

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

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