Designação do Projeto|	WEx-Atlantic: Weather Extremes in the Euro Atlantic Region - Assessment and Impacts
Código do Projeto|	LISBOA-01-0145-FEDER-029233-NORTE-01-0145-FEDER-029233-PTDC/CTA-MET/29233/2017
Objetivo Principal|	Reforçar a investigação, o desenvolvimento tecnológico e a inovação
Região de Intervenção|	Lisboa, Norte
Entidade Beneficiária|	FCiências.ID – Associação para a Investigação e Desenvolvimento de Ciências; Instituto de Engenharia de Sistemas e Computadores, Tecnologia e Ciências e Universidade de Trás-os-Montes e Alto Douro
Data de Aprovação|	14-05-2018
Data de Início|	20-07-2018
Data de Conclusão|	19-07-2022
Custo Total Elegível|	239.989,95€
Apoio Financeiro da União Europeia|	FEDER – 114.609,01€
Apoio Financeiro Público Nacional/ Regional|	OE – 125.380,94€

Objetivos

Weather extremes have recently gained great importance to the general public and policy makers, partly as a consequence of the large number of weather driven hazardous events occurring worldwide [1] in the last decade, namely in Europe that has been struck by record breaking extreme events with unprecedented socioeconomic impacts, including outstanding costly windstorms such as Klaus in 2009 [2] or Xynthia in 2010 [3], extreme precipitation and major flood events in the UK in 2007 and 2014, the Iberian Peninsula (IP) in 2009 [4] or Madeira Island in 2010 [5], 2007 heatwaves in Europe [6,7] and 2010 in Russia [8,9], the large droughts in southern Europe in 2005 [10,11] and 2012 [12,13]. Despite being major sources of natural hazards and having dramatic impacts on local and national populations, environment and economies, the processes involved in extremes intensification and generation of disastrous impacts, such as flash flooding, are not fully understood yet.

Therefore the main goal of WEx-Atlantic consortium is to perform research, to improve knowledge on weather extremes in the North Atlantic European sector and to communicate it to society. Considered extremes are mainly strong winds and heavy hydrometeorological (HM) events associated with extratropical cyclones, frontal systems and atmospheric rivers. WEx-Atlantic project will contribute to improve our understanding on the assessment of weather systems, the underlying physical mechanisms, variability and expected changes under global warming, as well as meteorological, environmental (e.g. forest) and socioeconomic (e.g. renewable wind energy and power grid) impacts on Portugal including the Macaronesia Islands.
WEx-Atlantic project will apply state-of-the-art techniques to detect and track weather systems, including AR [27-31], mid-latitude systems [22-26] and weather types [45,46] to different reanalyses datasets as well as to the last generation of GCMs available. Likewise, the project will rely on the accumulated experience of IDL team on multivariable impact analysis of extreme events. Another vital goal of WEx-Atlantic is the development of a 4D visualization and integration e-science tool to promote and facilitate climate research in service to society, while contributing to support "capacity building", including education and training of scientists to better translate scientific information into "actionable" usable information.WEx-Atlantic is a consortium between FCiências.ID, INESC TEC and UTAD.

Atividades

1. Project management
2. Storms' catalogues
3. Wind damage to forests
4. Impacts on power transmission grid
5. Storms' 4D visualization and integration e-tool
6. Mid-latitude storms' Dynamics
7. Storms' regional modelling
8. Future scenarios and risk assessment
9. International final workshop and dissemination

Resultados Esperados / Atingidos

« Resultados Esperados / Atingidos »

The scientific goals of WEx-Atlantic were fully achieved. The expected output indicators were not only attained but some of them exceeded the values initially indicated, as is the case of papers in international journals, with 25 publications (during the timeframe of the project) in recognized (JCR) international journals (more than 50% in first quartile journals), evidencing scientific quality.

The main aim of WEx-Atlantic project was to improve the understanding on the assessment of weather systems, the underlying physical mechanisms, variability and expected changes under global warming, as well as meteorological, environmental (e.g. forest) and socioeconomic (e.g. renewable wind energy and power grid) impacts on Portugal including the Macaronesia

Islands. These objectives were fully achieved through research and the publication of, for example, the following articles, relevant also at global scale:

Hénin R., A.M. Ramos, S. Schemm, C.M. Gouveia, M.L.R. Liberato, "Assigning precipitation to mid-latitudes fronts on sub-daily scales in the North Atlantic and European sector: Climatology and trends", International Journal of Climatology, Royal Meteorological Society, Vol. 39, pp. 317-330, 2018

Ramos A.M., R.M. Trigo, R. Tomé, M.L.R. Liberato, "Impacts of Atmospheric Rivers in Extreme Precipitation on the European Macaronesian Islands", Atmosphere, MDPI, Vol. 9, Nº8, pp. 325, 2018

Reale M., M.L.R. Liberato, P. Lionello, J.G. Pinto, S. Salon, S. Ulbrich, "A Global Climatology of Explosive Cyclones using a Multi-Tracking Approach", Tellus A: Dynamic Meteorology and Oceanography Vol. 71:1, 1-19, 2019

Nieto R., D. Ciric, M. Vázquez, M. L. R. Liberato, L. Gimeno, "Contribution of the main moisture sources to precipitation during extreme peak precipitation months", Advances in Water Resources, Vol. 131, 2019

Gimeno L., M. Vázquez, J. Eiras-Barca, R. Sorí, M. Stojanovic, I. Algarra, R. Nieto, A.M. Ramos, A. M. Durán-Quesada, F. Dominguez, “Recent progress on the sources of continental precipitation as revealed by moisture transport analysis”, Earth Science Reviews, 201, 103070; p: 1-25, 2020

Drumond, A.; Liberato, M.L.R.; Reboita, M.S.; Taschetto, A.S. "Weather and Climate Extremes: Current Developments", Atmosphere, 11(1), 24; 2020

Sorí, R., Vázquez, M., Stojanovic, M., Nieto, R., Liberato, M. L. R., and Gimeno, L., "Hydrometeorological droughts in the Miño–Limia–Sil hydrographic demarcation (northwestern Iberian Peninsula): the role of atmospheric drivers", Nat. Hazards Earth Syst. Sci., 20, 1805–1832, 2020

Stojanovic, M.; Liberato, M.L.R.; Sorí, R.; Vázquez, M.; Phan-Van, T.; Duongvan, H.; Hoang Cong, T.; Nguyen, P.N.B.; Nieto, R.; Gimeno, L., "Trends and Extremes of Drought Episodes in Vietnam Sub-Regions during 1980-2017 at Different Timescales", Water, 12(3), 813, 2020

Drumond A, Stojanovic M, Nieto R, Gimeno L, Liberato MLR, Pauliquevis T, Oliveira M, Ambrizzi T, "Dry and Wet Climate Periods over Eastern South America: Identification and Characterization through the SPEI Index", Atmosphere, 12 (2), 155, 2021

Stojanovic M., A. Gonçalves, R. Sorí, M. Vázquez, A.M. Ramos, R. Nieto, L. Gimeno, M.L.R. Liberato, “Consecutive extratropical cyclones Daniel, Elsa and Fabien and their impact on the hydrological cycle of mainland Portugal”. Water, 13 (11), 1476, 2021

Liberato M.L.R., I. Montero, C. Gouveia, A. Russo, A.M. Ramos, R.M. Trigo, “Rankings of extreme and widespread dry and wet events in the Iberian Peninsula between 1901 and 2016“. Earth Syst. Dynam., 12, 197–210, 2021

Stojanovic M., R. Nieto, M.L.R. Liberato, R. Sorí, M. Vázquez, L. Gimeno, "Tracking the origins of moisture over Vietnam: The role of moisture sources and atmospheric

drivers on seasonal hydroclimatic conditions" International Journal of Climatology, 2021

Vázquez M., R. Nieto, M.L.R. Liberato, L. Gimeno "A data base of contributions of major oceanic and terrestrial moisture sources on continental daily extreme precipitation". Data in Brief, Vol. 35, 106830, 2021

Eiras-Barca J., A. M. Ramos, I. Algarra, M. Vázquez, F. Dominguez, G. Miguez-Macho, R. Nieto, L. Gimeno, J. Taboada, F. M. Ralph, "European West Coast atmospheric rivers: A scale to characterize strength and impacts", Weather and Climate Extremes, Vol. 31, 100305, 2021

Algarra I., R. Nieto, A.M. Ramos, J. Eiras-Barca, R.M. Trigo, L. Gimeno, "Significant increase of global anomalous moisture uptake feeding landfalling Atmospheric Rivers", Nature Communications, 11: 5082, 2021

Hénin R., A.M. Ramos, G.P. Pinto, MLR. Liberato, "A ranking of concurrent precipitation and wind events for the Iberian Peninsula". International Journal of Climatology, Vol. 41(2), 1421-1437, 2021

Vázquez M., R. Nieto, M.L.R. Liberato, L. Gimeno, "Atmospheric Moisture Sources Associated with Extreme Precipitation During the Peak Precipitation Month" Weather and Climate Extremes, Vol. 30, 100289, 2021

Gonçalves A, Liberato MLR, Nieto R, Wind Energy Assessment during High-Impact Winter Storms in Southwestern Europe, Atmosphere, 12 (4), 509, 2021

Ribeiro SL, Gonçalves A, Cascarejo I, Liberato MLR, Fonseca TF, "Development of a catalogue of damage in Portuguese forest associated with extreme extratropical cyclones", Science of the Total Environment, 151948, 2022

Sori R, Nieto R, Liberato MLR, Gimeno L, "Oceanic versus terrestrial origin of El Niño Southern Oscillation–associated continental precipitation anomalies", Annals of the New York Academy of Sciences, 2021

Araújo, J.R., Ramos, A.M., Soares, P.M.M. et al. "Impact of extreme rainfall events on landslide activity in Portugal under climate change scenarios". Landslides, 2022

Kautz, L.-A., Martius, O., Pfahl, S., Pinto, J. G., Ramos, A. M., Sousa, P. M., and Woollings, T.: "Atmospheric blocking and weather extremes over the Euro-Atlantic sector – a review", Weather Clim. Dynam., 3, 305–336, 2022

O'Brien, T. A., Wehner, M. F., Payne, A. E., Shields, C. A., Rutz, J. J., Leung, L.-R., et al. "Increases in future AR count and size: Overview of the ARTMIP Tier 2 CMIP5/6 experiment". Journal of Geophysical Research: Atmospheres, 127, e2021JD036013, 2022

Rudenko R, Pires IM, Liberato M, Barroso J, Reis A. A Brief Review on 4D Weather Visualization. Sustainability. 14(9):5248, 2022

Several of these publications include international co-authorships; most of these results were presented national and internationally, with the participation of young researchers in international conferences – despite the restrictions due to the COVID-19 pandemic. Thus, the project contributed to foster the internationalization of the team.

Research was carried out for the development of a 4D visualization and integration e-science tool. The project contributed to the training of young researchers, with 1 PhD and 5 Master theses concluded:

Hénin R., "Weather extremes in a changing climate: variability, mechanisms and societal impacts", EarthSystems PhD Program, Lisbon Doctoral School on Earth System Science, Universidade de Lisboa, Supervisors: M. L. R. Liberato, A. M. Ramos, C. Gouveia (2022).

Master Thesis (RIS3):

Loureiro, S. "Análise do risco ambiental e estratégia de adaptação às alterações climáticas para as linhas elétricas aéreas implantadas em Portugal continental", Dissertação de Mestrado em Engenharia do Ambiente, Universidade de Trás-os-Montes e Alto Douro, Orientação: M. M. C. Marques & M. L. R. Liberato (2019)

Ribeiro, S. "Efeito das tempestades extremas na floresta do Norte de Portugal: avaliação de danos e orientações silvícolas para a minimização dos impactos". Dissertação de Mestrado em Engenharia Florestal, Universidade de Trás-os-Montes e Alto Douro, Orientação: T. Fonseca & M. L. R. Liberato (2020)

Ferreira, T. "Are cyclones with tropical origin a risk for Portugal?", Dissertação de Mestrado em Ciências Geofísicas - Especialização em Meteorologia e Oceanografia, Universidade de Lisboa, Orientação: A M. Ramos & J Martins (2021)

Rudenko, R. "Visualização de fenómenos meteorológicos em 4D". Dissertação de Mestrado em Engenharia Informática, Universidade de Trás-os-Montes e Alto Douro, Orientação: A. Reis & M. L. R. Liberato (2021).

Dissemination activities have been organized for different publics, including scientists, stakeholders, academy and high school students:

WEx-Atlantic Workshop at Semana da Ciência e da Tecnologia (UTAD) 25 Nov 2020 (14:30-17:30pm): open to high-school students and academy to disseminate results

Special Session (SS05) on 27th APDR Congress Sustainable Management of the Sea for Sustainable Regional Development 10-11 Sept, 2020, Angra do Heroísmo, Portugal - WEx-Atlantic dissemination results

Final WEx-Atlantic International Conference and Workshop, 5-6 July, 2022, Lisboa, Portugal