric phenomenon characterized by a very large variation of wind speed: it begins suddenly, has a duration of the order of minutes and decreases rather suddenly in speed. It is often accompanied by a shower or thunderstorm.

Squall line

Fictitious moving line, sometimes of considerable extent, along which squall phenomena occur.

Sun pillar

Pillar of white light, which may or may not be continuous, which may be observed vertically above or below the Sun. Sun pillars are most frequently observed near sunrise or sunset; they may extend to about 20° above the Sun, and generally end in a point. When a sun pillar appears together with a well-developed parhelic circle, a sun cross may appear at their intersection.

Synoptic hour

Hour, expressed in terms of UTC, at which, by international agreement, meteorological observations are made simultaneously throughout the globe.

Synoptic observation

A surface or upper-air observation made at standard time.

Synoptic surface observation

Synoptic observation, other than an upper-air observation, made by an observer or an automatic weather station on the Earth's surface.

Tropical (Tropic)

Pertaining to that region of the Earth's surface lying between the Tropic of Cancer and Tropic of Capricorn at 23°30'N and S, respectively.

Tropical cyclone

Cyclone of tropical origin of small diameter (some hundreds of kilometres) with minimum surface pressure in some cases less than 900 hPa, very violent winds and torrential rain; sometimes accompanied by thunderstorms. It usually contains a central region, known as the “eye” of the storm, with a diameter of the order of some tens of kilometres, and with light winds and more or less lightly clouded sky.

Tropical revolving storm

Tropical cyclone.

Tropopause

- (1) Upper limit of the troposphere. By convention, the “first tropopause” is defined as the lowest level at which the lapse rate decreases to $2^{\circ}\text{C km}^{-1}$ or less, provided also the average lapse rate between this level and all higher levels within 2 km does not exceed $2^{\circ}\text{C km}^{-1}$.
- (2) If, above the first tropopause, the average lapse rate between any level and all higher levels within 1 km exceeds $3^{\circ}\text{C km}^{-1}$, then a “second tropopause” is defined by the same criterion as under (1). This second tropopause may be either within or above the 1 km layer.

Twilight glow

See Purple light.

Twilight glow in the mountains (Alpenglühén)

See Alpine glow.

Unit of geopotential (H_m)

1 standard geopotential metre = 0.980 665 dynamic metre

$$H_m = \frac{1}{9.806\ 65} \int_0^z g(z) dz$$

where $g(z)$ = acceleration of gravity, in m s^{-2} , as a function of geometric height;

z = geometric height, in metres;

H_m = geopotential, in geopotential metres.

Vertical visibility

Maximum distance at which an observer can see and identify an object on the same vertical as himself, above or below.

Visibility (for aeronautical purposes)

Visibility for aeronautical purposes is the greater of:

- (a) The greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;
- (b) The greatest distance at which lights in the vicinity of 1000 candelas can be seen and identified against an unlit background.

Note: The two distances have different values in air of a given extinction coefficient, and the latter (b) varies with the background illumination. The former (a) is represented by the meteorological optical range (MOR).

Whiteout

Uniformly white appearance of the landscape when the ground is snow covered and the sky is uniformly covered with clouds. An atmospheric optical phenomenon of the polar regions in which the observer appears to be engulfed in a uniformly white glow. Neither shadows, horizon, nor clouds are discernible; sense of depth and orientation are lost; only very dark, nearby objects can be seen. Whiteout occurs over an unbroken snow cover and beneath a uniformly overcast sky, when, with the aid of the snowblink effect, the light from the sky is about equal to that from the snow surface. Blowing snow may be an additional cause. The phenomenon is experienced in the air as well as on the ground.

Wind (mean wind, spot wind)

Air motion relative to the Earth's surface. Unless it is otherwise specified, only the horizontal component is considered.

- (1) *Mean wind*: For the purpose of upper air reports from aircraft, mean wind is derived from the drift of the aircraft when flying from one fixed point to another or obtained by flying on a circuit around a fixed observed point and an immediate wind deduced from the drift of the aircraft.
- (2) *Spot wind*: For the purpose of upper-air reports from aircraft, the wind velocity, observed or predicted, for a specified location, height and time.

Zodiacal light

White or yellowish light which spreads out, in the night sky, more or less along the zodiac from the horizon on the side on which the Sun is hidden. It is observed when the sky is sufficiently dark and the atmosphere sufficiently clear.
