The Influence Analysis of the Rainfall Meteorological Conditions on the Operation of the Balloon Borne Radar in Plateau

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Abstract. Based on the characteristics of complex terrain and different seasons’ weather in Qinghai Tibet Plateau, through statistic the daily rainfall that from 2002 to 2012, nearly 11 years, by Bomi meteorological station, Bomi area rainfall forecast model is established, and which can provide the basis forecasting for dangerous weather warning system on the balloon borne radar in the next step, to protect the balloon borne radar equipment’s safety work and combat effectiveness.

1. Introduction
Over the past decade, balloon borne radar system are more and more popular in the armed forces around the world, with its strong ability of low altitude warning and leaving in the sky for a long time, high cost-effective, good mobility and maintenance ability. Because of the balloon borne radar works highly in the sky, its range of detection to the low altitude target is large, and it is mainly used to warning on some important area in military. With conservative calculation [1], the balloon borne radar’s coverage capability of low altitude defense is equivalent to a few or even more than a dozen conventional ground-based radar.

In practical, the survival ability of the balloon borne radar system is closely related to rain and other weather conditions in the work area. In addition, the balloon borne radar detection performance is equally affected by meteorological clutter which is mainly the rain and cloud, especially, the radar worked in the S and C band are more serious. Therefore, it is necessary to research for the rain and cloud meteorological characteristics, which can better grasp the influence to the survivability and operas ability and other aspects of the balloon borne radar, so as to take effective measures to maximize play equipment operational effectiveness.

2. Research status
In foreign countries, many military departments have a perfect weather forecasting model, which can make a more accurate forecasting of long-term, medium-term, short-term and near dangerous weather forecasting, the forecasting factors are rich, and the timeliness is obvious. Such as a total of 350 civil site and 150 military site provide a set of 6 to 60 hours of meteorological element forecast guidance in United States, publish the following weather elements forecast guidance two times every day: the highest and lowest temperature, humidity, dew point, precipitation probability, types of precipitation, precipitation, thunderstorm probability, snowfall, cloud cover and ceiling, visibility, solar energy, solar radiation, surface wind and so on. It provide guidance for both civil disaster prevention and safety production, but also for military carrying the normal work of the balloon borne radar.
In our country, there are comparatively perfect weather forecast system, which is relatively rich in civilian business product, but it is very few in the field of military balloon borne radar. At present, we have basically mastered the influence of meteorological conditions and atmospheric environment to the balloon borne radar equipment in the low altitude plain area, but have not adequately studied in some specific regions of plateau all the time, lack of an auxiliary decision-making measure for development and safe use of equipment in complex weather conditions, which can help the development organization and combat troops. According to the operation situation of the two type of balloon borne equipment have been developed [2], it occurs frequently that solders have to wait until the weather conditions reach at the safe operation requirements, and caused many accidents due to the non-standard weather, causing significant losses.

Due to the geographical features and the climate of the plateau is different with the low altitude area, it results in that there are some distinctions on design, production and use of the balloon borne radar equipment. Therefore, it is urgent and realistic to carry out the analysis and research on the meteorological environment in the specific region and the accurate forecasting of the weather phenomena which affect the safety of the equipment, in the early stage of the development of the balloon borne radar equipment in plateau.

2.1. The analysis method
Time series analysis is a kind of processing method which uses the parameter model to analyze the observed ordered data. The dynamic characteristics and the state of the system can be analyzed and predicted by the time series, which can provide the basis for the system state monitoring. Matlab toolbox contains a lot of functions, with these functions, you can easily carry out time series analysis.

Meteorological data is characterized by time series data, Matlab time series function can find the regularity in the data which meet the characteristic, and could find the value which contained in the data. First, save the Meteorological data in the text file format after arranging, which obtained by radar. The file name can be X.txt, X refers to the year. Second, enter the command! Type X.txt, then the data of the text file will store in the Matlab software cache, and then, the X.txt data will be red in the time series format by ascii2fts function. The function is: ak = ascii2fts ('X.txt', 2,1), which is named akin Matlab. By the ascii2fts function, the data all are stored in Matlab with the form of objects, the method of calling the data as follows: ak.dates read out the time field; ak.all read outall the weather field; ak.Rainball read out the rainfall field. Finally, draw the bar graph and enter bar (ak) to get Figure 1 to Figure 3.

2.2. The summary of geographical environment and meteorological condition on Bomi
Qinghai Tibet Plateau is 3000 to 5000 meters above sea level, with an average altitude of 4500 meters. Bomi area is located in the south eastern part of Tibet, is located in the middle reaches of the Yarlung Zangbo River north shore, shows a trend of North higher and south lower trend, has a wide disparity between the highest and the lowest terrain elevation, with a large fluctuation. At the same time, the meteorological characteristics of this region also has a significantly difference with the plain area, for example, dramatic and quickly changes in the weather, large distinction of temperature between day and night , lower air temperature in winter and spring, gusty wind, lightning, blizzard, long time for sunshine, strong ultraviolet. Bomi formed a special variety of climate zones which impacted by Indian Ocean of the southwest monsoon, coexisting in tropical, subtropical, temperate, frigid, humid and semi humid zone.

The characteristics of the plateau geographic and the meteorological environment determine that the design and use of the balloon borne radar equipment is very different within the Plain.

2.3. Analysis of the varied characteristics about rainfall in the last eleven years on Bomi
The weather station is located at 29.86 degrees north latitude, 95.76 degrees east longitude, altitude 2737 meters. This paper draws and analysis’s the rainfall varied characteristic diagram in the past eleven years from 2002 to 2012 on Bomi region, carried through a large number of statistical data which comes from Bomi meteorological station daily rainfall data, used matlab development environment for computing platform.
Figure 1 show, daily maximum rainfall per month all most exceeds 30mm from March to October in the past eleven years, especially, reached 86mm on October 2008. So the commander should avoid the tethered balloon flying, to guarantee the security of the radar equipment. From Figure 2 it can be seen that the annual average maximum rainfall in the past 11 years is June, reached 120.4mm. And the annual average rainfall is more than 65mm from March to October, reduced suddenly from November to February of the following year. From Figure 3 we can see that annual rainfall all most exceeds 120mm from March to October in the paste eleven years. Especially, the annual maximum rainfall reached 241mm on May 2010.

Generally, Bomi has a heavy rain more frequently than usual in summer. Due to the special terrain features of the plateau, Bomi Country appears cumulonimbus which can produce lightning throughout the entire year, and annual average rainfall is 977mm by statistic.
3. Concluding remarks
Plateau type of balloon borne radar [3] equipment is one of the key equipment is being developed by the air force; it will be deployed in the region of the Qinghai Tibet Plateau. From the performance of balloon borne radar’s debugging and use in recent years, rainfall is one of the important factors affecting equipment safety, even severe weather disasters will directly endanger the sphere, resulting in sphere plunging to the ground or damaged [4].

Rainfall over the Tibetan Plateau is more concentrated. Monthly average rainfall exceeds 65mm from March to October each year, affected by warm moist air of the Indian Ocean and the bay of Bengal. During the time when the weather cannot reach safe requirement, the meteorological station should keep warning advanced and the balloon borne radar should avoid operation. From November to February, there is heavy wind and little rain because of the ground controlled by cold high atmospheric pressure. The rainfall is about 977mm each year from 2002 to 2012. the daily maximum rainfall reached 86mm. the monthly maximum on May 2010 reached 241mm. In the rainy season, the rainfall proportion is more than 80% on total year. In the alternately season of dry and wet, the rainfall characteristic of swelled and plummeted suddenly is obvious.

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