



**DEPARTMENT OF
ATMOSPHERIC PHYSICS**



• ABOUT

Department's activities are focused on monitoring and investigating a wide range of physical atmospheric parameters including the columnar amount of ozone and its vertical distribution, atmospheric electricity and lightning activity, concentration and characteristics of airborne aerosols, UV spectra, trace gases concentrations, and thermodynamical processes in the tropics. These studies focus on different parts of the atmosphere: the surface layer, troposphere, stratosphere, and ionosphere. The common aim of these activities is to determine and predict the variability of atmospheric parameters and identify the sources of this variability on different time scales (from days up to decades). The Department contains four internal groups: Atmospheric Aerosols, Atmospheric Electricity, Ozone and UV, and Tropical Dynamics. The groups focus on the following topics in 2022:

- Examination of the vertical structure of aerosols with different techniques, complementing the remote technique with UAV measurements. Study of the influence of aerosol layering in the free troposphere on surface UV radiation and photolysis rates.
- Investigation of weather changes in the pattern of short-lived anomalies of high and low total ozone passing through Europe that is forced by climate change (troposphere warming & stratospheric cooling). A set of metrics characterizing the intensity of such TCO₃ events has been proposed. The expected increase in the intensity of ozone concentration anomalies cannot be supported by the present analysis. This means that previously developed models of 24h TCO₃ forecast will be valid for the next decades.
- Identification of sub-seasonal predictors of extreme precipitation events in the Maritime Continent using observations, ground-based and satellite remote sensing, and modeling (weather forecasts, atmospheric and oceanic reanalyses) resources.
- Detection of cloud-to-ground flashes by the measuring stations of the Local Lightning Detection Network (LLDN) in the Warsaw region and the Lightning Research Station (LOR) of the Rzeszow Technical University to identify different lightning development stages in the time and spectral domain.

New research projects funded by the NCN:

- Local and global Earth's atmospheric electric circuit signals in atmospheric electricity data from the observatory in Swider.
- Spatial representativeness of aerosol profiles, holistic multi-instrument approach.
- Modeling personal UV doses and their application to a pregnancy pattern prediction based on a large University College London Hospital (UK) database.
- Representation and predictability of Makassar (Sulawesi, Indonesia) flood of 2019 in MetOffice weather models (NAWA PROM).



• PERSONNEL

Head of Department

Aleksander Pietruczuk | Associate Professor

Professor

Janusz Krzyścin

Associate Professor

Janusz Jarosławski

Assistant Professors

Agnieszka Czerwińska

Magdalena Kossakowska

Michał Posytniak

Artur Szkop

Daniel Kępski

Tacza Jose

Marek Kubicki

Dariusz Baranowski

Jakub Guzikowski

Izabela Pawlak

Anna Odzimek

Research Assistants

Technical Assistant

Piotr Barański

Jakub Wink

Magdalena Murawska

Alicja Piłacik

Piotr Sobolewski

Anna Głowacka

Dorota Sawicka

PhD Students

Alnilam Fernandez | India | Supervisor: Aleksander Pietruczuk

Beata Latos | Poland | Supervisors: Aleksander Pietruczuk and Dariusz Baranowski

Anahita Sattari | Iran | Supervisor: Jacek Kamiński

Wojciech Szkółka | Poland | Supervisors: Krzysztof Mizerski and Dariusz Baranowski

• MAIN RESEARCH PROJECTS

Local and global Earth's atmospheric electric circuit signals in atmospheric electricity data from the observatory in Swider | **Odzimek A., Kępski D., Tacza J., Pawlak I.** | NCN | 2022-2024

Impact of absorbing aerosols on the planetary boundary layer height | **Posytniak M.** | NCN | 2017- 2022

Spatial representativeness of aerosol profiles, holistic multi-instrument approach | **Pietruczuk A., Szkop A., Kępski D.** | NCN | 2022-2024

Multi-station analysis of solar effects in the ground-level atmospheric electric field | **Tacza J., Odzimek A.** | NAWA, Ulam program | 2020 - 2022

Wpływ procesów wieloskalowych na powstawanie ekstremalnych opadów w tropikach | **Baranowski D., Latos B., Szkółka W.** | NCN OPUS | 2020 - 2023

Ekstrema pogodowe: powódzie i susze. W jaki sposób wielkoskalowa cyrkulacja atmosferyczna oraz para wodna nad Wschodnim Oceanem Indyjskim ze sobą oddziałują? | **Latos B., Baranowski D.** | NCN Preludium | 2021 - 2024

Monitoring całkowitej zawartości ozonu w atmosferze oraz natężenia promieniowania UV na stacji Belsk w latach 2021-2022 | **Jarosławski J.** | GIOŚ | 2021 - 2022

Technologia wytwarzania innowacyjnych samoczyszczących się prefabrykowanych elementów elewacyjnych i nawierzchniowych poprawiających jakość powietrza | **Jarosławski J.** | NCBiR | 2021 - 2023

Modelowanie personalnych dawek promieniowania UV i ich zastosowanie w modelu prognozy przebiegu ciąży na podstawie rozbudowanej bazy danych University College London Hospital (UK). | **Czerwińska A.** | NCN Miniatura 6 | 2022-2023

• INSTRUMENTS and FACILITIES

Equipment

- Two "heavy" UAV with around 2 kg of payload, equipped with SparvIO dataloggers and a set of lightweight detectors, including dual-redundant pHT sensors
- Two "small" UAV with lightweight data loggers (iMet-XQ2) and sea temperature sampling capability (RBR SoloT, SBE 56)
- Three automated weather stations
- Polar nephelometer

Laboratory

ACTRIS aerosol in-situ station at Racibórz. The joint laboratory of IG PAS and IEE PAS as a part of ACTRIS-PL Research Infrastructure. The station is equipped with:

- Polar nephelometer
- Scanning Mobility Particle Sizer, to be delivered in January 2023
- Aethalometer (owned by IEE PAS).

• SEMINARS and TEACHING

SEMINARS AND LECTURES

Posyniak M. | The use of cableways and ski lifts for smog profiling. | Institute of Environmental Protection PAS | Warsaw, Poland | 26.01.2022 | Seminar

Latos B. | The role of tropical waves in the genesis of tropical cyclone Seroja | School of Environmental Sciences, University of East Anglia | Norwich, UK | 25.02.2022 | Seminar

Latos B. | The role of tropical waves in the genesis of tropical cyclone Seroja | Faculty of Physics, University of Warsaw | Warsaw, Poland | 25.03.2022 | Seminar

Szkółka W. | Tropospheric winds over Sumatra – the diurnal evolution and its variability in response to large-scale phenomena | Faculty of Physics, University of Warsaw | Warsaw, Poland | 03.06.2022 | Seminar

THESIS

Baranowski D. | **Michał Ciuryło** | Atmospheric Boundary Layer Measurements with an uncrewed aerial vehicle (Bachelor Thesis) | University of Warsaw | Warsaw, Poland

PhD

Kamiński J. | **Anahita Sattari** | Sensitivity of the GEM model to different descriptions of city surface parameters over Warsaw | IGF PAN | Warsaw, Poland

VISITING SCIENTISTS

Jose Tacza | NAWA Polish National Agency for Academic Exchange | Peru | 06/07/2020 - 05/07/2022

Marina Azaneu | University of East Anglia | Norwich, UK | 3-8/10/2022

Adrian Matthews, Natasha Senior | University of East Anglia | Norwich, UK | 20-27/08/2022

MEETINGS, WORKSHOP CONFERENCES and SYMPOSIA

Karnas G., **Barański P.**, Maslowski G., **Odzimek A.** | XVII International Conference on Atmospheric Electricity | Identification in the time and spectral domain of reflective processes involved in intra-cloud discharges recorded by the lightning detection station in Rzeszow in 2019 | Tel Aviv, Israel | 19-24 June 2022 | Poster | Conference

Odzimek A., Tacza J., Kępski D. | XVII International Conference on Atmospheric Electricity | Review of results of Global Circuit modelling by the EGATEC model compared with observational data | Tel Aviv, Israel | 19-24 June 2022 | Poster | Conference



- Tacza J., Odzimek A.,** Raulin J.-P., **Kubicki M.** | XVII International Conference on Atmospheric Electricity | Effects of short-term solar disturbances on the potential gradient measurements recorded in two different stations | Tel Aviv, Israel | 19-24 June 2022 | Poster | Conference
- Posytniak M., Szkop A.,** Markowicz K.M. | 7th European Conference on Structural Control | Small sensors in atmospheric aerosols profiling | Poland | July 10th - 13th 2022 | Poster | Conference
- Sobolewski P., Kubicki M.** | 36th International Conference on Lightning Protection (ICLP) | Simulation of the atmospheric electric field and current structure for sensors with different geometry in relation to the electric current measured in the external circuit | South Africa, Cape Town | 02-07 October 2022 | Poster | Conference
- Krzyściński J.** | Workshop on Changes of the Polar Ecosystems | Is the polar ozone recovering? | Desne, Czech Republic | 09-11.11.2023 | Oral | Workshop
- Sobolewski P.** | Workshop on Changes of the Polar Ecosystems | UV observations in the polar region | Desne, Czech Republic | 09-11.11.2023 | Oral | Workshop
- Latos B., Baranowski D.** | 35th Conference on Hurricanes and Tropical Meteorology | The Role of Tropical Waves in the Genesis of Tropical Cyclone Seroja - the First Tropical Cyclone to Have a Significant Impact on Indonesian Land | New Orleans, USA | 9-13/05/2022 | Oral | Conference
- Szkółka W., Baranowski D.** | 35th Conference on Hurricanes and Tropical Meteorology | The Diurnal Evolution of Tropospheric Winds over Sumatra and its Variability in Response to Large-Scale Phenomena | New Orleans, USA | 9-13/05/2022 | Oral | Conference
- Baranowski D.** | 35th Conference on Hurricanes and Tropical Meteorology | Rainfall and Twitter. Spatio-Temporal Variability of Extreme Precipitation and Floods in Indonesia Assessed Using Satellite Observations and Twitter Activity | New Orleans, USA | 9-13/05/2022 | Poster | Conference
- Latos B., Baranowski D.** | European Geosciences Union (EGU) General Assembly 2022 | The role of tropical waves in the genesis of tropical cyclone Seroja | Vienna, Austria | 23-27/05/2022 | Oral | Conference
- Czerwińska A., Krzyściński J.** | International Radiation Symposium 2022 | Climatological Aspects of Melanoma Incidence Increase in Europe | Thessaloniki, Greece | 04-08/07/2022 | Oral | Symposium
- Czerwińska A., Krzyściński J.** | International Radiation Symposium 2022 | Patterns of teenagers' outdoor exposure in Spring-Autumn period during and after the first COVID-19 lockdown in 2020, Poland. | Thessaloniki, Greece | 04-08/07/2022 | Poster | Symposium
- Czerwińska A., Krzyściński J.** | European Conference on Solar UV Monitoring and Personal UV Exposure | Patterns of teenagers' outdoor exposure in Spring-Autumn period during and after the first COVID-19 lockdown in 2020, Poland. | Vienna, Austria | 14-16/09/2022 | Oral | Conference
- Czerwińska A., Krzyściński J.** | 1st MeteXchange ECS Conference | Exposure to solar UV radiation of Polish children (preschoolers and teenagers) during spring-autumn period in 2018 and 2020 | online | 17-18/03/2022 | Oral | Conference

• PUBLICATIONS

ARTICLES

Pietruczuk A., Fernandes A., Szkop A., Krzyściński J., 2022, Impact of Vertical Profiles of Aerosols on the Photolysis Rates in the Lower Troposphere from the Synergy of Photometer and Ceilometer Measurements in Raciborz, Poland, for the Period 2015–2020, *Remote Sensing*, 14 (5), 1057.

Sanchez-Cid C., et al., **Kępski D.**, Luks B., Nawrot A., 2022, Environmental and Anthropogenic Factors Shape the Snow Microbiome and Antibiotic Resistome, *Frontiers in Microbiology* 13-2022, 918622.

Karnas G., **Barański P.**, et al., 2022, A New Method for Modeling and Parameter Identification of Positively Charged Downward Lightning Leader Based on Remote Lightning Electric Field Signatures Recorded in the ELF/MF Range and 3D Doppler Radar Scanning Data, *Energies*, 15(22), 8566.

Zhang W., et al., **Kubicki M.**, 2022, Evaluation of ¹³⁷Cs, ¹³³Xe and ³H activity concentrations monitored in the Arctic atmosphere, *Journal Of Environmental Radioactivity*, 253-254:107013.

Czerwińska A., Krzyściński J., 2022, Exposure to solar UV radiation of Polish teenagers after the first COVID-19 lockdown in March-April 2020, *International Journal of Biometeorology*, 66 (10), 2021-2032.

Laska M., Luks B., **Kępski D.**, et al., Głowacki P., Nawrot A., 2022, Hansbreen Snowpit Dataset – over 30-year of detailed snow research on an Arctic glacier, *Scientific Data*, 9, 656 (2022).

Tacza J., Odzimek A., et al., **Kubicki M.**, 2022, MarunInvestigating Effects of Solar Proton Events and Forbush Decreases on Ground-Level Potential Gradient Recorded at Middle and Low Latitudes and Different Altitudes, *Space Weather*, 20, 3, e2021SW002944.

Witkowski H., et al., **Jarosławski J., Szkop A.**, 2022, Ozone Formation during Photocatalytic Oxidation of Nitric Oxides under UV Irradiation with the Use of Commercial TiO₂ Photocatalytic Powders, *Materials*, 15 (17), 5905.

Kępski D., Kubicki M., 2022, Thunderstorm activity at high latitudes observed at manned WMO weather station, *International Journal of Climatology*, 42, 15, pp. 7794-7816.

Jarosławski J., Pawlak I., Guzikowski J., Pietruczuk A., 2022, Impact of Shale Gas Exploration and Exploitation Activities on the Quality of Ambient Air—The Case Study of Wysin, Poland, *Atmosphere*, 13(8), 1228.

Szkop A., Fernandes A., Pietruczuk A., 2022, Towards a Multi-Instrumental Approach to Closing Aerosol Optical Extinction Profiles, *Atmosphere*, 13 (9), 1443.

CHAPTERS

Odzimek A., Barański P., 2022, Preface, In: *Atmospheric Electricity: Papers on Thunderstorm and Cloud Electricity*, Publications of the Institute of Geophysics, Polish Academy of Sciences, Geophysical Data Bases, Processing and Instrumentation vol. 442 (D-77), 2022, pp. 3–3.

Barański P., Guzikowski J., 2022, Dynamic and Electric Charge Structure of Thunderclouds Obtained from the WRF and WRF_ELEC Models and Related to the Charge Sources of Multiple CG Flashes Detected by the LLDN in the Warsaw Region during Thunderstorm Season in 2009, In: *Publications of the Institute of Geophysics, Polish Academy of Sciences, Geophysical Data Bases, Processing and Instrumentation vol. 442 (D-77)*, 2022, pp. 5–17.

Odzimek A., Barański P., Kubicki M., et al, 2022, Nimbostratus and Stratus Cloud Atmospheric Electricity Database and Analysis Methods for the Project “Research Studies on the Electricity of Low-Level Layer Clouds for the Purpose of Developments in Global Atmospheric Circuit Modelling (ELLECC)”, In: Publications of the Institute of Geophysics, Polish Academy of Sciences Geophysical Data Bases, Processing and Instrumentation vol. 442 (D-77), 2022, pp. 19-40.

Odzimek A., et al., 2022, Red Sprites over Thunderstorms in Czech Republic, Germany and Poland Observed from Gliwice in 2011–2013, In: Publications of the Institute of Geophysics, Polish Academy of Sciences Geophysical Data Bases, Processing and Instrumentation vol. 442 (D-77), 2022, pp. 41-54.

Odzimek A., et al., **Kubicki M.,** 2022, Red Sprites over Northwest Poland and the Southern Baltic Coast Observed from Świder Geophysical Observatory, In: Publications of the Institute of Geophysics, Polish Academy of Sciences, Geophysical Data Bases, Processing and Instrumentation vol. 442 (D-77), 2022, pp. 55-70.

Odzimek A., et al., 2022, Methodology of Estimating Time Accuracy in TV Recordings of Sprite Lightning Observed from Gliwice and Świder 2011–2015, Publications of the Institute of Geophysics, Polish Academy of Sciences, Geophysical Data Bases, Processing and Instrumentation, vol. 442 (D-77), 2022, pp. 71-83.

Parfiniewicz J., **Barański P.,** et al., 2022, A Novel Application of the Virtual Fujita Scale (VFS) Number Approach as a Useful Tool for Assessment of Lightning Discharges Development and Severity for the Derecho Episode in Poland on 11 August 2017 Together with its Synoptic Context, Publications of the Institute of Geophysics, Polish Academy of Sciences, Geophysical Data Bases, Processing and Instrumentation vol. 442 (D-77), 2022, pp. 85–119.

