UNIVERSITY OF PATRAS

SCHOOL OF SCIENCE

DEPARTMENT OF PHYSICS

LABORATORY OF ATMOSPHERIC PHYSICS

Activity Report 2016

Athanassios A. Argiriou, Andreas Kazantzidis, Ioannis Kioutsioukis

March 2017

Patras, Greece

Laboratory of Atmospheric Physics of the University of Patras[1]

Activity Report 2016

Note of the Head of the LAPUP

This is the fourth issue of the Activity Report of the Laboratory of Atmospheric Physics of the University of Patras, for the year 2016. It is also the last issue I'm editing as Head of the Lab.

These ten years, since 2006 when I was nominated in this position by the Department of Physics, were quite tedious; we inherited a Lab, unknown both in homeland and, of course abroad, with dilapidated infrastructure, practically zero personnel and zero research activity. Today, the Lab has another two professors, selected by merit of their CVs and skills, its research infrastructure has been developed - it operates a weather station and a radiometric station both fully equipped, issues daily weather forecasts on an operational basis, has completed successfully an important number of national and international research projects, has one of the highest publication and citation rates of the Department of Physics, its graduate students pursue remarkable careers in Greece and abroad. Our latest achievement is that the Lab runs on its own, a new M.Sc. degree on Applied Meteorology and Environmental Physics. Today the Laboratory of Atmospheric Physics belongs in the constellation of research groups of excellence in atmospheric physics, meteorology and climatology in Greece and abroad.

My main contribution to all the above, was not the numerous work ours I invested, but the selection of an excellent crew – based solely on academic criteria, namely, Professors Andreas Kazantzidis and Ioannis Kioutsioukis; both were (and still are) involved into the effort of developing the LAPUP as much as I am; I would like to thank them sincerely for the remarkable job they are doing. I would also like to thank Dr. Vasileios Salamalikis, a former student of mine and now a postgraduate researcher at the LAPUP, who worked closely and supported me and the Lab since the very first day of this ten-year period.

My experience taught me that for a research team to maintain its momentum and to advance, needs to be directed by someone having a deep knowledge of the respective scientific field, but also to have modern and pertinent ideas and to be enthusiastic to put them in practice. Therefore, after this ten-year period, I considered necessary to step back and nominate as new Head of the LAPUP, Associate Professor Andreas Kazantzidis, a

[1] Your comments are more than welcome and can be addressed to athanarg@upatras.gr
You can follow our activities via the following links:
Laboratory Web Page: www.atmoshpere-upatras.gr
LAPUP weather forecast page: www.weather.upatras.gr
The LAPUP on Facebook:
https://www.facebook.com/LaboratoryOfAtmosphericPhysicsUniversityOfPatras

scientist assuming all these qualities. With him at the helm, I am sure that the next ten years of the LAPUP, will be even more successful!

Patras, February 26, 2017

Professor Athanassios A. Argiriou

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 - 2016).
- 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., University of Patras (Stable isotopes in atmospheric processes).

Graduate Students

Ph.D. Candidates

- Galanaki Elissavet, Physicist, M.Sc. in Environmental Physics & Meteorology, National & Kapodistrian University of Athens, (Climatology of lightning activity in Greece).
- Kolokythas Constantinos, Hellenic Air Force - Meteorologist, M.Sc. in Environmental Sciences, University of Patras (Wind energy forecast – Topography and extreme weather events impact).
- Proestakis Manolis, Physicist, M.Sc. in Environmental Physics, University of Bremen (Study of the indirect effect of aerosols in clouds using ground and satellite measurements).
- Roukounakis Nikolaos, MEng Chemical Engineering, University of Birmingham, MSc Environmental Technology, Imperial College London (The application of a high-resolution weather forecasting model for estimating GPS tropospheric delay over complex terrain).
- Tzoumanikas Panayiotis, Computer and Informatics Engineer, M.Sc., University of Patras, (Estimation of atmospheric parameters using digital image processing).
- Ioannis Vamvakas, Physicist – M.Sc., University of Patras (Cloud and aerosol effects on solar irradiance).
- Geogre Kosmopoulos, Physicist – M.Sc. University of Patras (Effect of atmospheric constituents on solar irradiance).
- Elias Dimadis, Matematician (University of Patras), M.Sc. (University of Piraeus) (Homogenization of Atmospheric Time Series).

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 (7nth semester, Dept. of Physics, University of Patras)
- Atmospheric Physics II (8th semester, Dept. of Physics, University of Patras)
- Atmospheric Pollution (7nth 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)
- Meteorology – Climatology (7nt semester, Dept. of Geology, 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) (4rht semester, Dept. of Physics, University of Patras)

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)
- Atmospheric modeling (1st semester)
- Radiation and Atmosphere (1st 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

- Energy Meteorology (2nd semester)

Theses

Ph.D. Theses

Salamalikis Vasileios, Behavior of stable isotopes (D – ^{18}O) in atmospheric processes, February 2016. (http://hdl.handle.net/10889/9539) .

M.Sc. Theses

Kosmpopoulos Georgios, Aerosol optical depth effect on direct solar irradiance : evaluation from measurements and forecasting capability, 2016 (http://hdl.handle.net/10889/9981) .

Vamvakas Ioannis, The study of enhancements events of solar irradiance with the using of models, measurements and digital images of sky dome, 2016 (http://hdl.handle.net/10889/9978) .

Research Activities

The main research axes of the LAPUP include:

- Measurements, quality control, processing and homogenization of meteorological and environmental time series.
- Stable isotopes (δ^{18}O & δ^{2}H) 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 Modelling, Ensemble Forecasting, and Predictability.
- Uncertainty propagation and Sensitivity analysis of model output.
- Modelling 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

- Direct Normal Irradiance Nowcasting methods for optimized operation of concentrating solar technologies (DNICast), FP7-Energy project, 10/2013 – 9/2017.
- Air Quality Model Evaluation International Initiative (AQMEII), 2011-2016.

Publications in peer-reviewed journals

1. Recent trend analysis of mean air temperature in Greece based on homogenized data, A. Mamara, A.A. Argiriou, M. Anadranistakis, Theor. Appl. Climatol., 126:543-573, 2016.

2. Energy efficiency of PV panels under real outdoor conditions–An experimental assessment in Athens, Greece, Gaglia A.G., Lykoudis S., Argiriou A.A., Balaras C.A., Dialynas E., Renewable Energy, 101:236-243, 2016.

3. Lightning activity in the Mediterranean: quantification of cyclones contribution and relation to their intensity, E. Galanaki, Flaounas E., V. Kotroni, K. Lagouvardos, A. Argiriou, Atmospheric Science Letters, 17(9):510-516, 2016.

4. The effect of clouds on surface solar irradiance, based on data from an all-sky imaging system, P. Tzoumanikas, E. Nikitidou, A.F. Bais, A. Kazantzidis, Renewable Energy, 95, 314-322, 2016.

5. Lightning activities and aerosols in the Mediterranean region, E. Proestakis, S. Kazadzis, K. Lagouvardos, V. Kotroni, A. Kazantzidis, Atmospheric Research, 170,66-75, 2016.

6. Periodicity analysis of $d^{18}O$ in precipitation over Central Europe: Time–frequency considerations of the isotopic 'temperature' effect, V. Salamalikis, A.A. Argiriou, E. Dotsika, Journal of Hydrology, 534:150-163, 2016.

7. Isotopic modeling of the sub-cloud evaporation effect in precipitation, V. Salamalikis, A. A. Argiriou, E. Dotsika, Science of the Total Environment, 544:1059-1072, 2016.

8. Evaluation of WRF shortwave radiation parameterizations in predicting Global Horizontal Irradiance in Greece, Melina-Maria Zempila, Theodore M. Giannaros, Alkiviadis Bais, Dimitris Melas, Andreas Kazantzidis, Renewable Energy, 86,831-840, 2016.

9. High resolution WRF ensemble forecasting for irrigation: Multi-variable evaluation, Ioannis Kioutsioukis, Alexander de Meij, Hermann Jakobs, Eleni Katragkou, Jean-Francois Vinuesa, Andreas Kazantzidis, Atmospheric Research, 167/156-174, 2016.

10. Insights into the deterministic skill of air quality ensembles from the analysis of AQMEII data, Kioutsioukis I, Im U, Solazzo E, Bianconi R, Badia A, Balzarini A, Baró

R, Bellasio R, Brunner D, Chemel C, Curci G, Van Der Gon HD, Flemming J, Forkel R, Giordano L, Jiménez-Guerrero P, Hirtl M, Jorba O, Manders-Groot A, Neal L, Pérez JL, Pirovano G, San Jose R, Savage N, Schroder W, Sokhi RS, Syrakov D, Tuccella P, Werhahn J, Wolke R, Hogrefe C, Galmarini S, Atmospheric Chemistry and Physics, 16: 15629-15652, 2016.

11. Aerosol and lightning activity: the effect of vertical profile and aerosol type, E. Proestakis, S. Kazadzis, K. Lagouvardos, V. Kotroni, V. Amiridis, E. Marinou, C. Price, A. Kazantzidis, Atmospheric Research, 182, 243-255, 2016.

12. Seasonal Changes in Vitamin D-Effective UVB availability in Europe and associations with population serum 25-hydrovitamin D, CM O'Neill, A. Kazantzidis, MJ Ryan, N. Barber, CT Sempos, RA Durazo-Arvizu, R. Jorde, G. Grimmes, G. Eiriksdottir, V. Gudnason, MF Cotch, M. Kiely, AR Webb, KD Kashman, Nutrients, 8, 533, 2016.

13. A predictive model of serum 25-hydroxyvitamin D in UK white as well as black and Asian minority ethnic population groups for application in food fortification strategy development towards vitamin D deficiency prevention, C.M O' Neill, A. Kazantzidis, M. Kiely, l. Cox, S. Meadows, G. Goldberg, A. Prentice, R. Kift, AR Webb, K.D. Cashman, Journal of Steroid Biochemistry & Molecular Biology, http://dx.doi.org/10.1016/j.jsbmb.2016.09.010, 2016.

Presentations in peer-reviewed international conferences

- Argiriou A A, Salamalikis V, E. Dotsika, A total weighted least squares method for the determination of the Meteoric Water Line in precipitation for hydrological purposes. 13th International Conference on Meteorology, Climatology, and Atmospheric Physics COMECAP 2016, Thessaloniki, Greece, 19 – 21 September, 2016.
- Kolokythas K., A A Argiriou, Filling missing data in target-point wind speed time series. 13th International Conference on Meteorology, Climatology, and Atmospheric Physics COMECAP 2016, Thessaloniki, Greece, 19 – 21 September, 2016.
- Anadranistakis M, A Mamara, A A Argiriou, Spatial analysis of the air temperature in Greece for the Normal Period 1971-2000. 13th International Conference on Meteorology, Climatology, and Atmospheric Physics COMECAP 2016, Thessaloniki, Greece, 19 – 21 September, 2016.
- Mamara A, A A Argiriou, M Anadranistakis, Homogenization of Precipitation Series in Greece. 13th International Conference on Meteorology, Climatology, and Atmospheric Physics COMECAP 2016, Thessaloniki, Greece, 19 – 21 September, 2016.
- Kioutsioukis I, "Towards predictability limit: advancing the deterministic skill of ensembles", T Karakostas, A Bais and P Nastos (eds.), Perspectivess on Atmospheric Sciences, Springer Atmospheric Sciences, 00 87-92, 2016.
- Galmarini S, Solazzo E, Im U, Kioutsioukis I "AQMEII 1, 2 and 3: Direct and Indirect Benefits of Community Model Evaluation Exercises", D Steyn and N Chaumerliac

(eds.), Air Pollution Modeling and its Application XXIV. Series: Springer Proceedings in Complexity, pp 471-475, 2016.

- Kioutsioukis I, Galmarini S "*De praeceptis ferendis*: air quality multi-model ensembles", DG Steyn and N Chaumerliac (eds.), Air Pollution Modeling and its Application XXIV. Series: Springer Proceedings in Complexity, pp 553-556, 2016.
- *Predictive model of white and dark-sknned population serum 25-hydroxyvitamin D for application in strategy development for vitamin D deficiency prevention, C. O' Neil, M. Kiely, R. Kift, A. Kazantzidis, A.R. Webb, K.D. Cashman, The 19th Workshop on Vitamin D, 29-31/3/2016, Boston, MA, USA.*
- *Validation and application of a database of solar UV availability across Europe, A.R. Webb, A. Kazantzidis, A. Smedley, R. Kift, J. Rimmer, J. Berry, I. Fountoulakis, T. Koskela, L.E. Rhodes, International Radiation Symposium (IRS) 2016, 16/4 – 22/4/2016, Auckland, New Zealand.*
- *New Challenges in Solar Energy Resource and Forecasting at Different Temporal and Spatial Scales, A. Kazantzidis, E. Nikitidou, P. Tzoumanikas, V. Salamalikis, M.C. Kotti, A. Zagouras, 5th International Conference on Renewable Energy Sources & Energy Efficiency, 5-6 May 2016, Nicosia, Cyprus.*
- *Solar resource and forecasting needs in liaison with DNICast project in Plataforma Solar de Almeria, A. Kazantzidis, CAMS 1st General Assembly, 14-16/6/2016, Athens, Greece.*
- *A WebGIS Application for Cloud Storm Monitoring, S. Kolios, D. Loukadakis, C. Stylios, A. Kazantzidis, A. Petunin, International Baltic Conference on Databases and Information Systems(DB&IS), 4-6 July 2016, Riga, Latvia.*
- *Climatological maps of solar energy in Greec from the Hellenic Network of Solar Energy, P. Tzoumanikas, E. Nikitidou, V. Salamalikis, AF Bais, A. Kazantzidis, Proceedings of COMECAP 2016, 19-21/9/2016, Thessaloniki, Greece, Perspectives in Atmospheric Sciences, pp 713-718, Springer Atmospheric Sciences, TS Karakostas et al (eds.), 2017.*
- *Aerosol optical properties retrieval from surface radiation measurements, G. Kosmopoulos, A. Kazantzidis, Proceedings of COMECAP 2016, 19-21/9/2016, Thessaloniki, Greece, Perspectives in Atmospheric Sciences, pp 775-780, Springer Atmospheric Sciences, TS Karakostas et al (eds.), 2017.*
- *The effect of clouds on surface solar irradiance from an all-sky camera in Thessaloniki, Greece, E. Nikitidou, P. Tzoumanikas, AF Bais, A. Kazantzidis, Proceedings of COMECAP 2016, 19-21/9/2016, Thessaloniki, Greece, Perspectives in Atmospheric Sciences, pp 1157-1162, Springer Atmospheric Sciences, TS Karakostas et al (eds.), 2017.*
- *On the atmospheric water vapour effect on direct normal irradiance under clear skies, E. Kampouris, V. Salamaliks, A. Kazantzidis, Proceedings of COMECAP 2016, 19-21/9/2016, Thessaloniki, Greece, Perspectives in Atmospheric Sciences, pp 1163-1168, Springer Atmospheric Sciences, TS Karakostas et al (eds.), 2017.*
- *On the enhancement of solar irradiance due to the presence of clouds at Patras. Greece, I. Vamvakas, A. Kazantzidis, Proceedings of COMECAP 2016, 19-21/9/2016, Thessaloniki, Greece, Perspectives in Atmospheric Sciences, pp 1169-1174, Springer Atmospheric Sciences, TS Karakostas et al (eds.), 2017.*
- *All-sky imager: a new instrument for the estimation pf solar irradiance, cloudiness and aerosol optical properties, A. Kazantzidis, P. Tzoumanikas, E. Nikitidou, V.*

Salamalikis, Proceedings of COMECAP 2016, 19-21/9/2016, Thessaloniki, Greece, Perspectives in Atmospheric Sciences, pp 1175-1180, Springer Atmospheric Sciences, TS Karakostas et al (eds.), 2017.

- *The effect of cloudiness on global, direct and diffuse solar irradiance at a typical site of Eastern Mediterranean: what satellite instruments and climate models cannot usually estimate, I. Vamvakas, A. Kazantzidis, MedCLIVAR Conference 2016, 26-30/9/2016, Athens, Greece*
- *Evaluation of enhancement events of solar irradiance due to the presence of clouds at Patras (Eastern Mediterranean), I. Vamvakas, A. Kazantzidis, SolarPACES Conference 2016, October 11-14, 2016, Abu Dhabi, United Arab Emirates.*
- *Application of Simple All-sky Imagers for the Estimation of Aerosol Optical Depth, A. Kazantzidis, P. Tzoumanikas, E. Nikitidou, V. Salamalikis, S. Wilbert, C. Prahl, SolarPACES Conference 2016, October 11-14, 2016, Abu Dhabi, United Arab Emirates.*
- *Short-term forecasting of high resolution local DNI maps with multiple fish-eye cameras in stereoscopic mode, P. Blanc , P. Massip , A. Kazantzidis , P. Tzoumanikas, P. Kuhn , S. Wilbert , D. Schüler , C. Prahl, SolarPACES Conference 2016, October 11-14, 2016, Abu Dhabi, United Arab Emirates.*
- *Derivation and forecast of circumsolar radiation from whole-sky cameras and satellite sensors, L. Bugliaro, S. Wilbert, A. Kazantzidis, SolarPACES Conference 2016, October 11-14, 2016, Abu Dhabi, United Arab Emirates.*
- *Evaluation of Rotating Shadowband Irradiometer accuracy, L. Vuilleumier, F. Vignola, P. Blanc, J. Badosa, A. Kazantzidis, SolarPACES Conference 2016, October 11-14, 2016, Abu Dhabi, United Arab Emirates.*

Organization of Conferences and Workshops

Training course on Atmospheric Physics and Meteorology, organized by Ass. Prof. Ioannis Kioutsioukis, at the Navarino Environmental Observatory, December 13-14, 2016, Messinia, Greece.

Seminar on the “Estimation and Forecast of Solar Potential”, December 16, 2016, University of Patras, Patras, Greece.

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 for several local news media.
- Talks in events organized by local nonprofit organizations.

Invited talks

Argiriou Athanassios, “Current research trends on weather and climate: information from the atmospheric water”, keynote talk at the World Meteorology Day event, Section of Meteorology – Climatology, Department of Geology, Aristotle University of Thessaloniki, March 23, 2016, Thessaloniki, Greece.

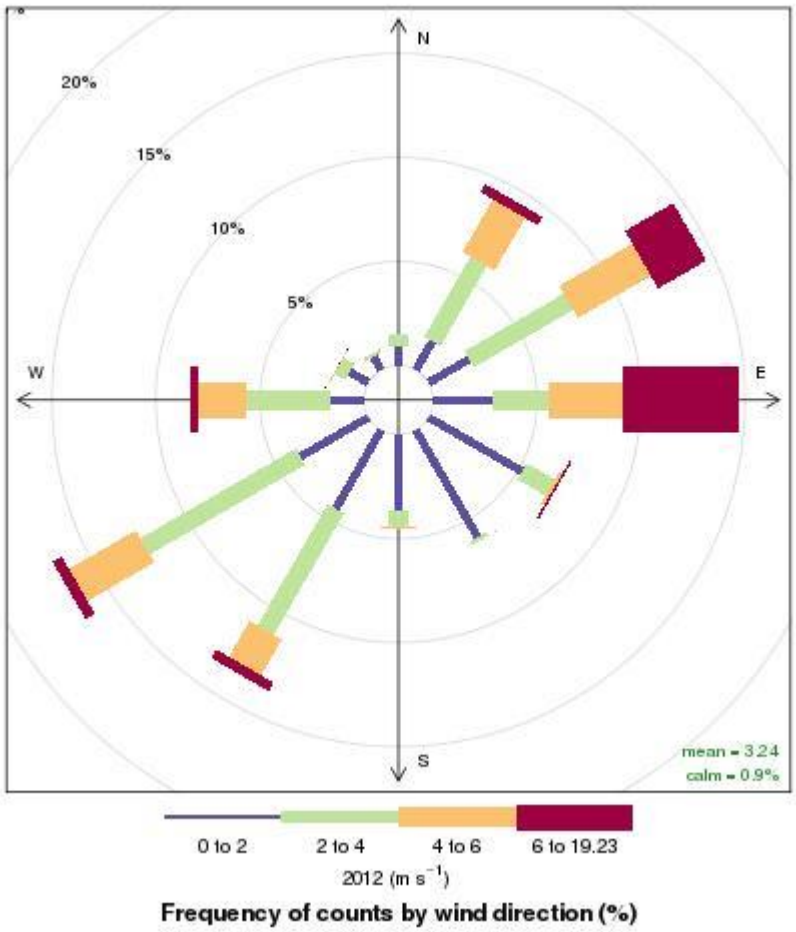
Argiriou Athanassios, “The Climate of Greece”, keynote talk at the event organized by the Hellenic National Meteorological Service, for the presentation of the first digital climate atlas of Greece, December 9th, 2016, Athens, Greece.

Weather Bulletin

Summary

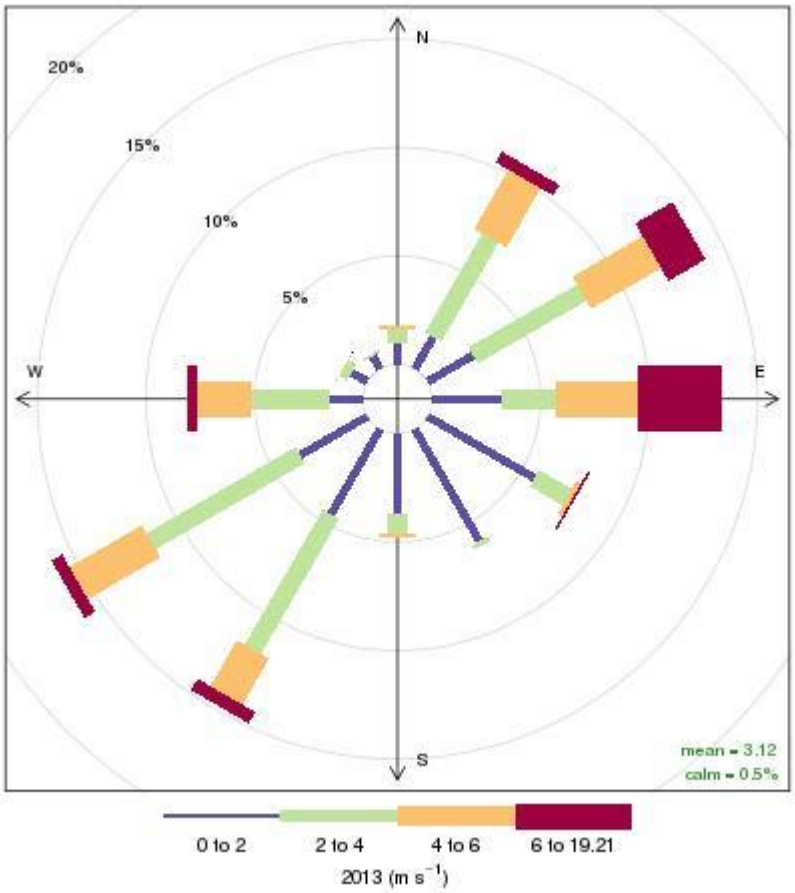
2012	Min	Max	Annual Average (Total for precipitation)
T (°C)	-0.1	38.4	17.9
RH (%)	8.5	91.3	61.5
WV [gust] ($m.s^{-1}$)		19.2 [30]	
RF (mm)			1 182.8
p (hPa)	978	1027	1009

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



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

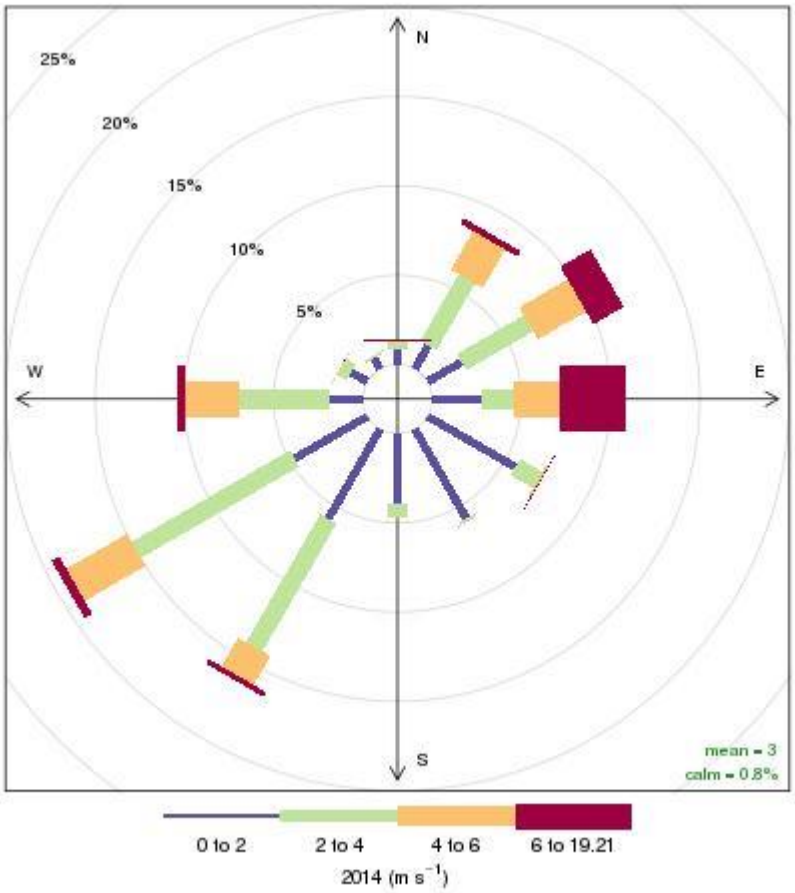
T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at m.s.l.h.)



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

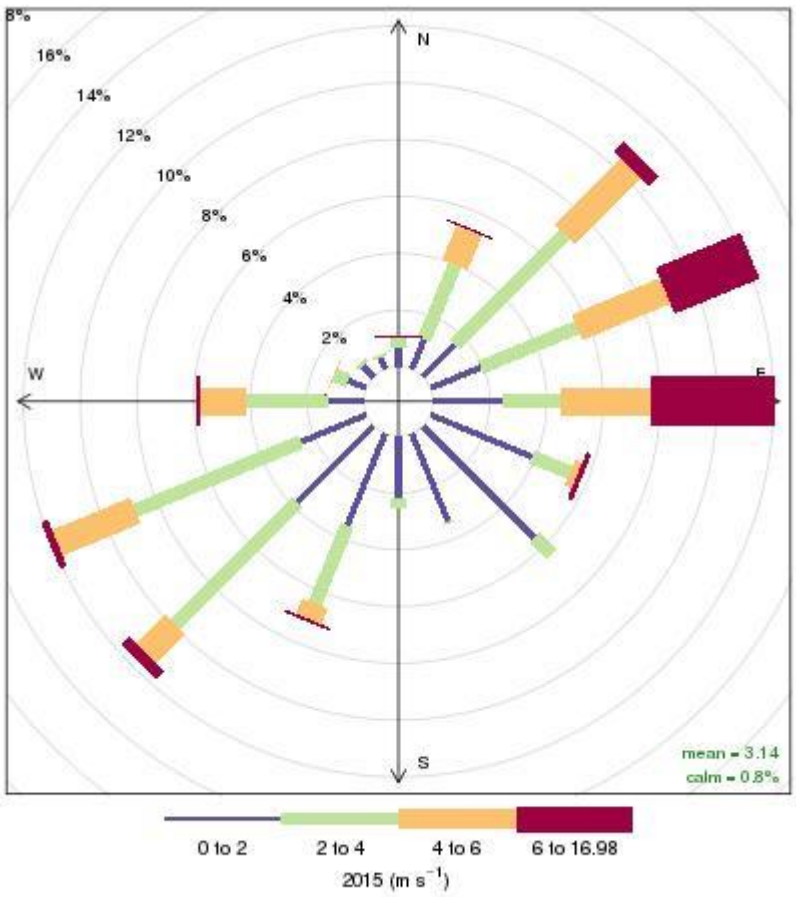
T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at m.s.l.h.)



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

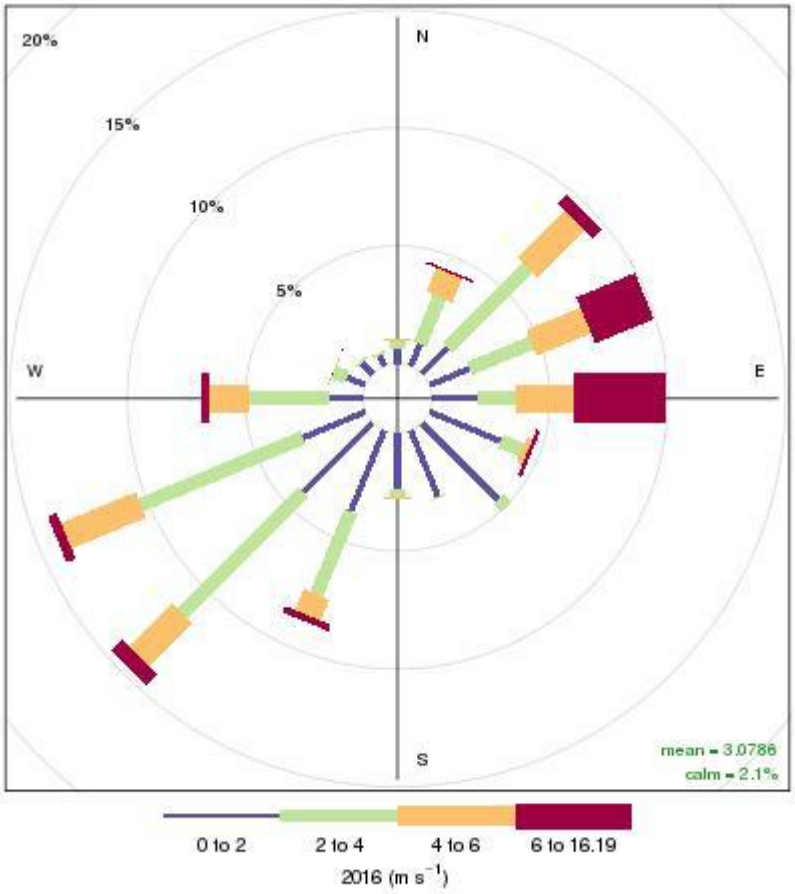
T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at m.s.l.)



Frequency of counts by wind direction (%)

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 m.s.l.)



Frequency of counts by wind direction (%)