

# IAA Study Group Status Report

**Responsible Commission:** Commission 1 - Space Physical Sciences

**Study Number and Title:** SG1.14 - Title: Integrated Precursor Distinguish in Multi-Geophysical Fields around Global Earthquake Events with Magnitude larger than 7 in Recent 10 Years

**Short Study Description** (repeat from Study Group Proposal):

Earthquake anomaly distinguishing and determination is one of the most difficulties in the area of natural sciences in the world. Space observation have been showing strong capability to monitoring global seismicity and acquires ten`s times of case study than ground-based observation.

This proposal mainly focus on the case study of global strong earthquake during last 10 years to draw out the statistical characteristics of space-based precursors, including Ionospheric disturbances, Geomagnetic and geo-electrical fields, gravity field, infrared, remote sensing as well as crustal deformation by GNSS and InSAR, making connections among them in temporal and spatial distribution to ensure the reliability of anomaly and improve the distinguishing probability related to earthquakes, and try to make a proposal on global virtual system on earthquake monitoring from space by integrate different satellite resources with multi geophysical and geochemical parameters.

Developing and exploring the new way for earthquake monitoring and prediction, as well as the reliability analysis on anomalies in multi geophysical and geochemical parameters around same earthquakes. Advancing the establishment of the global virtual satellite constellation on earthquake monitoring, including electromagnetic, meteorological, infrared RS and hyper spectral satellites etc.

**Progress in past six months:**

On February 2, 2018, the first Chinese Electromagnetic satellite Zhangheng-1 (ZH-1) has been launched successfully. Eight scientific payloads were installed onboard it to detect the wide-frequency band electric field and magnetic field, in-situ plasma parameters, electron density profiles and energetic particle flux. The function and performance of satellite platform and each scientific payload has been tested, and most of them satisfy the general requirements of satellite mission. As while, the satellite data quality has been assessed by comparison with the empirical models and other satellite data. Some interesting phenomena have been detected by ZH-1, including the perturbations in electromagnetic field and plasma parameters induced by artificial VLF transmitters, geomagnetic storms, HF facility, and those related to strong earthquakes. At middle November, the 3<sup>rd</sup> satellite international meeting was held in Beijing, and the satellite data and research results have been published to the international society. The first special issue about ZH-1 has been published on the Journal of “Earth and Planetary Physics”, in which 12 papers have been included in. The new results from ZH-1 will be summarized in our final report to exhibit the new achievement in satellite observations.

Based on ZH-1 satellite data, a few strong earthquakes in August 2018 have been studied by combing multi parameters, including those from the ground-based observing technologies. The results show that the preliminary stereo seismo-electromagnetic system

has been constructed and improved, especially in Southwest China, which help to illustrate the coupling processes from lithosphere to ionosphere during the preparation stage before earthquake occurrence. As while, ZH-1 as the only space-borne platform to detect the electromagnetic perturbations associated with earthquakes in the world at present, scientists have paid more and more attention on that. Our members have participated into a few international conferences including the 27<sup>th</sup> IUGG meeting in July 2019 in Canada, in which two invited presentations have been arranged in two sessions, and the reports about ZH-1 research were welcome widely and attracted many young scientists. Continuously, in Sep. 2019, our members will take part in the Swarm data quality workshop to push the cooperation between ZH-1 and Swarm missions.

**Website Study Information update:** (please give any update regarding Study Group Membership, documents, Study Plan and Schedule):  
The membership list has been updated correctly.

**Issues requiring resolution?** (recommend approach):  
Nothing.

**Product Deliveries on Schedule?** (If modified explain rationale):  
Yes.

In 2018, the draft report has been finished and revised in November and December by inserting the new results from ZH-1 satellite together. The final report in Chinese version has been planned in a new project (National Key R&D Program, no:2018YFC1503500) to publish in 2019. Since July 2019, the final report in English has been prepared on the basis of its Chinese version, and it will be submitted to IAA after inspection by the experts group of SG1.14 in the end of 2019.

**Study Team Member Changes?** (List any Study Team Members that you wish to discontinue, and provide names plus contact coordinates of any Members you wish to add on the second page of this Study Update form.) Note: Complete contact information including email, tel. and fax must be provided for all additions. Only Members with complete contact information will be listed and receive formal appointment letters from the IAA Secretariat.)  
Nothing.

The list of study group members on the website is Ok. It includes:

**Chair:** Bao Weimin  
**Co-Chair:** Contant Jean-Michel  
**Co-Chair:** Kuznetsov Vladimir  
**Secretary:** Xuemin Zhang

**Membership:**  
Cao Jinbin  
Du Jianguo  
Hattori Katsumi  
He Liming  
Kodama Tetsuya  
Liu Jann-Yenq

Ouzounov Dimitar  
Parrot Michel  
Picozza Piergiorgio  
Pulinets Sergey A.  
Ruzhin Yury  
Shen Xuhui  
Tramutoli Valerio  
Zhou Chen

**Name of person providing Study Group Status** (Study Group Chair or Co-Chair):

Study Group Chair: Academician Weimin Bao (Study Group Chair),  
Secretary: Prof. Xuemin Zhang

**Status Report Date:** July 30, 2019