Make our planet great again

Presentation of the 18 first researchers

Monday dec.11 2017

Following the decision of the United States to withdraw from the Paris Agreement, Emmanuel Macron, President of the French Republic, issued a call to researchers, entrepreneurs, associations and NGOs, students and the civil society to pull together and join France in the fight against global warming.

The priority research programme “Make our planet great again” was launched under the auspices of Frédérique Vidal, Minister of Higher Education, Research and Innovation, and of Louis Schweitzer, General Commissioner for Investment. The CNRS is in charge of the scientific aspects of the programme and of the processing of the applications in cooperation with the Agence Nationale de la Recherche.

Campus France received more than 5000 expressions of interest and 1822 completed applications for long term and short term research residencies, at PhD as well as post-doctoral level. Applications came from around one hundred countries, mainly from students and researchers resident in the USA (1123 candidates), but also from the UK (53 candidates) and India (51 candidates).

Scientific excellence and relevance to the call were the main criteria for the evaluation of the projects. 450 candidates were short-listed for long term residencies-approximately 25% of the applications received. In this first round, 18 high-level projects were selected by an international panel led by Mme Corinne LE QUERE, Professor of Climate Change Science and Policy at the University of East Anglia and Director of the Tyndall Centre for Climate Change Research. A second round will take place in the spring of 2018. Germany has now joined the initiative and the new calendar will be set up under a joint scientific leadership.

The 18 laureates, of which 7 are women, come from 6 different countries, mostly the USA (13 projects). The selected projects are of very high level and address especially important issues, such as the impact of climate change on hurricanes, the effect of clouds in climate models, the effects of climate change on pollution as well as the public health consequences of climate change and the impact of climate change on circular economy. The laureates will join their new research labs in France in the next months.

Earth system science

Laureate : Pr Venkatramani BALAJI, Senior Researcher

University of origin : USA, Princeton
Project : High-Resolution Modeling of the Earth System
French research lab : Saclay, CEA/CNRS/UVSQ, Laboratoire des sciences du climat et de l'environnement

Project Hermès has the key aim of addressing sources of uncertainty in our understanding of the Earth system and its variability and evolution under changes in external forcings. The uncertainty comes from our inability to resolve key processes relevant to climate: principally the role of clouds, but we hypothesize that similar approaches can be applied in the ocean for key mixing processes that are also below the current resolution threshold. The project can be summarized as follows:

• Conduct very high-resolution simulations of key processes in the atmosphere and oceans which are below the threshold available in global models today. Such simulations will be at the limit of capability on today's computing technology.

• Given trends in computational technology, use these simulations to build and train fast approximate models of the Earth system, to explore uncertainties in the system using ensembles that are beyond possibility with the full model.

Laureate : Dr Frédéric BOUCHARD, Junior Researcher

University of origin : Canada, Institut national de la recherche scientifique
Project : Permafrost and Greenhouse gas dynamics in Siberia
French research lab : Saclay, Université Paris-Sud/CNRS, Laboratoire Géosciences Paris-Sud

Occupying nearly a quarter of the land surface in the northern hemisphere, permafrost (frozen ground) is currently undergoing rapid and dramatic changes because of climate warming. Containing nearly twice as much carbon as in the global atmosphere, permafrost landscapes can be considered as potential 'hotspots' of greenhouse gas (GHG) emissions, notably CO2 and CH4 released from 'thermokarst' (thaw) lakes. Moreover, several Artic villages are built on permafrost and their communities strongly rely on lake-rich landscapes for their traditional lifestyle (e.g., fishing/hunting grounds). Climate change is thus putting pressure on Arctic ecosystems, and thermokarst lakes play a central role in mobilizing organic matter within these sensitive environments. As a global society, how will we cope with such a quick change? We must foster new discoveries in this vitally important new area of 'permafrost systems science'. The main goal of this project, called 'PErmafrost and Greenhouse gas dynamics in Siberia' (PEGS), is to identify the factors that control organic carbon mobilization (especially GHG emissions) resulting from permafrost degradation in Central Yakutia (Siberia), a region affected by one of the thickest and ice-richest permafrost in the world. Combining field-based, laboratory and analog modelling experiments, we will investigate the complex permafrost-carbon-climate feedbacks at the critical zone of the Earth's surface. By providing urgently needed field and lab data to complement and enhance existing Earth surface models, PEGS will contribute in structuring and consolidating the French Arctic science community as an international leader in climate change issues.

Laureate : Pr Julien BOUCHAREL, Junior Researcher

University of origin : USA, University of Hawaii
Project : Tropical Cyclone activity and upper-ocean Dynamics
French research lab : Toulouse, CNES/CNRS/IRD/Université Toulouse 3 Paul Sabatier, Laboratoire d'Etudes en Géophysique et Océanographie Spatiales

Identifying and understanding the mechanisms involved in hurricane genesis and intensification is paramount to building reliable forecast systems that are beneficial for risk management agencies and coastal populations. The two main goals of the proposed study are 1) to assess and quantify the control of the upper-ocean dynamics on the variability of hurricane activity in the Eastern Pacific and Atlantic basins from intraseasonal to seasonal timescales, 2) account for these mechanisms to provide a theoretical basis crucial to upgrade physical-empirical forecast models. It is proposed to critically evaluate the most recent oceanic, atmospheric in-situ data, reanalyze products and storm track archives focusing on the following key questions: how much of the variability of cyclonic activity in these regions originates from changes in oceanic conditions? To what extent are these changes related to natural modes of oceanic variability? What can we learn from the relatively predictable tropical ocean dynamics to improve hurricane forecasts in these basins? Results derived from observation-based products and theoretical analysis will be confronted to output from a hierarchy of models from intermediate complexity ocean-atmosphere models to state-of-the-art forced and coupled global and regional climate models. This will allow quantifying and comparing, via a variety of sensitivity experiments, the control of different timescales of oceanic variability on the cyclonic activity in these two basins. This research activity fits adequately the scope of the host institution LEGOS, involves numerous internal and external collaborations and will train a PhD student.

Laureate : Dr Virginie GUEMAS, Junior Researcher

University of origin : Espagne, Barcelona supercomputing center
Project : Atmosphere – Sea ice Exchanges and Teleconnections
French research lab : Toulouse, MétéoFrance/CNRS, Centre National de Recherches Météorologiques

Over the last decades, the Arctic sea ice has experienced a drastic decline which is expected to continue in the near-term future. Arctic changes are thought to impact the mid-latitude atmospheric circulation to an extent and through mechanisms which are still highly debated. The inability of state-of-the-art climate models to capture accurately both the rate of Arctic sea ice changes and their impact on lower latitudes is hypothesized to originate from inaccuracies in the representation of atmosphere-sea ice heat exchanges. The ASET project offers to improve the realism of modelled Arctic climate changes and linkages between polar and mid-latitude regions through the development of novel formulations of turbulent heat exchanges between the atmosphere and sea ice. The inadequate formulations currently used for turbulent heat fluxes are mostly due to the lack of available observations in polar regions. Within the framework of the Year of Polar Prediction which starts in 2017 and will last until 2019, several observational campaigns are being or will soon be launched in the Arctic and Antarctic. ASET aims at exploiting these new data to develop novel formulations for sensible and latent heat fluxes at the sea ice surface. The impact of these developments will be assessed in historical simulations and in climate change projections. Improving the realism of climate models is an essential step to provide trustworthy climate information to end users. The novel formulations of turbulent heat fluxes to be proposed in ASET could be exploited in the whole fluid mechanics domain.

Laureate : Dr Nuria TEIXIDO, Senior Researcher

University of origin : USA, Stanford University
Project : Predicting future oceans under climate change
French research lab : Villefranche-sur-Mer, Université Pierre et Marie Curie/CNRS, Laboratoire d'Océanographie de Villefranche

The increasing concentration of atmospheric CO2 is driving changes in the ocean's physical and chemical properties, with important consequences for its ecosystems and the critical services they provide to humans. Despite the ocean's critical role in regulating Earth's climate and contributing to the overall biodiversity of Earth, knowledge on the impacts of global change on marine ecosystems lags behind those on terrestrial ecosystems. The 4Oceans project seeks to investigate the physiological, ecological and adaptive responses of marine organisms to ocean warming and ocean acidification. I will adopt a multidisciplinary approach by collaborating with top scientists from European and US institutions and combining: i) ecological and physiological field surveys and experiments in marine volcanic CO2 vents, sites in the NW Mediterranean with highly variable seasonal temperatures and extreme heat waves; and sites at the edge of the current distribution of a coral species; ii) ecophysiological laboratory experiments; iii) functional, trait-based analysis and synthesis; and iv) ocean-based solution and restoration actions to minimize the impacts. This project will advance our understanding of species and ecosystem resilience under present conditions and future climate scenarios and will be critical for developing regional and local strategies to reduce ecological and economic loss through mitigation and adaptation.

Laureate : Pr Louis DERRY, Senior Researcher

University of origin : USA, Cornell University
Project : Water, reactions and isotopes in the Critical Zone
French research lab : Paris, Institut de Physique du Globe de Paris

Relationships between variations in stream discharge and solute concentrations (C-Q relations) contain information about multiple Critical Zone (CZ) processes, from hydrologic flow paths to weathering reactions to transport time scales. By adding high resolution time series of reactive tracer data (R - isotope ratios of reactive solutes) we will generate C-Q-R data to better understand water movement and reaction in the CZ. By combining recent advances in non-steady state hydrologic modeling, quantitative reactive transport processes, and geochemical tracer data, we can significantly advance our understanding of the combined geochemical and hydrologic processes that generate C-Q-R patterns. Our approach is to treat the Critical Zone as a complex biogeochemical reactor in which fluids and minerals interact as a function of fluid flow path, residence time and reaction. Tracers for weathering reactions such as Ge/Si, ∂30Si, and ∂44Ca reflect both their mineral sources and equilibrium and kinetic fractionations along their transport path, potentially providing unique constraints on flow paths and time scales. Stream outflow values are the result of a convolution of multiple individual transit times. Working with newly developed infrastructure for high resolution chemical sampling and analysis (CRITEX) we will develop methods for rapid isotope tracer analysis, and integrate new time series for tracer data into reactive transport and non-steady state TTD models. The integrated approach will allow us to interrogate the dynamic subsurface and build a more mechanistically based understanding of the key processes controlling water availability and quality in the Critical Zone.

Laureate : Dr Barbara ERVENS, Senior Researcher

University of origin : USA, NOAA Boulder
Project : Modeling biologically-driven process in clouds
French research lab : Clermont-Ferrand, CNRS/Université Clermont-Auvergne, Institut de Chimie de Clermont Ferrand

The project MOBIDIC (MOdeling BIologically-Driven processes In Clouds) aims at improving the representation of microbial processes in cloud water. The project takes advantage of the PI's expertise in process modeling of chemical and microphysical cloud processes and the hosts' expertise in collecting and interpreting data of microbiota in ambient cloud water at the Puy de Dome station. The first model objective addresses the development of a module to describe processes and dispersion of bacteria and biological compounds in clouds. Using data from Puy de Dome, a process model will be developed and applied to case studies. This model will be simplified and parameterized. The resulting module together with a module to predict dispersion and transport of bacteria will be included in a regional model. The second objective aims at the ice nucleation of bacteria. While for this, more data exist, MOBIDIC will take a different approach by evaluating the ice nucleation activity of various microbiota and categorize it by physical, chemical and/or biological characteristics so that trends emerge that will help to understand and predict ice nucleation ability of similar potential ice nuclei. Parameterizations of such trends will be implemented in process and regional models. In summary, MOBIDIC will improve the knowledge of biological, chemical and physical mechanisms in the Earth system. Model development and studies from molecular to regional scales will result in highly needed tools to the scientific community to predict the role of microbiota in clouds and their subsequent interactions with all compartments of the Earth.

Climate change and global sustainability

Laureate : Pr Joost DE GOUW, Senior Researcher

University of origin : USA, University of Colorado Boulder
Project : Budget of Organic Carbon in Polluted Atmospheres
French research lab : Lyon, Université Claude Bernard Lyon/CNRS, IRCELYON

Volatile organic compounds (VOCs) are released to the atmosphere from a multitude of natural and man-made sources. The photo-oxidation of VOCs in the presence of nitrogen oxides leads to formation of ozone and organic aerosol, two secondary pollutants that are short-lived radiative forcing agents in the climate system, and affect human and ecosystem health. Over the past decade, major breakthroughs have occurred in our understanding of the atmospheric processing of VOCs, thanks to the development of advanced mass spectrometers that unravel the chemical complexity of organic carbon in the gas and particle phases. Nevertheless, it is an ongoing challenge to understand the sources of VOCs and their chemical transformations in sufficient detail to describe and predicts the effects on climate, air quality and human health. Efforts to curb emissions of anthropogenic VOCs from motor vehicles have been very successful. As a result, the important VOC sources in polluted air have become much more diverse, and a paradigm shift is needed to study VOCs in urban air more comprehensively than before. The major goals of this project are as follows. (1) Improve analytical instrumentation for laboratory and field measurements of VOCs. (2) Characterize the VOC emissions from specific sources in the laboratory. (3) Study the chemical transformations of understudied VOCs in the laboratory. (4) Using field measurements, determine the important anthropogenic sources of VOCs in several different urban areas and study their photo-oxidation. (5) Improve the chemical mechanisms used in 3-dimensional chemistry-transport models to better account for the present-day diversity in VOC emissions.

Laureate : Dr Delphine RENARD, Junior Researcher

University of origin : USA, University of California Santa-Barbara
Project : AgrobiodiverSity for a food-Secure planet
French research lab : Montpellier, CNRS/Université de Montpellier/Université Paul Valéry Montpellier/EPHE/SupAgro/INRA/IRD, Centre d'écologie fonctionnelle et évolutive

Ensuring food security under a changing climate is among society's greatest challenges. Rising temperatures, heat waves and droughts have caused crop failures, reduced potential yields, and driven instability in global food markets. Climatic projections suggest that these impacts and their associated human costs of poverty, malnutrition, and political unrest will worsen. Research on solutions to develop robust food systems is therefore urgently needed. ASSET will evaluate the potential effectiveness of a novel agrobiodiversity-based strategy. Evidence suggests that increased agrobiodiversity reduces climatic risks to food production, but how to leverage such benefits remains largely unknown. ASSET will fill this critical gap by providing regionally-specific knowledge on (1) the spatial scale(s), (2) the combinations of crops, and (3) the existing practices adopted by farmers that promote the yield stabilizing effect of agrobiodiversity against climatic variability. We will combine statistical analyses of existing long-term datasets across Europe, the Mediterranean and Sub-Saharan Africa with mathematical simulations and ethnobiological fieldwork in three case studies (France, Morocco and Senegal). By placing farmers at the center of our approach, ASSET will yield transformational insights into the design and implementation of diversified agricultural systems that provide agronomic benefits while being feasible for and desirable to farmers. ASSET will thus help strengthen societies' capacities to face climate change, contributing to meeting the objectives of the Paris COP 21, implementing multiple Sustainable Development Goals, and ensuring a food-secure future for all.

Laureate : Pr Alessandra GIANNINI, Senior Researcher

University of origin : USA, Columbia University
Project : Processes of climate change in the tropics
French research lab : Paris, CNRS/ENS/Ecole Polytechnique/Université Pierre et Marie Curie, Laboratoire de météorologie dynamique

The goal of this research project is to reduce uncertainty in projections of tropical precipitation change. In the tropics, climatic impact – e.g., on agriculture, water resources and public health – is driven by variation in precipitation more than in temperature, yet it is precisely in these regions that model projections are most uncertain. To advance these goals, I propose two parallel lines of research. 1. Analysis of existing and planned model simulations, e.g., phases 3, 5 and 6 of the Coupled Model Intercomparison Project [CMIP], to diagnose the sensitivity of tropical climate to different configurations of external forcing 2. Design of "sensitivity simulations" based on the analyses under (1), to test the sensitivity to model formulation of the processes that translate oceanic influence on continental climates. A process-based approach to the reduction of uncertainty in projections of climate change in the tropics adds value to the analysis of model simulations, because it facilitates comparison between simulations and the reality of climate change as experienced on the ground, in rural and urban communities, in the present. Model projections are but one element of scenario building for practical purposes, such as the development of national adaptation plans.

Laureate : Pr Thomas LAUVAUX, Junior Researcher

University of origin : USA, PennState
Project : Quantification of urban greenhouse gas emissions
French research lab : Saclay, CEA/CNRS/UVSQ, Laboratoire des sciences du climat et de l'environnement

Urban emissions of Greenhouse Gases (GHG) represent currently about 70% of the global emissions and could increase rapidly as large metropolitan areas are projected to grow twice as fast as the world population in the coming 15 years. Monitoring these emissions will require the use of independent approaches to implement transparent regulation policies. The deployment of atmospheric GHG sensors across few metropolitan areas combined with meteorological models offers a unique solution to quantify GHG emissions rapidly and at high resolutions. Building upon existing measurement networks and satellite missions, the CIUDAD project will construct an adaptive assimilation system able to produce GHG emissions for each sector of the economy over multiple cities. The project will focus on Paris, Mexico City, Indianapolis and Los Angeles, four urban environments with varied economies and demographics. The first objective of the project is to quantify urban GHG emissions by utilizing atmospheric GHG data and aerosols with socio-economic information into a single data assimilation system. In the second objective, we propose to advance significantly the capability of current assimilations systems by implementing the next generation of meteorological models for urban applications. Our novel approach will use an Adaptive Mesh Refinement atmospheric model to simulate GHG mixing ratios over the entire globe at coarse resolution (few degrees) while zooming on specific cities at high resolution (about 1km) without any discontinuities in the atmospheric flow. The adaptive system will integrate urban deployments into broader observing networks to produce national-scale GHG emission assessments.

Laureate : Dr Vincent VADEZ, Senior Researcher

Research lab of origin : India, CGIAR
Project : Improve Crops in Arid Regions and future climates
French research lab : Montpellier, IRD/Université de Montpellier/CIRAD/CNRS, Laboratoire Diversité - Adaptation - Developpement

Farming in dry areas like the Sahel is extremely risky because of water limitation. Climate change will only accentuate this constraint. This undermines food security in the region and impedes its economic rural development, which in turn feeds discontent and become a security issue for the region and neighbour Europe. It is then urgent to find solutions to make agriculture safer and more resilient so that it becomes a driver of development. Pearl millet and sorghum - the food subsistence basis of dry sub-Saharan Africa – are the target of this research. Harvests fail in hot and dry conditions because the evaporative demand creates an atmospheric moisture stress for the plant. Genotypes adapted to these conditions exist and are those capable of controlling water losses under high evaporative demand. Through an approach integrating physiology, molecular biology, genetics and modeling, we will decipher the mechanisms underlying tolerance, and find the genetic basis of these traits and of plant architecture traits that allow to optimize light capture per unit of water loss. By modeling, we will classify the stress scenarios of the Sahel and predict for each of these scenarios the genetic variants that are the most likely to succeed in each agroecological zone. The end products of the project are therefore a better understanding of the mechanisms of tolerance, the genomic regions responsible for tolerance traits and a predictive knowledge of their effects in different agro-ecological zones. These results will guide and feed the crop improvement programs of our regional partners and those of the CGIAR, to which I am closely linked.

Laureate : Pr Christopher CANTRELL, Senior Researcher

University of origin : USA, University Colorado Boulder
Project : Atmospheric ChemistRy Of the Suburban ForeSt
French research lab : Créteil, Université Paris-Est Créteil/CNRS, Laboratoire Interuniversitaire des Systèmes Atmosphériques

This project aims to improve our understanding of the processes involving the formation of ozone and secondary organic aerosols, species that negatively affect global atmospheric composition. It consists of characterizing the diurnal and nocturnal oxidation products of organic compounds formed in continental air masses with anthropogenic and biogenic influences. The approach relies on intense observation campaigns at the surface and at altitude, dedicated laboratory simulation experiments, and the comparison of their results with the estimates of numerical models. This new research finds its programmatic framework in the activities of the host laboratory, LISA, and in the expertise and experience of the PA. LISA's work focuses on the fate of atmospheric organic carbon, the role of photochemical oxidation in air pollution, and the development and implementation of analytical instrumentation, simulation chambers and numerical models. The PA has world-renowned experience in the design and deployment of instrumentation for the measurement of radicals and atmospheric trace species, as well as interpreting these observations through statistical and numerical modeling approaches. This project will lead to a better understanding of the large-scale impacts of urban pollution, and a better representation of chemical processes in numerical models, in order to assess the climate and health impacts of gaseous and particulate air pollutants. and provide scientific support for environmental control strategies.

Laureate : Pr Camille PARMESAN, Senior Researcher

University of origin : USA, University of Texas Austin
Project : Climate Change Impacts on Species
French research lab : Moulis, CNRS/Université Toulouse III Paul Sabatier, Station d'écologie théorique et expérimentale

More than a decade has passed since it became clear that anthropogenic warming was driving observed changes in wild species. My group's recent work has concentrated on improving understanding and future projections of responses to climate change by wild species in their timing and their geographic ranges. My strength is in linking impacts of climatic trends and extreme climate events on ecological, evolutionary and behavioral processes at the population level to patterns of biodiversity change at the global level. I will continue this research into two new areas: (a) Impacts of societal importance: changes in human disease risk as a consequence of range shifts of disease organisms, their wild vectors and reservoirs; (b) Impacts in high-risk habitats: assessing climate change risks for species inhabiting montane and boreal regions, under-studied but vulnerable systems. Tackling impacts of global climate change at the population level also provides an appropriate platform for exploring uncertainty in future impacts, and incorporating that uncertainty into conservation planning for the coming century. I will use techniques from economic modeling to incorporate Robust Decision-Making (RDM) theory into conservation planning. RDM uses scenario modeling to provide a range of possible futures that accommodate uncertainties in what the future climate may be and how species may respond. RDM algorithms then allow us to select actions that could be taken now that lead to the highest probability of a positive outcome across all possible futures. Such an action is, then, "robust" to those uncertainties.

Laureate: Dr Benjamin SANDERSON, Junior Researcher

University of origin : USA, NCAR Boulder
Project: Risks ans Uncertainties under Climate Change
French research lab : Toulouse, CERFACS/CNRS, Laboratoire Climat, Environnement, couplage et incertitudes

A comprehensive climate risk exposure exercise is proposed to assess fundamental uncertainties in model parameterization, with a focus on impacts in central Europe, and for a set of societally relevant climatic hazards (urban heatwaves, flooding, drought, wildfire & crop failure). The core of the project will involve a parameter perturbation exercise for the CNRM-CM6 climate model, with a series of idealized experiments to isolate key parameters in the land and atmospheric components which are critical for controlling the extent of societally relevant impacts under climate change. A surrogate model emulator will be constructed to model performance metrics and model response to greenhouse gas forcing as a function of model parameters. An optimization suite will be used to propose plausible model configurations which represent a range of climate feedback strengths and future impact intensity. These idealized experiments will then be used to inform a fully coupled ensemble of perturbed climate simulations which will be made available to the wider climate community for impacts analysis. Coupled historical and future simulations will represent uncertainty in a range of societal impacts. For example, model configurations will be constructed which minimize and maximize respectively the risk of urban flooding. The PI will then work with impacts experts within CERFACS and CNRS (and externally where necessary) to produce targeted risk assessments in the context of model uncertainty for a number of key impacts which might influence France and central Europe under climate change. All code and simulations will be made available to the community.

Energy transition

Laureate : Dr Philip SCHULZ, Junior Researcher

Research lab of origin : USA, National Renewable Energy Laboratory
Project : Interfaces and Hybrid Materials for Photovoltaics
French research lab : Paris, EDF/CNRS/Chimie-ParisTech, Institut de Recherche et Développement sur l'Énergie Photovoltaïque

In order for photovoltaics to reach the multi terawatts level required for the energy transition we need to access new material systems and routes for their implementation into solar cells that combine low costs and high performance. The focus of the project will be on the design and analysis of interfaces in photovoltaics centered on emerging hybrid energy materials and hybrid organic/inorganic interfaces, such as halide perovskites, with remarkable semiconductor properties. Our main goal is to unravel, on the basis of fundamental scientific understanding, the interdependencies between the individual building blocks on a molecular level and their impact on the macroscopic optoelectronic properties. Results will encompass a technological demonstration and design rules for tailor-made interfaces for efficient, stable and scalable devices in tandem geometry. I thus propose an approach to generate a comprehensive model of the fundamental electronic processes in hybrid compounds and across interfaces. First, we will control the energetic alignment at the interfaces in high performance perovskite solar cells for enhanced charge carrier transfer. Second, we will use wet and vacuum deposition techniques to synthesize buffer- and interlayers for integrated tandem solar cell concepts. Third, we will advance and combine our means for spectroscopic in operando analysis on operating devices to optimize the cell architecture and composition. With these assets the new group at IPVF will become a research hub for materials science, process development and interfacial design for solar energy applications, at the forefront of the emerging field of hybrid organic/inorganic optoelectronics.

Laureate : Dr Lorie HAMELIN, Junior Researcher

Research lab of origin : Pologne, Institute of Soil Science and Plant Cultivation
Project : Carbon management towards low fossil carbon use
French research lab : Toulouse, INSA/INRA/CNRS, Laboratoire d'Ingénierie des Systèmes Biologiques et des Procédés

This proposal endeavors to build a foundation for establishing geo-localized, time-dependent and sustainable strategies for the development of bioeconomy in France, which strive to optimize carbon circularity. It targets residual biomass streams as well as bio-pumps grass species. I propose a geo-localized approach combining consequential Life Cycle Assessment, Energy System Analysis, Process Engineering and Sustainability Economics as the key methodological approaches. The bioeconomy strategies proposed will investigate 2 main pillars. The first is around carbon farming and the possibility to enhance the potential of the resilient soil organic pool as a net carbon sink, among others through bio-pump grass species and through determining geo-localized thresholds for the harvest of agricultural residues. The second pillar focuses on the supply chain and proposes to assess over 300 conversion pathways to produce a variety of innovative bioeconomy products (liquid hydrocarbons, proteins, bio-based material, non-fossil methane gas, etc.). Through these pillars, cutting-edge methodological developments will be performed. This will translate into time-dependant inventories allowing to reflect the circularity of carbon in the studied pathways (i.e. quantifying the advantage of keeping carbon in the technosphere as long as possible) and into advanced assessment models integrating life cycle assessment and economic sustainability. As a result of this 5-y project, tailored and quantified cost- and environmentally-efficient strategies towards the long-term development of France bioeconomy will be proposed to French policy makers and stakeholders.

Laureate : Dr Giuliano GIAMBASTIANI, Senior Researcher

Research lab of origin : Italie, CNR-ICCOM
Project : CaTalyst foR TrAnsItion to ReNewable Energy FutuRe
French research lab : Strasbourg, CNRS/Université de Strasbourg, Institut de Chimie et Procédés pour l'Energie, l'Environnement et la Santé

The project core moves from the preparation of tailored 1D-3D carbon networks to be employed as non-innocent platforms for the bottom-up synthesis of targeted metal and metal-free catalytic materials. Selected C-matrices with mesoporous structures and featuring with specific templating (chemical and morphological) microenvironments will be used for the controlled anchoring, growth and stabilization of single-atom or metal sub-nanoclusters as well as for the ultra-thin surface coating with defective or highly strained (exfoliated) metal-sulfide structures. Surface engineered C-based materials will be also considered as single-phase, metal-free systems for the effective activation and conversion of small molecules in processes at the heart of renewable energy technology. With its catalyst technology, TRAINER prompts the transition towards a sustainable catalysis era by addressing scientifically ambitious but technologically concrete breakthroughs. It will focus on the intensification of three highly energy-demanding processes, ensuring mild operative conditions and zero or negative CO2 impact all over the whole production chain. Its catalyst technology will be mainly applied to: 1) H2 production from water electrolysis (hydrogen-evolution reaction, HER), 2) Hydrocarbon production from hydrodeoxygenation (HDO) of oxygen-rich biomasses, 3) Production of chemicals and energy vectors from CO2 electro-reduction. Other satellite processes will complete the study, strengthening the impact and long-term vision of the proposal. Advanced characterization techniques (including operando studies) will give insight on the catalysts properties during all their operative life.

The Jury

President : Prof. Corinne Le Quéré (United Kingdom)

Professor of Climate Change Science and Policy, Director, Tyndall Centre for Climate Change Research, University of East Anglia.

Earth system science

Dr. Valérie Masson-Delmotte (France)

Graduated from the Ecole Centrale Paris in Fluid Physics and Transfers, researcher at the Atomic and Alternative Energy Commission (CEA), co-chair of IPCC Working Group 1, working on the physical basis of climate.

Pr. Pierre Friedlingstein (United Kingdom)

Royal Society Wolfson Research Merit recipient, professor in Mathematical Modelling of the Climate System at the University of Exeter.

Scott Collins (USA)

Former Chair of the Vegetation and Long-term Studies sections, Chair of the Publications Committee, Vice President for Public Affairs and as President of the Ecological Society of America, editor-in-Chief of BioScience.

Pr. Tuukka Petäjä (Finland)

Professor, Head of aerosol laboratory and SMEAR station I & II Division of Atmospheric Sciences Department of Physics, University of Helsinki.

Climate change and global sustainability

Prof Callie Babbitt (USA)

Associate Professor in the Golisano Institute for Sustainability at Rochester Institute of Technology.

Prof.Kensuke Fukushi (Japan)

Professor of Integrated Research System for Sustainability Science (IR3S), The University of Tokyo Institutes for Advanced Study, visiting Professor at the United Nations University Institute for the Advanced Study of Sustainability, and Adjunct Professor of Environmental Engineering Program at Vietnam Japan University (VJU), Vietnam National University, Hanoi (VNU).

Energy transition

Pr. Lucas BRETSCHGER (Swiss confederation)

President of the European Association of Environmental and Resource Economists (EAERE) Professor of Economics/Resource Economics CER-ETH Center of Economic Research at ETH Zurich

Pr. James CLARK (UK)

Professor, Department of Chemistry University of York.