



Department of
Atmospheric Physics

• ABOUT

The Department's activities focus on monitoring and modelling of a wide range of physical atmospheric parameters, including columnar amount of ozone and its vertical distribution, atmospheric electricity and lightning activity, concentration and characteristics of airborne aerosols, UV spectra, trace gases concentrations, as well as dynamics and atmosphere-ocean interaction processes in the tropics. These studies focus on different parts of the atmosphere: surface layer, troposphere, stratosphere, and ionosphere. The common aim of these activities is to determine and predict the variability of atmospheric parameters and to identify the drivers of this variability on various time scales (from days up to decades). The Department contains four internal groups: **Atmospheric Aerosols (AA)**, **Atmospheric Electricity (AE)**, **Ozone and UV (O3UV)**, and **Tropical Dynamics (TD)**. These groups focused on the following topics in 2021:

- Examination of the vertical structure of aerosols and impact of absorbing particles on the height of planetary boundary layer **(AA)**
- Influence of aerosol layering in the free troposphere on surface UV radiation. Identification of layer geometries that correspond to the differences observed between radiative transfer model calculations and measurements. **(AA)**
- Participation in ACTRIS COVID-19 initiative aimed at study of continent-wide lockdown on anthropogenic pollution. Data analysis from three participating sites by the GRASP software **(AA)**
- A short campaign in Belsk to close LIDAR derived extinction profiles with in-situ size distribution measurements. Preparation of UAV setup for low altitude profiling of particulate matter, filling the gap between in-situ and lowermost part of extinction profile **(AA)**, and preparation for UAV observation of the diurnal evolution of boundary layer temperature and humidity during planned TerraMaris experiment **(TD)**
- Detection of cloud-to-ground flashes by our measuring stations of Local Lightning Detection Network in the Warsaw region to identify their time development and main E-field components **(AE)**
- Analysis of main generators on the Global Electric Circuit (GEC) based on the atmospheric electricity, aerosol and air radioactivity measurements in mid-latitudes and polar regions **(AE)**
- Fair-weather atmospheric electricity and solar effects in ground-level atmospheric electric field at polar and mid-latitude regions **(AE)**
- Total column ozone measurements by the Dobson spectrophotometer at Central Geophysical Observatory in Belsk (from 1963), the total of ~120,000 intra-day observations, were homogenized. For the first time, the short-term variability (up to 24h) in the long-term ozone data was investigated. Climate changes did not intensify the ozone variability on this timescale. This is also confirmed by satellite observations of ozone over Belsk, which allows for the study of such variability of ozone on a global scale **(O3UV)**
- Estimations of the daily amount of skin-synthesized vitamin D and erythemal doses in teenagers after the first COVID-19 lockdown in 2020 (May-September) – on the basis on observations gathered in BRITEC project by children aged 12-18 **(O3UV)**
- Developing a novel method for measuring the vertical ozone profile from ground-based Brewer spectrophotometer measurements **(O3UV)**
- Investigation of lower tropospheric, upper ocean and cloud structure over tropical Atlantic during EUREC4A campaign in Jan/Feb 2020 **(TD)**
- Extreme precipitation and floods variability over the Maritime Continent in response to large scale forcing at sub-seasonal time scales **(TD)**
- Tropospheric and lower-stratospheric winds structure and variability over Sumatra (Indonesia) and feedbacks with local environment and large-scale meteorological conditions **(TD)**
- Examination of the vertical structure of aerosols and impact of absorbing particles on the height of planetary boundary layer **(AA)**
- Recognition of the influence of the vertical structure of aerosols on the intensity of the Earth's electric field during field campaign in Polish Polar Station Hornsund (Svalbard)

• PERSONNEL

Head of Department

Aleksander Pietruczuk | Associate Professor

Professor

Janusz Krzyścin

Associate Professors

Janusz Jarosławski

Jacek Kamiński

Assistant Professors

Dariusz Baranowski

Agnieszka Czerwińska

Jakub Guzikowski

Daniel Kępski

Magdalena Kossakowska

Marek Kubicki

Michał Posyniak

Artur Szkop

Tacza Jose

Research Assistants

Anna Odzimek

Izabela Pawlak

Technical Assistant

Piotr Barański

Anna Głowacka

Magdalena Murawska

Alicja Piłacik

Dorota Sawicka

Piotr Sobolewski

Jakub Wink

PhD Students

Alnilam Fernandez | India | supervisor: Aleksander Pietruczuk

Beata Latos | Poland | supervisors : Aleksander Pietruczuk, Dariusz Baranowski

Anahita Sattari | Iran | supervisor: Jacek Kamiński

Wojciech Szkółka | Poland | supervisors : Krzysztof Mizerski, Dariusz Baranowski

• MAIN RESEARCH PROJECTS

Atmospheric Electricity Network: coupling with the Earth System, climate and biological systems | A. Odzimek | COST | 2016 - 2021

Impact of the aerosol optical properties on the surface UV and photochemical smog | A. Pietruczuk – coordinator J. Krzyścin, A. Szkop, J. Wink, W. Wojtak | NCN | 2018 - 2021

Impact of absorbing aerosols on the planetary boundary layer height | M. Posytniak | NCN | 2016 - 2021

Rozpoznanie wpływu pionowej struktury aerozoli na natężenie pola elektrycznego Ziemi – badania pilotażowe | D. Kępski | NCN MINIATURA | 2021

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

Dopełnienie profili pionowych aerozoli atmosferycznych przy użyciu pomiarów in-situ na powierzchni ziemi | A. Szkop | NCN PRELUDIUM | 2018 - 2021

Wpływ procesów wieloskalowych na powstawanie ekstremalnych opadów w tropikach | D. Baranowski, B. Latos, W. Szkółka | NCN OPUS | 2020 - 2022

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

PROM | B. Latos | NAWA | 2021

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

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

• INSTRUMENTS AND FACILITIES

Equipment

- Two medium sized UAVs (drones) equipped with SparvIO dataloggers and a set of lightweight detectors, including dual-redundant pHT sensors, optical particle counters (alphasense N3 OPCs), and Trisonica sonic anemometers
- Particle counters SPS30 (7 psc.) | PM 2.5, PM10 concentration and aerosol size distribution
- High frequency ocean temperature data loggers: SBE 57 and RBR Solo T

Laboratory

- Thunderstorm electricity
- Three VLF/LF stations for the recordings of the electric field for the purpose of detection and classification of different types of lightning discharges in the Warsaw region – part of Local Lightning Detection Network installed in 2009.

• SEMINARS and TEACHING

SEMINARS AND LECTURE

A. Czerwińska | Biologicznie czynne promieniowanie UV | University of Warsaw, Department of Physics
Warsaw | 19.05.2021 | Seminar

B. Latos | Equatorial waves triggering extreme rainfall and floods in southwest Sulawesi, Indonesia Centre
National de Recherches Météorologiques, Toulouse, France | Toulouse | 02.09.2021 | Invited Lecture

FELLOWSHIPS AND VISITING SCIENTISTS

Jose Tacza | (fellowship) | NAWA Polish National Agency for Academic Exchange | Peru | 06.07.2020 -
05.07.2022

MEETINGS, WORKSHOP CONFERENCES and SYMPOSIA

P. Baranski, G. Karnas, G. Maslowski | 35th International Conference on Lightning Protection (ICLP 2021) |
Preliminary breakdown electric field signatures of positive ground flash incidents recorded during 2019
thunderstorm season in Warsaw region | online/Colombo Sri Lanka | 20.09.2021 | Oral | Conference

M. Kubicki, J. Konarski and W. Gajda | XXXVIII International Polar Symposium "Environmental changes in
polar regions: New problems – new solutions" | Thunderstorm observation in Polish Polar Station in Hornsund
(770N, 150E). Present infrastructure and further plans | Toruń, Poland | 19.11.2021 | Oral | Symposium

A. Odzimek, P. Baranski, M. Kubicki, J. Berlinski, D. Jasinkiewicz | European Geophysical Union General
Assembly 2021 | Ground-level atmospheric electricity of mid-latitude Nimbostratus and Stratus cloud at
Swider station, Poland | online | 29.04.2021 | Oral | Conference

J. Tacza, A. Odzimek, M. Kubicki, Raulin J.-P. | European Geophysical Union General Assembly | Effects
of energetic particles on the potential gradient measurements at different latitudes | online | 29.04.2021 | Oral
| Conference

D. Kępski, M. Kubicki | XXXVIII International Polar Symposium "Environmental changes in polar regions:
New problems – new solutions" | Thunderstorm activity in high latitudes registered on manned WMO
weather stations in years 2000-2019 | Toruń, Poland | 19.11.2021 | Oral | Symposium

A. Czerwińska, J. Krzyścin | Quadrennial Ozone Symposium 2021 (QOS) | Climatological aspects of melanoma
incidence increase in Europe | online | 08.10.2021 | Oral | Symposium

J. Krzyścin, B. Rajewska-Więch | Quadrennial Ozone Symposium 2021 (QOS) | Long-term variability (1980 - 2020)
of total column ozone in Northern Hemisphere from Reanalyses (MSR2, MERRA2, and ERA5) and a comparison
with the Dobson data taken at Belsk (51.84N, 20.79E), Poland | online | 04.10.2021 | Poster | Symposium

B. Rajewska-Więch, J. Krzyścin, J. Jarosławski | Quadrennial Ozone Symposium 2021 (QOS) | The reevaluated
intraday total column ozone series from the Dobson spectro-photometer No.84 operating at Belsk (51.84N,
20.79E), Poland, since March 23,1963 | online | 09.10.2021 | Poster | Symposium

J. Jarosławski, J. Krzyściński, B. Rajewska-Więch | Quadrennial Ozone Symposium 2021 (QOS) | Comparison of the Ozone Vertical Profiles based on the Umkehr Observations by collocated the Dobson and Brewer Spectro-photometers at Belsk, Poland, for the period 2011 - 2016 | online | 09.10.2021 | Poster | Symposium

J. Krzyściński | 21. výroční zasedání Polární sekce České geografické společnosti, České Skalici | On the recovery of the Northern Hemisphere total column ozone | face-to-face | 14.10.2021 | Oral | Workshop

P. Sobolewski, M. Posyński, J. Krzyściński | 21. výroční zasedání Polární sekce České geografické společnosti, České Skalici | Long-term UV Observations at the Polish Polar Station Hornsund in the period 2005 - 2021 (17 years) | face-to-face | 14.10.2021 | Oral | Workshop

A. Fernandes, A. Szkop, A. Pietruczuk | European Aerosol Conference (EAC) 2021 | Characterization and profiling of the anthropogenic aerosols in Europe during the COVID-19 ACTRIS/EARLINET campaign | online | 30.08.2021 | Poster

S.P. Malinowski, W. Kumala, J. Nowak, S. Król, R. Grosz, **M. Posyński**, T. Lachlan-Cope, A. Blyth, S. Boeing | European Geophysical Union General Assembly 2021 | Centimeter-scale-resolution airborne temperature measurements in clouds and in marine surface layer during EUREC4A | online | 30.04.2021 | Oral | Conference

B. Latos, T. Lefort, M.K. Flatau, P. J. Flatau, **D.B. Baranowski**, W. Szkółka, and P. Peyrillé | European Geophysical Union General Assembly 2021 | Application of SpectralWeather to prediction of flood and extreme rain events in the Maritime Continent | online | 27.04.2021 | Oral | Conference

Latos B., T. Lefort, M.K. Flatau, P. J. Flatau, **D.B. Baranowski**, and P. Peyrillé | 34th Conference on Hurricanes and Tropical Meteorology | On the Role of Tropical Waves in Sulawesi Flood of January 22, 2019: A Multi-Scale Interaction Perspective | online | 12.05.2021 | Oral | Conference

D.B. Baranowski, M.K. Flatau, P.J. Flatau | 34th Conference on Hurricanes and Tropical Meteorology | Convectively Coupled Kelvin Waves Contribution to Hazardous Weather in Sumatra | online | 12.05.2021 | Oral | Conference

W. Szkolka, D.B. Baranowski, M.K. Flatau and P.J. Flatau, D. Karnawati, K. Barabasz, M. Labuz, J. Schmidt, J.A.I. Paski and Marzuki | 34th Conference on Hurricanes and Tropical Meteorology | Upper Level Forcing of Interaction between Convectively Coupled Kelvin Waves and Local Diurnal Cycle over Sumatra | online | 12.05.2021 | Oral | Conference

• PUBLICATIONS

ARTICLES

Hunting E. R., et al., **Odzimek A.**, 2021, Challenges in coupling atmospheric electricity with biological systems, International Journal of Biometeorology, 65, pp. 45 – 58.

Fdez-Arroyabe P., et al., **Odzimek A.**, 2021, Glossary on atmospheric electricity and its effects on biology, International Journal of Biometeorology, 65, pp. 5 – 29.

Kyung M. Han, et al. Karasiński G., **Sobolewski P.**, 2021, Data Assimilation of AOD and Estimation of Surface Particulate Matters over the Arctic, Applied Sciences, 11, 4.

Barbaro E., et al., **Kępski D.**, Luks B., 2021, Measurement report: Spatial variations in ionic chemistry and water-stable isotopes in the snowpack on glaciers across Svalbard during the 2015–2016 snow accumulation season, *Atmospheric Chemistry and Physics*, 21, 4, pp.3163 – 3180.

Czerwińska A., et al., 2021, Estimations of the Erythemat UV Doses and the Amount of the Sun-Synthesized Vitamin D by Adults during the Cruise to Spitsbergen–Polar Measurement Campaign (2 – 21 July 2017), *Atmosphere*, 12, 4, 474.

Tacza J., et al., **Kubicki M.**, **Odzimek A.**, 2021, Measuring Global Signals in the Potential Gradient at High Latitude Sites, *Frontiers in Earth Science*, 8.

Michnowski S., **Odzimek A.**, et al., **Kubicki M.**, 2021, Review of Relationships Between Solar Wind and Ground-Level Atmospheric Electricity: Case Studies from Hornsund, Spitsbergen, and Swider, Poland, *Surveys in Geophysics*, 42, pp. 757 – 801.

Kubicki M., et al., **Odzimek A.**, 2021, Nature of relationships between atmospheric electricity parameters at ground surface and air ionization on the basis of nuclear accidents in power plants and weapons tests, *Frontiers in Earth Science*, 9.

Latos B., et al., **Baranowski D.**, 2021, Equatorial Waves Triggering Extreme Rainfall and Floods in Southwest Sulawesi, Indonesia, *Monthly Weather Review*, 149, 5.

Azaneu M., et al., **Baranowski D.**, 2021, Subsurface Oceanic Structure Associated With Atmospheric Convectively Coupled Equatorial Kelvin Waves in the Eastern Indian Ocean, *Journal of Geophysical Research-Oceans*, 126, 7, e2021JC017171.

Fernandes A., **Pietruczuk A.**, **Szkop A.**, **Krzyściń J.**, 2021, Aerosol layering in the free troposphere over the industrial city of Raciborz in southwest Poland and its influence on surface UV radiation, *Atmosphere* 2021, 12, 7, 812.

Narbutt J., **Krzyściń J.**, **Sobolewski P.**, et al., **Rajewska-Więch B.**, 2021, A Priori Estimation of the Narrow-Band UVB Phototherapy Outcome for Moderate-to-Severe Psoriasis Based on the Patients' Questionnaire and Blood Tests Using Random Forest Classifier, *Clinical, Cosmetic and Investigational Dermatology*, 14.

Krzyściń J., **Rajewska-Więch B.**, **Borkowski J.**, 2021, Short-term variability of total column ozone from the Dobson spectrophotometer measurements at Belsk, Poland, in the period 23 March 1963 – 31 December 2019, *Tellus B: Chemical and Physical Meteorology*, 73, 1, pp. 1 - 10.

Burakowska A., **Kubicki M.**, et al., 2021, Concentration of ⁷Be, ²¹⁰Pb, ⁴⁰K, ¹³⁷Cs, ¹³⁴Cs radionuclides in the ground layer of the atmosphere in the polar (Hornsund, Spitsbergen) and mid-latitudes (Otwock-Świder, Poland) regions, *Journal of Environmental Radioactivity*, 240, 106739.

Krzyściń J., **Rajewska-Więch B.**, **Jarosławski J.**, 2021, Total column ozone measurements by the Dobson spectrophotometer at Belsk (Poland) for the period 1963 – 2019: homogenization and adjustment to the Brewer spectrophotometer, *Earth System Science Data*, 13, 4425 – 4436.

Kosmopoulos P. G., et al., **Jarosławski J.**, 2021, Real-time UV index retrieval in Europe using Earth observation-based techniques: system description and quality assessment, *Atmospheric Measurement Techniques*, 14, 5657 – 5699.

Posyński M., et al., 2021, Experimental study of smog microphysical and optical vertical structure in the Silesian Beskids, Poland, *Atmospheric Pollution Research*, 12, 9, 101171.

Stevens B., et al., **Baranowski D., Posyniak M., Szkółka W.**, 2021, EUREC4A, Earth System Science Data, 13, 4067 – 4119.

Pawlak I., 2021, Statistical analysis of ozone weekend effect in the largest cities in Poland, Earth Sciences, 10, 6, pp. 265 - 274.

Markowicz K., et al., M., **Posyniak M., Kamiński J.W., Szkop A., Pietruczuk A.**, 2021, A Decade of Poland-AOD Aerosol Research Network Observations, Atmosphere, 12, 12, 1583.

Markowicz K. M., et al., **Posyniak M.**, 2021, A large reduction of direct aerosol cooling over Poland in the last decades, International Journal of Climatology.

Baldysz Z., et al., **Latos B., Baranowski D.**, 2021, Interannual Variability of the GNSS Precipitable Water Vapor in the Global Tropics, Atmosphere 2021, 12, 12, 1698

MONOGRAPH

Kępski D., The Influence of Topography and Vegetation on the Snow Cover in Tundra: Case Study from the Southern Spitsbergen Area, Publications of the Institute of Geophysics Polish Academy of Sciences, Geophysical Data Bases, Processing and Instrumentation, 438 (P-3).

CHAPTERS

Odzimek A., et al., 2021, Ocena aktywności burzowej w latach 2012 – 2017 na lotniskach kontrolowanych na terenie Polski na podstawie zobrażeń satelitarnych meteosat w produktach overshooting tops, In: Wykorzystanie technik nawigacyjnych w lotnictwie. Część 1, Lotnicza Akademia Wojskowa, pp. 187 - 200.

Salzano R., et al., **Kępski D.**, Luks B., 2021, Terrestrial photography applications on snow cover in Svalbard (PASSES), In: SESS report 2020: The State of Environmental Science in Svalbard – an annual report, Svalbard Integrated Arctic Earth Observing System (SIOS), pp. 236 - 251.