

UNIVERSITY OF PATRAS

SCHOOL OF SCIENCE

DEPARTMENT OF PHYSICS

LABORATORY OF ATMOSPHERIC PHYSICS

Activity Report 2015

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Patras, Greece



Laboratory of Atmospheric Physics of the University of Patras

Activity Report 2015

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 2015. Starting from this issue we will be providing in this report a summary of the various weather parameters as measured at the LAPUP station (38.29° N, 21.79° E). Exceptionally in this issue, we have included data for the past years also.

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>

Staff

Faculty Members

- Athanassios A. Argiriou, Physicist (U. Patras) - D.E.A. (I.N.P. Grenoble) - Ph.D. (Univ. Aix-Marseille 1), Professor (Head of the LAPUP)
- Andreas Kazantzidis, Physicist - M.Sc. - Ph.D. (Aristotle University of Thessaloniki), Associate Professor
- Ioannis Kioutsioukis, Physicist - M.Sc. - Ph.D. (Aristotle University of Thessaloniki), Assistant Professor
- Anastasia Rapti, Physicist - Ph.D. (University of Patras), Lecturer with tenure

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)

- Kotti Maria – Christina, Physicist, University of Patras – M.Sc., National & Kapodistrian University of Athens (Use of modern techniques for solar radiation measurement and estimation for energy applications)
- Mamara Anna, Mathematician – M.Sc., University of the Aegean (Homogenization of meteorological parameters)
- 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)
- Salamalikis Vasileios, Physicist - M.Sc., University of Patras (Stable isotopes in atmospheric processes)
- Tzoumanikas Panayiotis, Computer and Informatics Engineer, M.Sc., University of Patras, (Estimation of atmospheric parameters using digital image processing)
- Varotsou Eufrosyni, Physicist, M.Sc. in Environmental Sciences, University of Patras (Study and characteristics of the urban microclimate in Patras, Greece – Urban heat island effect)

Research Associates

- Dimopoulos Spyridon, Computer Engineer, M.Sc., Ph.D. (Under contract in the frame of the ETCP MED 2007 - 2013 Program “POSEIDON”)
- Kanakaris Ioannis, Informatics for Business Planning Engineer (Under contract in the frame of the ETCP Greece – Italy 2007 -2013 Program “CESAPO” and ETCP MED 2007 - 2013 Program “POSEIDON”)
- Karagiannidis Athanassios, Physicist – M.Sc. – Ph.D. (Under contract in the frame of the ETCP Greece – Italy 2007 -2013 Program “CESAPO” and ETCP MED 2007 - 2013 Program “POSEIDON”)
- Efterpi Nikitidou, Physicist – M.Sc. – Ph.D. (Under contract in the frame of the FP7 Program “DNICast”)

Teaching Activities

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

Undergraduate Programs

- Atmospheric Physics I (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)
- Differential Equations (2nd semester, Dept. of Physics, University of Patras)
- Environmental Physics (3rd semester, Dept. of Physics, University of Patras)
- Meteorology – Climatology (7th 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) (4th semester, Dept. of Physics, University of Patras)
- Physics for Chemists (Electromagnetism – Optics) (1st semester, Dept. of Chemistry)

Graduate Programs

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

- Dynamic Meteorology (1st Semester)
- Environmental Physics (1st Semester)
- Atmospheric modeling (1st Semester)
- Radiative transfer modeling (1st 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 and Environment (1st Semester)

The diploma, M.Sc. and Ph.D. theses, presented in 2015 were:

Diploma Theses

1. Villiotis Costantinos, Study on the vertical column of water vapor over Patras and the effect on solar irradiance
2. Markantonis Iason, Climatology and assessment of risks and benefits from exposure on solar UV radiation in Europe
3. Tzavela Assimina, Calculation of evapotranspiration over the area of Patras: correlation with meteorological parameters and comparison with satellite data.
4. Avgeri Theodora, Near real-time weather forecasting: evaluation of the WRF model predictions

Ph.D. Theses

Anna Mamara, Homogenization of Hellenic climatic time series and spatial analysis of homogenized temperature data, December 2015.

(<http://hdl.handle.net/10889/9349>)

Research Activities

The main research axes of the LAPUP include:

- Measurements, quality control, processing and homogenization of meteorological and environmental time series.
- Stable isotopes ($\delta^{18}\text{O}$ & $\delta^2\text{H}$) 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.

Research projects

- Pollution monitoring of ship emissions: an integrated approach for harbors of the Adriatic basin (POSEIDON). MED Maritime Integrated Projects, 06/2014 – 05/2015, www.medmaritimeprojects.eu/section/poseidon

- Direct Normal Irradiance Nowcasting methods for optimized operation of concentrating solar technologies (DNICast), FP7-Energy project, 10/2013 – 9/2017.
- Dispersion study of air pollutants from the TITAN plant at Drepano, Achaia, 06/2015 – 11/2015.
- Air Quality Model Evaluation International Initiative (AQMEII), 2011-2016.
- Modelling Environment and Vector-borne Disease Interaction, JRC PACAR project (Policies and Atmospheric Change impacting the Arctic), 06/2015-12/2015.

Publications in peer-reviewed journals

An Integrated Predictive Model of Population Serum 25-Hydroxyvitamin D for Application in Strategy Development for Vitamin D Deficiency Prevention, Kevin D Cashman, Andreas Kazantzidis, Ann R Webb and Mairead Kiely, [The Journal of Nutrition](#), doi:10.3945/jn.115.217968, 2015.

A ten-year analysis of the cloud-to-ground lightning activity over the Eastern Mediterranean region, E. Galanaki, V. Kotroni, K. Lagouvardos, A. Argiriou,, [Atmospheric Research](#), 166(1):213-222, 2015.

A modelling approach to determine how much UV radiation is available across UK and Ireland for health risk and benefit studies, A. Kazantzidis, A. Smedley, R. Kift, J. Rimmer, J.L. Berry, L.E. Rhodes, A.R. Webb, , [Photochem. Photobiol. Sci.](#), 14, 1073-1081, 2015.

Cloud observations in Switzerland using hemispherical sky cameras, S. Wacker, J. Groebner, C. Zysset, L. Diener, P. Tzoumanikas, A. Kazantzidis, L. Vuilleumier, R. Stockli, S. Nyeki, N. Kampfer, , [Journal of Geophysical Research](#), 120(2), 695-707, 2015.

The air quality of a Mediterranean urban environment and its relation to major meteorological parameters, A. Karagiannidis, A. Poupkou, T. Giannaros, C. Giannaros, D. Melas, A. Argiriou , , [Water, Air & Soil Pollution](#), 226:2239, 2015.

Stable isotopic composition of atmospheric water vapor in Patras, Greece: A concentration weighted trajectory approach, V. Salamalikis, A.A. Argiriou, E. Dotsika , [Atmospheric Research](#), 152:93-104, 2015.

Retrieval of surface solar irradiance, based on satellite-derived cloud information, in Greece, E. Nikitidou, A. Kazantzidis, P.Tzoumanikas, V. Salamalikis, A.F. Bais, *Energy*, 90, 776-783, 2015

Identification of surface NO_x emission sources on a regional scale using OMI NO₂, Zyrichidou I, Koukouli ME, Balis D, Markakis K, Poupkou A, Katragkou E, Kioutsioukis I, Melas D, Boersma KF, van Roozendael M, [Atmospheric Environment](#), 101: 82-93, 2015.

Evaluation of operational on-line-coupled regional air quality models over Europe and North America in the context of AQMEII phase 2. Part I: Ozone, Im U, Bianconi R, Solazzo E, Kioutsioukis I, Badia A, Balzarini A, Baro R, Bellasio R, Brunner D, Chemel C, Curci G, Flemming J, Forkel R, Giordano L, Jimenez-Guerrero P, Hirtl M, Hodzic A, Honzak L, Jorba O, Knote C, Kuenen J, Makar P, Manders-Groot A, Neal L, Perez J, Pirovano G, Pouliot G, San Jose R, Savage N, Schroder W, Sokhi R, Syrakov D, Torian A, Tuccella P, Werhahn J, Wolke R, Yahya K, Zabkar R, Zhang Y, Zhang J, Hogrefe C, Galmarini S, Atmospheric Environment, 115: 404-420, 2015.

Evaluation of operational online-coupled regional air quality models over Europe and North America in the context of AQMEII phase 2. Part II: Particulate matter, Im U, Bianconi R, Solazzo E, Kioutsioukis I, Badia A, Balzarini A, Baro R, Bellasio R, Brunner D, Chemel C, Curci G, van der Gon H, Flemming J, Forkel R, Giordano L, Jimenez-Guerrero P, Hirtl M, Hodzic A, Honzak L, Jorba O, Knote C, Makar P, Manders-Groot A, Neal L, Perez J, Pirovano G, Pouliot G, San Jose R, Savage N, Schroder W, Sokhi R, Syrakov D, Torian A, Tuccella P, Wang K, Werhahn J, Wolke R, Zabkar R, Zhang Y, Zhang J, Hogrefe C, Galmarini S, Atmospheric Environment, 115: 421-441, 2015.

Presentations in peer-reviewed international conferences

1. D. Contini, A. Donateo, A. Gambaro, A. Argiriou, D. Melas, D. Cesari, A. Poupkou, A. Karagiannidis, A. Tsakis, E. Merico, R. Cesari, A. Dinoi, Impact of Ship Traffic to PM_{2.5} and Particle Number Concentrations in Three Port-Cities of the Adriatic/Ionian Area. Proc. ICAST 2015: 17th International Conference on Aerosol Science and Technology, Lisbon, Portugal, International Journal of Chemical, Nuclear, Materials and Metallurgical Engineering Vol:9, No:4, pp. 454-459, 2015.
2. D. Contini, A Gambaro, A Argiriou, A Alebic-Juretic, E Barbaro, D Cesari, S Dimopoulos, A Dinoi, A Donateo, E Gregoris, A Karagiannidis, T Ivosevic, N Liora, D Melas, E Merico, B Mifka, I Orlic, A Poupkou, and K Sarovic, Impact of maritime transport on particulate matter concentrations and chemical compositions in four port-cities of the Adriatic/Ionian area: an overview of the results of POSEIDON project. Geophysical Research Abstracts Vol. 17, EGU2015-10519, 2015 EGU General Assembly 2015.
3. A Karagiannidis, A Poupkou, N Liora, S Dimopoulos, C Giannaros, D Melas, and A Argiriou, Model study of the ship emissions impact on the air quality in the Adriatic/Ionian area. Geophysical Research Abstracts Vol. 17, EGU2015-9307, 2015 EGU General Assembly 2015.
4. N. Roukounakis, P. Elias, P. Briole, A. Argiriou, I. Kioutsoukis, A. Retalis, D. Katsanos, A. Ganas, D. Dimitrov. Improvement of the vertical component of GPS and INSAR measurements in the western Corinth Gulf (Greece), by the use of high-resolution meteorological modeling of the lower troposphere: The PaTrop Experiment. 12th

- European Conference on Applications of Meteorology (ECAM) | 07–11 September 2015 | Sofia, Bulgaria.
5. Roukounakis N, P Elias , P Briole , A Argiriou , I Kioutsioukis , A Retalis , D Katsanos, Improved estimation of the tropospheric delay component in GPS measurements in the western Corinth Gulf (Greece) by the use of a high-resolution meteorological model: The PaTrop Experiment, 9th HYMEX meeting, Mykonos, Greece, 21-25 September 2015.
 6. *Chromatic ratios in art paintings and digital pictures as a new tool in estimating aerosol optical depths*, C.S. Zerefos, A. Kazantzidis & co-authors, **Volcanos, Climate, and Society, Bicentenary of the Great Tambora Eruption**, 7-10/4/2015, Bern, Switzerland.
 7. *Estimation of aerosol optical properties from all-sky imagers*, A. Kazantzidis, P. Tzoumanikas, V. Salamalakis, S. Wilbert, C. Prah, **EGU General Assembly 2015**, Vol. 17, EGU2015-11654, 12-17/4/2015, Wien, Austria.
 8. *Comparison of Artificial Neural Networks and ARIMA statistical models in simulations of target wind time series*, K. Kolokythas, V. Salamalakis, A. Argiriou, A. Kazantzidis, **EGU General Assembly 2015**, Vol. 17, EGU2015-11326, 12-17/4/2015, Wien, Austria.
 9. *Lightning activity and aerosols over the Mediterranean*, E. Proestakis, S. Kazadzis, V. Kotroni, K. Lagouvardos, A. Kazantzidis, **EGU General Assembly 2015**, Vol. 17, EGU2015-2126, 12-17/4/2015, Wien, Austria.
 10. *Determination of aerosols and clouds from all-sky images for the estimation and forecasting of solar irradiance*, A. Kazantzidis, **VII Atmospheric Sciences Symposium**, April 28-30th 2015, Istanbul, Turkey.
 11. *A database of solar UV availability across Europe*, A. Kazantzidis, A. Smedley, R. Kift, J. Rimmer, J. Berry, I. Fountoulakis, T. Koskela, L.E. Rhodes, A.R. Webb, **European Society of Photobiology 2015 Congress**, 21/8 – 4/9/2015, Aveiro, Portugal.
 12. *CIE, Vitamin D and DNA damage: A synergetic study in Thessaloniki, Greece*, M. M. Zempila, I. Fountoulakis, A. Bais, M. Taylor, M. E. Koukouli, C. Meleti, N. Kouremeti, S. Kazadzis, D. Balis, A. Kazantzidis, **European Society of Photobiology 2015 Congress**, 21/8 – 4/9/2015, Aveiro, Portugal.
 13. *AQMEII 1, 2 and 3: Direct and Indirect Benefits of Community Model Evaluation Exercises*, Galmarini S, Solazzo E, Im U, Kioutsioukis I, *Air Pollution Modeling and its Application XXIV*. Series: Springer Proceedings in Complexity 2015.
 14. *De praeceptis ferendis: air quality multi-model ensembles*, Kioutsioukis I, Galmarini S *Air Pollution Modeling and its Application XXIV*. Series: Springer Proceedings in Complexity 2015.

Organization of Conferences and Workshops

- POSEIDON MED project close-out meeting, Patras, Greece, May, 2015

Dissemination activities

- Sailing Meteorology – A free course offered for the students of the sailing schools of the Sailing Club of Patras (IOP).
- Organized visits in the Lab for high school students.
- Weather forecasts for several local media.

Invited talks

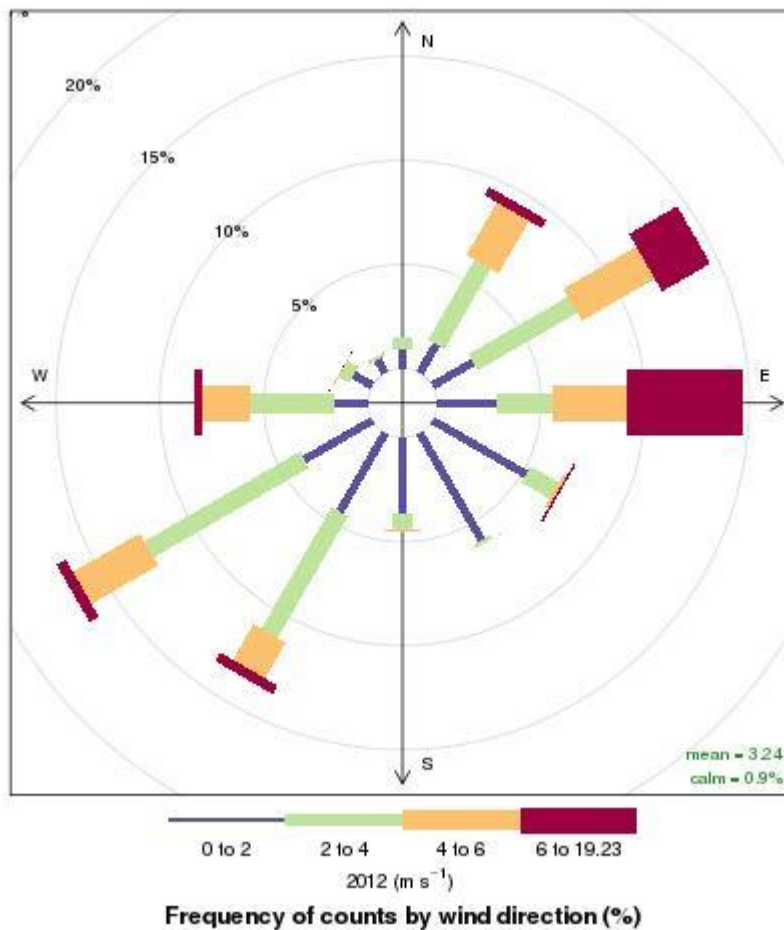
1. Andreas Kazantzidis, Determination of aerosols and clouds from all-sky images for the estimation and forecasting of solar irradiance, VII Atmospheric Sciences Symposium, April 28-30th 2015, Istanbul, Turkey.
2. Andreas Kazantzidis, Solar energy resource and forecasting, Conference on “Green Procurement and Smart City Support in the Energy Sector (GRASP)”, May 28-29th 2015, Patras, Greece.

Weather Bulletin

Summary

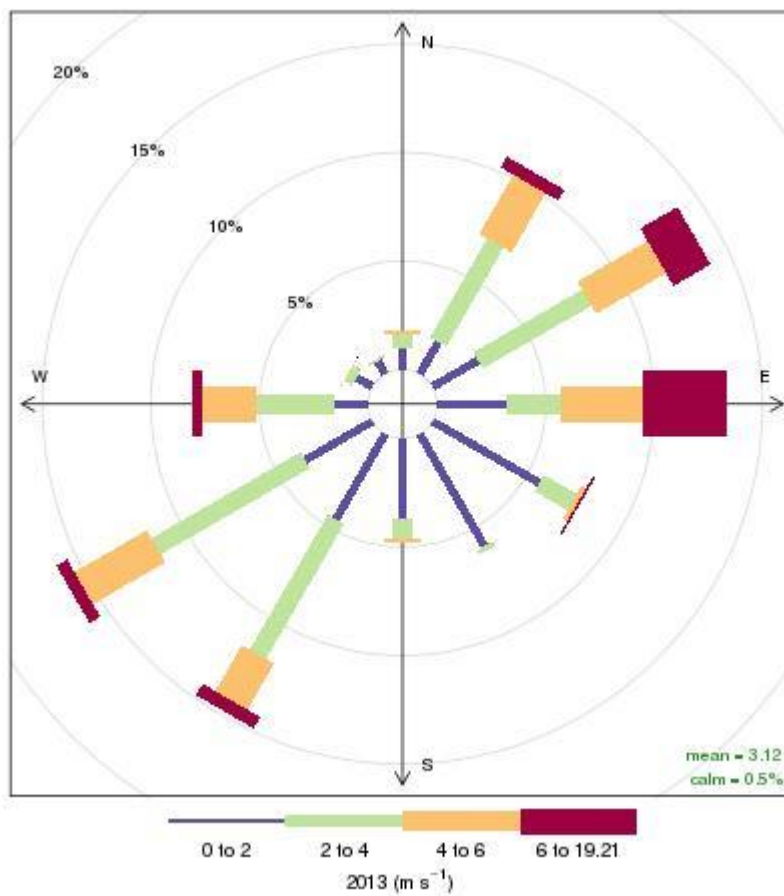
2012	Min	Max	Annual Average (Total for precipitation)
T (°C)	-0.1	38.4	17.9
RH (%)	8.5	91.3	61.5
WV [gust] (m.s ⁻¹)		19.2 [30]	
RF (mm)			1 182.8
p (hPa)	978	1027	1009

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

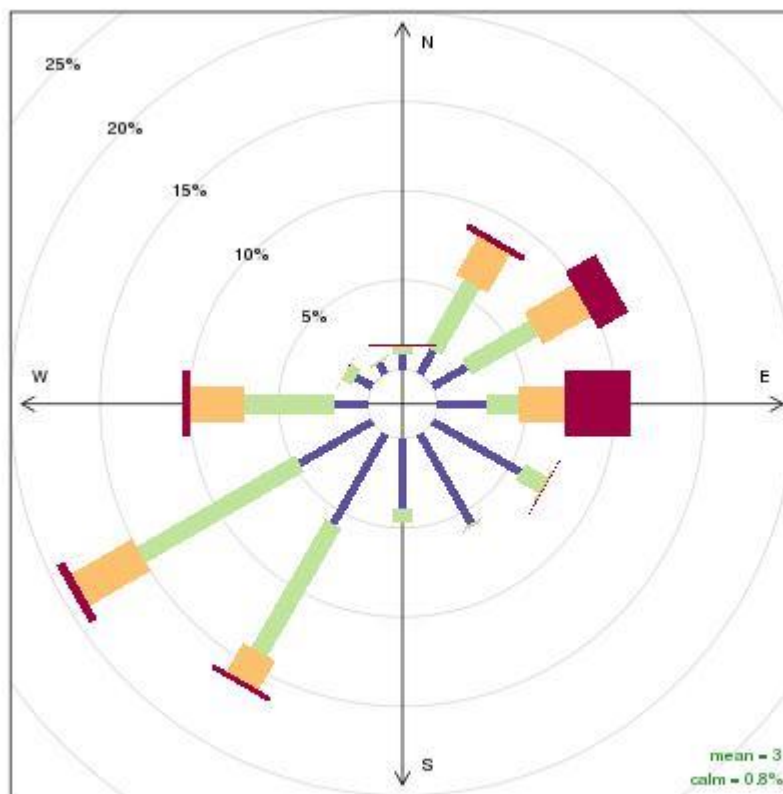
T: air temperature, RH: relative humidity, RF: precipitation, p (pressure at m.s.l.h.)



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.)



0 to 2 2 to 4 4 to 6 6 to 19.21
2014 (m s⁻¹)
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.)

