Status of Chinese DCS and DCP Technical Standard

Executive summary

The paper is an update briefing on the Chinese Data Collection System of meteorological satellites along with DCP technical descriptions. Currently the FY-4A at 104.7 ° E is operationally used for DCS. It has 433 channels composed of 400 HDCP channels (750Hz spacing/600bps) and 33 international channels (3KHz/100bps). The Chinese DCS is established based on an approach of FD (Frequency Division) with the combination of TD (Time Division). The FY-4A DCS is operated by NSMC (National Satellite Meteorological Center) which is one of the operational units of China Meteorological Administration. Currently there are 52 HDCPs deployed within China territory.

Action/Recommendation proposed: None

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1 INTRODUCTION

The Data Collection System, or DCS, is established to provide satellite channels that satisfy the requirements of meteorology, hydrology, oceanography, and environment management to collect and transmit data from data collecting platforms deployed in remote areas rarely visited by people -mountains, lakes, deserts, forests, or the common approach of data collection and communications can hardly achieve.

DCS is an important part of ground applications of China geostationary meteorological satellite. It is composed of Data Collection Platforms (DCP), satellite transponder, and Data Collection Platform Report (DCPR). Both FY-2 and FY-4 of Chinese geostationary meteorological satellites are carrying the transponder for data collection service.

With the user demand and the technical development since FY-2F (launched on 2012/01/13), the DCP data transmission rate has raised to 600bps, and the channel spacing narrowed from 3 KHz to 750Hz. The present DCS is therefore called the High-rate Data Collection System, or HDCS. Error correcting code and QPSK demodulation is being used by HDCS.

2 CURRENT DATA COLLECTION SYSTEM

At present, China deploys 5 geostationary meteorological satellites: FY-2E/2F/2G/2H and FY-4A, at 86.5E/112E/ 99.5E/79E/104.7E, respectively. The Data Collection System is operationally using FY-4A(104.7E) to accomplish collecting and demodulating domestic and international DCP data, and responsible for channel allocation to DCP (now domestic only), data process, management, and distribution. The content of received data is mainly of the meteorological observation reports from domestic DCP.
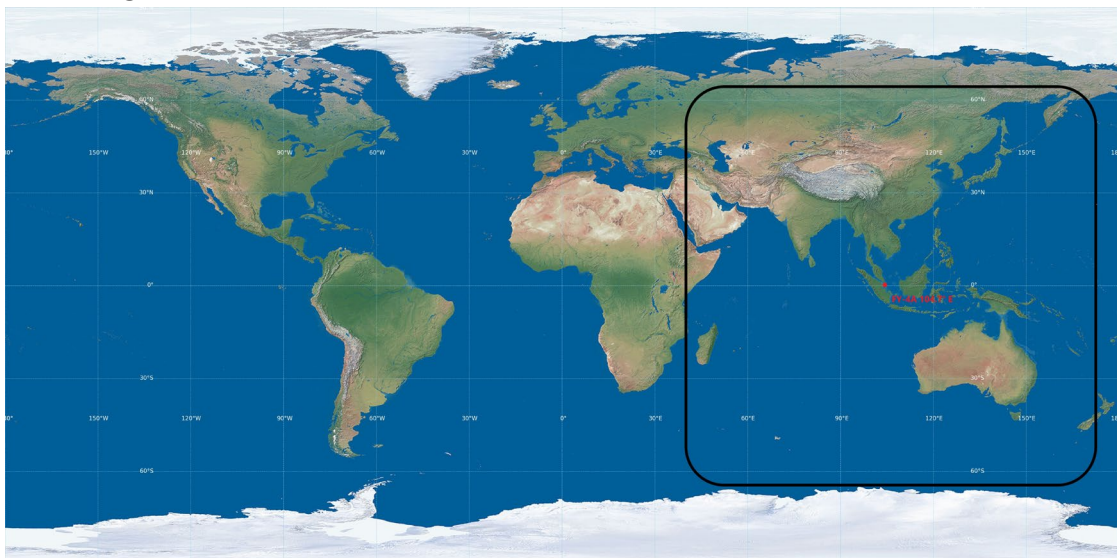
Figure 1 Schematic of FY-4A DCS Coverage Area

The FY-4A DCS is operated by NSMC (National Satellite Meteorological Center) which is one of the operational units of China Meteorological Administration. The vast majority of users are internal to the domestic weather system. There are a few Chinese commercial companies offering corresponding DCP transmitter manufacturing and deployment services as NSMC partners.
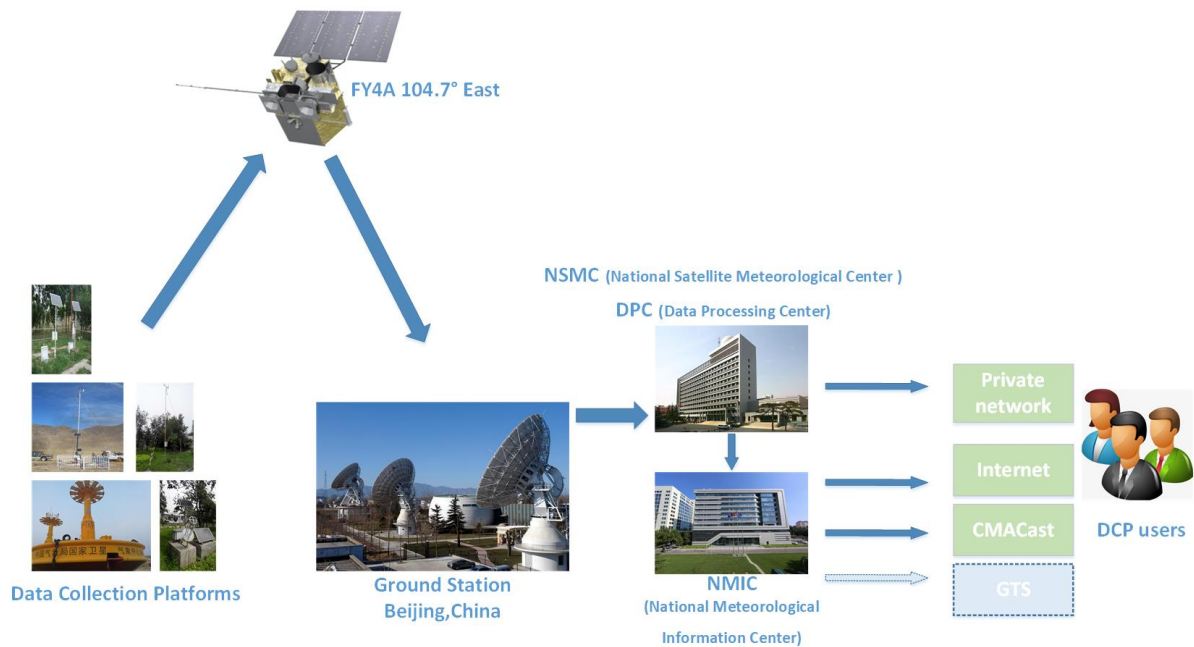
Figure 2   FY-4A Data Collection Service

DCP messages from Certified DCP Transmitters within the FY-4A satellite field of view are relayed to the DCPR (Data Collection Platform Report) in ground stations operated by the NSMC, and then routed immediately to the DPC (Data Processing Center) for processing. NSMC provides data distribution services to specific users over a private network. In addition, NSMC distributes data to the NMIC (National Meteorological information Center, one of the operational units of CMA), which provides data distribution services over the Internet or CMACast to the end user. NMIC has the ability to exchange data with GTS. The International Meteorological Communication System of the NMIC is the Regional Telecommunications Hub (RTH) for Asia on the backbone network of Global Telecommunications System (GTS)。

Since the operation of FY-2C (launched in 2004), user demands for DCS to become operational is growing louder, the number of deployed DCP has gradually increased.

Table 1   DCP Status

Number of DCPs	Location
44	Ground stations in Xinjiang, Beijing, Guangzhou, Heilongjiang
2	Qinghai Hu Lake, Qinghai-Tibet Plateau
6	South China sea

At present, there are 52 data collection platforms deployed within China, of which 44 are fixed in the Xinjiang Uygur Autonomous Region (north part and south part), Beijing, Guangzhou, Heilongjiang (Jiamusi), respectively; two mobile platforms on the Qinghai Hu Lake; six ocean buoys in the south China sea. Normally, the arrival ratio of DCP reporting exceeds 95%.

3 DCP TECHNICAL DETAILS

There is one DCPR which is located within the CDAS (Command and Data Acquisition Station) in Beijing Ground Station. With the high-rate data collection system it can cope with DCPs within the FY-2 and FY-4 footprints. The data is demodulated at the ground station and distributed through data network.

Table 2 FY-4A DCP technical specifications

		Domestic		International	
Up-link	Frequency coverage (MHz)	401.099500～401.399500	Frequency coverage (MHz)	402.0025～402.0985	
	No. of channels	400	No. of channels	33	
	Channel spacing	750Hz	Channel spacing	3 KHz	
	Bit rate	600bps	Bit rate	100bps	
	Modulation	QPSK	Modulation	±60°PCM-PSK	
	Emission power	2～10W adjustable (1dB step) EIRP=43～50dbm	Emission power	5W	
	Polarization	Right hand circular	Polarization	Right hand circular	
Down-link		FY-2		FY-4	
	Central frequency (MHz)	1709.5	Central frequency (MHz)	1688	
	Bandwidth (MHz	1	Bandwidth (MHz	1	

*DCP time is synchronized with GPS signals

The HDCS is operating on the basis of frequency division with combination of time division.

●Frequency Division: the frequency band for DCS is divided at 750Hz spacing for domestic usage, the old international channels of each 3KHz spacing is unchanged. Thus the number of domestic channels increases to 400, and the number of international channel remains 33, there are totally 433 channels.

●Time Division: the timesolt for international channel is unchanged, remains 1min and 30 sec except for Channel No.17, which is dedicated for aviation and has 2 minute timesolt. The timesolt for domestic channel is changed to 18 seconds.

4   DESCRIPTION OF THE HDCP TIME TABLE

HDCPs are classified as the Regular or the Irregular ones in China. Majority regular HDCPs reports within the timesolt of 18 seconds. However, the platform to transmit large message can get 58 second time allowance at the most. The channel No.391～No.400 are allocated to irregular HDCPs - those that transmit randomly in time, for instance, when one of the sensors' reading exceeds the thresh hold value, the HDCP automatically starts reporting immediately. The length of message can be variable between the shortest one of the two message sub-frames and the longest that corresponds to the message length transmitted within 18 seconds by regular platforms.