

WORLD METEOROLOGICAL ORGANIZATION

ICTSW-4/Doc. 8.2(4)
(25.XI. 2013)

COMMISSION FOR BASIC SYSTEMS
COMMISSION FOR AERONAUTICAL METEOROLOGY

INTER-PROGRAMME COORDINATION TEAM ON SPACE WEATHER

ITEM: 8.2

FOURTH SESSION

GENEVA, 25-28 NOVEMBER 2013

Original: ENGLISH

DATA AND PRODUCT EXCHANGE ISSUES

Formats and standards:

FY-3C GNOS Data Formats

(Submitted by Xiaoxin Zhang)

Summary and Purpose of Document

This document provides a description of the GNOS/FY-3 Level 2 data, including the atmospheric refractivity, density, temperature, and moisture, as well as the electron density. The satellite FY-3C and the GNOS payload are also briefly described in this document.

(Prepared by Guanlin Yang Jiawei Li and Xiaoxin Zhang in CMA)

ACTION PROPOSED

The Inter-Programme Coordination Team is invited to discuss on the FY-3C GNOS data formats and make recommendations on data exchange of GNOS data.

DISCUSSION

1. ABOUT FY-3C SATELLITE

“Storm III” (FY-3) is China's second-generation polar orbit meteorological satellite series. It is based on the legacy of FY-1 meteorological satellite technology with significant development and improvement in functionality and a big technological step forward with qualitative changes: specific requirements to solve the three-dimensional atmospheric detection, ability to obtain substantial increase in global data to further enhance the cloud and surface characteristics remote sensing capabilities, enabling access to global, all-weather, three-dimensional, quantitative, multi-spectral atmosphere, surface and sea surface parameters. FY-3 meteorological satellite applications for purposes such as four aspects:

- The provision of global numerical weather prediction for the medium-term resolution of the meteorological parameters uniform.
- Study of global change, including climate variation, climate prediction for the variety of meteorological and geophysical parameters.
- Monitoring of large-scale natural disasters and the surface environment.
- To provide global weather information for a variety of professional activities (aviation, maritime traffic, etc.) of any region and meteorological support services for the military.

2. INSTRUMENT GNOS

The Global Navigation Satellite System Occultation Sounder (GNOS) is a newly developed payload on-board FY-3 02 series, the first satellite of which (FY-3C) was successfully launched on 23 Sep., 2013. The goals for GNOS/FY-3 mission include:

- (1). providing all-weather data for operational numeric weather prediction, atmospheric physics study and climate research, and
- (2). monitoring ionospheric electron density profile for space weather research and operation.

The principle of GNOS sounding is to receive the GNSS signal occulted by the Earth atmosphere and ionosphere, using the GNSS receiver on-board FY-3 satellite. Measurements can be converted into excess delay by the atmosphere and ionosphere, and then the atmospheric refractivity, temperature, pressure, water vapor profiles and the electron density profiles will be retrieved.

3. DATA

3.1 Atmospheric Refractivity Profile

GNOS Atmospheric Refractivity Profile products provide the atmospheric refractivity profile and auxiliary data of single occultation. The products include the record of time, the occultation PRN number of the GNSS satellites, position of perigee point, impact parameter, bending angle, and refractivity.

The data are saved as NC format, which includes global attributions and profile data.

Table 1: GNOS Atmospheric Refractivity Profile Product global attribution definition

Attribution Name	Description	Data Type	Comment
satName	Satellite name	char	FY-3C
payName	Payload name	char	GNOS
dataLevel	Data level	char	L2
dataName	Data name	char	ARP
year	Year of the starting time for the occultation	int	
month	Month of the starting time for the occultation	int	
day	Day of month of the starting time for the occultation	int	
hour	Hour of the starting time for the occultation	int	
minute	Minute of the starting time for the occultation	int	
second	Second of the starting time for the occultation	int	
dayOfYear	Day of year	int	
occulding_sat_id	GNSS satellite ID for occultation link	char	
reference_sat_id	GNSS satellite ID for reference link	char	
lat	Latitude of perigee point at occultation point	double	units: degree
lon	Longitude of perigee point at occultation point	double	units: degree
rflict	Local curvature radius of the reference ellipsoid for the occultation point	double	units: km
curv	The X, Y and Z offset of the center of sphericity used in the inversion from the center of mass of the Earth	3*double	Units: km
rgeoid	The height of the geoid ABOVE the reference ellipsoid at the lat/lon position at the occultation point	double	Units: m
azim	Azimuth angle of the occultation plane at tangent point with respect North direction, positive to the East from the North direction.	double	units: degree
qc	Data check	char	

Table 2: GNOS Atmospheric Refractivity Profile Product profile data definition

Attribution Name	Description	Data Type	Comment
Lat	Latitude of perigee point	float	units: degree
Lon	Longitude of perigee point	float	units: degree
Azim	Azimuth angle of the occultation plane at tangent point with respect North direction, positive to the East from the North direction.	float	units: degree
Impact_parm	Impact parameter	double	units: km
Bend_ang	Bending angle	double	units: rad
Opt_Impact_parm	Optimized impact parameter	double	units: km
Opt_bend_ang	Optimized bending angle	double	units: rad
MSL_alt	Mean sea level altitude of perigee point	float	units: km
Ref	Refractivity	double	units: N

3.2 Atmospheric Density Profile

GNOS Atmospheric Density Profile Products provide the atmospheric profile and auxiliary data of single occultation. The products include the record of time, the occultation PRN number of the GNSS satellite, position of perigee point, atmospheric density, dry temperature and dry pressure. The data are saved as NC format, which includes global attributions and profile data.

Table 3: GNOS Atmospheric Density Profile Product global attribution definition

Attribution Name	Description	Data Type	Comment
satName	Satellite name	char	FY-3C
payName	Payload name	char	GNOS
dataLevel	Data level	char	L2
dataName	Data name	char	ADP
year	Year of the starting time for the occultation	int	
month	Month of the starting time for the occultation	int	
day	Day of month of the starting time for the occultation	int	
hour	Hour of the starting time for the occultation	int	
minute	Minute of the starting time for the occultation	int	
second	Second of the starting time for the occultation	int	
dayOfYear	Day of year	int	
occulating_sat_id	GNSS satellite ID for occultation link	char	
reference_sat_id	GNSS satellite ID for reference link	char	
lat	Latitude of perigee point at occultation point	double	units: degree
lon	Longitude of perigee point at occultation point	double	units: degree
rflict	Local curvature radius of the reference ellipsoid for the occultation point	double	units: km
curv	The X, Y and Z offset of the center of sphericity used in the inversion from the center of mass of the Earth	3*double	Units: km
rgeoid	The height of the geoid ABOVE the reference ellipsoid at the lat/lon position at the occultation point	double	Units: m
azim	Azimuth angle of the occultation plane at tangent point with respect North direction, positive to the East from the North direction.	double	units: degree
qc	Data check	char	

Table 4: GNOS Atmospheric Density Profile Product profile data definition

Attribution Name	Description	Data Type	Comment
MSL_alt	Mean sea level altitude of perigee point	float	units: km
Dens	Atmospheric density	double	units: g/m ³
Temp	Dry temperature	double	units: K
Pres	Dry pressure	double	units: mb

3.3 Atmospheric Temperature Profile

GNOS Atmospheric Temperature Profile Products provide the atmospheric moisture profile and auxiliary data of single occultation. The products include the record of time, the occultation PRN number of the GNSS satellite, position of perigee point, temperature,

pressure. The data are saved as NC format, which includes global attributions and profile data.

Table 5: GNOS Atmospheric Temperature Profile Product global attribution definition

Attribution Name	Description	Data Type	Comment
satName	Satellite name	char	FY-3C
payName	Payload name	char	GNOS
dataLevel	Data level	char	L2
dataName	Data name	char	ATP
year	Year of the starting time for the occultation	int	
month	Month of the starting time for the occultation	int	
day	Day of month of the starting time for the occultation	int	
hour	Hour of the starting time for the occultation	int	
minute	Minute of the starting time for the occultation	int	
second	Second of the starting time for the occultation	int	
dayOfYear	Day of year	int	
occulating_sat_id	GNSS satellite ID for occultation link	char	
reference_sat_id	GNSS satellite ID for reference link	char	
lat	Latitude of perigee point at occultation point	double	units: degree
lon	Longitude of perigee point at occultation point	double	units: degree
qc	Data check	char	

Table 6: GNOS Atmospheric Temperature Profile Product profile data definition

Attribution Name	Description	Data Type	Comment
MSL_alt	Mean Sea Level geometric height	float	units: km
Temp	Temperature	double	units: K
Pres	Pressure	double	units: mb

3.4 Atmospheric Moisture Profile

GNOS Atmospheric Moisture Profile Products provide the atmospheric moisture profile and auxiliary data of single occultation. The products include the record of time, the occultation PRN number of the GNSS satellite, position of perigee point, specific humidity. The data are saved as NC format, which includes global attributions and profile data.

Table 7: GNOS Atmospheric Moisture Profile Product global attribution definition

Attribution Name	Description	Data Type	Comment
satName	Satellite name	char	FY-3C
payName	Payload name	char	GNOS
dataLevel	Data level	char	L2
dataName	Data name	char	AMP
year	Year of the starting time for the occultation	int	
month	Month of the starting time for the occultation	int	
day	Day of month of the starting time for the occultation	int	
hour	Hour of the starting time for the occultation	int	
minute	Minute of the starting time for the occultation	int	

Attribution Name	Description	Data Type	Comment
second	Second of the starting time for the occultation	int	
dayOfYear	Day of year	int	
occulding_sat_id	GNSS satellite ID for occultation link	char	
reference_sat_id	GNSS satellite ID for reference link	char	
lat	Latitude of perigee point at occultation point	double	units: degree
lon	Longitude of perigee point at occultation point	double	units: degree
qc	Data check	char	

Table 8: GNOS Atmospheric Moisture Profile Product profile data definition

Attribution Name	Description	Data Type	Comment
MSL_alt	Mean Sea Level geometric height	float	units: km
Shum	Specific humidity	double	units: g/kg

3.5 Electron Density Profile

GNOS Electron Density Profile Products provide the electron density profile and auxiliary data of single occultation. The products include the record of time, the occultation PRN number of the GNSS satellite, position of perigee point, refractivity, electron density. The data are saved as NC format, which includes global attributions and profile data.

Table 9: GNOS Electron Density Profile Product global attribution definition

Attribution Name	Description	Data Type	Comment
satName	Satellite name	char	FY-3C
payName	Payload name	char	GNOS
dataLevel	Data level	char	L2
dataName	Data name	char	EDP
year	Year of the starting time for the occultation	int	
month	Month of the starting time for the occultation	int	
day	Day of month of the starting time for the occultation	int	
hour	Hour of the starting time for the occultation	int	
minute	Minute of the starting time for the occultation	int	
second	Second of the starting time for the occultation	int	
dayOfYear	Day of year	int	
occulding_sat_id	GNSS satellite ID for occultation link	char	
reference_sat_id	GNSS satellite ID for reference link	char	
lat	Latitude of perigee point at occultation point	double	units: degree
lon	Longitude of perigee point at occultation point	double	units: degree
qc	Data check	char	

Table 10: GNOS Electron Density Profile Product profile data definition

Attribution Name	Description	Data Type	Comment
MSL_alt	Mean Sea Level geometric height	float	units: km
ion_Refr	Ionospheric refractivity	double	units: N
elec_Dens	Electron density	double	Units: el/cm ³