

RWC China- SAPC 2014 Annual Report

1. Recent Accomplishments

1.1 New artificial intelligence classifying algorithm for flare and proton events prediction models

In order to setup artificial intelligence classifying algorithm, a series of new measures from solar magnetic observations are suggested. For example, we extract some measures, such as , maximum horizontal gradient, length of neutral line, number of singular points from full disk solar magnetograms as predicting factors. Decision tree method is employed to replace the traditional statistics method for prediction modeling.

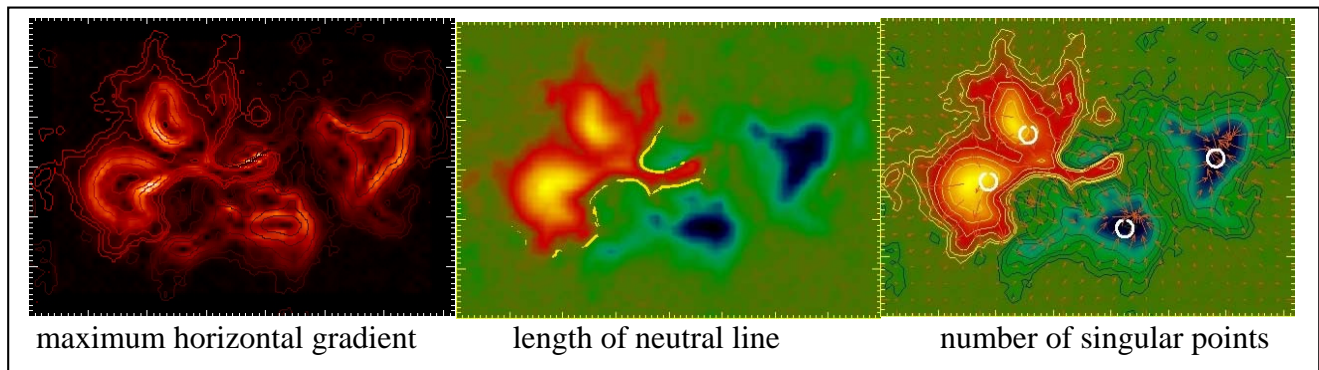


Figure 1 some measures extracted from solar magnetic field

1.2 3-D computer simulation - Virtual-Sun

A new-generation computer platform with 3-D interface for operational space weather service (from solar perspective) is developed at National Astronomical Observatories, Chinese Academy of Sciences (NAOC). This platform is named as Virtual-Sun. The Virtual-Sun is a Client-Server (C-S) system, the Server part keeps the data of solar activity, the Client part is installed on the user's computer. The Virtual-Sun Client obtains the solar data from the Server through Internet connection, constructs the 3-D virtual image of the Sun, and displays various solar activity components on the virtual sun (e.g., sunspots, magnetograms, active region numbers, flare classes, active levels, etc). The 3-D virtual sun can be rotated and zoomed freely by using computer mouse or keyboard. A test version of the Virtual-Sun Client is available on the website of the platform.

1.3 EUV Observations from Chang'e 3

In order to observe the Earth's plasmasphere in a global scale meridian view, a moon based EUV camera (EUVC) has been making observations at a wave band of 30.4nm and with a field of view of 15 degrees since December of 2013. On the top deck of Chang'e 3, this camera provides images of the Earth's plasmasphere with a high angular resolution of 0.1 degrees and a temporal resolution of 10 minutes within some time intervals of moon's day during the life time of Chang'e 3 mission (probably more than one year). For this reason ,we shall have many good

opportunities to observe how the plasmasphere responds to solar activity and investigate behaviors of plasma in the megnetosphere.

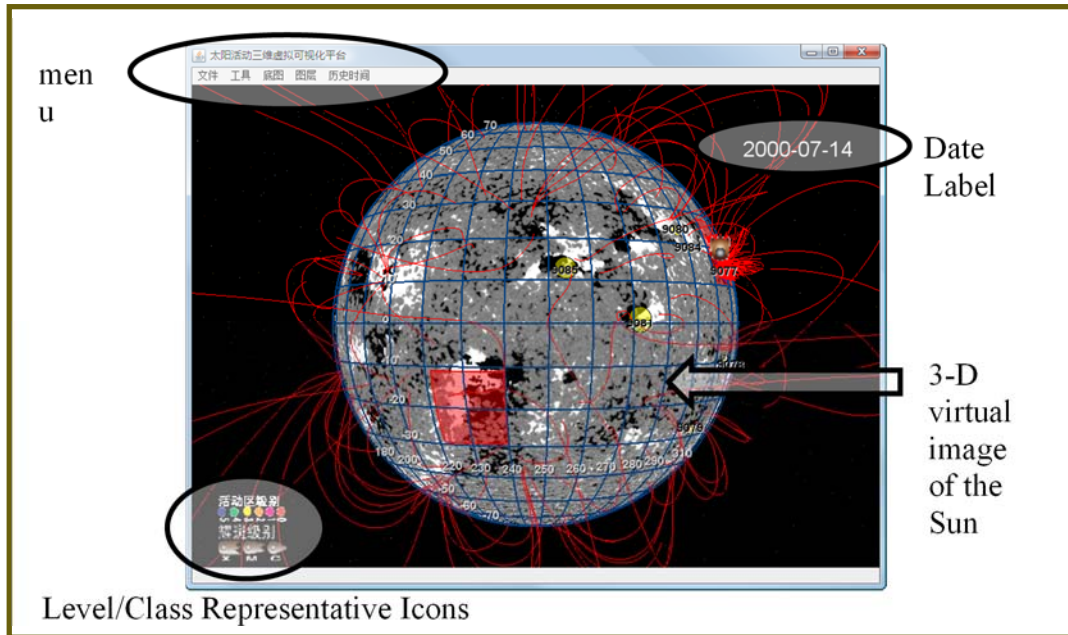


Figure 2 Virtual-Sun Client interface

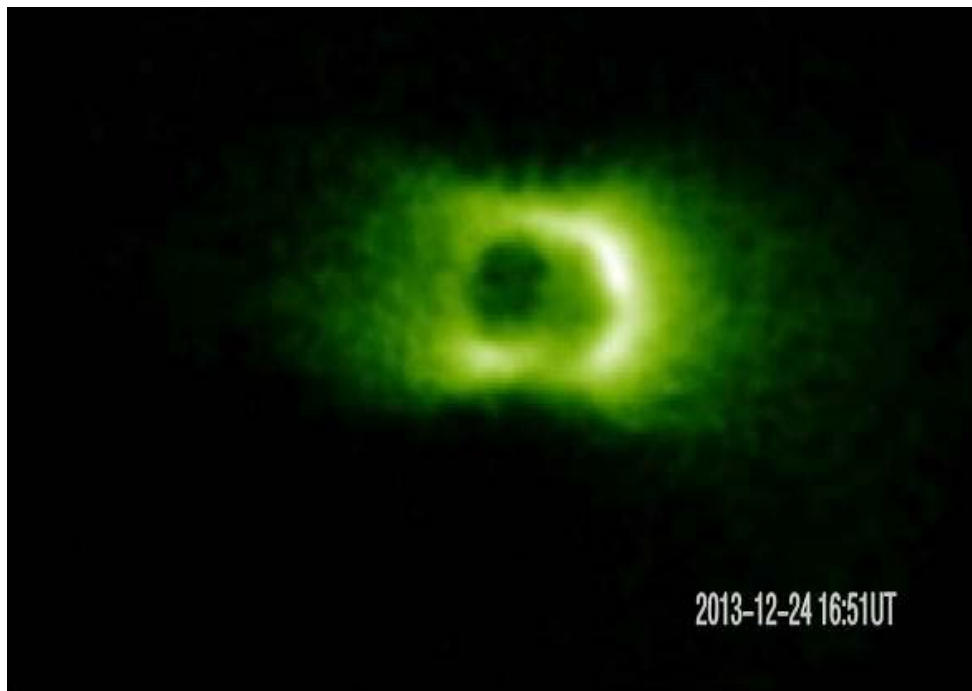


Figure 3 A preliminary result from EUVC onboard Chang'e 3
The north of the Earth is to the top side of the image, and the day side is in the right.

2. High Priority Product Goals

A new concept of solar activity forecast

Disturbances caused by solar eruptions, such as major solar flares and coronal mass ejections, propagate through interplanetary space, and create shock waves in the solar wind interacting with the geomagnetosphere. There exist two problems in forecasting solar eruption: (1) when and how will it happen? (2) will it have effect on the Earth? The information of solar eruptions impacting on the Earth cannot be fully provided with the normal solar activity forecast focusing on probability of solar flares and solar energetic particle events. For this reason, we suggest a new concept of solar activity forecast: the erupting frequency and the main attack direction of major solar eruptions should be included in forecasting contents. The erupting frequency and the main attack direction are determined by physical properties and location of source region, solar global magnetic field. The main attack direction finally toward the Earth depends on solar rotation, IMF, and orbit motion of the Earth.

3. High Priority Data Needs

Moon based EUV observational data

The EUVC of Chang'e 3 provides EUV observational data of the Earth's plasmasphere in a global scale meridian view, which is very useful for the monitoring of space environment nearby the Earth. However, the EUVC cannot continuously provide observational data. We tend to propose a space mission to setup an EUV observational station based on the Moon to monitor the Earth's plasmasphere and ionosphere under the help of future missions for lunar explorations. If this proposal is made by the ISES, we might have a very good collaboration for manufacturing the payload among ISES members.

4. Forecast Verification

RWCC-SAPC took part in the second flare-forecasting comparison workshop hosted by Northwest Research Associates at Colorado Boulder during April, 2-4, 2013. As one of nine models proposed by authors from different institutes in the world, our flare-forecasting model supported with a new artificial intelligence classifying algorithm was used to deal with the data source provided by the workshop organizer and realized a good mark in this comparison. However, this model should be improved further.