

IAA Commission 1 Space Physical Sciences

24 September 2016

Guadalajara Mexico

The Commission 1 meeting was cancelled but several topics were discussed during the SAC meeting (report is enclosed) and several study group status reports were received and are available at the end of this document.



**International
Academy of
Astronautics**

IAA Commission 1 Space Physical Sciences

Scientific Activities Committee Report

**24 September 2016 – 16h00-17h30
Guadalajara Mexico**



Study Groups

1.5 The energetic particle radiation hazard en route to and at Mars

Lead: S. McKenna-Lawlor. In the printing process

1.6 Lunar Farside Protection

Lead: C. Maccone. Closed. Follow-up study in another Commission.

1.8 Global satellite system for monitoring and forecasting of the Earth's seismic activity

Lead O. Degtyarev. Final report forwarded to the Sec. General. Presentation on Academy Day 25 September 2016. Publication foreseen.

1.9 Satellite remote sensing of aerosols in the Earth's atmosphere.

Lead: Y. Yatskiv. Report received.



Study Groups

1.10 Terrestrial analogue. Comparison of terrestrial and planetary geology.

Lead: M. Coradini. No report received.

1.11 Comparative climatology: Studying planetary climate to understand the planet. Lead: R. Ramaschandran. Study terminated by Prof. Goswami but a report received.

1.12 Virtual planet. Virtual exploration of planets.

Lead: M. Coradini. No report received.

1.13 Planetary science generated by the new generation of cubesats and miniaturized scientific instruments;

Lead: Blake/Vane/Bousquet. Report received. Presentation on Academy Day 24 December 2016.



1.14 Integrated precursor. Distinguish in multi-geophysical fields around global Earthquake events with magnitudes larger than seven in recent ten years;

Lead: BaoWeimin. Report received.

1.15 International Cooperation on Space Weather.

Lead S. McKenna-Lawlor. Report received.

1.16 Expanding options for implementing planetary protection during human space exploration.

Lead S. Conley. A request that this Study Group (3.20) would be transferred to Commission 1 was considered during the Paris Meeting. The study program was questioned and it was recommended that the team should be asked to provide justification of the content.



Recommendations

The Chair recommends that SG 10 and 1.12 (lead M. Coradini) be cancelled due to prolonged lack of activity.

Also that the SG 3.20 team (Lead C. Conley) be asked to provide an update as to how this study relates to other major studies presently in progress throughout the community. It may be that this investigation is no longer needed.

With regard to the issue of how IAA studies are published and referenced, Commission 1 recommends that reports should be made available electronically (free to members for sale to others). Also, that citations should include all authors.



Commission 1 events

The IAA Human Space Exploration Conference (May 24-26,2016) was held in the Moscow Korolyov Region.

The Third IAA Symposium on “Space Flight Safety” was held from July 4-8, 2016 (the period of “white nights”) at St.Petersburg.

The IAA program planned for the first day of the 41st COSPAR meeting (30 July) at Istanbul (prepared jointly by Dr. G. Vane and Prof.Goswami) was not presented due to the cancelation of COSPAR.

The 45th IAA Symposium on the ‘Search for extra-terrestrial intelligence (SETI)’ is scheduled to take place at Guadalajara, Mexico (IAC-A4) in association with the 67thIAC.



New Conferences Proposals

It is expected that a fourth IAA Symposium on “Space Flight Safety” will be proposed by Prof. Smirnov (Chair of Commission 1).

Plans are in train to mount a meeting at CALTEC Pasadena on Low Cost Planetary Mission in June 2017. This will form part of a series of successful conference series that first started about 20 years ago.

IAA Study Group Status Report

Responsible Commission:

COMMISSION 1: Space Physical Science

Study Number and Title:

1.9 Satellite remote sensing of aerosols in the Earth atmosphere

Short Study Description (repeat from Study Group Proposal):

Overall Goal:

The polarimetry satellite remote sensing purpose and place in the investigation of temporal and spatial distribution of physical parameters of troposphere and stratosphere aerosol and cloud particles in the Earth atmosphere including evaluation their influence on climate, ecology and weather.

Intermediate Goals:

1. Long-term satellite global monitoring and database creation of optical, micro- and macrophysical and chemical characteristics of aerosol and cloud in the Earth atmosphere, their spatial and temporal distribution.

2. Precise quantitative determination of aerosol input to the Earth climate system energy balance.

3. Determination of antropogeneous aerosol impact on Earth climate change and ecology.

Methodology:

Forming an international study group, draft a detailed schedule of the study.

Agreement on a study report outline.

Assigning individual responsibility for parts of the study report.

Assigning editor to coordinate individual parts and compile a coherent study report.

Work to be conducted through on-line collaboration and study group meetings held in the course of annual International Astronautical Congresses and the IAA Spring meetings.

Time Line: 5 Years

Final Product: Report, publications

Target Community: Scientists, engineers, Governments at large, local authorities, Space Agencies, UN, European Commission

Support Needed: TBD

Potential Sponsors:

National Academy of Sciences of Ukraine; State Space Agency of Ukraine (SSAU); NASA; CNES; European Commission

Progress in past six months:

The works during past six months are concentrated on (1) final assembling of the spectropolarimeter ScanPol and preparing for test experimet in the laboratory and (2) opticak and computer design of full details and parts for the multispectral imager-polarimeter MSIP (3) design accommodation of the ScanPol and MSIP instruments for satellate platform Yuzhsat.

The ScanPol scanning polarimeter

The ScanPol polarimeter serves to receive the spectral polarimetric properties of the reflected atmospheric radiation on aerosol at about 200 viewing directions over each observed scene. The design of the ScanPol polarimeter provides a rather comprehensive characterization of the angular distribution of both total and polarized components (the Stokes parameter I, Q, and U) with expected relative accuracy of polarization about 0.15%. The ScanPol instrument is assembled and electronic part is prepared for test measurements.

Multispectral imager–polarimeter MSIP

The multispectral wide-angle imager–polarimeter (MSIP) will collect images on the state of the atmosphere (cloud distribution) and surface (surface homogeneity, land surface, sea surface) in the area of the ScanPol polarimeter measurements to retrieve aerosol optical depth and polarisation properties of aerosol by registration of three Stokes parameters simultaneously in three spectral channels 410, 555 and 865 nm. The fourth channel of the MSIP is the intensity channel that serves to obtain images in four spectral wavebands 410, 555, 865 and 910 nm to retrieve the aerosol optical depth. The main feature of the MSIP channels is the splitting of the image by a special prism-splitter for four images on the same CCD detector in each channel. In that way we can measure simultaneously four polarization components 0°, 45°, 90° and 135° as images in each of three polarization channels and four images in four spectral bands in the intensity channel.

Four independent identical camera units (three for polarisation and one for intensity) will collect images of the undersatellite scene with a field-of-view of 60°×60° (770×770 km²) and a spatial resolution of 0.5–0.2 km. The main feature of MSIP is the polarization accuracy of expected better than 1% due to intercalibration within ScanPol data onboard the satellite.

We continue to study aerosol parameters and behavior in the atmosphere over Ukraine. The paper on aerosol distribution modelling using GEOS-Chem model has been published.

Website Study Information update: (please give any update regarding Study Group Membership, documents, Study Plan and Schedule):

Aerosol-UA Project website <http://aerosol-ua.mao.kiev.ua/index.php/en/main>

Documents:

New papers on the Study topic

1. G. Milinevsky, Ya. Yatskiv, O. Degtyaryov, I. Syniavskiy, M. Mishchenko, V. Rosenbush, Yu. Ivanov, A. Makarov, A. Bovchaliuk, V. Danylevsky, M. Sosonkin, S. Moskalov, V. Bovchaliuk, A. Lukenyuk, A. Shymkiv, E. Udodov. New satellite project "Aerosol-UA": remote sensing of aerosols in the terrestrial atmosphere // *Acta Astronautica* – V. 123. – 2016. – P. 292–300. doi:10.1016/j.actaastro.2016.02.027, <http://authors.elsevier.com/a/1Sr3RLWHFg8By>

2. N. Miatselskaya, V. Kabashnikov, G. Milinevsky, A. Chaikovskiy, V. Danylevsky and V. Bovchaliuk (2016) Atmospheric aerosol distribution in the Belarus-Ukraine region by the GEOS-Chem model and AERONET measurements, *International Journal of Remote Sensing*, 37:14, 3181-3195, <http://dx.doi.org/10.1080/01431161.2016.1194541>

3. Grytsai, A., Milinevsky, G., Klekociuk, A., and Evtushevsky, O.: Evolution of the eastward shift in the quasi-stationary minimum of the Antarctic total ozone column, *Atmos. Chem. Phys. Discuss.*, doi:10.5194/acp-2016-537, in review, 2016, <http://www.atmos-chem-phys-discuss.net/acp-2016-537/>

Issues requiring resolution? (recommend approach):

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

Report, publications

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.)

No changes

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

Study Group Chair

Dr Yaroslav Yatskiv

E-mail: yatskiv@mao.kiev.ua

Status Report Date: August 30, 2016

The status of activities as of September 2016 on the study group 1.11 on Comparative Climatology:

1. The second meeting of Comparative Climates of Terrestrial Planets (CCTP2) took place during September 8-11, 2015 at the NASA Ames Research Center, Mofett Field, CA. The meeting brought together researchers that study terrestrial climate from a variety of perspectives, including Earth's climate history and future, the climates of solar system worlds, interactions of the Sun with its planets, and the diversity of exoplanet climates. The primary take-home points from this meeting were that 1) the climate of terrestrial worlds is a function of the intersections of surface, interior, space, and life processes, and 2) to best understand these intersections, we should leverage lessons learned from all these planets regardless of the artificial barriers.

A third CCTP meeting is being planned to be held during late 2017 or early 2018. CCTP3 committee will soon start their work to put the program together and define the venue.

2. CCTP steering committee will work with NASA Analysis Groups (AGs), COSPAR, and IAA organizational elements. (ON-GOING)

3. A key recommendation relevant to meeting the IAA objectives from the international assembly of scientists at the CCTP1 conference was that there is a need for a long-term, continuous, observation/measurement of the solar system's terrestrial planets. Climate is a planetary-wide phenomenon, and a deeper understanding is possible by continuously observing the other examples in the solar system. CCTP can move forward with NASA's continuing support for planetary observations using orbiting telescopes, high altitude balloons, and sounding rockets. [STRATEGIC DIALOGUES REQUIRED BETWEEN RESEARCH INSTITUTIONS AND ALSO SPACE AGENCIES, IN COSPAR, IAA CLIMATE CONFERENCE AND OTHER VENUES](#) (completed via CCTP2)

4. A detailed review on the following topics is being taken up:

- Evolutionary theory of terrestrial planets and giant planets, General (or unified) evolutionary theory for planets including exoplanets: What is the status?
- Timeline of Evolution of terrestrial planets, giant planets
- Composition of the planetary atmosphere- what are the factors responsible, what is current understanding about all planetary bodies
- Energy budget of planets
- Solar variability and its affect on the climate of planets

Currently a review on "current understanding of the temperature state of planetary bodies" is nearing completion ([Review report to be completed by March 2017](#)).

5. Following CCTP2 conference, the outcome of the conference will be absorbed in the activity based on the deliberations at the CCTP2. (In progress)

6. Areas of activities that need to be considered in the Comparative Climate research, with participation of developing countries, are:

- a. short term variables for comparative climatology : This could include ground based campaign for measurements that could be folding into models and satellite data.
- b. Regional variables for comparative climatology; such as the measurement of different spectral radiance.
- c. Development of cubesat concepts for comparative climatology observations.

IAA Study Group Status Report

Responsible Commission: Commission 1

Study Number and Title: Planetary Science Enabled by the New Generation of Cube-Sats and Miniaturized Scientific Instruments, 1.13

Short Study Description (repeat from Study Group Proposal):

In light of recent advances in science instruments and spacecraft technologies that have emerged in just the past couple of years, cubesats and other very small spacecraft can now be considered for use in planetary exploration, either as adjuncts to larger missions on which they could “catch a ride” to the most remote and challenging destinations in the solar system, or in some cases, as stand-alone missions of their own.

The new generation of cubesats that is emerging is also compatible with capabilities that exist within many universities. This enables students to gain first-hand experience in the design and development of spaceflight hardware, and hence provides an opportunity to further expand the workforce in space sciences and aerospace. If cubesats are launched “piggy back” on larger missions, they also provide a low-cost opportunity for emerging nations to develop and test their capabilities in an endeavor that is currently a very expensive enterprise that requires decades of dedicated capacity building.

In this study we will focus first on the planetary science that can now be considered using these emerging capabilities. The assessment of science opportunities will be anchored in the planetary science priorities of those nations that already have long-term plans and priorities. A key element of the study will be identification of current capabilities and future trends in science instrumentation that are compatible with Cube-Sats and other very small platforms such as micro-rovers, balloon-borne planetary atmosphere probes, etc. A brief survey of emerging capabilities in spacecraft platforms, namely Cube-Sats, miniature rovers, etc, also will be completed in order to, finally, explore example mission concepts where all key elements come together in the pursuit of new scientific knowledge of the solar system.

Progress in past six months:

An updated draft of the report has been completed and has been distributed to the team for comment. Additional studies are progressing that continue to point to high science utility and other applications. An informal industry survey was recently conducted that points to increasing performance of power generation, propulsion and attitude control further enabling the utility of these probes.

Unfortunately, due to circumstances beyond our control, the two “half-day” session events at the 2016 COSPAR Scientific Assembly in Istanbul had to be canceled. This has caused some delays.

Website Study Information up to date? (Study Group Membership, Study Plan and Schedule): under development

Issues requiring resolution? (recommend approach): None

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

Our report delivery has been delayed. We expect to release a final report in March 2016.

Study Team Member Changes? Please add: Dr. Julie Castillo-Rogez to the website. She has been a significant contributor to the report thus far.

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

Status Report Date:
August 31, 2016

Study Team Membership Changes
Effectivity Date:

Discontinue:

Add:

Dr. Julie Castillo-Rogez
julie.c.castillo@jpl.nasa.gov
+1 818-640-9231
4800 Oak Grove Drive
Pasadena, CA 91109

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:

Under the support of China Aerospace Science & Industry Corp., the project secretary Prof. Xuemin Zhang kept contact with the IAA office and commission 1 secretary to confirm the appointment in this project, until now the project chair and co-chairs all send their approval letters to IAA office, and all of the members have sent back their appointment signature letter to IAA office. Prof. Zhang checked the website in August 2016 of SG1.14 group, and she found that there occurred some wrong person shown in the list. The membership list has been updated.

On Aug. 22, 2016, we held an international meeting of IAA SG1.14, more than ten scientists attended this meeting and gave their presentations, including Prof. Dimitar Ouzounov, Valireo tramutoli, Katsumi Hattori, Jann-Yeng Liu, Xuhui Shen, Lixin Wu, Xuemin Zhang, Jianping Huang, Xinyan Li and Dr. Ye Liu. After the presentation. The members discussed together the outlines of the final report of this proposal, and decided to push forward the report preparation work according the proposal progress plan.

On Sep. 25, Prof. Xuemin Zhang will attend the IAC 2016 meeting in Mexico, and also attend the IAA commission meeting just before the IAC 2016. She will present the new development about this project on the meeting.

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

Issues requiring resolution? (recommend approach):
Nothing.

Product Deliveries on Schedule? (If modified explain rationale):
Yes. Our study group was approved by the IAA in June 2015. We will complete the task in 3 years.

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.)

Yes.

All the members have sent back their signature to the IAA office.
Prof. Dimitar Ouzounov was added to the list on August 22, 2016.

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

Dr. Weimin Bao (Study Group Chair)

Status Report Date: August 31, 2016

Study Team Membership Changes

Effectivity Date:

Add:

Name: Dimitar Ouzounov

Mailing address: Center of Excellence in Earth Systems

Modeling & Observations (CEESMO), Chapman University, One University Drive,
Orange, CA 92866, USA

Tel : +1-703-404-8858

Fax:+ 1-703-444-0850

E-mail: ouzounov@chapman.edu

Status Report on SG 1.15

Responsible Commission

Commission 1.

Study Number and Title

1,15 International Cooperation on Space Weather

Short Study Description

The complex interaction of: the solar magnetic field; electromagnetic radiation; particles emitted by the Sun; and galactic radiation with the interplanetary magnetic field and planetary atmospheres causes events and effects that are commonly referred to as Space Weather.

Space weather can adversely affect spacecraft, satellites, electronic components and power-plant facilities, radio communications and other infrastructure (i.e. elements on which human society is increasingly dependent). Over the last few decades a wide range of scientific programs and international initiatives have been conducted to study space weather which have contributed toward increasing our understanding of space weather related events and effects.

The purpose of the present study is to review, from an international, scientific, economic and policy perspective: our present knowledge of space weather and its (socioeconomic) effects on: human society; past and ongoing programmes and initiatives to identify possible still existing gaps and untapped opportunities. Recommendations and proposals charting ways forward that could contribute to increasing the understanding and resilience of human society to space weather will be formulated.

Progress in last 6 months

At the Spring Meeting (2016) this Study Group (originally S.G. 3.20) was transferred to Commission 1 where several recommendations as to suitable study group members were put forward. The study was renamed SG 1.15.

Thereafter the study lead (Acad. Susan McKenna-Lawlor) approached various international specialists in Space Weather and secured their commitment to join the Study Group. The names/contact details of these persons will shortly be provided to the Academy so that formal invitations to join the group can be issued to them.

While these preparations were in train, S.McKL prepared and presented a talk at the 3rd. IAA Space Flight Safety Symposium in St. Petersburg (4-8 July 2016) on **The performance and reliability of spacecraft in the near Earth environment**. This material will be submitted to a special edition of Acta Astronautica and will constitute the first spin off paper of the study.

Issues requiring resolution

Experts on economic and policy perspectives required for the study remain to be identified and will be sought within the Academy.

Invitation

The study group aims at producing a report by end of 2018. Any person interested may apply to join the group (membership is open to those who are not Academy members - subject to their being appropriately qualified). Persons interested in participating may contact the [IAA office by email](#) or call on 33 1 47 23 82 15. The work of this international team is on a volunteer basis and conducted primarily using the internet. No travel support is required.

Name of person providing the Study Group status

The group chair (Acad.) Susan McKenna-Lawlor

Status Report Date

10 September 2016

Meeting of IAA Commission 1 (Space Physical Sciences)
24 September 2016
Congress Centre, Guadalajara, Mexico

Agenda

1

1. **Welcome** (Prof. S. McKenna-Lawlor, V. Chair)
2. **Self-Introduction**
 - i. Commission 1 Members;
 - ii. All other attendees
1. **Adoption of the Agenda**
2. **Minutes of the Spring/Paris Meeting (sent by Sec. R/ Lopez)**
1. **Adoption of the Minutes**
2. **IAA Cosmic Studies**
 - 1.5 The energetic particle radiation hazard en route to and at Mars
Lead: S. McKenna-Lawlor. *Entered the printing process*
 - 1.6 Lunar farside Protection
Lead: C. Maccone. *Closed. Follow-up study in another Commission.*
 - 1.8 Global satellite system for monitoring and forecasting of the Earth's seismic activity. Lead O. Degtyarev. Final report forwarded to the Sec. General. *Presentation on Academy Day 25 September 2016. Publication foreseen.*
 - 1.9 Satellite remote sensing of aerosols in the Earth's atmosphere.
Lead: Y. Yatskiv. *Report received. Presentation on Academy Day by Yatskiv. Publication foreseen.*
 - 1.10 Terrestrial analogue. Comparison of terrestrial and planetary geology.
Lead: M. Coradini. *No report during this year or last year.*
 - 1.11 Comparative climatology: Studying planetary climate to understand the planet.
Lead: R. Ramaschandran. *Terminated by recommendation of Prof. Goswami.*
 - 1.12 Virtual planet. Virtual exploration of planets.
Lead: M. Coradini. *No report during this year or last year.*
 - 1.13 Planetary science generated by the new generation of cubesats and miniaturized scientific instruments; Leads; Baker/Vane/Bousquet. *Written report received. Presentation on Academy Day by Baker.*

- 1.14 Integrated precursor. Distinguish in multi-geophysical fields around global Earthquake events with magnitudes larger than seven in recent ten years; Lead: Bao Weimin. *No report received.*
- 1.15 International Cooperation on Space Weather. Lead S. McKenna-Lawlor *Report received.*
- 1.16 Expanding options for implementing planetary protection during human space exploration. Lead S. Conley. A request that this Study Group (3.20) would be transferred to Commission 1 was considered during the Paris Meeting. The study program was questioned and it was decided to ask the team for justification of some items. No reply has thus far been received.

1. **Commission 1 events**

The IAA Human Space Exploration Conference (May 24-26, 2016) was held in the Moscow Korolyov Region.

The Third IAA Symposium on “Space Flight Safety” was held from July 4-8, 2016 (period of “white nights”) at St.Petersburg. A report of this meeting received from Prof. Nickkolay Smirnov is attached.

The IAA program planned for the first day of the 41st COSPAR meeting (30 July) at Istanbul (prepared jointly by Dr. G. Vane and Prof. Goswami) was not presented due to the cancelation of COSPAR.

The 45th IAA Symposium on the ‘Search for extra-terrestrial intelligence (SETI)’ is scheduled to take place at Guadalajara, Mexico (IAC-A4) in association with the 67th IAC.

8 AOB

9. Adjourn