CIVIL AND ENVIRONMENTAL ENGINEERING

Arpa Piemonte - Verification of weather-climate modelling

Funded By	ARPA PIEMONTE - AGENZIA REGIONALE PROTEZIONE AMBIENTALE [P.iva/CF:07176380017]
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Context of the research activity	High-resolution weather forecasting and machine learning can predict climate change impacts in urban areas at street-level, essential for understanding urban microclimates. High-resolution weather forecasting empowers urban planners to develop resilient and sustainable cities in the face of climate change. Benefits are related to the following aspects: 1. Urban Heat Island Effect: Identify areas with higher temperatures, enabling targeted interventions like green spaces and heat-resilient infrastructure. 2. Extreme Weather Events: Improve preparedness by predicting storms, heavy rainfall, or heatwaves accurately. 3. Infrastructure Planning: Inform decision-making for climate-resilient urban systems. 4. Public Health: Anticipate and mitigate health risks associated with climate change.
Objectives	The specific objectives of the research are those included in the Arpa Piemonte collaboration with the National Civil Protection Department and the Agency's commitment in the project HIGHLANDER 2018-IT-IA-0084, Connecting Europe Facility (CEF), Telecommunications Sector. The overall objective of the research is to explore the potential of the innovative approach involvinghigh resolution weather simulations and machine learning to improve the operational services for the natural risk forecasting and prevention, with a focus on risks related to extreme weather events (heat waves, storm, etc.)in urban areas. Notably, specific objectives will be: Specific Objectives: • Validate numerical modeling by comparing outputs with high-resolution historical data series. • Develop algorithms for objective verification of numerical modeling, considering spatial and point-wise assessment. • Utilize artificial intelligence algorithms to predict street-scale ground-level air temperature based on satellite surface data, distributed citizens' network, local land use indices, urban morphology. • Develop post-processing algorithms for refining quantitative forecasts, with

	a focus on ground-level temperature (effective and perceived) and precipitation. • Study the reliability of very high-resolution modeling chains using fuzzy-type verification systems and cost/benefit methodologies. • Develop post-processing algorithms that incorporate multimodel and ensemble approaches for more accurate quantitative forecasts. • Use high-resolution numerical simulations to assess urban greening scenarios' effectiveness in mitigating climate change impacts.

Skills and competencies for the development of the activity	Physics: meteorological and climate processes, climate change scenarios Statistics: data analysis, also using machine learning technique application, weather and climate data format managing and visualization Information Technology: good knowledge of Python (the knowledge of others coding languages will be highly appreciated) and software R for meteorological and climate data processing (e.g. grib, grib2 and netcdf format reading and writing; interpolation algorithms), good knowledge of html, css, javascript and libraries for data visualization on interactive maps (e.g. leaflet) Soft skills: teamwork, problem-solving, self-time management, critical thinking, curious personality.