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## Urban Meteorological Disasters and the Ecological Environment Monitoring and Evaluation System

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**Abstract** natural disasters caused great loss to human world every year, based on the polar stationary satellite ground receiving system, doppler radar detection system as the foundation, using satellite remote sensing technology, doppler radar data results, application technology, local geographical information system and statistical mathematical model, such as the combination of through the influence of Harbin meteorological disasters such as ecological environment more hail monitoring data analysis and research, the development process of the meteorological disasters and possible to forecast the result of the ecological environment impact assessment, information service for the decision of the government response to meteorological disasters.

**Keywords** meteorological disasters, hail, remote sensing technology, environment

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### Introduction

Natural disasters cause huge losses to the human world every year, among which the economic losses caused by meteorological disasters account for more than 70% of all natural disasters. Meteorological disasters generally include weather, climate disasters and meteorological secondary, derivative disasters. Main storm floods, droughts, tropical cyclones, frost and so on freezing, hail, even rain and fog and sandstorms and other disasters a total of 7 major categories of more than 20 species, if the segment; up to dozens or even. Meteorological disaster is a kind of natural damage, which not only seriously affects the construction of local national economy, but also causes serious casualties and property losses. At the same time, other disaster by meteorological disasters triggered or derivative of mountain flood disasters, geological disasters, marine disasters, biological disasters, forest fires, etc., to the national economic construction, safety of life and property of the people constitute a great threat [1]. Therefore, close monitoring of the occurrence and development of meteorological disasters, accurate prediction of meteorological disasters and early release forecasts and warnings (to remind the leaders at all levels and the competent authorities in advance to take preventive measures) and accurate monitoring of a wide range of drought and flood disasters, the objective and quantitative evaluation of the affected area, but that the government leaders and departments at all levels in the drafting of the system and the direction of disaster mitigation and protection of the ecological environment to provide scientific basis [2].

Modern meteorological science of meteorological disasters monitoring and early warning means more and more developed, with satellite, radar, automatic weather station modern equipment applied to the meteorological observation system, people of weather phenomena and meteorological disaster monitoring and early warning method have the substantive progress, weather forecasting accuracy rate is getting higher and higher [3], these are we of meteorological disasters monitoring and early warning research provides favorable conditions.

### Meteorological Disaster Monitoring and Forecast Evaluation Analysis

Taking the hail disaster in Harbin in June 18, 2003 as an example.

#### Hail monitoring analysis

Hail is Harbin in late spring and early summer common a kind of disastrous weather, is characterized by small scale and rapid development, only routine weather data and forecast is difficult, therefore, to combined with satellite imagery and Doppler radar data of small and medium scale detection tools, to better forecast the hail and other severe convective weather.



### The influence of hail on the ecological environment

Hail disasters often accompanied by a storm can cause crop failures or even, also can cause damage to houses, trees, cars, people, animals [4]. Its characteristics are: sudden strong, difficult to defend. Because of thunderstorms and movement speed quickly, and on the move up quickly, often cloud to hail, tilting moment between, big winds, hail tilt hit, heavy rain bang bo, ferocious; harm time short [5]. The time only a few minutes, rarely more than half an hour; less harmful. General hail disaster is strip-shaped, length from a few hundred meters to several kilometers, the strongest up to hundreds of kilometers, 1-2 km wide; destroy. Due to strong wind and hail, the land, often house damage, trees lodging pole, crops were destroyed; high frequency. According to statistics, China's annual average of more than 1 thousand times hail county. Up to more than 2 thousand and 150 counties, and spread to 29 provinces (autonomous regions and municipalities), there are at least more than and 600 county [6]. Although each hail disaster disaster, but the range is small, high frequency, there a wide range of serious harm [7].

### Hail monitoring and analysis method

Hail, heavy rain and other severe convective weather is caused by the small scale weather system, causing serious damage to human life and property. This system of space is small, only a few tens of kilometers to 500km, the time scale is short, less than ten minutes, most also not more than one day. Can not be timely and accurate analysis of the use of conventional data. With spatial and temporal resolution rate high stationary satellite cloud images can not only observing the distribution of the cloud system in a large area, and observation of small and medium scale cloud occurrence and development, mature and dissipating the evolution of the whole process. The satellite image is obtained by measuring the electromagnetic radiation emitted by the sun, the earth and the atmosphere. All solids, liquids and gases are emitted by electromagnetic radiation. The greater the radiation source, the greater the intensity of the radiation. The temperature of the radiation source can be calculated according to the intensity of the radiation. The sun emitted by the wavelength of the radiation is much more than the cold earth atmosphere system emitted radiation of short wavelength.

$T_{bb}$  and  $T_{bb}$  gradient

Brightness temperature  $T_{bb}$  refers to the satellite cloud top brightness temperature and  $T_{bb}$  value is lower, lower the cloud top temperature, the higher the Gending, convective activity is strong, resulting in the possibility of hail is larger. In Heilongjiang Province, when the cloud top brightness temperature  $< -22$  degrees, there will be hail. Compared with the  $T_{bb}$ , Gending temperature gradient is a more important indicator of characterization of hail. Cloud top temperature gradient, indicating the cloud texture rich, dramatic ups and downs, also shows that the strong convection development. Using  $3 \times 3$  to calculate the pixel width of the cloud top temperature gradient, and its expression is:

$$G = \left\{ [T_{1+i,j} - T_{1-i,j}]^2 + [T_{i,j+1} - T_{i,j-1}]^2 \right\}^{1/2}$$

Formula T for the temperature, I, J for the pixel coordinates. For the analysis of hail clouds found that fall within the area of Hail Cloud  $T_{bb}$  gradient with cloud top brightness temperature has a good negative correlation, is cloud top brightness temperature is low in the region cloud top temperature gradient is larger, and the cloud top brightness temperature higher regional Gending bright temperature gradient is small. Can determine the vortex cloud system or  $T_{bb} < -26$  degrees and  $G > 10$  in the cold front cloud area is prone to hail cloud. In the cold evil cloud or cold front cloud system according to  $T_{bb} < -26$  degrees and  $G > 10$ , as prone to hail cloud index [8].

Hail of strong convective clouds occurred in some large scale synoptic system, development and evolution of, Heilongjiang area hail the vast majority are and the cold eddy accompanied. Of the cold vortex cloud system marks the upper cold vortex strength. The cold advection in the upper air coupled with low layer warm and humid air active, and the ground was solar radiation heating, the atmosphere is extremely unstable, and promote the development of strong thunderstorm cloud, leading to hail

Under the weather background to determine the Heilongjiang Province under the influence of cold vortex cloud system or the cold front cloud system, according to the satellite data, it is concluded that the entire cloud chart in the cloud top brightness temperature TBB, according to cloud top brightness temperature gradient formula calculated the gradient value of each point, then according to the index " $T_{bb} < -26$  degrees and  $G > 10$ " to judge a hail of key points. According to the index visitors view of nationwide satellite images, combined with geographic information system in Harbin for the prediction of Harbin City area should be more accurate.



### Hail monitoring analysis and forecast evaluation results

As shown in Figure 1, east of Harbin is the weakening of the vortex cloud system, Acheng in Wuchang West junction is a curved line of cloud, Harbin to the South and two bubble like convective clouds. The polar orbiting satellites can see inside the weakening of the vortex cloud system, there are a lot of bubbly clouds exist, indicating strong ascending motion and arc cloud line tend to form in the early stage of fine weather, receive more sunlight radiation of underlying surface on clouds in the middle and lower classes. This is due to the low altitude itself contains a large amount of water vapor, absorbing a lot of sunshine radiation, become warm and moist while the top is still in the dry and cold airflow control, air is very unstable, strong convective weather is easily happened.

Prediction on June 18, 2003, Harbin Wuchang area, Acheng with strong thunderstorm monomer development, moving slowly, reaches a thickness of more than 10 kilometers, easily produce hail weather. The June 18, 15 points 10 points, 17 points and 10 minutes, Wuchang City of red flag, cattle Lalin, Xinglong, Shahezi and township has twice suffered the history of a rare hail storm.

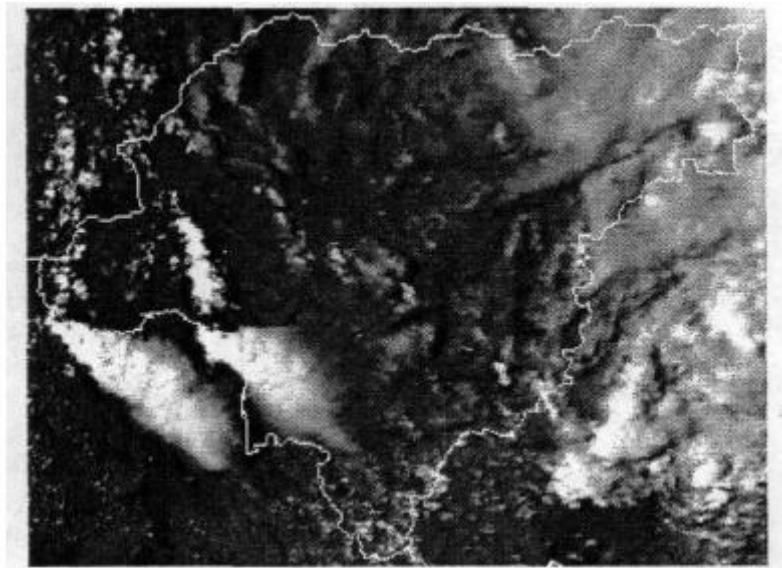


Figure 1: June 18, 12003 16 NOAA-12 three channel synthetic image

### Ecological Environmental Monitoring and Evaluation System

Implementation of ecological construction on the need to establish a set of feasible ecological monitoring method. Ecological monitoring is a new work, but also the focus of environmental protection work in the future. How in a short period of time effective monitoring changes in the ecological environment, and to evaluate the changes in the ecological environment, and under the guidance of the macro step of economic construction, put forward specific planning advice, is a problem to be solved. Harsh environmental conditions in our province, the ecological environment is a huge and complicated system. To achieve a comprehensive, timely, accurate and objective survey of this huge and complex ecosystem, monitoring and evaluation of modern remote sensing technology is the most effective way to the best.

### Research Contents and Directions of Urban Ecological Remote Sensing

1. The sense of technology can be insight into the ground investigation of the restricted area and dead, the large area of environmental resources in the state of to improve the integrity and comprehensiveness of the investigation.
2. The way of remote observation object detection, so do not damage the research object and its environment
3. The objectivity of observation data is guaranteed.
4. Multi point, multi spectral, multi temporal, multi height of the remote sensing image and "multiple enhancement" of the remote sensing Information.

### Research Directions of Urban Ecological Remote Sensing

Current situation and analysis of urban land use; urban environmental pollution investigation, environmental monitoring and assessment; urban climate and urban heat island circulation; urban structure, dynamic analysis of edge development and urban regional planning, etc..



### Application of Remote Sensing Technology in the Analysis of Urban Ecosystem Model

The application of remote sensing technology in the analysis of urban ecosystem can be carried out according to the procedures listed below. The upper frame represents the urban ecosystem, and the researchers in this system can define the parameters according to the problem that they have studied. For remote sensing analysis, we must first study the city's shape and structure, in order to distinguish it from the city around or away from the city's environment. On the basis of the analysis and understanding of the natural ecosystem. And the human ecosystem, the research information feedback to the urban area and determine the next step of the research task. (Figure 2)

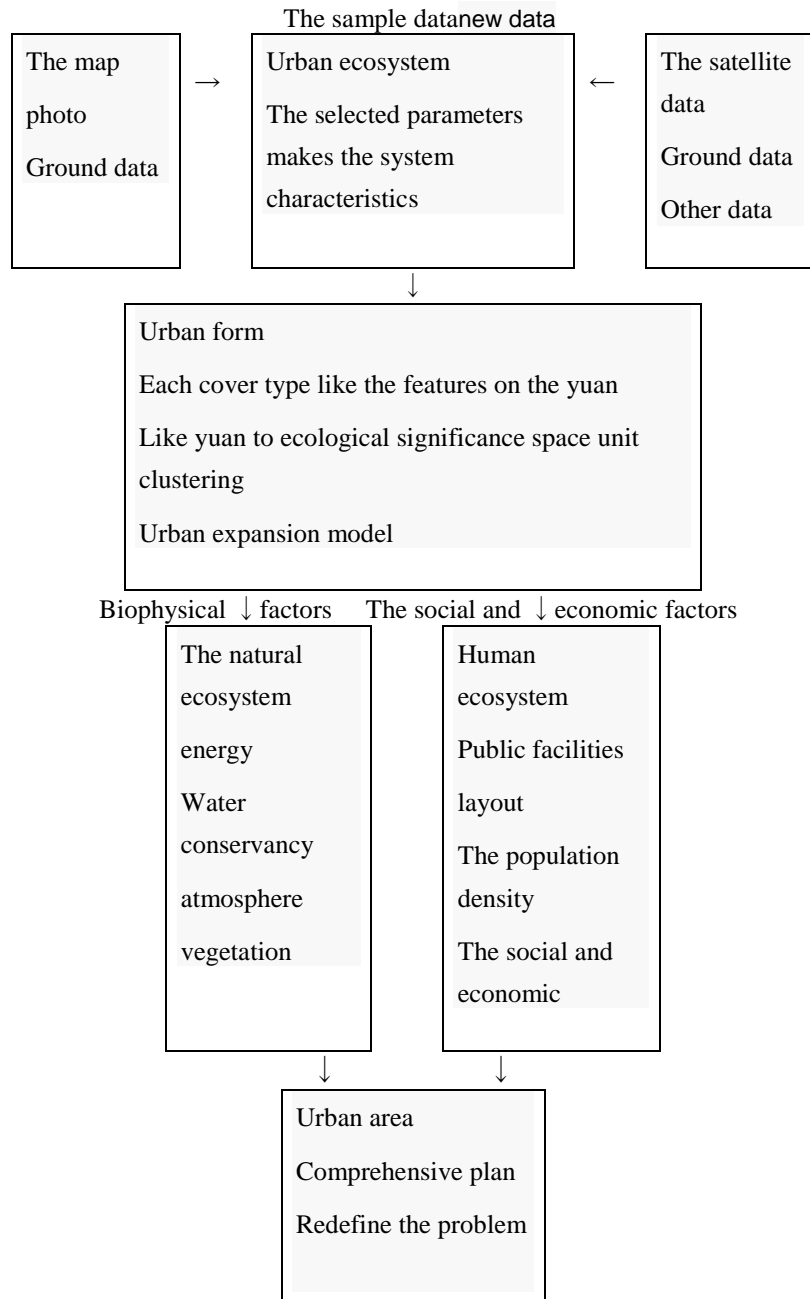


Figure 2: using remote sensing for urban ecosystem research program

### Conclusion

Meteorological disasters and ecological environment monitoring and assessment of the decision-making service research using observational data of various meteorological elements and meteorological disasters comprehensive meteorological observation system, the use of satellite remote sensing technology, geographic information system (GIS), meteorological satellite and Doppler radar monitoring technology, using statistical



models were used to establish the city meteorological disaster monitoring and forecast and evaluation system and ecological environment monitoring and evaluation system. Take mature stage research results timely conversion principles of production and research results of the system can be in the city flood control and drought relief, agricultural production decision service, ecological construction and meteorological disaster monitoring, early warning and forecasting business work in the application, through the Internet transmission to the remote computer terminal services were installed in Harbin City flood control headquarters, the municipal government departments, for the municipal government decision-making provide scientific basis, improve the ability of the city's defense meteorological disasters, the meteorological disasters caused by the loss and reduce the harm to the lowest degree, not only has significant economic and ecological benefits, and has significant social benefits. Using observational data of various meteorological elements and meteorological disasters comprehensive meteorological observation system, of short-term meteorological disasters (hail) forecasting and warning and assessment, can not only improve the accuracy of the forecast of meteorological disasters in short-time weather forecast and the near disaster weather alerts, and think that government departments to cope with meteorological disasters to provide decision-making information services.

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