CIMEE'26

Theme : Materials & electrochemistry for clean energy & environmental sustainability
Online Event

September 24-26, 2026 | LEBANON

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8th International Symposium on Materials, Electrochemistry & Environment. CIMEE'26

- Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
- Laboratory of Applied Chemistry & Environment, ENSA, University of Ibn Zohr, Morocco
- Laboratory of Environmental Engineering & Ecotechnology, LGEET, ENIS, University of Sfax, Tunisia.
- Department of analytical Chemistry, Faculty of Pharmacy, Ankara University, Turkey.
- Laboratory of Electrochemistry, LEIMCR, Faculty of Technology, University of Ferhat Abbas Sétif-1, Algeria
- Faculty of Public Health, Faculty of Science, Doctoral School for Science & Technology, DSST, Lebanese University, Lebanon

June 30, 2026 – Deadline for FP and WP (Second round)

August 31, 2026 – Deadline for FP and WP (Final round)

Key elements & essential information of the session

We warmly invite you to join the CIMEE'26 – the 8th international Symposium on Materials, Electrochemistry and Environment taking place from September 24–26, 2026, in Lebanon, and accessible worldwide through an online platform. https://cimee-science.org/cimee26/ centered around the theme: "Materials and electrochemistry for clean energy and environmental sustainability", the event champions scientific dialogue and real-world application. Through advanced chemical studies and research to investigate and explore rational solutions to global and local environmental problems, new technologies are being developed to combat issues such as air, water, and soil pollution, climate change, waste, and soil contamination. Using analytical techniques and environmental fate modeling, methods for measuring and assessing pollutants released into the environment can determine the persistence time of chemical substances and their transfer through the food chain. Furthermore, new, sustainable, and safe technologies are being developed to improve the energy efficiency of electricity, natural gas, and renewable energy sources. The topics of this conference actively contribute to research aimed at identifying and developing ways to prevent, reduce, and eliminate environmental pollutants for the benefit of humans, plants, and animals. Advances in research and technology are frequently implemented in numerous fields, including industrial processes, waste treatment, and resource management. This effectively contributes to resolving global environmental challenges. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals

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Keywords: **Materials Chemistry, Electrochemistry, Environmental Analytical Chemistry, clean energy, environmental sustainability, climate change, waste, air, water, soil pollution,** resource management

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CIMEE 2026 - Call for Papers

The CMEE'26 symposium is a leading academic event that brings together researchers, scholars, and professionals to explore the critical intersections of advanced materials, Electrochemistry, sustainable energy systems, and environmental preservation. It encourages participants to share their knowledge and develop their professional skills. By creating a stimulating and interactive environment, it fosters the emergence of innovative ideas and the building of connections among participants. https://cimee-science.org/cimee26/

CMEE'26 emphasizes the crucial role of new materials, including nanomaterials, composites, and smart materials, electrochemistry, and the environment in driving innovation across various sectors and addressing global needs for energy efficiency and environmental sustainability. It showcases cutting-edge advances in renewable energy technologies, such as biomass, biowaste, hydrogen, and bioenergy, as well as energy storage and conversion systems, demonstrating how materials science and electrochemistry underpin these innovations. The conference also focuses on environmental resilience through green chemistry, water and air purification, waste management, and green technologies, with the aim of mitigating pollution and adapting to climate challenges. By fostering dialogue and collaboration across disciplines, CIMEE'26 highlights the interdependence of materials, electrochemistry, energy, and the environment, offering a holistic approach to addressing global challenges and promoting sustainable solutions.


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Scientific Sessions

1. Air Quality: from aerosol Complexity to modeling Challenges.
2. Aerosols and Air Quality: from sources to Chemical Complexity
3. Atmospheric pollution in Eastern Mediterranean region: From aerosol Complexity to modeling Challenges
4. Intelligent Remote sensing of atmospheric aerosol properties for climate modeling and air quality monitoring
5. Mitigating atmospheric hydrocarbon pollutants from initial emission to final removal: the potential role of Innovative technologies
6. Spatio-temporal models & ecological data to develop mitigation & adaptation strategies: towards supporting both ecosystem & goals of sustainable development & climate neutrality
7. Advanced artificial intelligence–based approach for atmospheric monitoring of air pollution
8. Combating climate change by using both technological innovations and nature-based solutions
9. Carbon-climate connection monitoring: the potential role of Remote sensing
10. Electrochemical Carbon Dioxide Reduction Reaction (CO2RR) as a crucial bridge toward a sustainable, circular carbon economy

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Air Quality: from aerosol Complexity to modeling Challenges

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Keywords: aerosol complexity, Organic aerosol, Secondary Aerosol Formation, capture aerosol-planetary boundary layer, volatile, semi-volatile, non-volatile organic compounds, Aerosol-Cloud Interactions, monitoring, modeling of aerosols.

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Key elements & essential information of the session

Air quality modeling faces significant challenges due to the extreme complexity of aerosols, which are non-spherical, have varied compositions, and involve complicated multi-phase chemical reactions. These challenges are compounded by the need for high-resolution modeling to capture aerosol-planetary boundary layer (PBL) interactions, accurate emission inventories, and the computational demand of simulating these processes. **Aerosol Complexity and modeling Challenges:** (i) Massive Chemical Diversity: Organic aerosol (OA) makes up a large fraction of sub-micrometer aerosol mass (20–90%) but is difficult to simulate due to the vast number of organic compounds existing in the atmosphere. (ii) Secondary Aerosol Formation (SOA): SOA, formed in the atmosphere through oxidation, is notoriously hard to model and often underestimated in global climate chemistry models compared to field observations. (iii) Spatial Variability: Unlike long-lived greenhouse gases, aerosols are not evenly distributed; their climate and health effects depend heavily on location, atmospheric transformation, and emission sources. (iv) Modeling Gaps: Current models struggle to differentiate between volatile, semi-volatile, and non-volatile organic compounds, leading to large uncertainties in radiative forcing and climate projections. **Key Challenges in Aerosol Modeling:** (i) Aerosol Complexity & Dynamics: Aerosols involve intricate life cycles (emissions, transformations, transport, removal) and complex chemical reactions (e.g., secondary organic aerosols formation), making them difficult to represent accurately. (ii) Secondary Organic Aerosol (SOA) Formation: The formation of secondary organic aerosols involves complex, not fully understood, chemical reactions. (iii) Aerosol-Cloud Interactions: Aerosols influence cloud properties, albedo, and precipitation efficiency, creating feedback loops that are hard to accurately model. (iv) Computational Intensity: Simulating these processes, particularly with high-resolution, is computationally intensive. (v) Measurement Limitations: Biases between different observing systems (e.g., satellites, ground observations) need to be removed to accurately inform models. **Modeling Challenges and Advancements.** (i) Grid Resolution Limitations: Coarse grids in global models limit the ability to simulate localized pollution. (ii) Variable-Resolution Models: Utilizing variable-resolution global models can improve simulations, such as the MUSICAv0 model which has a finer resolution over regions like East Asia. (iii) Machine Learning (ML) Integration: ML techniques are increasingly used to fill data gaps, improve prediction, and interpret complex data. (iv) Source Contribution Estimation: Models are crucial for determining source contributions to pollution, such as identifying the impact of nitrate-rich aerosols from industrial or vehicular sources. (v) Multi-scale Structure: A multi-scale structure is necessary to link on-road and near-road UFP simulations. **The session will address the following points:** (i) Improving representations through more advanced aerosol modeling to better reflect their physicochemical complexity. (ii) Moving towards better integration of ground-based and satellite observations. (iii) Improving computational performance through the development of methods to reduce computation time. (iv) Through continuous monitoring and modeling using a combination of online monitoring and models for comprehensive real-time assessment. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Aerosols and Air Quality: from sources to Chemical Complexity

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Keywords: Atmospheric Aerosols, Air quality, long-Term Monitoring, climate change, Sources to Air Quality Impact, aerosol formation and transformation, Volatile and semi-volatile organic compounds.

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Key elements & essential information of the session

Atmospheric aerosols, fine solid or liquid particles (PM), are critical factors in air quality degradation and climate regulation, stemming from diverse natural and anthropogenic sources. Globally, atmospheric aerosols, particularly their complex organic component, represent a critical challenge to climate modeling and public health. Their complex chemical composition makes it difficult to accurately assess their impacts, limiting the effectiveness of control measures to reduce pollution-related mortality. They are characterized by complex chemical compositions—including organic aerosols (OA), inorganic salts, and heavy metals—that evolve through transformation processes like condensation and atmospheric oxidation, directly influencing their toxicity and impacts on human health. **Key Sources, Chemical Complexity and transformation**: (i) Anthropogenic Sources: Significant contributors include vehicular exhaust, industrial emissions, and biomass burning. (ii) Natural Sources: These include volcanic eruptions, sea salt aerosols, and wind-driven mineral dust. (iii) Organic Aerosol (OA) Complexity: OA is a major component of submicron particulate matter (PM1), often divided into HOA (like Hydrocarbon), BBOA (Biomass Burning), and CCOA (Coal Combustion). (iv) Oxidation : Volatile and semi-volatile organic compounds (VOCs) react with oxidants (OH, O3 radicals) to form secondary organic aerosols (SOAs), increasing particle mass. (v) Photochemical processes: Sunlight plays a crucial role in gas-to-particle conversion, transforming. (vi) Aging : Particles evolve in the atmosphere, changing their size, shape, and toxicity. **Sources to Air Quality Impact:** (i) Urban vs. Rural: Aerosols are often more concentrated in urban areas with high fossil fuel combustion. (ii) Regional Trends: Studies show that while total aerosol mass is decreasing, specific, and regional, nitrate-rich aerosols remain a challenge, especially when influenced by Eastern air masses, which are typically more polluted. (iii) Impact on Human Health: Submicron particles (especially $PM2.5$) can penetrate deep into the respiratory tract, causing cardiovascular and respiratory diseases. (iv) Climate Change: Aerosols interact with radiation, scattering it (e.g., sulfate) to cool the atmosphere, or absorbing it (e.g., black carbon) to warm it. **Challenges in Understanding.** (i) Incomplete Knowledge: Many processes, such as secondary aerosol formation and the transformation of volatile organic compounds, are not fully understood or accurately represented in models. (ii) Transformation: Aerosols can become more toxic or chemically complex during long-range transport, altering their chemical properties through. (iii) Long-Term Monitoring: Identifying the shifting sources of particulate matter requires long-term studies to effectively guide air quality policies. As these particles evolve, their size, shape, and chemical composition constantly shift. This alters their atmospheric lifetime, their ability to travel, and their role in climate. To understand these particles and their constant evolution through complex atmospheric chemical reactions, this session will examine in details advanced analytical instruments and computer modeling techniques used to map the atmospheric life cycle of pollutants and aerosols. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Atmospheric pollution in Eastern Mediterranean Region : From aerosol Complexity to modeling Challenges

The Eastern Mediterranean Region (EMR) is a known atmospheric pollution hotspot, heavily impacted by a combination of dense urban centers, industrial emissions. The region faces persistent high levels of particulate matter PM2.5 and PM10. Atmospheric pollution in the EMR is driven by a complex, dynamic mix of natural and anthropogenic aerosols. The region's chemical transport and climate models face severe challenges in resolving the non-linear interactions between these fine particles, meteorology, and boundary layer structures

The Aerosol Complexity: East Asia features a highly diverse array of aerosol types and emission sources that vary by season and geography:

Dust Aerosols: Originating from the Gobi and Taklamakan deserts, these coarse-mode particles dominate the springtime. Their emissions are deeply sensitive to wind speed, soil temperature, and boundary layer height.

Anthropogenic Particulates: Driven by dense megacity populations, industrial activities, and vehicular emissions, these include fine-mode sulfate, nitrate, and absorbing black carbon (BC).

Biomass Burning: Agricultural fires and slash-and-burn practices in surrounding regions heavily contribute to periodic regional haze and gaseous pollution

Atmospheric Dipoles: Aerosols play a major role in regional climate, with sulfate cooling and absorbing black carbon interacting to shift the Asian Westerly Jet Stream and influence precipitation.

Modeling Challenges: Scientists utilize regional models and global climate models to understand and project these environmental shifts, but they grapple with significant bottlenecks:

Spatial Resolution: Global models notoriously underestimate Aerosol Optical Depth (AOD). High-resolution grid-refinements are required to accurately capture the vertical and horizontal transport of aerosols across complex topographies

Secondary Aerosol Chemistry: Accurately simulating the spatial segregation of NOx and VOC chemical regimes is highly demanding but crucial to resolving ozone and fine particulate PM2.5 levels.

Aerosol-PBL Interactions: Models struggle to simulate the complex feedbacks where aerosols reduce incoming shortwave radiation, thus altering the boundary layer structure and suppressing wind speeds.

Emission Inventories: Tracking exact, real-time emission variations across diverse receptor and source regions remains difficult, leading to uncertainties in space-borne observations and trajectory tracking.

The results will surely be beneficial in the context of the importance of aerosol-PBLH interaction in the genesis of haze episodes in large cities and providing scientific elements for the development of local policies to reduce pollution.

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Intelligent Remote sensing of atmospheric aerosol properties for climate modeling and air quality monitoring

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June 30, 2026 – Deadline for FP and WP (Second round)

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Keywords: Multi-Angle Polarimetric Sensors, Lidar profiling, high-resolution imaging spectroscopy, air quality monitoring, Climate Modeling, multi-spectral satellite imagery, meteorological data, surface reflectance, Spectrometers, Radiometers.

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Key elements & essential information of the session

Aerosol remote sensing is certainly essential for understanding the impact of particles on global climate and air quality. It combines passive and active instruments deployed on the ground and in space to continuously map the optical thickness and distribution of particles. Intelligent remote sensing combines artificial intelligence (AI) with physical modeling to extract crucial aerosol properties (such as aerosol optical depth (AOD), particle size, and composition) from satellite and ground-based observations. This data is essential for assessing climate forcing and generating high-resolution, near-real-time maps of particulate matter (PM) for public health. The rapid evolution of this field is transforming environmental science and atmospheric studies through several key mechanisms: **Advanced Remote Sensing Technologies:** Advanced remote sensing technologies measure atmospheric aerosols by analyzing how they absorb and scatter sunlight. These techniques are critical for monitoring global air quality, and understanding climate change. It can capture various aerosol properties through specific technological approaches: (i) Multi-Angle Polarimetric (MAP) Sensors: Instruments like the Directional Polarimetric Camera (DPC) and POLDER capture how light intensity and polarization vary across different viewing angles. This provides highly detailed information about aerosol shape and scattering behaviors. (ii) Lidar Profiling: Active sensors emit laser pulses to measure backscatter. They pierce through atmospheric layers to capture the vertical distribution and three-dimensional transport of dust, smoke. (iii) Spectrometers & Radiometers: Instruments like TROPOMI and MODIS monitor aerosol index, trace gases, and columnar properties at global scales. **The Role of Artificial Intelligence:** Traditional retrieval methods (like look-up tables) often struggle to process the massive, high-dimensional datasets produced by modern satellite sensors and often lack real-time efficiency. Deep learning methods process this information quickly while preserving physical interpretability. (i) Neural Networks: Convolutional Neural Networks (CNNs) and Graph Neural Networks (GNNs) are used to decouple the atmospheric signal from surface reflectance, significantly improving data accuracy. (ii) Data Fusion: AI-driven ensemble models merge multi-spectral satellite imagery, meteorological data, and ground station observations to predict ground-level PM2.5 and PM10 with remarkable local accuracy. **Applications:** (i) Climate Modeling: Aerosols have a significant impact on Earth's energy balance by reflecting sunlight and altering cloud formation. Accurately retrieving their optical and microphysical properties reduces one of the largest uncertainties in current climate change assessments. (ii) Air Quality Monitoring: By integrating AOD data with AI and Chemical Transport Models (CTMs), scientists can generate kilometer-scale heat maps of air pollution. This empowers governments to track trans-boundary pollution, manage haze events, and enforce emission controls. Recent atmospheric research is increasingly using high-resolution imaging spectroscopy to refine aerosol optical thickness (AOD) estimates. By leveraging continuous and contiguous wavelength measurements, we can better isolate atmospheric scattering from surface reflectance. High-resolution imaging spectroscopy enhances aerosol research by addressing three key points that will be discussed in this session: (i) Improved Composition Discrimination: Traditional multi-spectral instruments like MODIS have limited spectral sensitivity. Imaging spectrometers use hundreds of narrow, continuous bands, allowing researchers to differentiate between aerosol types (e.g., dust, smoke, sulfates) based on their distinct absorption signatures. (ii) Combined Surface and Atmosphere Retrievals: Advanced models use Optimal Estimation (OE) to fit a combined model of atmospheric scattering and surface reflectance across the full solar-reflected interval. This helps untangle complex signals, especially over bright, arid surfaces where older algorithms struggle. (iii) Uncertainty Quantification: Newer algorithms provide a strict uncertainty budget for both atmospheric parameters and surface properties, yielding more statistically rigorous optical thickness estimates for climate modeling and air quality analysis. . All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Mitigating atmospheric hydrocarbon pollutants from initial emission to final removal: the potential role of Innovative technologies

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Keywords: Mitigating atmospheric pollutants, advanced catalysts, AI-driven monitoring, biodegradation, greenhouse gas mineralization, transition to Renewable Energy and Electrification, Cleaner Fuels, Catalytic Converters, Carbon Capture and Storage, Atmospheric Removal and Remediation, Direct Air Capture, Bioremediation and Biofiltration, Photocatalytic Oxidation (PCO) System, Nature-Based Solutions.

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Key elements & essential information of the session

Mitigating atmospheric hydrocarbon pollutants requires a comprehensive approach, ranging from source reduction to active atmospheric removal of these pollutants. Innovative technologies are transforming this continuum, using advanced catalysts, AI-driven monitoring, biodegradation, and greenhouse gas mineralization to drastically reduce the environmental impact of volatile organic compounds (VOCs) and hydrocarbons. This approach involves a combination of preventative strategies, point-source capture, and environmental remediation. **Initial Emission Prevention:** The primary focus is on preventing the formation and release of hydrocarbons in the first place through process optimization and alternative energy sources. (i) Transition to Renewable Energy and Electrification: Shifting from fossil fuels to renewable energy sources (solar, wind, hydrogen fuel cells) for power generation, heating, and transportation is a fundamental preventative measure. (ii) Process Efficiency and Automation: In industries like oil and gas, innovations such as directional drilling (reducing the number of well pads and associated traffic), centralized production facilities, and well automation via telemetry significantly reduce fugitive methane/VOC emissions and traffic-related pollutants. (iii) Cleaner Fuels and Catalytic Converters: Developing and using cleaner fuels (e.g., low-sulfur gasoline, biofuels, hydrogen) and advanced catalytic converters in vehicles convert toxic exhaust hydrocarbons and other pollutants into less harmful substances like water vapor and CO_2 before they leave the tailpipe. (iv) VOC-free Products: Developing and utilizing low-emitting or VOC-free consumer products, paints, and building materials reduces a major source of indoor and general urban air pollution. **Point-Source Capture and Treatment:** For unavoidable emissions from industrial processes, innovative technologies capture and treat the pollutants before they are released into the atmosphere. (i) Adsorption Systems: Activated carbon filters are widely used to adsorb hydrocarbon vapors, VOCs, and odors from industrial exhaust streams. Novel adsorbents and advanced regeneration techniques (thermal or chemical) are improving efficiency and reducing waste disposal issues. (ii) Oxidizers and Scrubbers: (a) Thermal Oxidizers (including Regenerative Thermal Oxidizers, RTOs) achieve high temperatures to break down VOCs into harmless CO_2 and water vapor, often using the heat generated by the process itself to be energy efficient. (b) Catalytic Oxidizers perform a similar function at lower temperatures by using a catalyst, requiring less energy. (c) Wet/Dry Scrubbers wash harmful gases from exhaust streams using liquid sprays or dry reagents to neutralize pollutants. (iii) Carbon Capture and Storage (CCS): For major point sources of CO_2 (a primary hydrocarbon combustion product), innovative CCS technologies capture the gas and store it permanently underground, preventing atmospheric release. **Atmospheric Removal and Remediation**: Once hydrocarbons enter the atmosphere, removal is more challenging, but emerging technologies and natural processes play a role. (i) Direct Air Capture (DAC): This technology acts like a "giant vacuum" to remove CO_2 directly from the ambient air using specialized filters or sorbent materials. (ii) Bioremediation and Biofiltration: Harnessing the power of microorganisms (bacteria and fungi) to naturally degrade or transform hydrocarbon pollutants into benign byproducts is an increasingly popular, low-cost, and environmentally friendly approach. Biofilters use immobilized microbes to treat contaminated air streams. (iii) Photocatalytic Oxidation (PCO) Systems: These systems use UV light and a catalyst (like titanium dioxide) to break down airborne VOCs and other organic pollutants into harmless substances, suitable for both indoor and outdoor (e.g., in specialized paints or building materials) applications. (iv) Nature-Based Solutions: Reforestation and conserving ecosystems like wetlands and mangroves naturally sequester carbon and filter air pollutants. Overall, innovative technologies provide solutions across the entire pollutant lifecycle, but their effectiveness is maximized when integrated into a comprehensive strategy that includes robust policies and community action. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Spatio-temporal models & ecological data to develop mitigation & adaptation strategies: towards supporting both ecosystem & goals of sustainable development & climate neutrality

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Keywords: Spatio-temporal models, ecological data, climate resilience, Carbone storage, Carbon Neutrality and Mitigation, Ecosystem-based Adaptation, ecosystem services, climate-resilient strategies, sustainable urban environments.

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Key elements & essential information of the session

Spatio-temporal models combined with ecological data are crucial for climate resilience, allowing scientists to track how ecosystems shift across both geography and time. Integrated with rich ecological data, they constitute powerful tools for building climate-resilient strategies. By identifying where and when ecological changes occur, these models enable precise, targeted interventions that balance habitat preservation with the pursuit of Sustainable Development Goals (SDGs) and net-zero targets. **Main Methodological Framework:** (i) Predictive Mapping & Scenario Testing: Models such as InVEST (Integrated Valuation of Ecosystem Services and Trade-offs) and PLUS (Patch-generating Land Use Simulation) allow researchers to map out alternative futures. They simulate how changes in land use (e.g., urbanization vs. reforestation) will affect ecosystem services like carbon sequestration, water yield, and habitat connectivity. (ii) Integrated Species Distribution Models (SDMs): Advanced Bayesian models process historical atlas observations, tracking biodiversity shifts and range changes under varied climatic pressures. (iii) Dynamic Spatial Planning: Utilizing frameworks like Spatial-Planning-Based Ecosystem Adaptation (SPBEA) ensures that local land-based decisions (such as farming or infrastructure zoning) are managed collectively across ecosystems rather than in isolation. **Translating Models into Strategies:** (i) Carbon Neutrality and Mitigation: These models quantify exact rates of carbon storage, helping regions align their land-management techniques with net-zero mandates. (ii) Ecosystem-based Adaptation (EbA): Spatio-temporal frameworks help design and connect Blue-Green Infrastructure (B-GI) networks. They identify the most cost-effective spatial locations for conservation measures to protect vulnerable flora and fauna from rapid temperature and precipitation shifts. (iii) SDG Support: By evaluating metrics such as biodiversity protection (SDG 15), climate action (SDG 13), and sustainable urban environments (SDG 11), planners can avoid the "spatial mismatches" where areas of high ecological value do not align with areas of high human need. Based on the steps in Building Climate-Resilient Pathways, the points of discussion in the session will be focused on identifying vulnerable areas, optimizing resource allocation, and designing data-driven adaptation strategies. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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VIII International Symposium on Materials, Electrochemistry & Environment

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Advanced artificial intelligence–based approach for atmospheric monitoring of air pollution

- Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
- Laboratory of Applied Chemistry & Environment, ENSA, University of Ibn Zohr, Morocco
- Laboratory of Environmental Engineering & Ecotechnology, LGEET, ENIS, University of Sfax, Tunisia.
- Department of analytical Chemistry, Faculty of Pharmacy, Ankara University, Turkey.
- Laboratory of Electrochemistry, LEIMCR, Faculty of Technology, University of Ferhat Abbas Sétif-1, Algeria
- Faculty of Public Health, Faculty of Science, Doctoral School for Science & Technology, DSST, Lebanese University, Lebanon

Call for paper

June 30, 2026 – Deadline for FP and WP (Second round)

August 31, 2026 – Deadline for FP and WP (Final round)

Freely accessible

Keywords: air quality, sensors, satellite imagery, meteorological variables, deep Learning, Machine learning, pollution maps, ground stations, Advanced artificial intelligence, atmospheric monitoring

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Key elements & essential information of the session

Advanced artificial intelligence approaches for atmospheric monitoring utilize IoT-integrated sensor networks combined with deep learning algorithms to capture complex spatiotemporal air quality patterns. These systems ingest real-time data from satellites, ground stations, and mobile sensors to predict pollutant concentrations and identify super-emitters with high accuracy. **Key Technological Pillars:** (i) Deep Learning (DL): Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks excel at time-series forecasting, allowing systems to predict pollution levels and short-term spikes hours in advance. (ii) Machine Learning (ML): Models like Random Forest and Gradient Boosted Trees process multi-variate environmental data (e.g. PM2.5, PM10, NO2, and meteorological variables) to achieve up to (98%) prediction accuracy. (iii) Computer Vision: Advanced systems utilize Convolutional Neural Networks (CNNs) to estimate Air Quality Index (AQI) categories simply by analyzing daylight photographs of the sky and surrounding landscape. (iv) Edge Computing & Federated Learning: Decentralized AI processing directly on local hardware ensures low-latency alerts, enhanced data privacy, and real-time anomaly detection. **Real-World Applications & Platforms:** (i) Emissions Tracking: Global projects such as Climate TRACE leverage artificial intelligence and satellite imagery to track pollution plumes and identify industrial "super-emitters" across the globe. (ii) Smart City Deployments: Cities are increasingly pairing Google AI's Air View with localized IoT sensor deployments to generate street-by-street pollution maps, enabling authorities to optimize environmental systems. (iii) Industrial Proactive Compliance: Large-scale industries utilize automated AI monitoring systems to track facility emissions, automatically triggering abatement mechanisms (like exhaust fans or dust suppressors) the moment pollutant thresholds are exceeded. To map the dynamics of air pollution and to track the movement of pollutants and predict future concentrations, this session focuses on modern technologies that allow us to capture complex spatio-temporal patterns of air quality by merging, through advanced artificial intelligence, real-time data from IoT sensors, satellite imagery and meteorological variables. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Combating climate change by using both technological innovations and nature-based solutions

- Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
- Laboratory of Applied Chemistry & Environment, ENSA, University of Ibn Zohr, Morocco
- Laboratory of Environmental Engineering & Ecotechnology, LGEET, ENIS, University of Sfax, Tunisia.
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Call for paper

June 30, 2026 – Deadline for FP and WP (Second round)

August 31, 2026 – Deadline for FP and WP (Final round)

Freely accessible

Keywords: carbon neutrality, climate change, Energy Transition, Remove Carbon, reduce emissions, Green Materials, Direct Air Capture, transition to renewable energies, Circular Economy, Clean Energy, Precision Agriculture.

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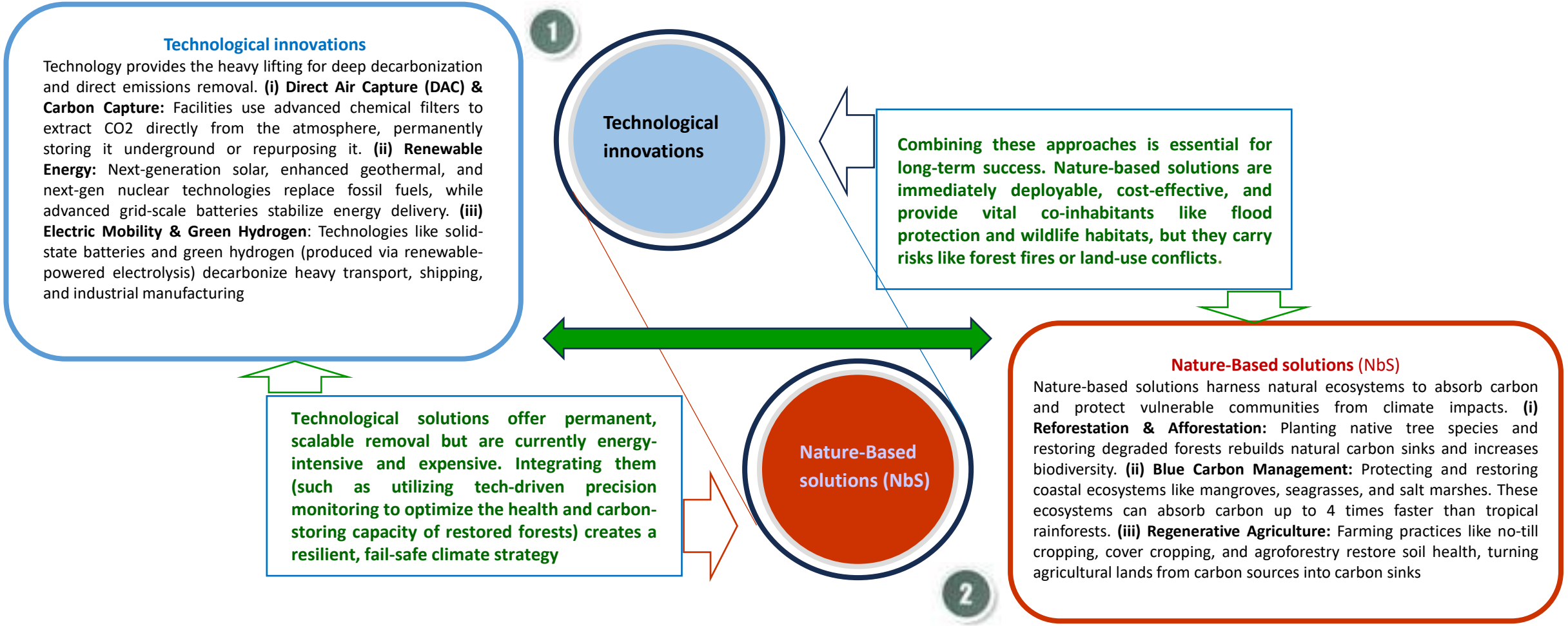
Key elements & essential information of the session

Climate, Carbon Neutrality, and Energy are deeply linked: climate change is driven by greenhouse gases (GHGs) from energy use, and carbon neutrality (net-zero emissions) is the goal to stop it, requiring a massive shift to clean energy (renewables, efficiency, innovation) and balancing remaining emissions via removal methods like reforestation or capture, transforming industry, transport, and lifestyles to achieve a sustainable planet. **Climate Change & Energy:** (i) The Problem: Burning fossil fuels for energy releases GHGs (like CO_2, methane) that trap heat, causing global warming, extreme weather, and ecosystem disruption. (ii) The Goal: Limit warming (e.g., to 1.5°C) by achieving global net-zero emissions, primarily by decarbonizing energy systems. **Carbon/Climate Neutrality: The Solution:** (i) Net Zero: Achieving a balance where GHGs emitted equal GHGs removed from the atmosphere. (ii) Key Actions: (a) Reduce Emissions: Drastically cut fossil fuel use in power, industry, buildings, and transport. (b) Boost Clean Energy: Scale up renewables (solar, wind, bioenergy) and improve energy efficiency. (c) Remove Carbon: Use natural sinks (forests) or technology (Carbon capture) for hard-to-abate emissions. **Energy Transition Strategies.** (i) Renewable Energy: Solar, wind, hydro, and bioenergy (biomass, biogas) are crucial. (ii) Energy Efficiency: Using less energy for the same output (better insulation, efficient machines, process optimization). (iii) Innovation: Developing low-carbon gases, carbon management, and sustainable infrastructure. (iv) Battery Storage: Lithium-ion and emerging solid-state battery grids store excess renewable energy, overcoming the intermittent nature of wind and sun. **Carbon Capture & Circular Economy:** (i) Direct Air Capture (DAC): by using massive filters to extract CO2 directly from the atmosphere, which can then be safely stored underground or repurposed into sustainable fuels. (ii) Green Materials: Low-carbon alternatives to traditional materials, such as cement-free concrete that traps CO2 inside the blocks, are fundamentally greening the construction industry. **Precision Agriculture & AI:** (i) AI Climate Models: Advanced AI and satellite Earth observation systems provide real-time data to help communities and governments predict extreme weather and adapt to droughts or floods. (ii) AgTech Innovations: Drones, Internet of Things (IoT) soil sensors, and AI-driven precision irrigation allow farmers to reduce water usage, minimize fertilizer runoff, and maintain crop yields amid extreme heat. Achieving carbon neutrality and ensuring a stable climate for the future can be achieved through a systemic renovation of energy and economic systems, with a transition from fossil fuels to clean sources and the removal of excess carbon. Indeed, the global transition to net-zero greenhouse gas emissions, by balancing emissions and carbon absorption capacity, effectively contributes to achieving carbon neutrality. This session will focus on three points: • Recent techniques for the transition to renewable energies, • Improving energy efficiency, • and the large-scale deployment of carbon capture technologies. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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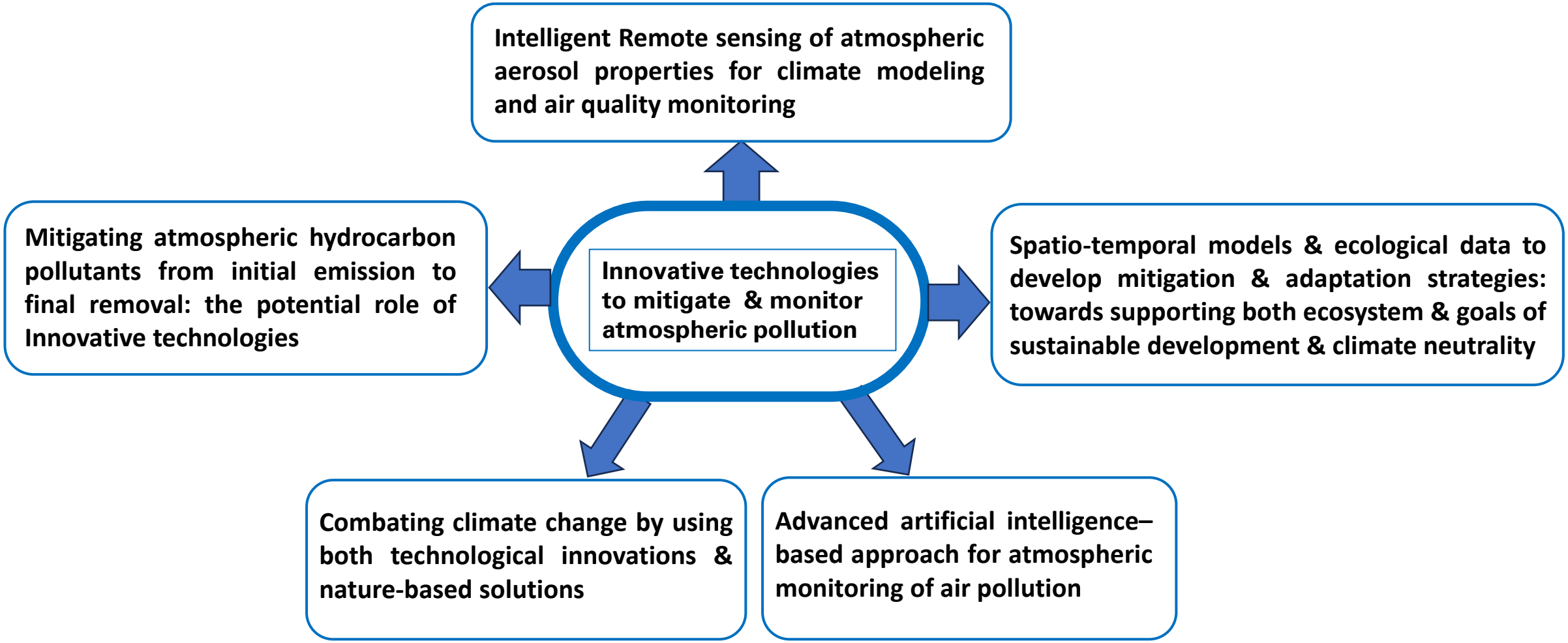
Combating climate change by using both technological innovations and nature-based solutions

Combating climate change effectively requires a dual approach: technological innovations rapidly reduce greenhouse gas emissions and decarbonize energy grids, while nature-based solutions (NbS) safely capture existing carbon, restore ecosystems, and build long-term climate resilience. Here is how the two strategies work together to create a comprehensive climate strategy:



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Advanced technological solutions for monitoring and mitigating air pollution



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Carbon-climate connection monitoring: the potential role of Remote sensing

• Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
• Laboratory of Applied Chemistry & Environment, ENSA, University of Ibn Zohr, Morocco
• Laboratory of Environmental Engineering & Ecotechnology, LGEET, ENIS, University of Sfax, Tunisia.
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Keywords: Remote Sensing, local-scale carbon monitoring, Monitoring Greenhouse Gas Emissions, Monitoring Terrestrial Ecosystems, Monitoring Climate Impacts on Carbon Cycle, Hyperspectral Imagers, Space-Air-Ground Integration

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Key elements & essential information of the session

Remote sensing plays an indispensable, "watchful eye" role in monitoring the carbon-climate connection by providing large-scale, continuous, and independent measurements of greenhouse gases and ecosystem carbon sinks. It enables scientists to track increasing carbon dioxide CO2 and methane CH4 concentrations in the atmosphere, quantify carbon storage in vegetation and soil, and monitor the impacts of disturbances like wildfires and deforestation. The Role of Remote Sensing in Carbon-Climate Monitoring. Remote sensing provides crucial data across three main pillars, linking atmospheric changes to surface responses: **Monitoring Greenhouse Gas Emissions (Atmospheric)**: (i) Satellite Observations: measure column-averaged dry mole fractions CO2 and CH4 of GHGs, enabling the identification of high-emission areas. (ii) Plume Detection: High-resolution instruments can identify and quantify CO2 plumes from point sources, such as coal-fired power plants, allowing for independent monitoring of anthropogenic emissions. (iii) Synergistic Monitoring: Combining satellite data (e.g., combining NO2 with CO2 data) improves accuracy in estimating emissions and mapping the impact of climate-relevant activities. **Monitoring Terrestrial Ecosystems (Carbon Sinks)**: (i) Biomass Estimation: LiDAR (e.g., GEDI) and SAR instruments map forest structure, biomass, and carbon stocks, providing detailed spatial information on carbon storage in forests, grasslands, and wetlands. (ii) photosynthesis Mapping (SIF): Sun-induced chlorophyll fluorescence (SIF) remote sensing directly monitors actual plant photosynthesis (Gross Primary Productivity—GPP), advancing understanding of vegetation's role in absorbing CO2. (iii) Land Use Changes: Satellites track land-cover changes, including deforestation and land degradation, which are critical for calculating carbon emissions. **Monitoring Climate Impacts on Carbon Cycle**: (i) Surface Temperature and Water: Thermal infrared sensors are used to invert land surface temperatures, which are key drivers of respiration—the release of CO2 from soil to the atmosphere. (ii) Fire Monitoring: Satellite hotspots and burn-area product estimate carbon emissions from forest fires and crop residue burning. **Technological Advances and Techniques:** (i) Multi-sensor Data Fusion: Combining optical sensors (Sentinel-2, Landsat), Synthetic Aperture Radar (Sentinel-1, ALOS PALSAR), and LiDAR (GEDI, ICESat-2) allows for overcoming limitations of single sensors (e.g., saturation in dense forests or cloud cover in the tropics) to improve biomass estimates. (ii) Artificial Intelligence (AI) and Machine Learning: Deep learning algorithms are increasingly used to process large satellite datasets, enhancing the precision of land-use mapping and carbon emission extraction. (iii) UAVs (Drones): Drones provide high-resolution data for local-scale carbon monitoring, calibrating satellite data, and conducting detailed inventories in complex landscapes like mangroves. Despite advancements, significant challenges remain, including the need for higher precision in soil carbon monitoring, standardizing remote sensing methods for carbon markets, and the high cost of acquiring high-resolution data. This session will focus on study of Impact on Carbon Neutrality, improving the accuracy of carbon flux models and integrating multi-source data to better support carbon neutrality goals. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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Electrochemical Carbon Dioxide Reduction Reaction (CO2RR) as a crucial bridge toward a sustainable, circular carbon economy

• Center of Materials Technology and Photonics, Hellenic Mediterranean University, Heraklion, Crete, Greece
• Laboratory of Applied Chemistry & Environment, ENSA, University of Ibn Zohr, Morocco
• Laboratory of Environmental Engineering & Ecotechnology, LGEET, ENIS, University of Sfax, Tunisia.
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Keywords: Keywords Carbon Dioxide Reduction Reaction, capture of atmospheric CO2, direct air capture, circular carbon economy, Decentralized Production, renewable Storage, Catalyst Performance

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Key elements & essential information of the session

The capture of atmospheric CO2, through technologies such as direct air capture (DAC) or industrial processes (CCUS), is a central pillar of the circular carbon economy. It transforms a waste product (the greenhouse gas) into a resource, making it possible to produce synthetic fuels or materials without extracting new fossil fuels. The electrochemical carbon dioxide reduction reaction (CO2RR) converts captured CO2 and water into valuable, net-zero e-fuels (like ethanol) using renewable electricity. It enables a circular carbon economy by directly transforming greenhouse gas emissions and intermittent clean power into transportable, energy-dense chemical bonds. **CO2RR, a driver of the circular economy:** (i) Renewable Storage: It converts the intermittent output of wind and solar grids into dense, stable chemical bonds (like ethanol or ethylene), acting as both an emission sink and an energy storage medium. (ii) Decentralized Production: CO2RR systems can be installed directly at point-source emitters (e.g., cement plants) or coupled with Direct Air Capture (DAC) to create localized production loops for everyday commodities. (iii) Fossil-Free Feedstocks: Instead of extracting new fossil fuels, CO2RR allows industry to continuously recycle existing carbon to produce plastics, fuels, and chemical precursors. **Main Mechanisms and Outputs**: The CO2RR process uses an electrolyzer where an applied voltage facilitates proton-electron transfer to reduce CO2. By tuning the catalyst, electrolyte, and voltage, the process can be directed to yield specific, valuable products: (i) C1 Molecules: Carbon Monoxide (CO), Formate, and Methane. (ii) C2+ Molecules: Ethylene, Ethanol, and n-propanol, which are vital for the chemical and polymer industries. **Technological Hurdles:** Despite massive academic and industrial breakthroughs, scaling CO2RR for commercialization requires overcoming three main obstacles: (i) Catalyst Selectivity: The high stability of the CO2 molecule makes it notoriously difficult to break. Competing reactions—like the hydrogen evolution reaction (HER)—often lower the product's Faradaic efficiency. Advanced materials (such as bimetallic alloys and structurally engineered copper) are being developed to strictly drive specific reaction pathways. (ii) Mass Transport & Solubility: CO2has low solubility in aqueous electrolytes. Modern zero-gap electrolyzers and gas diffusion electrodes are currently being engineered to push reactants to the catalyst surface effectively and achieve industrial current densities. (iii) System Durability: Trace impurities and operational degradation over thousands of hours present ongoing challenges. **Recent Advances and Catalyst Performance:** The latest developments focus on overcoming kinetic limits and blocking the side effect of hydrogen evolution (HER). (i) C1 Products (Carbon Monoxide, Formate): Significant progress has been made with catalysts based on single atoms or macrocyclic complexes (such as porphyrinoids), offering excellent selectivities and faradaic efficiency (FE) often exceeding 90% for CO or formate.(ii) C2+ Products (Ethylene, Ethanol): Copper (Cu) remains the undisputed reference catalyst for C-C bond formation. Recent innovations focus on engineering active sites (nanometric structuring, control of the Cu+/Cu0 oxidation state, and tandem strategies), allowing for a considerable increase in selectivity towards higher-value products. (iii) Advanced catalyst systems: Complex materials such as metal-organic networks (MOFs) and covalent organic networks (COFs) are increasingly being studied for their ability to modulate the local environment and stabilize reaction intermediates. This session will be dedicated to discussing several points: recent advances and especially the latest developments in catalyst performance and reactor design, the optimization of mechanisms, and fundamental advances in the field of electrocatalysis. All authors and researchers interested in making a scholarly contribution at the conference are invited to submit an abstract by following the procedure described on the CIMEE'26 information website. The accepted papers considered of having enough quality can be further considered by Advisory and review committee for publication in International Journals.

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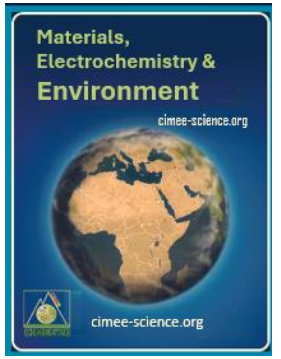
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H - Bio-Green-Energy & Waste Treatment Technology

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Important dates

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June 30, 2026
Final Round Submission:
August 31, 2026

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September 10, 2026

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