Introduction of CLoud Analysis and Ingestion System(CLAIS)

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1.Introduction of CLoud Analysis and Ingestion System(CLAIS)

In recent years, there is a growing demand for high spatial-temporal resolution, high-precision and three-dimensional cloud elements in the fields of numerical prediction, weather analysis, aviation meteorology, etc. Although there are more and more ways of meteorological observation and detection, such as surface observations, radar observations and satellite detection, etc. But any single observation of them still can not meet this demand. How to integrate multiple sources of ground, satellite, radar and other kinds of observation data to obtain spatiotemporal continuous, high efficiency, high-resolution cloud products has become one of the trends of technology development.

Through many years of study, National Satellite Meteorological Center of CMA has established the three-dimensional Cloud Analysis and Ingestion system (CLAIS) which can combine FY series meteorological satellite data with ground, sounding, radar and other observations to get 3D cloud parameters.The prototype of the three-dimensional Cloud Analysis and Ingestion system (CLAIS) comes from NOAA LAPS/ STMAS. It is a three-dimensional fusion analysis system that integrates the advantages of a variety of observation data. The accuracy of three-dimensional cloud construction was improved greatly after a series of algorithm updates and improvements including cloud top construction, cloud base constraints, multi-source data collaborative fusion algorithm etc. At present, it can integrate background field of numerical prediction (GRAPES of CMA, NCEP, ECMWF), conventional observation and sounding (MICAPS, CIMISS interface), satellite data (FY-2 VISSR, FY-4 AGRI, FY-4 LMI,FY3 MWHS,H8), radar (Reflectivity), GPS and other data. These observation data is comprehensively analyzed and fused to obtain three-dimensional cloud structure information, three-dimensional Microphysical parameters, and other atmospheric and surface parameters.Study shows that the distributions of the analyzed cloud structure is consistent with the CloudSat observations.Post-processing software was developed to display three-dimensional cloud structure and draw two-dimensional cross section of cloud, and has overlay display function, providing user a convenient tool for accomplishment display and scientific research.

2.The application of CLAIS system

First of all, cloud is one of the important uncertainties of the numerical prediction model. The lack of cloud information in the initial field of the model will lead to the phenomenon of significant delay in the development of cloud and precipitation at the early stage of a model forecast, that is, the problem of spin-up model. Therefore, how to obtain the accurate three-dimensional and space-time continue cloud field and provide the initial field of the model has always been the way of data assimilation efforts. Using 3D cloud analysis data of CLAIS as initial fields of GRAPES and WRF forecasting model, and through case and batch tests, the prediction performance is evaluated. The research shows that the application of CLAIS 3D cloud analysis system can improve the cloud process of NWP model and has a positive effect on the precipitation area and intensity forecast.The system has a very important application potential in convection analysis, artificial weather, aviation meteorology, military application and other fields.

Keywords: CLAIS, Three-dimensional cloud, multi-source data

