

UNIVERSITY OF PATRAS

SCHOOL OF SCIENCE

DEPARTMENT OF PHYSICS

LABORATORY OF ATMOSPHERIC PHYSICS

Activity Report 2018

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Ioannis Kioutsioukis

March 2019

Patras, Greece



Laboratory of Atmospheric Physics of the University of Patras¹

Activity Report 2018

Note of the Head of the LAPUP

Dear friends and colleagues,

This report provides an overview of our activities for the year 2018. This year in LAPUP could be characterized by significant increase in personnel and new projects. We had the chance to start new EU and national projects, renew our facilities and build up a new group of bright young minds to work closely with us. Moreover, we had the pleasure to accept new BSc and MSc students and communicate all the hot topics in atmospheric sciences as well as to set up activities beyond the academic sector, to the real world.

We are really indebted to all of them for bringing fresh air and new dynamics in LAPUP and we are looking forward to report progress, innovation and enjoy atmospheric physics in 2019!

Patras, March 30, 2019

Associate Professor Andreas Kazantzidis

¹ Your comments are more than welcome and can be addressed to akaza@upatras.gr
You can follow our activities via the following links:

- LAPUP's Web Page: www.atmosphere-upatras.gr
- The LAPUP on Facebook: <https://www.facebook.com/455557894536561>
- The LAPUP on YouTube: <https://www.youtube.com/channel/UCqMUy30C-U8IEPEebxkzJHQ>

Staff

Faculty Members

- Athanassios A. Argiriou, Physicist (University of Patras), D.E.A. (I.N.P. Grenoble) - Ph.D. (Univ. Aix-Marseille 1), Professor (2006 -).
- Andreas Kazantzidis, Physicist, M.Sc., Ph.D. (Aristotle University of Thessaloniki), Associate Professor (2015 -).
- Ioannis Kioutsioukis, Physicist, M.Sc. (Aristotle University of Thessaloniki), Ph.D. (Aristotle University of Thessaloniki, Joint Research Centre Ispra), Assistant Professor (2016 -).

Postgraduate Researchers

- Salamalikis Vasileios, Physicist, M.Sc., Ph.D University of Patras (Stable isotopes in atmospheric processes).

Graduate Students

Ph.D. Candidates

- Kolokythas Constantinos, Hellenic Air Force - Meteorologist, M.Sc. in Environmental Sciences, University of Patras. Thesis topic: Wind energy forecast – Topography and extreme weather events impact.
- Panagopoulos – Kontostavakis Orestis, Physicist, M.Sc. in Green Energy (University of Patras). Thesis topic: Experimental study and modelling of the Urban Heat Island in Patras.
- Roukounakis Nikolaos, MEng Chemical Engineering, University of Birmingham, MSc Environmental Technology, Imperial College London. Thesis topic: The application of a high-resolution weather forecasting model for estimating GPS tropospheric delay over complex terrain.
- Ioannis Vamvakas, Physicist, M.Sc. Energy & Environment, M.Sc. Applied Meteorology & Environmental Physics, University of Patras. Thesis topic: Cloud and aerosol effects on solar irradiance.
- Geogre Kosmopoulos, Physicist, M.Sc. Energy & Environment, University of Patras Thesis topic: Effect of atmospheric constituents on solar irradiance.

Research Associates

- Kanakaris Ioannis, Informatics for Business Planning Engineer (Technical Educational Institute of Patras), M.Sc. in Accounting (Price Waterhouse Coopers S.A.)

Teaching Activities

During the reporting period, the LAPUP faculty taught the following undergraduate and graduate courses:

Undergraduate Programs

- Atmospheric Physics I - Meteorology (7th semester, Dept. of Physics, University of Patras)
- Atmospheric Physics II (8th semester, Dept. of Physics, University of Patras)
- Atmospheric Pollution (7th semester, Dept. of Physics, University of Patras)
- Calculus (1st semester, Dept. of Physics, University of Patras)
- Differential Equations (2nd semester, Dept. of Physics, University of Patras)
- Introduction to Environmental Physics (5th semester, Dept. of Physics, University of Patras)
- Dynamical Systems (7th semester, Dept. of Physics, University of Patras)
- Meteorology – Climatology (7th semester, Dept. of Geology, University of Patras)
- Atmospheric Physics I-Meteorology I (7th semester, Dept. of Mathematics, University of Patras)
- Atmospheric Physics II-Meteorology II (8th semester, Dept. of Mathematics, University of Patras)
- Physics Laboratory II (Mechanics – Fluid Mechanics) (2nd semester, Dept. of Physics, University of Patras)
- Physics Laboratory III (Thermodynamics – Waves - Optics) (3rd semester, Dept. of Physics, University of Patras)
- Physics Laboratory IV (Electromagnetism) (4th semester, Dept. of Physics, University of Patras)
- Renewable Energies Laboratory (8th semester, Dept. of Physics, University of Patras)
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Graduate Programs

Graduate Program on Applied Meteorology and Environmental Physics

- Dynamic and Synoptic Meteorology (1st semester)
- Radiation and Atmosphere (1st semester)
- Measurements and Data Processing in Atmospheric Sciences (1st semester)
- Energy Meteorology (2nd semester)
- Statistical Methods in Atmospheric Sciences (2nd semester)
- Atmospheric Modelling (2nd semester)

Graduate Program on Energy & Environment, Department of Physics, University of Patras

- Dynamic Meteorology (1st semester)
- Environmental Physics (1st semester)
- Radiation and Atmosphere (1st semester)
- Atmospheric modeling (2nd semester)
- Energy Meteorology (2nd semester)

Interdisciplinary Graduate Program on Environmental Sciences, University of Patras

- Environmental Physics (1st Semester)
- Meteorological Sensors (2nd Semester)

Interdisciplinary Graduate Program on Electronics and Information Processing, University of Patras

- Meteorological Sensors (2nd Semester)
- Geophysical – Atmospheric Signals and Remote Sensing (2nd Semester)

Interdisciplinary Graduate Program on Distributed green electricity and advanced network infrastructure management and economy, University of Patras

- Integrated Modelling (1st semester)
- Energy Meteorology (2nd semester)

Theses

Ph.D. Theses

- Elissavet Galanaki, Study of lightning and thunderstorm climatology in the Mediterranean area, February 2018 (<http://hdl.handle.net/10889/11342>). Supervisor: A. Argiriou.

- Emmanuel Proestakis, Remote sensing from space for depicting the aerosol connection with atmospheric electricity, February 2018 (<http://hdl.handle.net/10889/11825>). Supervisor: A. Kazantzidis.

- Panagiotis Tzoumanikas, Digital image processing techniques for atmospheric constituents detection and evaluation, February 2018 (<https://www.didaktorika.gr/eadd/handle/10442/42789>). Supervisor: A. Kazantzidis.

M.Sc. Theses

- Markantonis Jason, Development of a geostatistical model for the calculation of the mean climatic temperature in Greece, September 2018. Supervisor: A. Argiriou.

- Kampouris Emmanouil, Assessment of precipitable water effect on direct normal irradiance across the globe, September 2018. Supervisor: A. Kazantzidis.

- Kampouris Emmanouil, Assessment of precipitable water effect on direct normal irradiance across the globe, September 2018. Supervisor: A. Kazantzidis.

- Apostolopoulou Catherine, Solar resource methodologies and typical climatological averages, April 2018. Supervisor: A. Kazantzidis.

Research Activities

The main research axes of the LAPUP include:

- Measurements, quality control, processing and homogenization of meteorological and environmental time series.
- Stable isotopes ($\delta^{18}\text{O}$ & $\delta^2\text{H}$, nitrogen isotopes) in rain and in atmospheric water vapor.
- Ultraviolet radiation: Measurements, modeling and biological dose rates.
- Solar Radiation: Measurements, modeling and solar energy.
- Energy meteorology.
- Artificial intelligence methods applied to atmospheric and environmental physics problems.
- Chemical Weather forecasting.
- Atmospheric Modeling, Ensemble Forecasting, and Predictability.
- Uncertainty propagation and Sensitivity analysis of model output.
- Modeling Environment and Vector-borne Disease Interaction.

In the frame of the above research axes, the LAPUP carried out a number of research projects that led to a series of publications in international scientific journals and conferences.

On-going research projects

- Aerosol and cloud effects on solar irradiance, Hellenic Foundation for Research & Innovation, 11/2017-7/2019.
- Solar Resource for High Penetration and Large Scale Applications, International Energy Agency - Photovoltaic Power Systems Program Task 16, 7/2017 – 6/2020.
- Solar Collectors with Static Concentrators, for solar thermal applications at intermediate to medium temperatures - SCoSCo (Bilateral cooperation between Greece and Germany), 5/2018 – 4/2020.
- Global Monitoring of Nitrogen Isotopes in Atmospheric Waters (International Atomic Energy Agency Coordinated Research Project F32008 – Contract #22879/R0), 6/2018 – 5/2021.
- PatrasAir: Set-up and monitoring of the air quality in the metropolitan area of Patras (patrasair.gr). Self-funded project.
- UHI: Set-up and monitoring of the urban heat island effect in the metropolitan area of Patras (patrasair.gr). Self-funded project.
- AQMEII (phase III): Air Quality Model Evaluation International Initiative
- Modeling Environment and Vector-borne Disease Interaction. Self-funded project.
- Middle East – North Africa Hybrid Solar System (HYMENSO), ERANETMED Renewable Energies, 1/11/2016 – 30/4/2019 (www.hymenso.eu).

- Towards an innovative strategy for skills development and capacity building in the space geo-information sector supporting Copernicus user uptake, H2020 Erasmus+, 1/1/2018 – 31/12/2021 (www.eo4geo.eu)
- Panhellenic infrastructure for atmospheric composition and climate change, GSRT 1/9/2018 – 31/8/2021.

Publications in peer-reviewed journals

- Droutsas, K.G., Balaras, C.A, Daskalaki, E.G., Kontoyiannidis, S., Argiriou, A.A. (2018) Energy use intensities for asset rating of Hellenic non-residential buildings. *Glob. J. Energ. Technol. Res. Updat.* 15, 19-36 (<http://www.avantipublishers.com/downloads/gjetruv5a3/>).
- Im U, Brandt J, Geels C, Hansen KM, Christensen JH, Andersen MS, Solazzo E, Kioutsioukis I, Alyuz U, Balzarini A, Baro R, Bellasio R, Bianconi R, Bieser J, Colette A, Curci G, Farrow A, Flemming J, Fraser A, Jimenez-Guerrero P, Kitwiroon N, Liang CK, Nopmongkol U, Pirovano G, Pozzoli L, Prank M, Rose R, Sokhi R, Tuccella P, Unal A, Vivanco MG, West J, Yarwood G, Hogrefe C, Galmarini S, Assessment and economic valuation of air pollution impacts on human health over Europe and the United States as calculated by a multi-model ensemble in the framework of AQMEII3, *Atmospheric Chemistry and Physics*, 18: 5967-5989, 2018.
- Astitha M, Kioutsioukis I, Fisseha GA, Bianconi R, Bieser J, Christensen JH, Cooper OR, Galmarini S, Hogrefe C, Im U, Johnson B, Liu P, Nopmongkol U, Petropavlovskikh I, Solazzo E, Tarasick DW, and Yarwood G, Seasonal ozone vertical profiles over North America using the AQMEII3 group of air quality models: model inter-comparison and stratospheric intrusions, *Atmospheric Chemistry and Physics*, 18: 13925-13945, 2018.
- Galmarini S, Kioutsioukis I, Solazzo E, Alyuz U, Balzarini A, Bellasio R, Benedictow AMK, Bianconi R, Bieser J, Brandt J, Christensen JH, Colette A, Curci G, Davila Y, Dong X, Flemming J, Francis X, Fraser A, Fu J, Henze DK, Hogrefe C, Im U, Garcia Vivanco M, Jiménez-Guerrero P, Jonson JE, Kitwiroon N, Manders A, Mathur R, Palacios-Peña L, Pirovano G, Pozzoli L, Prank M, Schultz M, Sokhi RS, Sudo K, Tuccella P, Takemura T, Sekiya T and Unal A, Two-scale multi-model ensemble: is a hybrid ensemble of opportunity telling us more?, *Atmospheric Chemistry and Physics*, 18: 8727-8744, 2018.
- Webb A.R., A. Kazantzidis, R.C. Kift, M.D. Farrar, J. Wilkinson, L.E. Rhodes. "Colour Counts: Sunlight and Skin Type as Drivers of Vitamin D Deficiency at UK Latitudes", *Nutrients* 10, 457; doi:10.3390/nu10040457, 2018.
- Kuhn P. , M. Wirtz, N. Killius, S. Wilbert, J.L. Bosch, N. Hanrieder, B. Nouri, J. Kleissl, L. Ramirez, M. Schroedter-Homscheidt, D. Heinemann, A. Kazantzidis, P. Blanc, R. Pitz-Paal. "Benchmarking three low-cost, low-maintenance cloud height measurement systems and ECMWF cloud heights against a ceilometer", *Solar Energy*, 168, 140–152, 2018.

- Webb A.R., A. Kazantzidis, R.C. Kift, M.D. Farrar, J. Wilkinson, L.E. Rhodes, “Meeting Vitamin D Requirements in White Caucasians at UK Latitudes: Providing a Choice”, *Nutrients*, 497; doi:10.3390/nu10040497, 2018.
- Oikonomou S., A. Kazantzidis, G. Economou, S. Fotopoulos, “A local binary pattern classification approach for cloud types derived from all-sky imagers” *International Journal of Remote Sensing*, doi: 10.1080/01431161.2018.1530807, 2018.

Presentations in peer-reviewed international conferences

- Kolokythas K., Argiriou, A A, Investigating the impact of the length of the input datasets in wind speed time series forecasting. 14th International Conference on Meteorology, Climatology and Atmospheric Physics COMECAP 2018, Alexandroupolis, Greece, 15 – 17 October, 2018.
- Salamalikis V, Argiriou A A, Dotsika E, From atmosphere to cave: a simplified isotope – stalagmite model for climate reconstruction applications. 14th International Conference on Meteorology, Climatology and Atmospheric Physics COMECAP 2018, Alexandroupolis, Greece, 15 – 17 October, 2018.

Argiriou A A, Panagopoulos O, Urban heat island effect in Patras, Greece. Preliminary results. 14th International Conference on Meteorology, Climatology and Atmospheric Physics COMECAP 2018, Alexandroupolis, Greece, 15 – 17 October, 2018.

- Kioutsioukis I and Stilianakis N, “Mathematical modelling of the temperature dependent WNV transmission: model evaluation and sensitivity analysis”, 14th International Conference on Meteorology, Climatology and Physics of the Atmosphere, 14-16 October 2018, Alexandroupolis, Greece.
- Astitha M, I Kioutsoukis, GA Fisseha, R Bianconi, J Bieser, JH Christensen, O Cooper, S Galmarini, C Hogrefe, U Im, B Johnson, P Liu, U Nopmongcol, I Petropavlovskikh, E Solazzo, DW Tarasick, G Yarwood (2018) “Seasonal ozone vertical profiles over North America using the AQMEII group of air quality models: model inter-comparison and stratospheric intrusions”, 36th International Technical Meetings (ITM) on Air Pollution Modelling and its Application, Ottawa (Canada) 14-18 May 2018.
- Im U, J Brandt, C Geels, K Hansen, J Christensen, M Andersen, E Solazzo, I Kioutsioukis, U Alyuz, A Balzarini, R Baro, R Bellasio, R Bianconi, J Bieser, A Colette, G Curci, A Farrow, J Flemming, A Fraser, P Jimenez-Guerrero, N Kitwiroon, C Liang, G Pirovano, L Pozzoli, M Prank, R Rose, R Sokhi, P Tuccella, A Unal, M Garcia Vivanco, J West, G Yarwood, C

Hogrefe, S Galmarini. Multi-model assessment of air pollution-related premature mortality in Europe and U.S.: Domestic vs. foreign contributions. ITM 2018 - 36th International Technical Meeting on Air Pollution Modelling and its Application, Ottawa, CANADA, May 14 - 18, 2018.

- Galmarini S, I Kioutsioukis, E Solazzo. “Two-scale multi-model ensemble. Is a hybrid ensemble of opportunity telling us more?” ITM 2018 - 36th International Technical Meeting on Air Pollution Modelling and its Application, Ottawa, CANADA, May 14 - 18, 2018.

Organization of Conferences and Workshops

- World Meteorology Day event, March 23rd, 2018, University of Patras Conference Center.
- Workshop on assessing the skills shortages, gaps and mismatches between supply and (future) demand for Copernicus Program, December 4th, 2018, EO4GEO project.

Dissemination activities

- Sailing Meteorology – A free course offered for the students of the sailing schools of the Sailing Club of Patras (IOP).
- Guided visits in the Lab for high school students.
- Weather forecasts and extreme weather event analyses for the local news media.
- Seminar on climate change at the TITAN cement manufacturing plant in the frame of the World Environment Day (June 5, 2018).
- Visit in the Lab of the graduate students from the Department of Geography, University of Essen
- Seminar on climate change at the TITAN cement manufacturing plant in the frame of the World Environment Day
- In collaboration with the Navarino Environmental Observatory, two café-NEO (science café) events were organized in Patra. At the first meeting, in November 21st, the attendees had the chance to discuss with Professor Athanasios Argiriou, Department of Physics, University of Patras, topics related to past climate variability, future projections for climate change and ways to mitigate the impacts and adapt to future conditions. During the second meeting, the focus was on “Plastics and microplastics and their impact on the environment and health”, with invited speaker Associate Professor Hrisi Karapanagioti, Department of Chemistry, University of Patras.



Invited talks

- “New perspectives for observation of the atmosphere and solar energy forecasting using digital images of the sky vault, 17th Panhellenic Conference of the Greek Physical Association, 15-18 / 3/2018, Thessaloniki.

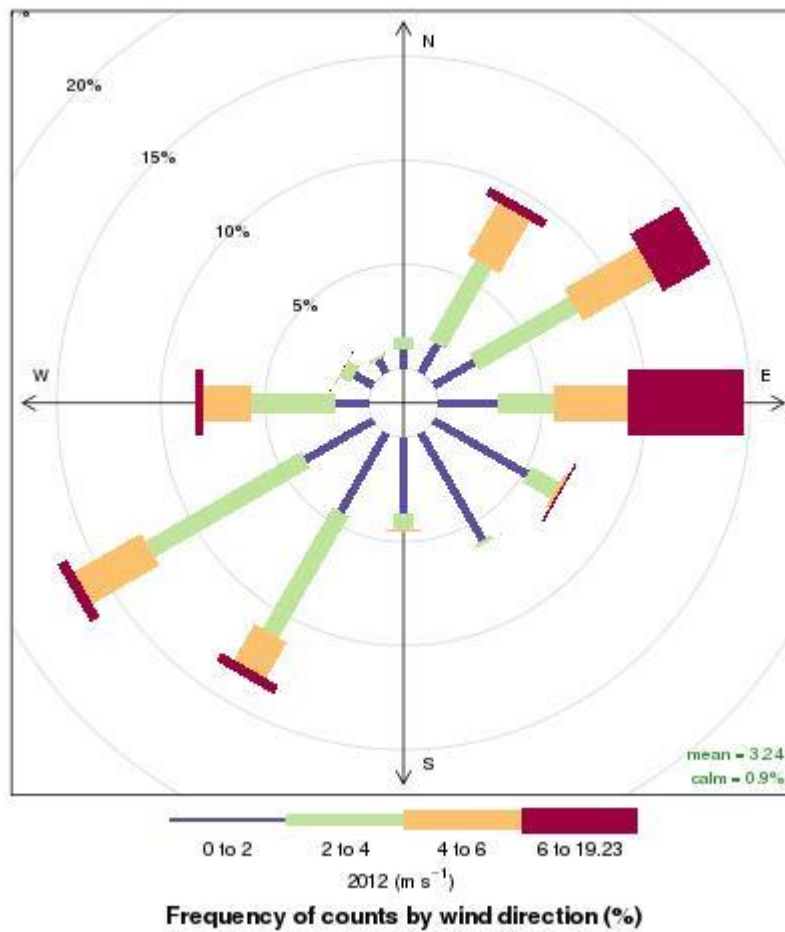
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Weather Bulletin

Summary

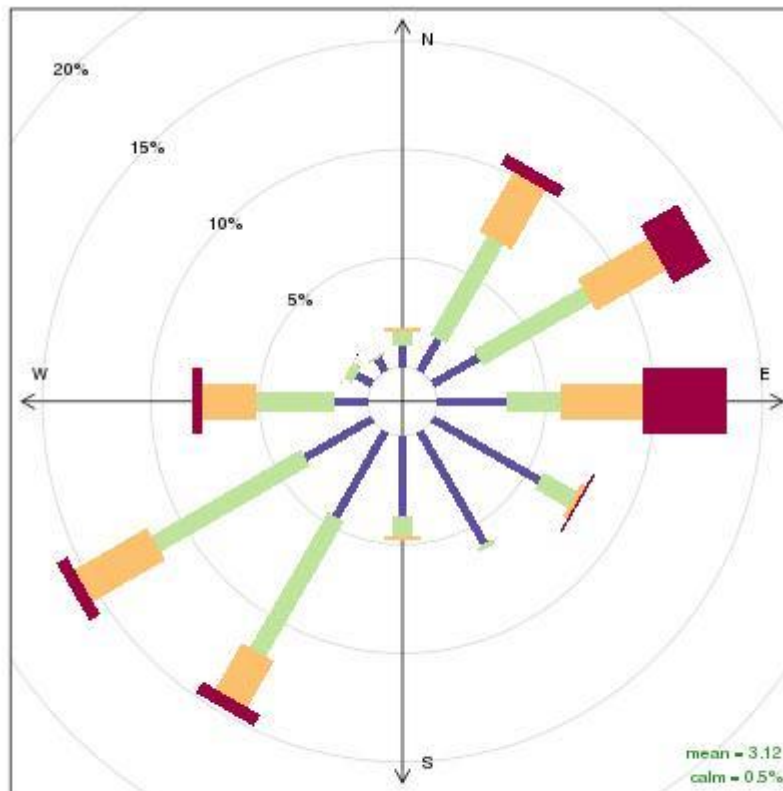
| 2012 | Min | Max | Annual Average (Total for precipitation) |
|--------------------------------|------|-----------|---|
| T (°C) | -0.1 | 38.4 | 17.9 |
| RH (%) | 8.5 | 91.3 | 61.5 |
| WV [gust] (m.s ⁻¹) | | 19.2 [30] | |
| RF (mm) | | | 1 182.8 |
| p (hPa) | 978 | 1027 | 1009 |

T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at 24.78 m)



| 2013 | Min | Max | Annual Average (Total for precipitation) |
|--------------------------------|-----|-----------|---|
| T (°C) | 0.4 | 35.7 | 17.7 |
| RH (%) | 5 | 91.3 | 62.4 |
| WV [gust] (m.s ⁻¹) | | 19.2 [30] | |
| RF (mm) | | | 958.6 |
| p (hPa) | 985 | 1029 | 1008 |

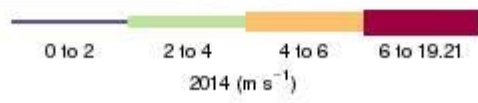
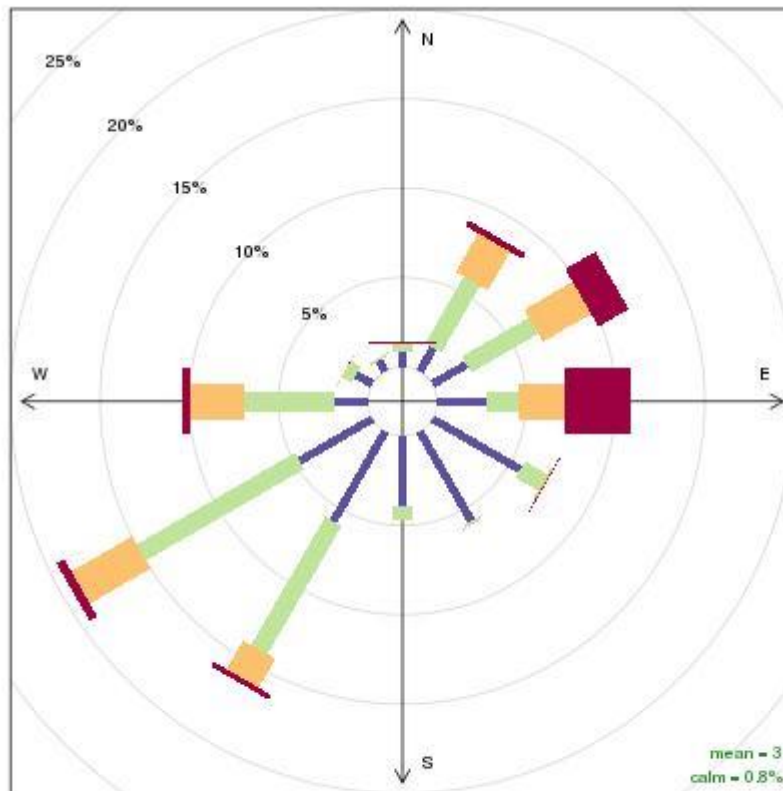
T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at 24.78 m)



0 to 2 2 to 4 4 to 6 6 to 19.21
2013 (m s⁻¹)
Frequency of counts by wind direction (%)

| 2014 | Min | Max | Annual Average (Total for precipitation) |
|--------------------------------|-----|-----------|---|
| T (°C) | 3.2 | 35.8 | 17.3 |
| RH (%) | 9.4 | 91.2 | 68.1 |
| WV [gust] (m.s ⁻¹) | | 19.2 [30] | |
| RF (mm) | | | 976.6 |
| p (hPa) | 989 | 1023 | 1009 |

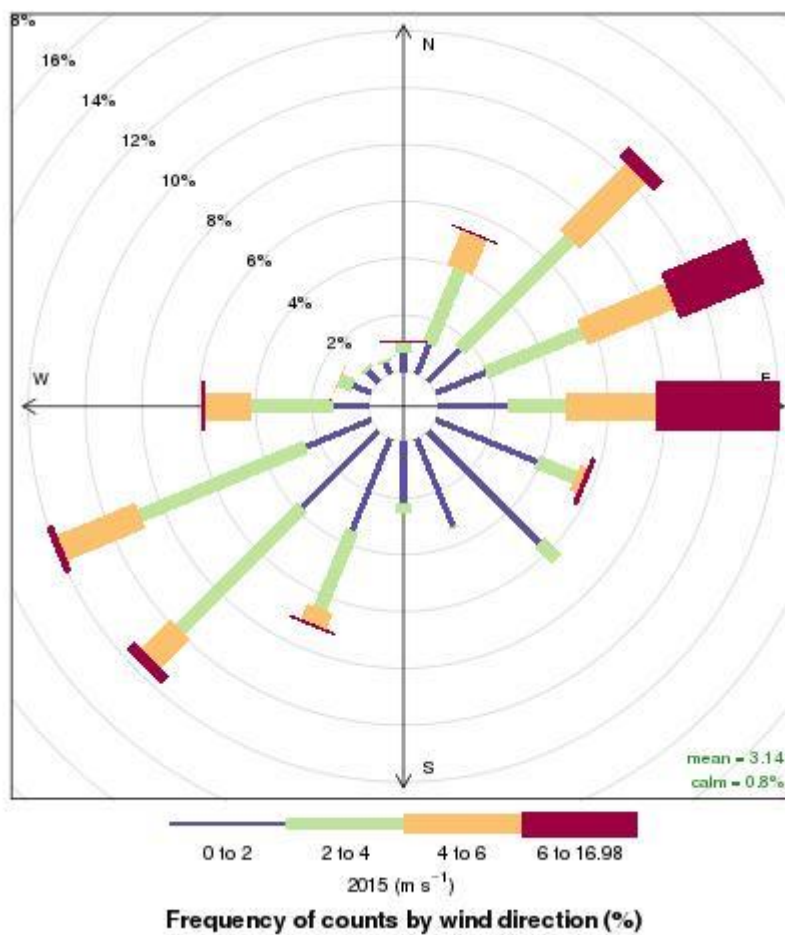
T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at m.s.l.h.)



Frequency of counts by wind direction (%)

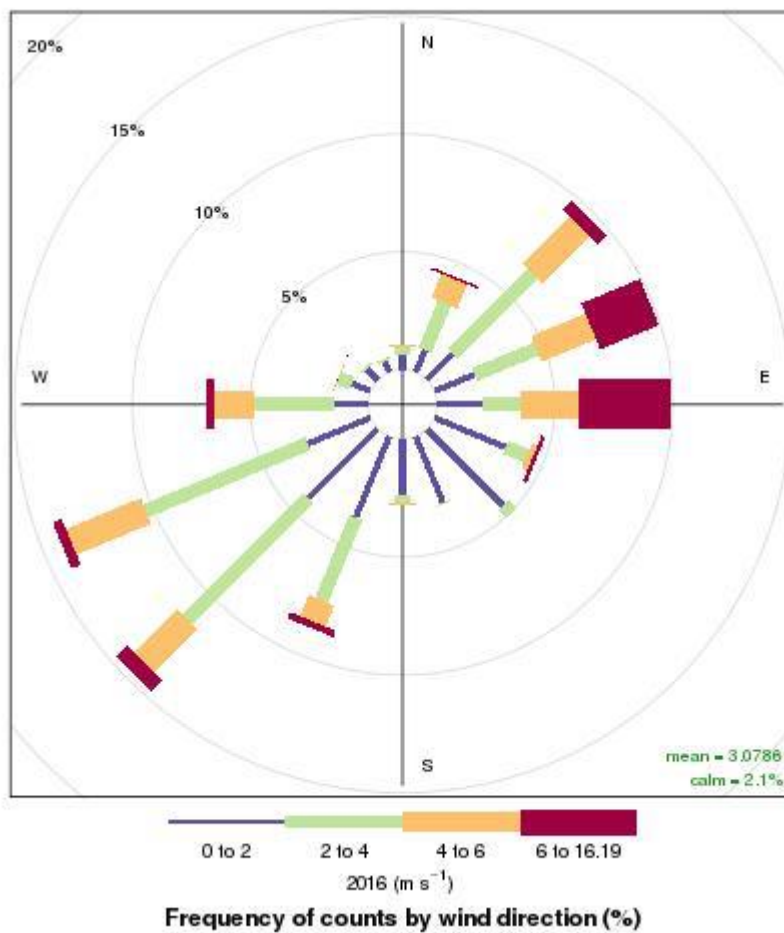
| 2015 | Min | Max | Annual Average (Total for precipitation) |
|--------------------------------|------|---------|---|
| T (°C) | -0.5 | 37.9 | 18.2 |
| RH (%) | 5.8 | 97.7 | 63 |
| WV [gust] (m.s ⁻¹) | | 17 [53] | |
| RF (mm) | | | 803.6 |
| p (hPa) | 987 | 1030 | 1010 |

T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at 24.78 m)



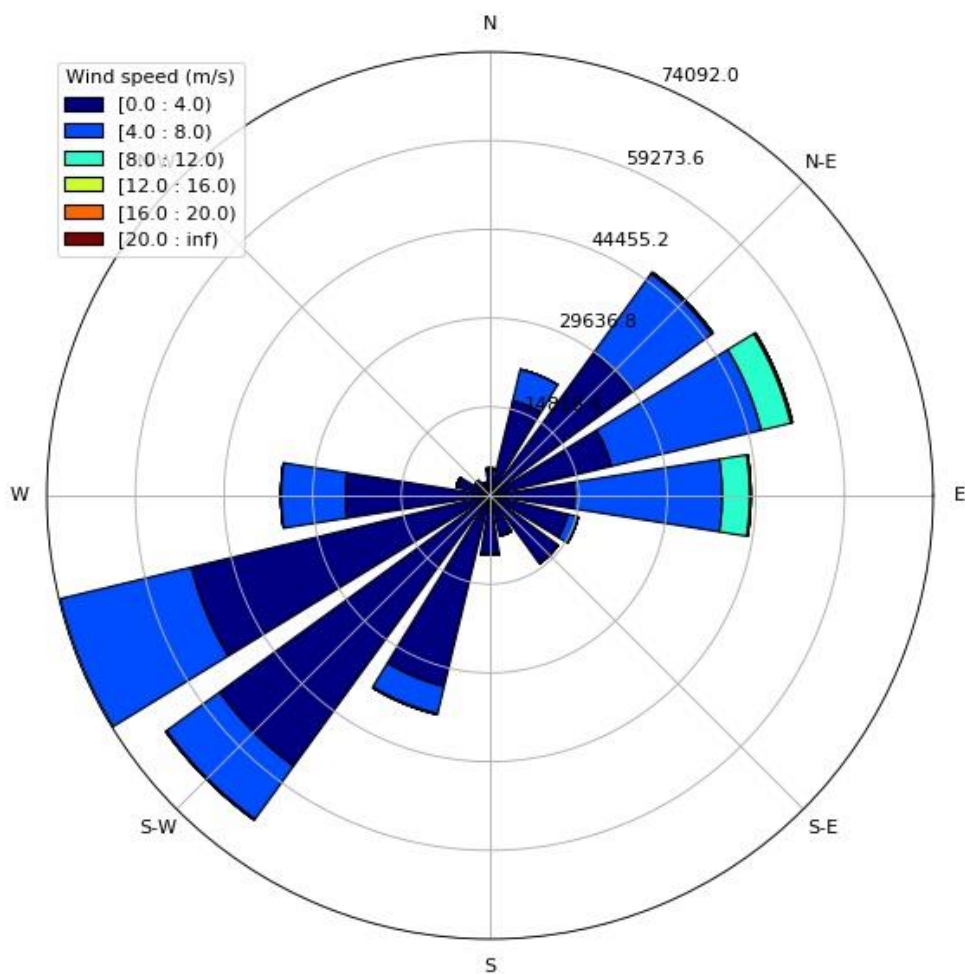
| 2016 | Min | Max | Annual Average (Total for precipitation) |
|--------------------------------|--------|---------|---|
| T (°C) | 1.0(4) | 38.8 | 19.2 |
| RH (%) | 11.73 | 97.7 | 64 |
| WV [gust] (m.s ⁻¹) | | 17 [53] | |
| RF (mm) | | | 772.4 |
| p (hPa) | 990 | 1029 | 1010 |

T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at 24.78 m)



| 2017 | Min | Max | Annual Average (Total for precipitation) |
|---------|------|------|---|
| T (°C) | -1.2 | 40.4 | 18.1 |
| RH (%) | 9.15 | 97.7 | 62.7 |
| RF (mm) | | | 813.0 |
| p (hPa) | 978 | 1026 | 1010.3 |

T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at 24.78 m)



| 2018 | Min | Max | Annual Average (Total for precipitation) |
|---------|-----|------|---|
| T (°C) | 2.5 | 35.4 | 18.7 |
| RH (%) | 7.5 | 97.7 | 64.9 |
| RF (mm) | | | 809.8 |
| p (hPa) | 987 | 1026 | 1008.6 |

T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at 24.78 m)

