CONSTRUCTION OF A GROUND SYNTHETIC SYSTEM FOR CLOUD ANALYSIS BASED ON WEBGIS

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1. INTRODUCTION

Recently，the Ground Synthetic System for Cloud Analysis has been built in many provinces in China[1-4]. With the development of WebGIS technique, WebGIS has been applied in meteorological field[5-6]. ArcGIS is one kind of commercial software developed by a company of the United States named ESRI. It is a platform based on GIS, utilizing many important techniques in computer, such as GIS, Databank, Software engineering, artificial intelligence, etc. It is composed of three basic parts. They are Application Platform of ArcGIS Desktop, ArcSDE Platform of managing data-base and ArcIMS, which is based on Internet distributed data and GIS service. Our system is designed mainly on the basis of the ArcIMS part.

2. IDEA OF CONSTRUCTION

The ArcGIS software platform and the hardware platform of computer servers are used to construct a ground synthetic system for cloud analysis based on the WebGIS techniques. The system is built on three layers. The bottom layer is for the management of data, which are made up of three types. The first is the weather satellites and radar data. The second is the spatial geographical data of the whole Guangdong province and the network of airports. The third is the discrete data, which include automatic rain gauges, lightning, forest fires and flight track, which are all stored in real-time in the Oracle databank. The intermediate layer is for technological treatment, in which the ArcGIS is used to build a WebGIS-based software to support the system. The software is made up of ArcSDE (Space Data Engine) and ArcIMS (Internet Map Server). The part of ArcIMS is constructed based on Internet distributed data and GIS service. It is composed of the Client (or browser) and the Server. The part of Server uses Web server and the Client uses the ordinary browser of WWW for interactive processing, so that the ArcIMS can distribute maps, data or metadata via the Internet. For example, when the Client sends a request via IE browser to inquire for some kind of meteorological products, the Web server communicates with ArcIMS Server through the ArcXML (Extensible Markup Language). Then the ArcIMS receives the request and analyzes, then submits it to the ArcSDE. The ArcSDE is responsible for managing the information of data-base. It is used to supervise space utilization and provide its information, so that the system can read and write the geographical data of map correctly, which are stored in the databank, and execute those commands of searching space data or lodging the operation data, and send the data which meet the requests of the ArcIMS. Then the ArcIMS sends it to the browser of Client. In this way, the system can provide the services of display and searching space data in the mode of Web. Fig.1 shows System Architecture of ArcIMS.

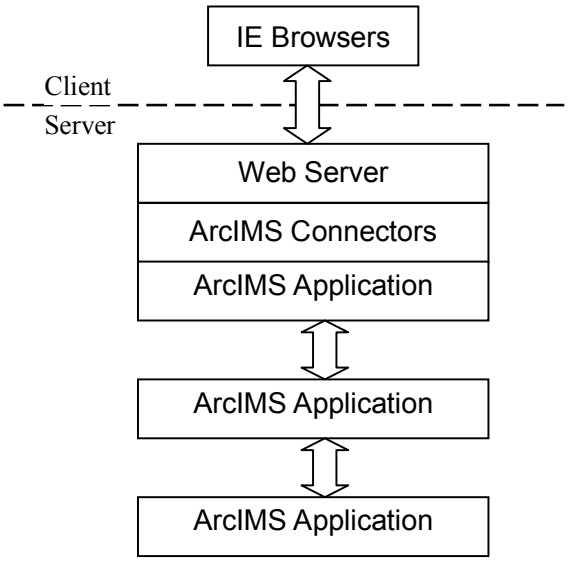

Fig.1 Sysetm Architecture of ArcIMS

The top layer is for application, which is also the layer being displayed in the terminal. It consists of weather analysis, radar echo prediction, cloud observations and numerical simulation etc. Fig.2 shows cloud and precipitation in real time mode platform.

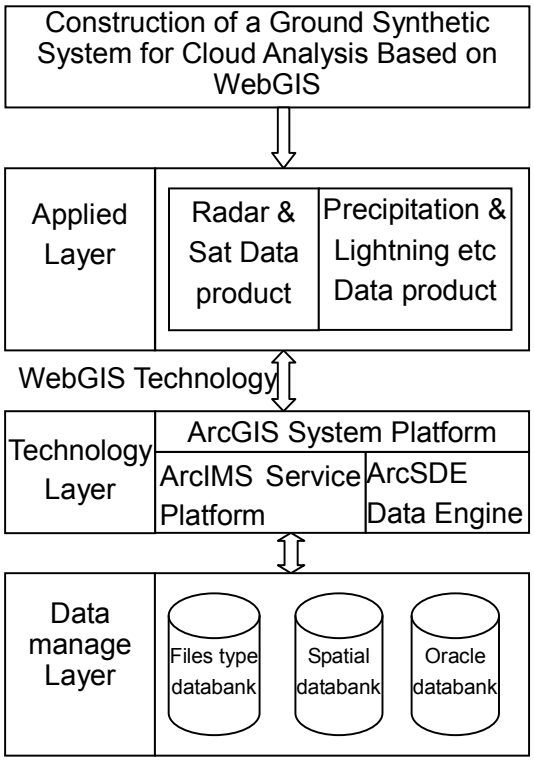

Fig 2:Cloud And Precipitation In Real Time Mode Platform

3. PIVOTAL TECHNIQUE

How to make full use of internet technique and meteorological information detected (such as data obtained by satellite and Doppler radar) to construct a display system, which can display weather events in real time (based on GIS) and can run automatically in operation, is the key point and a difficult task in constructing a system. We use image files (in the format of IMG) as one layer of pictures added to GIS and can display via the web. The format of IMG is one of the popular formats used in remote image files and corresponding software. We transfer the detected products to IMG format files at set time intervals in operation. Based on the data of precipitation and lightning, which are distributed on discrete points, we send them via a ftp server and write to the Oracle database. The flow chart of processed data of satellite, Doppler radar, precipitation and lightning is shown in fig3.

ArcIMS connector is used to connect Web server and ArcIMS application server. ArcIMS

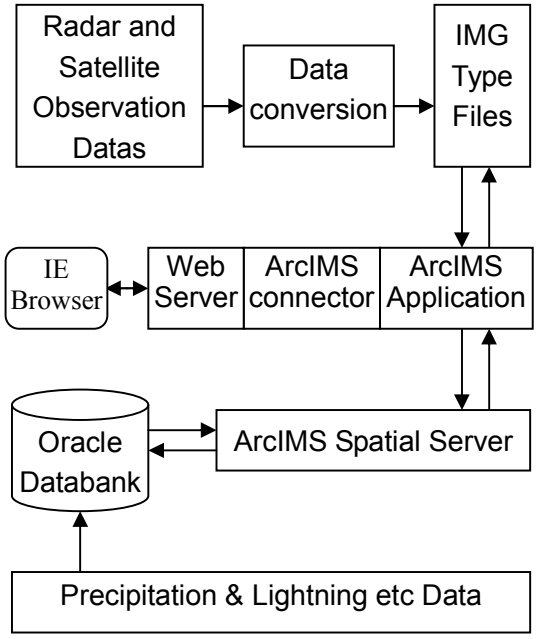

Fig3：Display of Data product and GIS

application server deals with requested load balance and assigns certain ArcIMS spatial server to run for task of map service. ArcIMG spatial server is the kernel of ArcIMS. It creates a dynamic map according to map data requests and relevant information. The map is sent to the IE browser of clients.

4. DISCUSSION AND CONCLUSION

This system provides a convenient tool for cloud and precipitation analysis. With the GIS and Internet techniques, it is also a command platform for rainfall enhancement operations. It is now possible to have access to the real situation of weather modification across the province from the Internet. With the availability, particularly, of real-time and dynamic monitoring from web browsers of flight track, operation vehicle, radar and satellite measurements and display of meteorological observations in any needed combination with GIS, terminal users are able to operate the commanding system right from computers connected with the Internet. It brings much convenience to the operators of weather modification and improves the efficiency of relevant decision-making. The successful construction of the system makes it easier to run weather modification and speeds up the operational development of weather modification in Guangdong province. Fig 4:Shows the flow chart of airplane and vehicle rain enhancement in real time mode.

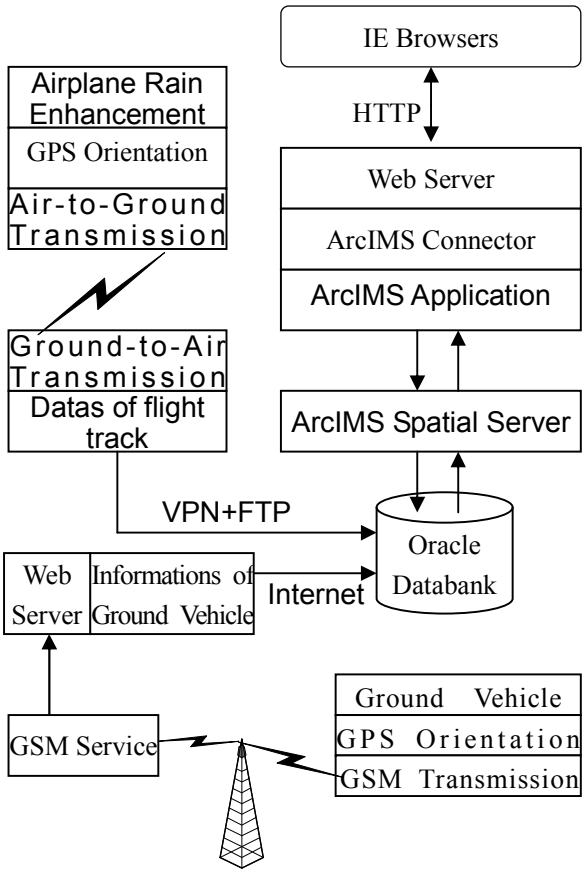

Fig 4:The Flow chart of Airplane and Vehicle Rain Enhancement In Real Time Mode

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