Research on Status and Development Trend of Beidou Satellite Early Warning Communication System in Fujian Meteorological System

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Abstract. This article describes the principle of Beidou satellite early warning communication system, and application status quo, And make a study on its future development trend in Fujian based on the characteristics of Beidou satellite early warning communication system.

Introduction

In recent years, in Fujian Province, operator's cable trunk breaks down every once in a while due to typhoons, heavy rains and other disastrous weather, which results that the data of the national automatic weather station can not be upload. In order to improve the security capabilities of the communications of the state-level automatic station of our province in disastrous weather, dual standby communication is used for common data transmission. In the event of severe weather and the main communication system of the original national automatic stations is destroyed, it is quite important that how to ensure the timely transmission of weather data by using Beidou satellite warning communication system to achieve national automatic station weather observation data transmission,.

In order to strengthen the ability of meteorological disaster monitoring, early warning and defensive, to build meteorological disaster monitoring and early warning network, and to carry out the Beidou satellite emergency communication transmission pilot work, Beidou satellite communication system has gradually been installed in the stations of cities and counties, automatic station observation data transmission can be achieved when the circuits of the public network operators break down, therefore the purpose of disaster prevention and mitigation is fulfilled.

There is a new trend for meteorological disaster monitoring and early warning network construction. Beidou satellite early warning communication system is increasingly becoming a new means of meteorological data transmission.

Fujian Provincial Bureau of Meteorology has established 400 Beidou data transmission terminal stations of weather stations, and 100 handheld terminal location display and short message transmission and developed other functions in cities, counties, townships, towns and field monitoring locations. These are important parts of Beidou satellite early warning communication system (hereinafter referred to as "Beidou system") .Through the emergency communications services of Beidou satellite channel, such as weather data collection and analysis, the poor network in remote areas and communication network failure which are "blind spot" of meteorological communications, can be eliminated. The timeliness, stability and effectiveness of the weather data transmission of the backbone observation sites are ensured. The disaster weather monitoring and the degree of refinement of early warning are further strengthened. And the process of meteorological modernization is promoted. Therefore, the importance of the principle research on Beidou satellite early warning communication system, the application of the status quo and the future development trend in Fujian Province is increasingly prominent, this paper describes the above issues.

Beidou satellite communication system function

At present, the existing way of meteorological data transmission of our province is achieved by broadband network (SDH), Without affecting the observation function of existing stations,,the existing communications network is embedded in the Beidou satellite communications system, so as to transmit the observation data of the automatic stations by wired network and wireless network, and the reliability (including the rate of data, the rate of reporting, the consistency of time) of meteorological observation data transmission is improved.

The main construction content of the project is to build the Beidou satellite communication transmission terminal at the county level station and build the Beidou satellite communication transmission and receiving system (center station) in the city office. So as to realize the transmission of the observation data of national automatic stations, system time-synchronizing, text communication and other functions by using Beidou satellite communication system.

Data file transfer

The observing and predicting computers and the Beidou meteorological data transmission computers are connected to the inner network of the service station. The software of ground auxiliary system and Beidou meteorological data transmission system are installed on the Beidou meteorological data transmission computers. The ground auxiliary system generates the punctual observation data of the automatic stations by reading relating data from observing and predicting computers through the local area network. And the data are stored in the designated folders in the Beidou meteorological data transmission computers. The software of the Beidou meteorological data transmission system will regularly check the folders and found the existence of a new type of designated file, then to apply for the transmission of the document to the Beidou satellite communications system.The file is transmitted to central station server through Beidou satellite communication network, and the server will unpack, integrate and archive the received data.

System time-synchronizing

Beidou satellite communication system obtains the Beidou time, and the Beidou meteorological data transmission computer obtains the Beidou satellite time command through the local area network and display on the computer desktop. Then the time of the Beidou meteorological data transmission computer is artificially synchronized; the automatic time-synchronizing of the LAN computers is achieved by installing related software on those computers.

Text communication

The software of Beidou meteorological data transmission system has a text communication module to achieve text communication between the Beidou meteorological data transmission computer and the central station. When the central station receives the text sent by the weather station, it can display information on the screen and make sound alarm.

Technical design

On the basis of preserving the original communication system (SDH network), a backup communication mode is added to the Beidou satellite communication system to realize the synchronous operation of the two-mode communication. (Fig.1)

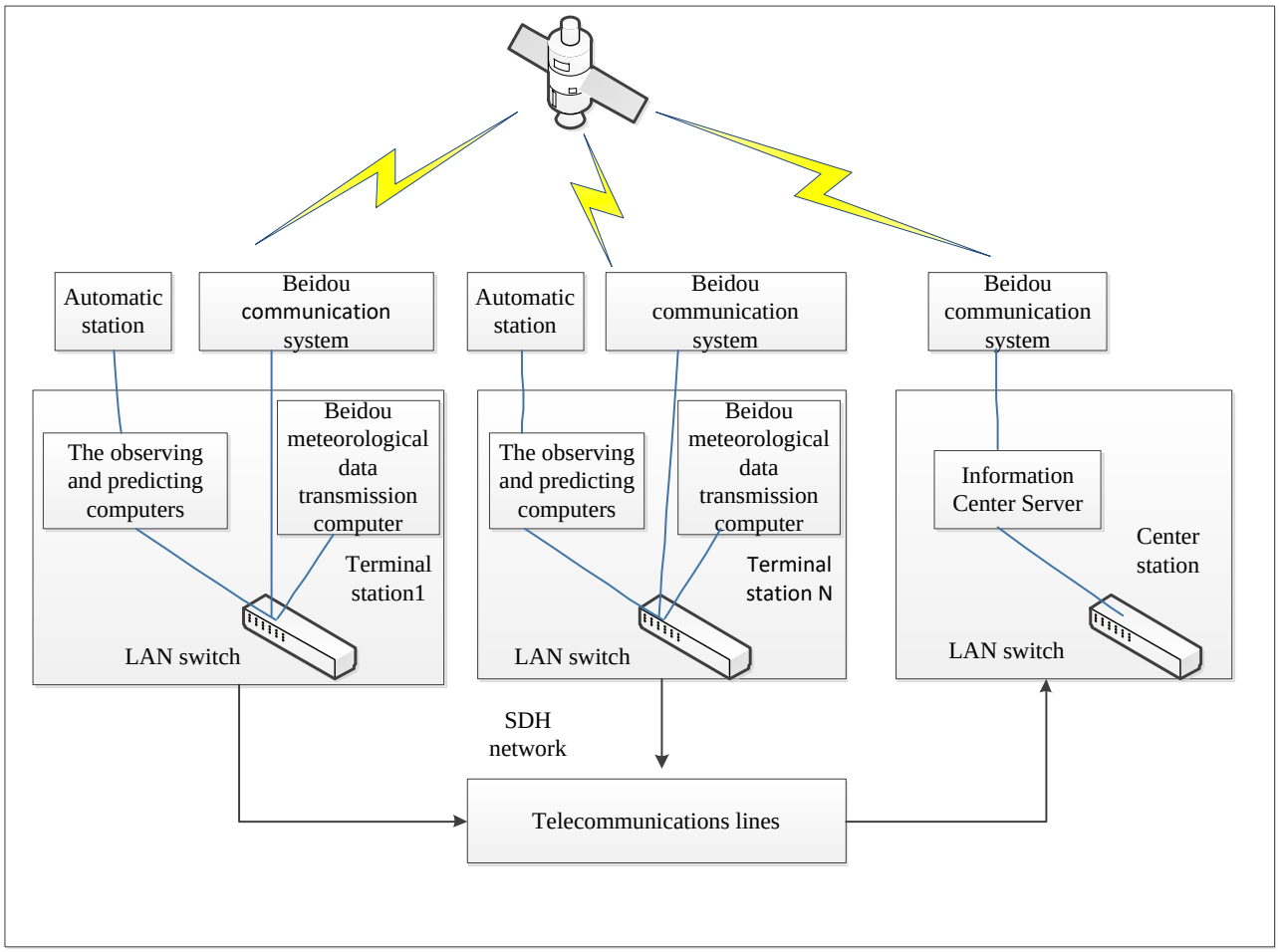

Fig.1 Coexistence of Communication Network of Primary Mode and Standby Mode

Beidou satellite communication system is connected to the inner network of the service station(Fig.2). The software of ground auxiliary system and Beidou meteorological data transmission system are installed on the Beidou meteorological data transmission computers. The ground auxiliary system generates the punctual observation data of the automatic stations by reading relating datas from observing and predicting computers through the local area network. And the software of the Beidou meteorological data transmission system is in charge of receiving, sending and processing datas of the transmission system. The functions are achieved as follows: the punctual observation datas of the automatic stations are generated in regular time by the ground auxiliary system and are stored in the designated folders in the Beidou meteorological data transmission computers. The software of the Beidou meteorological data transmission system will regularly check the folders and found the existence of a new type of designated file, then to apply for the transmission of the document to the Beidou satellite communications system.The file is transmitted to central station server through Beidou satellite communication network. The software of the Beidou satellite communication system obtains the Beidou time through the local area network and display on the computer desktop. Then the time of the observing and predicting computer and the automatic station system is artificially synchronized. The software of Beidou meteorological data transmission system has a text communication module to achieve text communication between the Beidou meteorological data transmission computer and the central station. When the central station receives the text sent by the weather station, it can display information on the screen and make sound alarm.

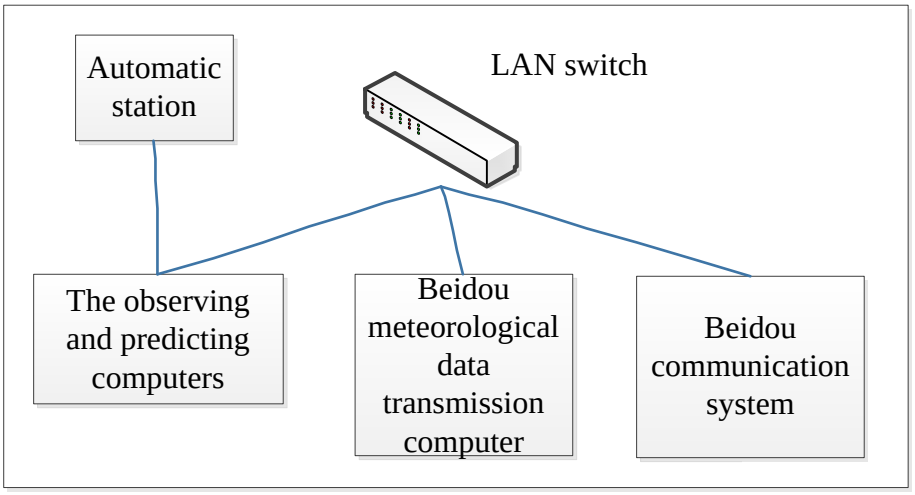

Fig.2 Physical connection diagram of Beidou equipment

Status and demand

Status quo of Automatic station

Our province has 70 national automatic stations, and uses China Telecom SDH network to transmit data of those national automatic stations(Fig.3). Meanwhile, communication lines based on INTERNET and China Telecom CDMA wireless communication lines for emergency backup communications are constructed. . However, these communications rely heavily on the operator, when the operator backbone network is interrupted, the automatic weather observation data will not be transmitted.

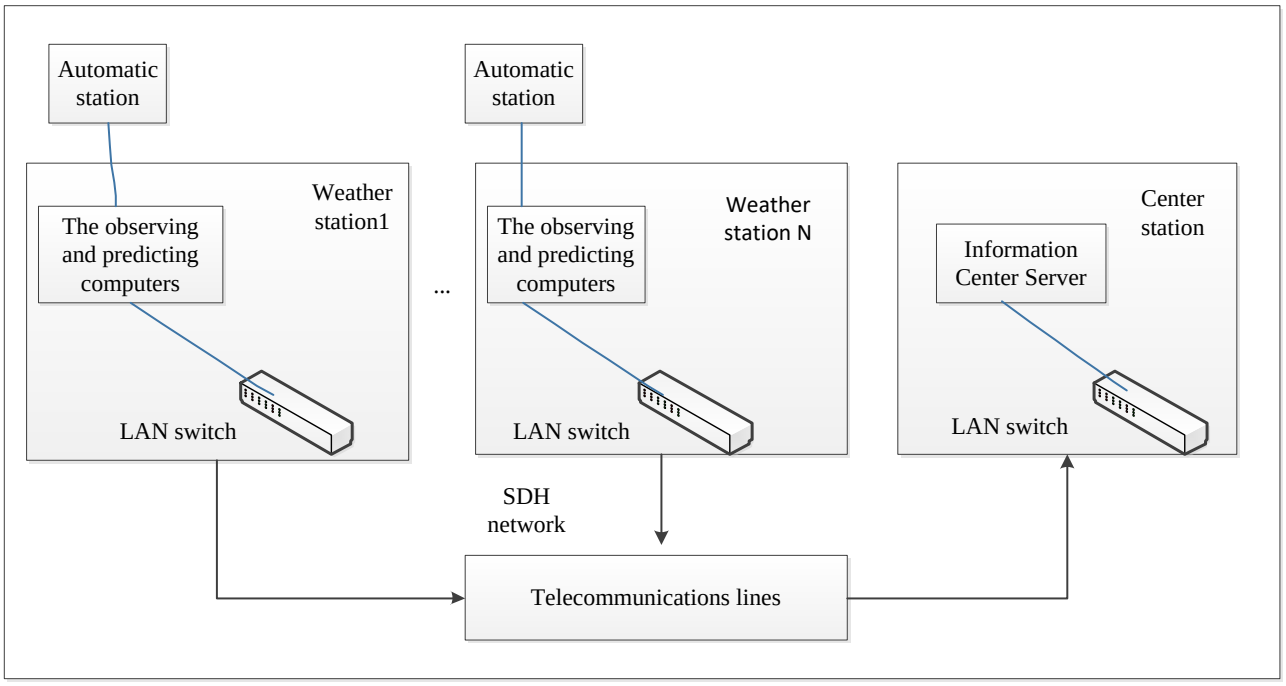

Fig.3 Existing national automatic station communication network

Cities in Fujian are trying to build the Beidou system, for strengthening the capacity in response and disposal of sudden disasters, so as to protect the safety of lives and property and to provide fast and effective rescue. Beidou meteorological data acquisition system and early warning information management system was launched on March 27, 2016, and was well applied when Typhoon "Nibert" came, the first typhoon in 2016, which provided a backup transmission channel for meteorological emergency data transmission in Minqing County. The system also provided backup support for Quanzhou Meteorological Bureau and Pingtan Meteorological Bureau during the typhoon "Morandi", and has been unanimously approved. The Beidou short message

communication function of the hand-held terminal of the Beidou satellite system provide a good support to the meteorological bureaus in emergency communications during the typhoons.

"Beidou system" mainly has two parts: the emergency communication management platform of Beidou communication system and the early warning emergency Beidou communication station. The emergency communication management platform is composed of Beidou commander and early warning information management system. The early warning emergency Beidou communication station is composed of Beidou communication terminal, display control unit and solar panel, battery module, inverter, bracket and other security equipment. The 400 automatic stations can pack the weather data on-demand, generate "c" file format and upload to the designated meteorological server via FTP, and achieve a seamless docking effect with a meteorological standard data format. The provincial emergency communication management platform uses the configured Beidou commander to achieve early warning information release of the affiliated stations by Beidou short message and receive disaster information and help signals uploaded by the terminals of the stations and can also control the terminals and flexibly adjustment system parameters.

It can guarantee that the weather data can be timely transmitted to the weather Bureau in counties by Beidou satellite communication when the communication is interrupted and the meteorological data can not be transmitted due to instable signals of the automatic weather stations in mountain area. Thus it ensures smooth timely and reliable transmission of weather data.

For example, the installation and commissioning of 10 sets of Beidou station and the upgrading of 4 sets of landing station in the whole area of Pingtan are underway. The construction of the Beidou system and the upgrading of the landing station have solved the problem of poor signal and instable transmission in island area to a certain extent, and further improved the quality and efficiency of meteorological data transmission and ensured the stability of data transmission in the case of severe weather, and laid a good foundation in order to better carry out forecasting and early warning business and taken a solid step for the realization of meteorological modernization.

In addition, the capacity of emergency response in dealing with meteorological disasters of typhoons and storms in Sanming City is comprehensively enhanced, and casualties and property damage caused by meteorological disasters is minimized or avoided. Recently, the Meteorological Bureau of Sanming City also carried out emergency drills of the meteorological Beidou hand-held terminal. The business backbones of meteorological bureaus of counties or cities display, on field, the location of mobile terminals in real time in the Beidou weather warning system, and, simulate how to use the Beidou hand-held terminal to quickly set up a reliable emergency communications network, to send and receive early warning information of emergency transmission when encounter unexpected situation. Through this exercise, the capacity of response and disposal of sudden and severe weather is further improved, the location information of the front-line rescuing personnel can be controlled in real time, and they can be commanded and controlled to protect the life of those rescuers and the safety of the properties and ensure quick and effective rescue.

There are nine sites in Zhao’an, including relatively remote mountain towns and coastal islands, the installation task is heavy. Zhao’an Bureau actively do the preparatory work by taking into account the flood season meteorological services, and scientific arrangements. The installers have to overcome the hot weather to speed up the installation of Beidou satellite communications terminal in the county, even when they are sick. Among them, the vehicle can not be driven to the outer island, the successful site construction can only be achieved by paying close attention to the time of the low tide and then manually carrying equipment materials including generators onto the island.

Demand

Due to the frequent occurrence of meteorological disasters caused by typhoons, torrential rains, mountain torrents and other natural disasters, when the original communication system (especially the trunk circuit) is destroyed, it is often impossible to recover data transmission in a short time. Persistent rainstorm will cause the interruption of domestic communications, the data can not be uploaded in time, and the up and down communication will be affected. Therefore, the

establishment of backup communication ways which can not be influenced by the disastrous weathers is very necessary to the automatic station data transmission system.

Construction requirements

Beidou satellite terminal infrastructure construction should be carried out in accordance with the requirements of foundation construction. It needs to choose the open locations as infrastructure sites, and to ensure that no obvious obstruction in their south direction.

The objectives of the project

To realize transmission of national automatic station observation data, system timing, text communication and other functions by using Beidou satellite communication system in such emergency state when the telecom operators trunk lines are broken down.

National automatic station observation data transmission content

Punctual observation data (once per hour) of the automatic station; Theoretically, the automatic station has the transmission function of date data (20 points per day), but the ground auxiliary software does not generate this file. The data can only be manually copied for quantitative test in this experiment; other observation data transmission is currently not considered.

Transmission requirements of State - level automatic station observation data

(a)Achieve reporting rate of the data transmission to at least 95%, and strive to reach more than 97%;

(b)The time-delay of the automatic station point observation data transmission is 8 minutes, no more than 10 minutes;

(c)Bit error rate (BER) is less than 5 * 10-6.

Text communication

Transmission requirements: it can transmit 45 Chinese characters (including symbols) each minute during non-file transmission period, the central station can receive the data, display on the screen and issue a sound alarm.

In the trial operation, it is needed to be improved and upgraded to improve transmission efficiency and to expand the transmission function for laying a good foundation for the appropriate expansion of other transmission content in the following promotion. After the trial operation, a mature satellite emergency communications transmission program will be formed based on the summary of test assessment, in order to promote the use in the meteorological stations of our province.

Conclusion

Fujian Province is a province of frequent natural disasters, it will face typhoons, hail, heavy rain, floods and other extreme weather in annual flood season. With the expansion of the meteorological network, the enhancement of monitoring density and accuracy, it has higher requirements in timeliness and stability. Especially in extreme weather, weather data emergency transmission has always been the focus and difficulty. Based on the Beidou satellite system, which has the characteristics of large coverage, safe and reliable, it can realize the construction of Beidou meteorological data acquisition system and early warning information management system. The initial application, especially during the period of typhoon, set up an emergency data transmission backup channel, which ensured timely data transmission in the first line, realized a very good application. Accurate position, feature-rich background processing and monitoring system, the construction of Beidou emergency meteorological data transmission is very necessary. It is also the inevitable development trend of meteorological data transmission and backup.

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