WORLD METEOROLOGICAL ORGANIZATION
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COMMISSION FOR BASIC SYSTEMS
OPEN PROGRAMME AREA GROUP ON INTEGRATED OBSERVING SYSTEMS

EXPERT TEAM ON SATELLITE SYSTEMS

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ANY OTHER BUSINESS

Implications of Using the World Geodetic System 1984 (WGS84)

(Submitted by the WMO Secretariat)

Summary and Purpose of Document

This document draws the attention to a discrepancy between the geostationary projection defined in the CGMS LRIT/HRIT Global Specification, on one hand, and the World Geodetic System 84 (WGS84), on the other hand. Since WMO, through its Commission for Basic Systems, has recommended the adoption of WGS84, it is suggested to raise the issue at CGMS with a view to align the CGMS specification with WGS84.

ACTION PROPOSED

The Expert Team is invited to recommend that the CGMS LRIT/HRIT specification be aligned with WGS84.

Appendix: Rec. 6.1/1(CBS-Ext.(06)) – Adoption of a World Geodetic System and a Global Geoid Model as References for Positioning the Observing Station

IMPLICATIONS OF USING THE WORLD GEODETIC SYSTEM 1984 (WGS84)

1. BACKGROUND

The Commission for Basic Systems adopted in 2006 the Recommendation 6.1/1 on *Adoption of a World Geodetic System and a Global Geoid Model as References for Positioning the Observing Station* (See Appendix). It recommended:

(1) The World Geodetic System 1984 (WGS84) be used as the primary reference for horizontal positioning;

(2) The Earth Geodetic Model (EGM-96) be used as the fixed reference level for MSL determination;

The WGS84 is maintained by the United States National Imagery and Mapping Agency (NIMA) and is described in NIMA Technical Report TR8350.2.

The WGS84 uses as prime meridian the IERS Reference Meridian (IRM) established by the International Earth Rotation and Reference Service (IERS). The latest version of WGS84 documentation includes the EGM-96 documentation.

It may be noted that the refinement of this system is due to a large extent to satellite observations, in particular altimetry data from the GEOSAT, ERS-1 and TOPEX/POSEIDON satellites and additional satellite tracking data from geodetic satellites at various inclinations. It is the coordinate system used by the Global Positioning System (GPS).

2. WGS84 CHARACTERISTICS

The WGS84 reference ellipsoid is characterized by four parameters, of which several geometric constants are derived, some of which are indicated below:

WGS84 Four Defining Parameters

Parameter	Notation	Value
Semi-major Axis	a	6378137.0 meters
Reciprocal of Flattening	1/f	298.257223563
Angular Velocity of the Earth	ω	7292115.0 x 10-11 rad/s
Earth's Gravitational Constant (Mass of Earth's Atmosphere Included)	GM	3986004.418 x 108m3/s2

Some WGS 84 Ellipsoid Derived Geometric Constants

Constant	Notation	Value
Semi-minor Axis	b	6356752.3142 m
Mean Radius of Semi-axes	R1	6371008.7714 m
Radius of Sphere of Equal Volume	R3	6371000.7900 m

As concerns the IRM, it is located 5.31 arcseconds East of the Greenwich meridian, which corresponds to a shift of about 102m at the latitude of Greenwich.

3. COMPARISON WITH LRIT/HRIT GLOBAL SPECIFICATION

In the LRIT/HRIT Global Specification established by CGMS (http://www.eumetsat.int/groups/cps/documents/document/pdf_cgms_03.pdf), the values used to define the normalized geostationary projection are differing from WGS84:

- The reference meridian is the Greenwich meridian (=difference of 5.31 arcseconds);
- The equator radius is 6378169.0 m (= difference of 32 m);
- The polar radius is 6356583.8 m (=difference of 168.5 m).

4. CONCLUSION

It is suggested to raise the attention of CGMS on the discrepancy between the LRIT/HRIT specification and the WGS84 standard and to propose that the CGMS LRIT/HRIT specification be aligned with WGS84.

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RECOMMENDATION

Rec. 6.1/1(CBS-Ext.(06)) – ADOPTION OF A WORLD GEODETIC SYSTEM AND A GLOBAL GEOID MODEL AS REFERENCES FOR POSITIONING THE OBSERVING STATION

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

(1) The position of a weather station is given by longitude, latitude and altitude,

(2) No standard reference system has been endorsed by the WMO to be used as the reference for both horizontal and vertical position of a station,

(3) Both longitude and latitude require one universal standard positioning system as reference,

(4) The *International Meteorological Vocabulary* (WMO-No. 182) defines the Mean Sea Level (MSL) as the average sea surface level for all stages of the tide over a 19-year period, usually determined from hourly heights observed above a fixed reference level, while the fixed reference level for MSL is yet to be identified,

Considering that:

(1) The standard reference system the World Geodetic System 1984 (WGS84) is applicable for the worldwide use by all applications used in meteorology,

(2) Most regional and national systems refer to WGS 84,

(3) The WGS 84 is endorsed by other international bodies, such as ICAO,

(4) The Earth Geodetic Model - EGM-96 is applicable for all applications in meteorology,

Recommends that:

(1) The World Geodetic System 1984 (WGS84) be used as the primary reference for horizontal positioning;

(2) The Earth Geodetic Model - EGM-96 be used as the fixed reference level for MSL determination;

(3) The *WMO Technical Regulations* (WMO-No. 49) and the appropriate WMO Manuals and Guides are updated accordingly.

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