

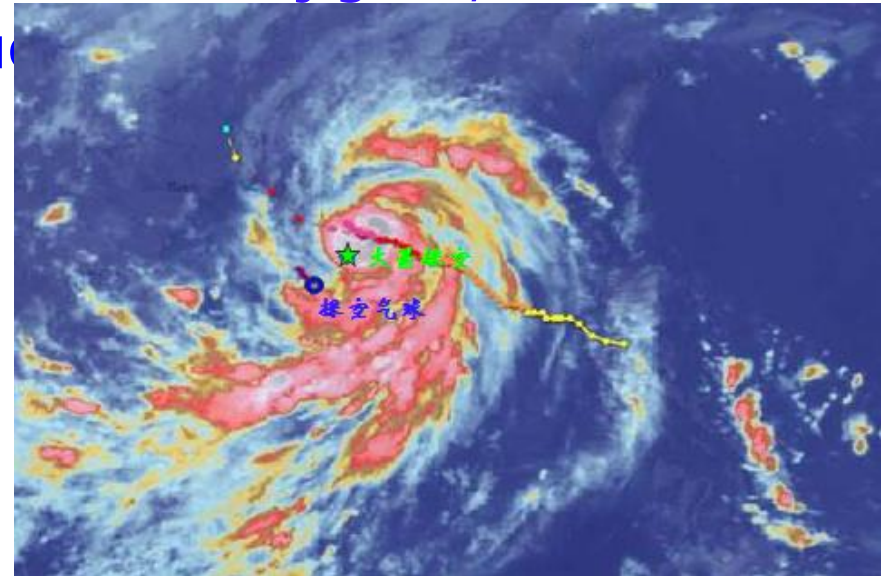


Design and Experiment On The Rocket Detection System of Typhoon

Hubei Aerospace Vehicle Institute
Shanghai Typhoon Institute of China
Meteorological Administration
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Function and Composition

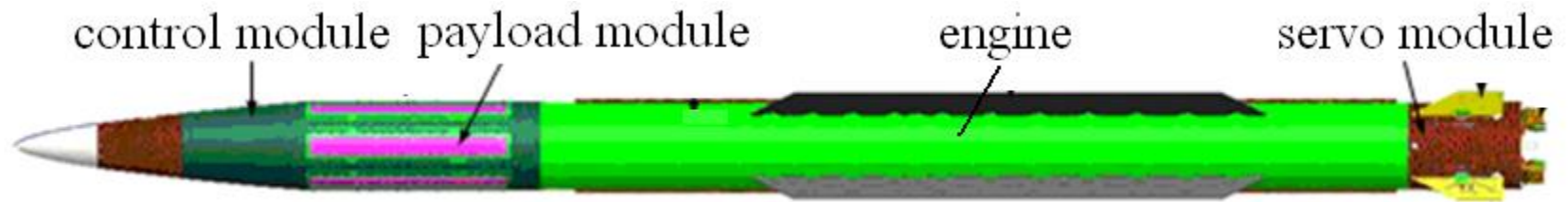
In order to strengthen the study of typhoon mechanism, China Aerospace Science and Industry Corporation (CASIC) and China Meteorological Administration organized and implemented the public welfare industry (meteorological) research project of "research on accurate and rapid sounding of offshore typhoons based on rocket platform". On October 3, 2015, the world's first rocket sounding flight experiment was conducted for the typhoon "mujigae", the



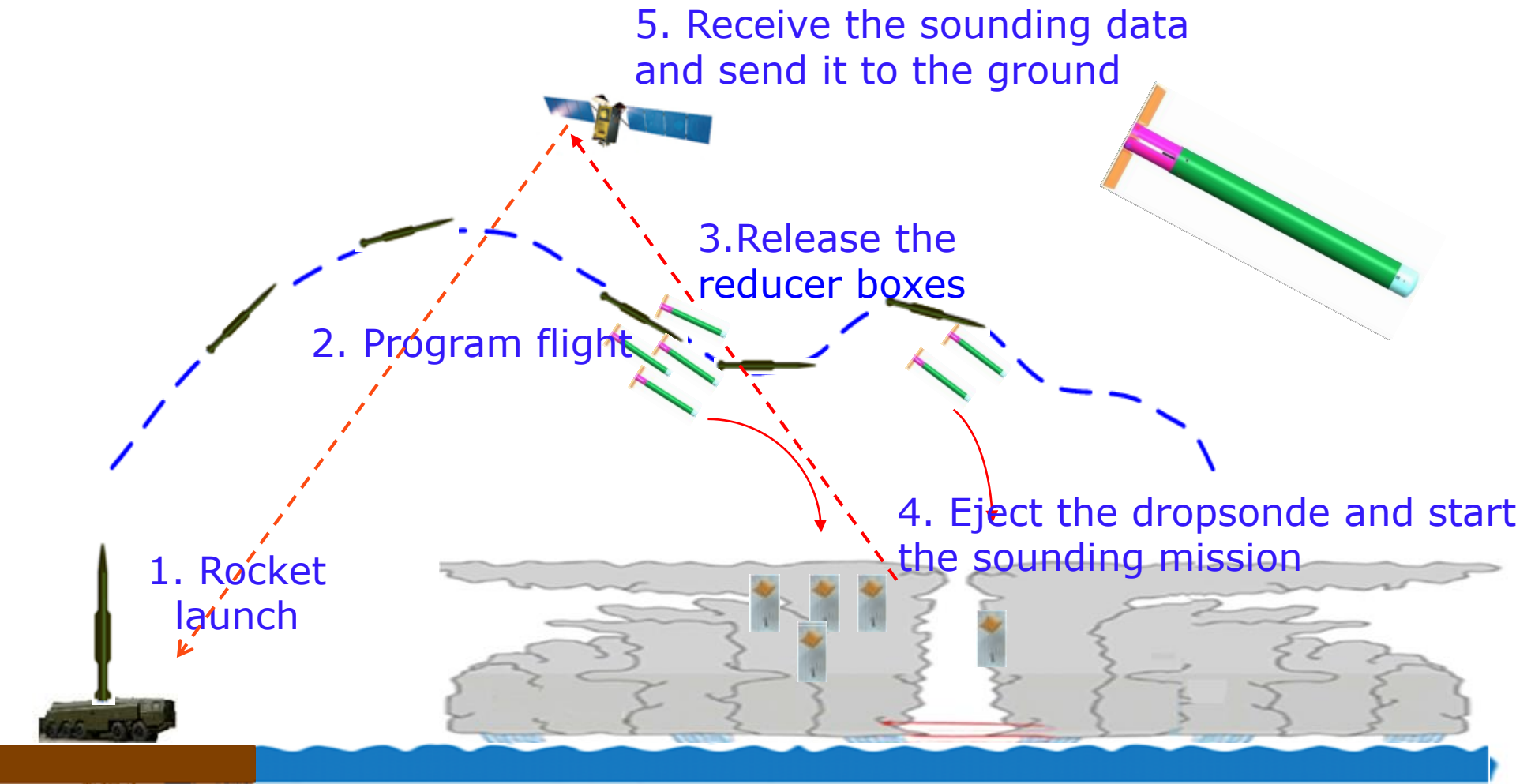
Function and Composition

The rocket can fly steadily in typhoon environment, with characteristics of strong maneuvering ability, fast flight speed, wide coverage and high precision.

The sounding rocket is divided into control module, payload module, engine and servo module, the payload module is equipped with six dropsondes. The rocket flight time is about 4 minutes and the flight distance is not less than 220km. The reducer boxes will be released to the predetermined location and drop steadily. The dropsonde will be **ejected at a** predetermined altitude from the reducer box, then the deceleration parachute was opened and the dropsonde started to measure wind speed, wind direction, temperature, pressure and humidity. The sounding data is transmitted to the ground receiving station in real time by satellite, the time of the dropsonde to fall in the typhoon (about 12km to sea level) is about 20 minutes.



Function and Composition



Key-technology

➤ Based on the rocket dispersing technique, Multi-point sounding by the dropsonde is realized

The payload module is mainly used for loading reducer boxes(built-in dropsonde).After releasing the reducer boxes, the rocket maintains the original shape. Six reducer boxes are distributed in the payload module along the circumferential direction. According to the control system instruction, the reducer box is released, then the rocket maintains its original shape through the piston.



Key-technology

➤ Based on reducer box and deceleration parachute technology, Realizing stable deceleration of the dropsonde

The reducer box is the carrier of the dropsonde and the secondary release device. After being released, the foldable tail fins expand, stabilizing and slowing down the reducer box to a certain speed. The dropsonde is then released, and continues to slow down through an inflatable parachute.



Key-technology

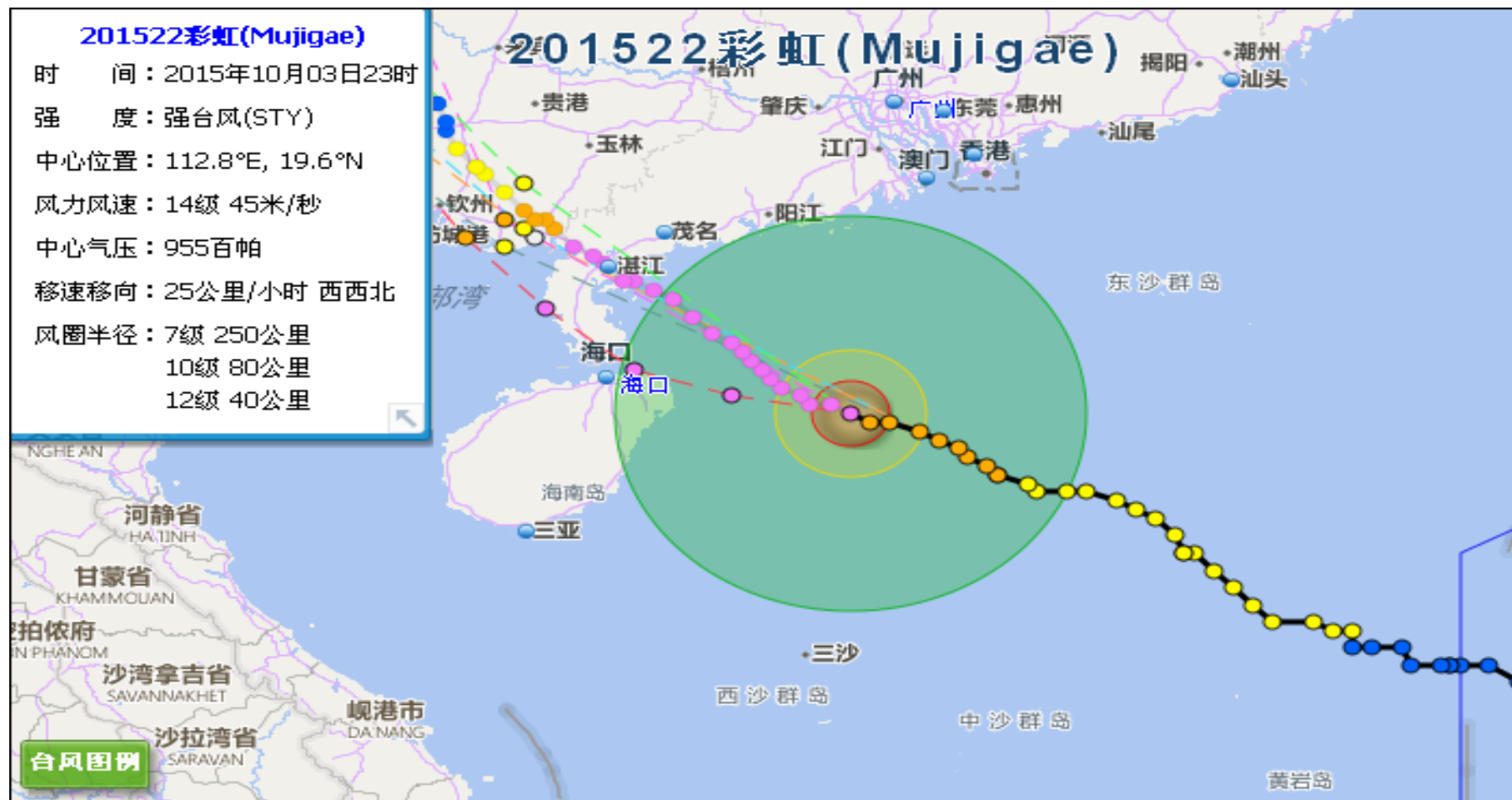
➤ Based on satellite communication, the data remote transmission of the dropsonde is realized

The dropsonde is released , switched on and used to measure the wind, temperature, pressure and humidity in the typhoon in the slow descent. The sounding data is forwarded to the ground receiving equipment by Beidou satellite, which will be analyzed and processed by the ground receiving equipment to obtain the required meteorological products.



Flight Experiment Condition

The sounding flight experiment was carried out in WanNing, HaiNan, on October 3, 2015.



Flight Experiment Condition

The sounding rocket launched and flew normally. The time sequence of the two dispersion was completed accurately, the target point deviation was 31.8 m, sounding data of the dropsondes were received synchronously, satisfying the requirement. By three sets of receiving devices in WanNing and WuHan, a total of four dropsondes had obtained valid data.

DropSonde number	Initial point longitude (°)	Initial point latitude (°)	Initial point height (m)	Data continuity rate (%)
2081	111.760829	19.066305	10983.917	96.774%
2082	111.760175	19.065680	10864.267	97.826%
2078	111.761003	19.065445	10984.950	98.027%
2080	111.760718	19.064915	10848.843	65.419%

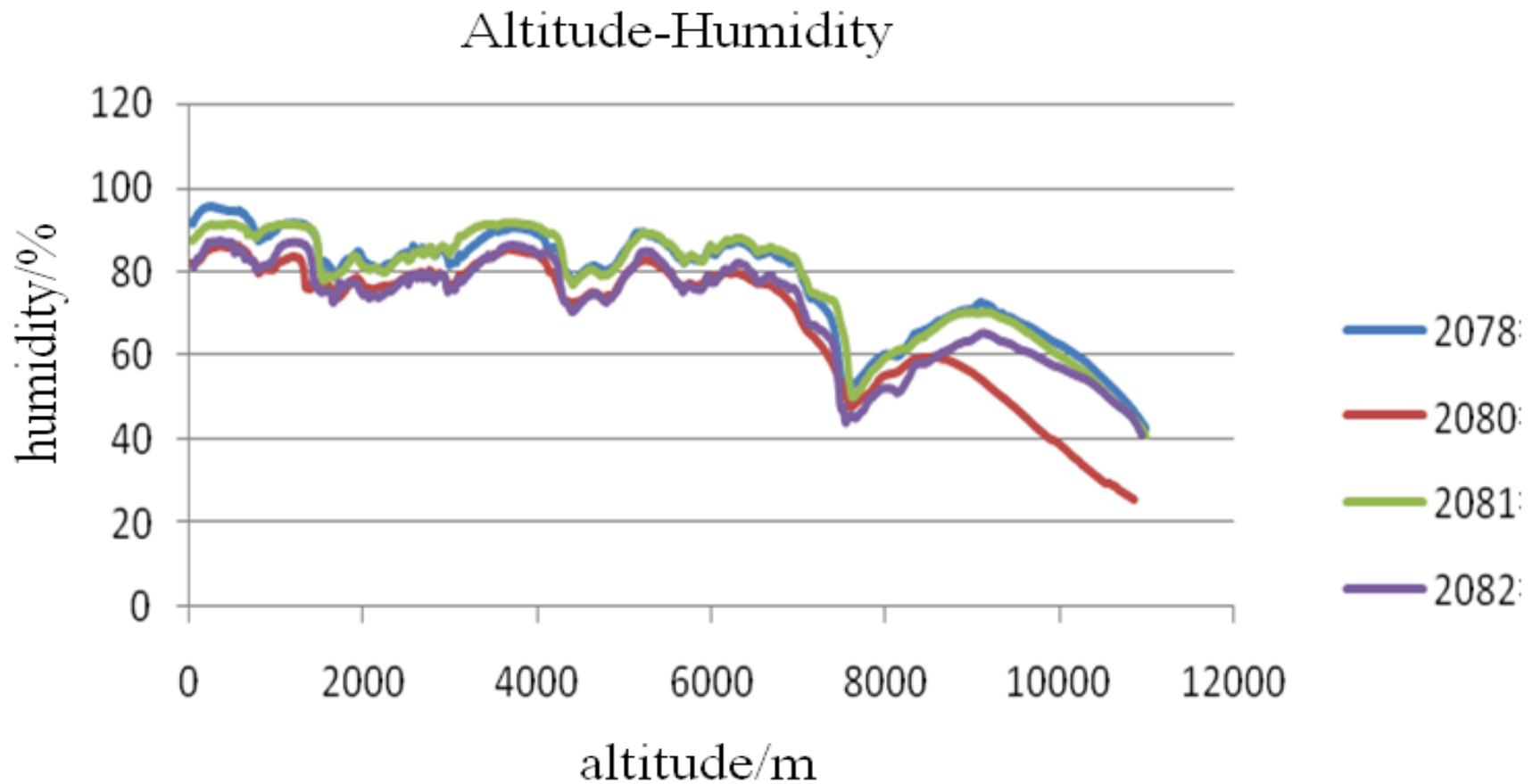
Flight Experiment Condition

At the same time as the sounding rocket was fired, the typhoon mobile monitoring vehicle of Shanghai typhoon research institute conducted GPS encrypted sounding observation at the launch site. The HaiNan Meteorological Bureau released two large sounding balls for an encrypted observation in HaiKou and SanYa at 23:00.



Flight Experiment Condition

Test data interpretation and analysis



Flight Experiment Condition

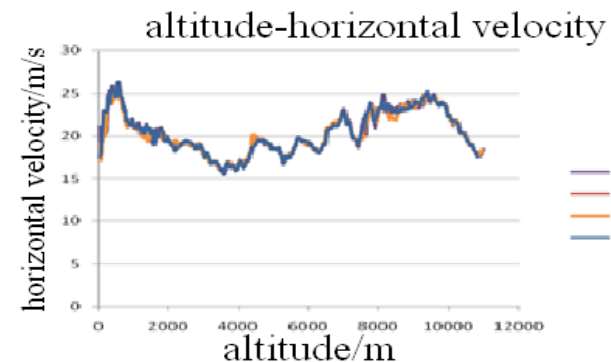
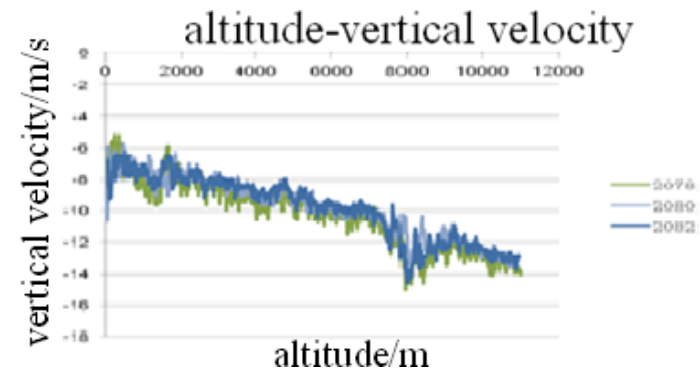
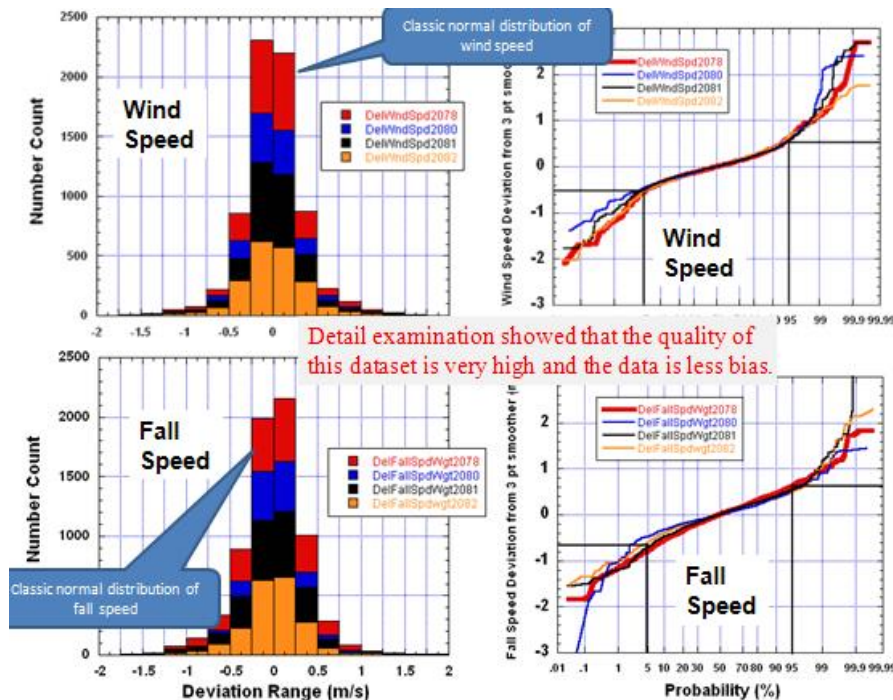
The data quality obtained by dropsondes is very high, synchronous and regular. It is proved to be feasible to use the rocket platform's lower-drop sounding technique. Based on the rocket platform, the dropsonde can help to obtain more accurate typhoon vortex and more accurate marine typhoon intensity, providing a better and more accurate initial data for the typhoon numerical model.

Compared with the aircraft sounding, the sounding rocket has a short flight time, At the same time, it has the advantages of the vertical structure profile and the lower security risk.



Flight Experiment Condition

For the first time in the world, the data of different regions of typhoons is obtained at the same time. It has obtained the accurate data of typhoons which can be used in the study of typhoon mechanism and structure. The rocket platform is a new, feasible and effective means of typhoon sounding, which will play a significant role in improving the accuracy of typhoon prediction and preventing typhoon.



Follow-up Development Assumption

In combination with the construction of national meteorological observation and prediction system, we will carry out the development of multiple range (maximum range $\geq 500\text{km}$), multi-type dropsonde and low cost advantage series sounding rockets, forming the ability to detect the typhoons, stratospheric, rainstorm and other extreme weather.

Thank you all for
your guidance!