Proposal

Bouger + Saucède - WiSeNet - 1258

2021/2022 New 1/4

1. General Information

Polar area

Zone / District / Period	Location	Comment
Sub-Antarctic / Kerguelen : Summer	Port-aux-Français	The project will be first implemented in Kerguelen, at Port au Français for an initial testing phase (2021-22). Then, it aims to be extended to other districts in a second stage (Crozet and DDU in 2022-23). In Crozet, a priority site is targeted in Baie du Marin and in DDU at Pointe Géologie (second phase). In a third phase (2023-24), remote sites are targeted in Kerguelen (Presqu'île Jeanne d'Arc, Ratmanoff, Suhm and Channer islands) of testing the LoRa network using relay antennas between each site and Port aux Français. Finally, the fourth phase (2024-25) will consist in the deployment of LoRa relay antennas to connect local dataloggers to Alfred Faure, in Crozet (Chaloupe, Petite Manchotière, Jardin Japonais, and Mare aux Elephants).

Duration (year)	Acronym	Title	Titre
4	WiSeNet	Implementation of Wireless environmental Sensor Networks in the French Southern and Antarctic Lands using the Long Range (LoRa) technology and Wide Area Network (LoRaWAN) protocol.	Déploiement de réseaux de capteurs environnementaux connectés dans les Terres australes et antarctiques françaises à l'aide de la technologie LoRa et du protocole LoRaWAN

Disciplines	Keywords
Ecology, Environmental Science, Physical Sciences	ZATA, wireless, sensor_network, LoRaWAN, time-series

Co-Investigators identities

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Research unit identity	Comment
Zone Atelier Antarctique et Terres Australes (ZATA)	

Abstract

The Zone Atelier Antarctique et Terres Australes (ZATA) is a French CNRS Long Term Socio-Ecological Research Infrastructure (LTSER) and one of the two French components of eLTER (Integrated European Long-Term Ecosystem & Socio-Ecological Research Infrastructure). It aims at monitoring the dynamics of biodiversity in the sub-Antarctic and Antarctic marine and terrestrial ecosystems, analyzing biodiversity patterns, mechanisms and interactions, as well as the effect of direct anthropogenic activities (fishing, tourism,

management) and global changes (climate, toxics) on the resilience of biodiversity and ecosystems. Understanding the dynamics of biodiversity requires a correct assessment of environmental variations in either marine, terrestrial or freshwater ecosystems. Up to now, such an assessment is mainly achieved in the French Southern Lands by each IPEV scientific project individually and at the geographic scale of the respective study areas. Additionally, most of the sensors deployed in the field must be accessed on a regular schedule so as to download data but also to check for sensor integrity and state. Finally, not all datasets are fully known by the whole scientific community, since it requires an effort for each project to provide access to these data. In this context, the present WiSeNet project # 1258 (Implementation of Wireless environmental Sensor Networks in the French Southern and Antarctic Territories using the Long Range (LoRa) technology and Wide Area Network (LoRaWAN) protocol) proposes a joint effort to design a common strategy between scientific projects of ZATA (but not only) and the French Polar Institute, to conceive, experiment and deploy intelligent networks of sensors in the various districts (Crozet, Kerguelen, and Dumont D'urville). The main objectives are to create a technical, economical and methodological synergy between projects, to produce a replicable design for intelligent networks, wherein the Polar Institute resources are optimally allocated, and thereby to help science projects to take the next step of environmental variation sensoring.

Resumé

La Zone Atelier Antarctique et Terres Australes (ZATA) fait partie du réseau national des Zones Ateliers du CNRS, Infrastructure de Recherche qui participe à l'infrastructure européenne eLTER (Integrated European Long-Term Ecosystem & Socio-Ecological Research Infrastructure). Les objectifs scientifiques de la ZATA consistent à réaliser des suivis de la dynamique de la biodiversité dans les écosystèmes marins et terrestres subantarctiques et antarctiques et à analyser les motifs de cette biodiversité, ses mécanismes et multiples interactions biotiques et abiotiques. Elle cherche aussi à caractériser les effets directs des activités anthropiques (pêche, tourisme, gestion) et des changements globaux (climat, toxiques) sur la résilience de cette biodiversité et des écosystèmes. La compréhension de la dynamique de la biodiversité nécessite un suivi et des relevés précis des variations environnementales affectant les écosystèmes marins, terrestres et d'eau douce. Jusqu'à présent, ces analyses étaient principalement réalisées dans les Terres australes françaises par chaque projet scientifique individuellement et à l'échelle des zones d'étude respectives. De plus, la plupart des capteurs environnementaux déployés sur le terrain par chaque programme doivent être relevés régulièrement afin de pouvoir télécharger les données et vérifier l'état des capteurs. Enfin, les jeux de données existants ne sont pas tous connus de l'ensemble de la communauté scientifique, car cela nécessite que chaque projet scientifique puisse faire l'effort de rendre ces données accessibles. Dans ce contexte, le projet WiSeNet (Déploiement de réseaux de capteurs environnementaux connectés dans les Terres australes et antarctiques françaises à l'aide de la technologie LoRa et du protocole LoRaWAN) propose de regrouper les efforts déployés pour concevoir une stratégie commune entre projets scientifiques de la ZATA (mais pas seulement) et de l'Institut polaire, afin de concevoir, expérimenter et déployer des réseaux intelligents de capteurs connectés dans les différents districts (Crozet, Kerguelen, Dumont D'urville). Les principaux objectifs consistent à créer une synergie entre projets scientifiques sur les plans technique, économique et méthodologique, afin de concevoir des architectures de réseaux de capteurs standardisées et reproductibles. Ce projet commun devrait permettre d'optimiser l'affectation des ressources de l'Institut polaire et aider les projets scientifiques à accéder, utiliser et mettre en œuvre sur le terrain les nouvelles technologies et méthodes de suivi environnemental en écologie.

Long term observatory

National endorsement	Start date	End date	Endorsement letters
Zone Atelier Antarctique et Terres Australes (ZATA)	2021-11-01	2024-12-31	The projet is endorsed by the French CNRS LTSER ZATA and Zone Atelier Network, and eLTER Research Infrastructure (Integrated European Long-Term Ecosystem & Socio-Ecological Research Infrastructure).

International endorsement	Start date	End date	Endorsement letters

Links with conservation activities

National endorsement	Start date	End date	Endorsement letters or other document
National Nature Reserve of the French Southern Lands	2021-11-01	2024-12-31	Several projects of the ZATA are strongly involved in Conservation activities with tight relationship with the National Nature Reserve of the French Southern Lands (RNN TAF), which is also one of the ZATA partners. First, by giving full open access to data generated by our intelligent sensoring network initiative, we will enhance exchange and collaboration with the Reserve to mutual benefits with regards to different environmental compartments (terrestrial and aquatic) and factors (abiotic and biotic). Second, the deployment of intelligent sensors networks will particularly aim at a better efficiency in the management of sensors, allowing timely and fast detection of sensor malfunctions and efficient action when necessary.

			Additionally, because the sensor network will be deployed for the benefit of several IPEV projects, unnecessary replication of sensor deployment will be avoided. For all the aforementioned reasons, the environmental impact will be reduced and optimized in the field.

International endorsement	Start date	End date	Endorsement letters or other document

2. Scientific project description and organisation

Context, general objectives (originality and/or novelty of objectives), bottlenecks and expected significance

The Zone Atelier Antarctique et Terres Australes (ZATA) is a French CNRS Long Term Socio-Ecological Research Infrastructure (LTSER) and one of the two French components of eLTER (Integrated European Long-Term Ecosystem & Socio-Ecological Research Infrastructure). It aims at monitoring the dynamics of biodiversity in the sub-Antarctic and Antarctic marine and terrestrial ecosystems, analyzing biodiversity patterns, mechanisms and interactions shaping this diversity, and the effects of direct anthropogenic activities (fishing, tourism, management) as well as of global changes (climate, toxics) on the resilience of biodiversity and ecosystems. Understanding the dynamics of biodiversity requires a correct assessment of environmental variations. Environmental parameters are numerous, and can be recorded in either marine, terrestrial or freshwater ecosystems, sometimes to describe relationships between these ecosystems. Depth or altitude, record frequency, spatial arrangement are purposely contrasted so to grasp physical variation at desired scales, depending on the scientific question. In the recent years, environmental sensoring has seen major developments in both quantity and quality, and became a mandatory companion to ecological sciences.

Up to now, such assessment is mainly obtained at the individual scientific project level and at the scale of projects area of interest. Additionally, most of sensors deployed in the field must be accessed on a regular schedule so to download data but also to check for sensor integrity. Finally, the existence of data is not fully known and accessible to the whole community, since it requires an effort for each project to provide access to these data. This situation generates several bottlenecks regarding:
- resources (from labs or from the polar institute) might be expensed on multiple programs, whereas a synergy could obviously be expected.
- relatively costly technological novelty is harder to fund at the level of individual projects
- multiple access to sensors means increased human resources / working costs, which also translates in higher impacts on the environment
- The benefit of acquiring data is probably not optimized: data should be fully and automatically shared between all scientific projects, and beyond.

We therefore propose a joint effort to design a common strategy between scientific projects among the ZATA (but not only) and the French Polar Institute, to conceive, experiment and deploy intelligent networks of sensors in the various districts (Crozet, Kerguelen, Dumont D'urville) using the LoRa technology and LoRaWAN protocol. Our main objective is to create a technical, economical and methodological synergy between IPEV projects, to produce a replicable design for intelligent networks, wherein the Polar Institute resources are optimally allocated, and thereby to help science projects to take the next step of environmental variation sensoring.

The ZATA will itself support the effort through the present application, but also by regularly funding this initiative over years, and by linking this initiative to the national CNRS network of Zone Ateliers (RZA). Additionally, the ZATA is part of an RZA EQUIPEX PIA program on sensoring, which may provide substantial funding resources in the second part of the coming decade (2025-2030). Finally, the RZA Research Infrastructure will provide cloud resources and FAIR based methodology to host the end products of the intelligent networks.

The present technical project will require a shared strategy with the French Polar Institute, notably with its logistics and computer branches. It will also require technical exchanges with our international partners of the SCAR Life Science groups ISSA (Integrated Science for Sub-Antarctic) and ANTOS (Antarctic Nearshore and Terrestrial Observation System) so to ensure compatibility of measurement protocols, and therefore implement an international strategy for data acquisition, management, and sharing in the sub-Antarctic and Antarctic areas.

State of the art

Designed for the internet of objects, developed and optimized for low-power end-devices (battery-powered), the LoRa (Long Range) technology and LoRaWAN (LoRa Wide Area Network) wireless communication protocol and architecture are particularly suited to implement wireless low-power wide-area networks to connect low-cost and low-power environmental sensors. The LoRaWAN architecture is composed of three units : sensors, gateways and server where data are forwarded, managed, and stored, the network

coverage can extend to up to 15km wide. Such a technology has already shown reliable in a wide range of fields and applications. In particular, the LoRa network of Campbell CR1000X measurement and control dataloggers implemented in continental Antarctica (Dome C) has shown that the system is well-adapted to harsh environmental conditions and remote areas.

Such a system constitutes the appropriate solution for the present project. It will allow to connect the wide variety of environmental sensors (coastal marine, freshwater, soil, and air sensors) of direct interest for several IPEV projects in ecology to monitor environmental variations in the different compartments of the critical zone (water, soil air), from coastal marine areas to pools, soil and weather conditions. Only rs232 pore series are required to connect end-devices to the network, gateways being used to manage and forward data to a server. The system will be valuable to provide information both on end-device status (battery level, amount of data stored) and on environmental data themselves. Coupled with datal logger stations and relayed by dedicated antennas between distant stations (> 15km apart), this technology will allow to make raw environmental data available and useful for many projects implemented in the French Southern and Antarctic Lands using classic software data storage solutions following FAIR principles.

Scientific questions

All environmental data will be made available and used to address scientific questions tackled by several IPEV projects in Kerguelen (mainly prog. #136, 137, 409, 1041, 1044, 1116), Crozet (#119 and 137) and Dumont d'Urville (#137) in links with environmental monitoring of penguin colonies (#119 and #137), terrestrial plants and invasive species (#136, #1041, #1116), freshwater (#1041) and marine coastal areas (#409, #1041, #1044). New iterations of other historical programs of ZATA as well as future programs will directly be able to integrate the project. More broadly, beyond IPEV and ZATA, data will be managed and made accessible to a wide community of end users following the FAIR principles. Data are devoted to be accessible and usable by the community of Antarctic and sub-Antarctic ecologists for various research projects addressing scientific questions relating environmental variations and biodiversity patterns and mechanisms.

Methodology to fulfil objectives (methods, data acquisition ...)

Methodology will first consist in the set up in the field of a limited but varied selection of environmental (coastal marine, terrestrial freshwater and soil, air) sensors of strong, direct scientific interest for several IPEV projects of ZATA (#119, #136, #137, #409, #1044, #1041, #1116), to monitor environmental variations in different ecosystems and natural compartments, from coastal marine areas (temperature and currents) to freshwater habitats (temperature, water level in rivers and pools), soil (temperature, humidity, heat flux) and weather conditions (air temperature, humidity, pressure, rainfall, wind, radiation). More broadly, these data may be of interest for other research projects as well (within and beyond ZATA). Practically, weather stations (Campbell CR1000Xand Vaisala) will be deployed in Kerguelen (Port aux Français, Presqu'île Jeanne d'Arc, Ratmanoff), Crozet (Chaloupe, Petite Manchotière, Jardin Japonais, Mare aux Elephants) and Dumont d'Urville (Pointe Géologie) and connected to a LoRaWAN network. Former weather stations and data loggers installed at Cap Cotter, Sourcils Noirs, and Armor will be upgraded (from CR300 to CR1000X), connected and integrated to the network architecture. The LoRaWAN-based communication systems will allow the automated collection of meteorological data. Freshwater and soil sensors (#1116) will be deployed at Port aux Français and in Presqu'île Jeanne d'Arc following an altitudinal transect, along with sea water sensors ashore Suhm and Channer islands (#1044). The system will be completed by time-lapse cameras used by IPEV projects 119 and 137 for year-round environmental monitoring of penguin colonies in Crozet (Baie du Marin, Petite Manchotière, Chaloupe, Jardin Japonais) and DDU (Pointe Géologie) with minimal disturbance and human-power in the field. Cameras will be connected to the LoRaWAN network for status (battery level). A mobile automatic identification system of birds will be deployed in the framework of program 137 in Kerguelen (Ratmanoff), Crozet (Mare aux Eléphants, Chaloupe, Petite Manchotière, Baie du Marin) and DDU (Pointe Géologie) and connected to the network. All operations in the field will be achieved in close collaboration with the aformentionned IPEV projets. All environmental data will be made available and used to address scientific questions tackled by several scientific projects.

All sensors will have rs232 pore series to be connected to the LoRa network with dedicated cards. Soil and air sensors will be physically connected to Campbell CR1000X data loggers (#1116), while seawater sensors will be set up remotely (#1044). LoRa gateways will be installed to manage and forward sensor data to a local server. A local LoRa network (LoRaWAN protocol) will be first tested at Port aux Français before being deployed in other areas and district. Local networks will be deployed in DDU (Pointe Géologie, #137) and Crozet (Baie du Marin, #119, 137). In DDU and Crozet, the system will connect both abiotic and biotic end-devices, with weather stations (Campbell CR1000X or Vaisala), automatic identification antennas (#137) and cameras if feasible (#119, 137).

In a further stage, relay antennas will be used to extend local networks beyond the base area and connect to the server distant sensors and stations (> 15km apart). In the east Kerguelen part (from Presqu'île Jeanne d'Arc, and Morbihan Bay area to Courbet Peninsula), relays will be fixed to connect remote air/soil sensors (#1116) installed along an altitudinal gradient in Presqu'île Jeanne d'Arc, seawater sensors (#1044) at Suhm and Channer islands, identification antennas at Ratmanoff (#137) and weather stations of Sourcils Noirs, Armor and Cap Cotter (V. Favier). Target sites were preliminary identified for relay antennas to be deployed at Ile aux

Cochons, Peninsule Ronarch, and central Courbet (data transfer from Ratmanof and Cap Cotter to Port aux Français). Finally, in Crozet, relays will be set up to connect end-devices (weather stations, automatic identification devices and cameras) used to monitor penguins colonies of Petite Manchotière, Chaloupe, Mare aux Elephants and Jardin Japonais.
Local servers will be used in each district (Port aux Français, Alfred Faure, DDU) to manage, store and forward data from local networks to the end application server. This server will be hosted in CNRS INSU OSUR (OSU Rennes).

Detailed description of fieldwork

Overall, fieldwork will consist in (1) the set up of sensors and implementation of LoRaWAN network, (2) test for data management and transfer to a local server and (3) test for data transmission to a CNRS application server.
Year 1 of the project, fieldwork will consist in setting up soil sensors, weather station (air sensor +datalogger+mast), and water sensors at Port aux français along with the LoRa network for the testing phase. The weather station and soil sensors will be set up at the start of the fell field area behind the BCR. Seawater sensors will be set up by scuba divers close to La Flotille. LoRa antennas will be deployed at these two locations. The wireless network will be tested for data transfer to the local IPEV server. We will install the Lora antenna, gateway, and server at the IPEV Shelter (L2) for collecting sensor data and relays around and send data to mainland France via satellite communication.
Years 2 to 4, field work will consist in the set-up of sensors, weather stations, antennas and relays to be deployed at different localities in Kerguelen, Crozet, and Dumont d'Urville.

Feasibility, risk management and alternative strategies (in case of instrumental development, meteorological hazards, on-field instrumental failures, political developments...)

Former implementations of wireless sensor networks using the LoRaWAN protocol in Antarctica (Dome C) and in other French Zone Ateliers (ZAAR, OSUR) ensure the feasibility of the project. In particular, weather stations (using Campbell CR1000X data loggers) have long proved to be adapted to harsh local conditions that prevail in the Southern and Antarctic territories. Planning a first testing year at Port-au-Français where human resources can easily access the structure and solve potential technical issues will ensure that relevant technical solutions can be chosen and implemented. Identified potential technical issues:

- sensor functioning and LoRa antenna: spare sensors can be purchased, and some can be repaired. In case a sensor is not working, it will not impede the functioning of the entire infrastructure.
- data transfer and storage on local server: tight collaboration with the IPEV engineers and technical can ensure that alternatives will be found to address technical issues
- long-term data transfer and accessibility: finally, data transfer and storage to CNRS servers will guarantee data management and accessibility to the community
- The heterogeneity of sensors (memory capacity, transfer protocol, brand) may be a problem to ascertain that a Lora communication will be efficient for each unit. Some brands have built-in Lora capacity, other will need an adaptation. Soon, the IOt (Internet of object) will be more easily available (even with Campbell Scientific data loggers).

We will have to test the efficiency (power supply, range, bandwidth, gateway/server programming) of relay to expand the Lora network across the archipelago and valleys (whereas in more continental contexts, satellites and/or 4G network are usually preferred).

Expected outputs, outcomes and timetable

Objectives of the project are to help generate, manage and make available several time series for the monitoring of environmental variations. Data will be regularly updated, forwarded and stored on an end application server. Sensor status will be also regularly informed to improve maintenance. Environmental data will consist in local:

- weather data (air temperature, humidity, pressure, rainfall, wind speed and direction)
- soil temperature, heat flux, and water content
- sea water temperature and current

All data will be transferred, stored, managed and made accessible to the scientific community following the FAIR principles.

Analysis strategy to reach objectives and expected outputs

We propose to organize the project following four incremental steps and test for infrastructure and network efficiency before deployment to other areas and districts :

- Year 1: deployment test around Port aux Français (KER) using a single LORA antenna, and a limited but varied selection of environmental (coastal marine, terrestrial freshwater and soil, air) sensors to monitor environmental variations in different ecosystems and natural compartments, from coastal marine areas (temperature and currents) to freshwater pools (temperature,

water level), soil (temperature, humidity, heat flux) and weather conditions (air temperature, humidity, pressure, rainfall, wind, radiation).
- Year 2: if successful, the above protocol will be deployed in Crozet and DDU
- Year 3 : implementation of relay antennas in Kerguelen to extend the local network beyond the base area and connect to the server distant sensors and stations (> 15km apart)
- Year 4 : finally, in Crozet, relays will be set up to connect end-devices (weather stations, automatic identification devices and potentially, cameras) used to monitor penguins colonies of Petite Manchotière, Chaloupe, Mare aux Eléphants and Jardin Japonais.

Local servers will be used in each district (Port aux Français, Alfred Faure, DDU) to manage, store and forward data from local networks to the end application server. This server will be hosted in CNRS INSU OSUR (OSU Rennes).

Do you agree with IPEV data policy? IPEV data policy

August 12, 2008 **IPEV guidelines for Scientific Data and Metadata** V2.0

General Guidelines

- Article III of the Antarctic Treaty states that : "*In order to promote international cooperation in scientific investigation in Antarctica, as provided for in Article II of the present Treaty, the Contracting Parties agree that, to the greatest extent feasible and practicable, [...] scientific observations and results from Antarctica shall be exchanged and made freely available*".
- Individual scientists, Principal Investigators (PI) teams and programmes will be permitted a reasonable period of exclusive access to datasets which they have collected, allowing them to work on them and produce publications.
- PI of the Research programs should make their data available to all reasonable requests and data should be normally released to the general public within 2 years from collection and no later than the publication of the main findings from the dataset, unless special arrangements are made with the "Conseil des Programmes Scientifiques et Techniques" (CPST). By contrast, data from Observatory programs must be available as soon as possible and not later than 6 months from their recovery in Europe.
- Any restriction requires a well documented justification and it remains exceptional. Some examples of such restrictions may include: locations of rare or endangered species, data that are covered under licensing or copyright (e.g. satellite data...).
- IPEV and the CPST considers metadata, as vital to the exchange of information on polar research and to a data set's accessibility and longevity for reuse.
- The PI of a IPEV supported project is in charge to promptly submitted the metadata no later than the submission of the updated proposal for the next seasons, as described below, in responsibilities of PI.
- IPEV supported projects metadata should include easily accessible information about the data holdings, access and contact information. Complete information including methods, structure, quality control/assurance is expected for most datasets.
- All metadata will be publicly available regardless of any restrictions on access to the data.
- An important indicator of the quality of the scientific research is the publication of results. It is the reason why references to all publications issued from supported (funded/hosted) projects must be submitted to the Publication Database.

Responsibilities of Principal Investigators of IPEV supported projects

For all projects receiving support in the previous year, PI of IPEV supported projects are REQUIRED to submit to appropriate electronic data directories a description of their data (i.e. metadata) resulting from Concordia supported research in the form of a Directory Interchange Format (DIF) entry. Projects initiated prior to 2008 are strongly encouraged but not required to comply with DIF submission. Submission of the DIF may be at any time during the tenure of the grant but no later than the submission of the final report to the CPST. An annual submission of metadata is strongly encouraged. Metadata must be submitted through website which permits electronic submission of metadata.

At the time of submission of the Final Report to the CPST, PI must send a list of the DIF to the Chief scientist of IPEV. Failure to provide final reports and list of the DIF will delay the review and processing of pending proposal for that PI.

Similarly, PI must yearly submit the references of publications issued from their project to the Publication Database. Submission of these bibliographic data is mandatory. An electronic reporting system is associated to the electronic tool for on-line submission of proposals.

Further details and assistance is available by calling or emailing to the Data Officer (contact list on website).

Acknowledgement

Acknowledgement to IPEV for funding and logistical support should be explicitly mentioned in each publication issued from an IPEV supported (funded/hosted) project. This acknowledgement should take the form of a formal citation such as the following: "*The present research project No XXX has been performed at XXX Station and was supported by the French Polar Institute (IPEV)*".

Thomas Saucède

List of time series endorsed at national and/or international levels

The generated time series will be endorsed at national level by ZATA as part of the french LTSER IR-RZA (http://www.za-inee.org). Meta-data will be endorsed at international level on DEIMS (https://deims.org/5d621971-e68c-4015-b01f-a259f27dd6a0), the information management system on long-term ecosystem research sites around the globe.

Knowledge dissemination after project on the field operations

Over the years, time series will contribute to several on going scientific projects of ZATA (#119, 136, 137, 1116, 1044) and beyond (#409, 1041). Results will be disseminated through scientific publications, and communications to meetings of ZATA members and projects (online, yearly participation to meetings in France and abroad, SCAR conferences). The dedicated ZATA website (https://zaantarctique.org/programs/) will also contribute to metadata dissemination and online access to resources.

Outputs from the previous project

3. References of research project team

Co-Investigators

Name	Orcid	CV with 5 most significant papers
Thomas Saucède Saucède	0000-0001-6056-4447	**Present position** **2006 - Present** Associate Professor, UMR 6282 Biogeosciences, CNRS, Université Bourgogne France-Comté **Education and Academic background** **2002** PhD thesis: Origin and evolution of deep-sea and irregular sea urchins, University of Bugundy, France **2002-2006** Teaching and Research Assistant, University of Grenoble, France **2006 -** ... Associate Professor, University of Bugundy, France **2014** HDR accreditation to supervise research, University of Bugundy, France **Science & policies** • Deputy director Biogeosciences Laboratory (115 people), U Burgundy, France (2017-..) • Head of the Bachelor Degree in Earth Sciences, U Burgundy, France (2010-..) • Member of the Executive Council of the Observatory of the Sciences of the Universe (OSU) THETA, Besançon, France (2016-..) • World Register of Marine Species (WORMS) associate editor for Echinoidea (2017-..) **International networking** • *Member of the French National Committee for Antarctic* and Arctic *Research* (*CNFRA*) (2016-..) • Member of LTSER Zone Atelier Antarctique (ZATA, LTER-France network) (2015-..) • National representative (France) at the SCAR Life Sciences Group (2020-..) • Member of the steering committee of the SCAR Integrated Science for the sub-Antarctic (ISSA) Action Group (2018-..) **Top five international peer-reviewed publications relevant to the project** Fabri-Ruiz S, Danis B, Navarro N, Koubbi P, Laffont R, **Saucède T**. 2020. Benthic Ecoregionalization of the Southern Ocean supports current proposals of Antarctic Marine Protected Areas under IPCC scenarios of climate change. ***Global Change Biology***, doi: 10.1111/gcb.14988 **Saucède T**, Guillaumot C, Michel L, Fabri-Ruiz S, Bazin A, Cabessut M, García-Berro A, Mateos A, Mathieu O, De Ridder C, Dubois P, Danis B, David B, Díaz A, Lepoint G, Motreuil S, Poulin E, Féral JP. 2019. Modelling species response to climate change in sub-Antarctic islands: echinoids as a case study for the Kerguelen plateau. In: Welsford, D., J. Dell and G. Duhamel (Eds). ***The Kerguelen Plateau: marine ecosystem and fisheries. Proceedings of the Second Symposium***. Australian Antarctic Division, Kingston, Tasmania, Australia, pp. 95-116. ISBN: 978-1-876934-30-9, doi : 10.5281/zenodo.3251680. Guillaumot C, Fabri-Ruiz S, Martin A, Eleaume M, Danis B, Féral J-P,; **Saucède T**. 2018. Benthic species of the Kerguelen Plateau show contrasting distribution shifts in response to environmental changes.***Ecology & Evolution***, 8 (12): 6210-6225, doi: 10.1002/ece3.4091 Guillaumot C, Martin A, Eléaume M, **Saucède T**. 2018. Methods for improving species distribution models in data-poor areas: example of sub-Antarctic benthic species on the Kerguelen Plateau. ***Marine Ecology Progress Series*** 594: 149-164, doi: 10.3354/meps12538

		Chenuil A, **Saucède T**, Hemery L, Eléaume M, Féral J-P, Améziane N, David B, Lecointre G, Havermans C. 2018. Understanding processes at the origin of species flocks with a focus on the marine Antarctic fauna. ***Biological Reviews***, 93 : 481-504 doi : 10.1111/brv.12354
Guillaume Bouger Bouger Bouger		**Present position** **2008 - Present** Ingeneer Assitant CNRS - UMS 3343 OSUR Rennes **Education and Academic background** **2001** Master 1 - Maîtrise de Biologie des Populations et des Écosystèmes, option écologie aquatique - Université Claude Bernard Lyon1 **2002-2008** Technician for "Laboratoire des Hydroystemes Fluviaux" at Lyon1 University - Biological samples and metrology for subterraneous systems. **Networking** • *Member of SNO Tourbieres - part of eLTER Network* • *Member of Zone Ateleir Armorique (ZAA, eLTER-France network)* • *Member of Zone Atelier Terres Australes (ZATA, eLTER-France network)* **Top five international peer-reviewed publications relevant to the project** Transdisciplinary Bioblitz: Rapid biotic and abiotic inventory allows studying environmental changes over 60 years at the Biological Field Station of Paimpont (Brittany, France) and opens new interdisciplinary research opportunities; Nicolai, Annegret ; Guernion, Muriel ; Guillocheau, Sarah BIODIVERSITY DATA JOURNAL Volume 8 Published 2020 Daily Monitoring of Shallow and Fine-Grained Water Patterns in Wet Grasslands Combining Aerial LiDAR Data and In Situ Piezometric Measurements ; Rapinel, Sebastien ; Rossignol, Nicolas ; Gore, Oliver SUSTAINABILITY Volume 10 Issue 3 Published 2018 Phosphorus more than temperature controls the phytoplankton community in a deep quarry lake: a combined field and laboratory approach; Pannard, A. ; Guislain, A. ; Chorin, M. INLAND WATERS Volume 8 Issue 1 Page 22-35 Published 2018 Foulquier A., Malard F., Barraud S. & Gibert J. 2009. Thermal influence of urban groundwater recharge from stormwater infiltration basins. *Hydrological Processes* 23, 1701-1713.

Research project team

Name	Organism	Country	Status	Speciality	Orcid	Personal web site
Guillaume BOUGER	CNRS	France	Engineer/technician	Metrology / Biology		
Thomas Saucède	Université de Bourgogne	France	Scientist	Marine ecology	0000-0001-6056-4447	https://thomassaucede.wordpress.com
Jacques Labonne	INRAE	France	Scientist	behavioural ecology, demogenetic modelling, evolutionary ecology, ecology, sexual selection	0000-0001-5953-3029	https://www6.bordeaux-aquitaine.inrae.fr/st_p Ecobiop/Fiches-chercheurs/Jacques-Labonne
Jean-	CNRS	France	Scientist	Ecology,	0000-0002-9500-2724	http://www.iphc.cnrs.fr/-Jean-Patrice-Robin-.

Patrice Robin				Nutrition, Metabolism, Energy, Conservation, Physiology, Zoology		
Françoise Binet	Université Rennes 1	France	Scientist	soil, microbial communities	0000-0002-4800-3388	https://www.researchgate.net/profile/Francois
Françoise Hennion	CNRS	France	Scientist	ecophysiology, endemism, subantarctic, Brassicaceae	0000-0001-5355-5614	https://ecobio.univ-rennes1.fr/personnel.php?qui=Francoise_Hennion
Vincent Viblanc	CNRS	France	Scientist	behavioral ecology, ecophysiology	0000-0002-4953-659X	http://www.iphc.cnrs.fr/-Vincent-A-Viblanc-.ht
Céline Le Bohec	CNRS	France	Scientist	behavioral ecology, population genetics	0000-0003-0149-6477	http://www.iphc.cnrs.fr/-Celine-Le-Bohec-.htr
David Renault	Université de Rennes 1	France	Scientist	population ecology, physiology, metabolomics, proteomics	0000-0003-3644-1759	https://sites.google.com/site/davidrenaultecol
Stéphane Bétoulle	Université de Reims	France	Scientist	Parasitology, Zoology, Ecology	0000-0001-6486-7787	https://www.researchgate.net/profile/Stephan
Philippe Gaudin	INRAE	France	Scientist	Evolutionary Ecology, Behavioral ecology, Fish, Amphidromy, Biological invasions	0000-0002-2274-1884	https://www.researchgate.net/profile/Philippe_

Research team publications

Peer-reviewed publications.

Bretagnolle V, Benoit M, Bonnefond M, Breton V, Church JM, Gaba S et al.2019. Action-orientated research and framework: insights from the French long-term social-ecological research network. Ecology and Society 24(3):10. https://doi.org/10.5751/ES-10989-240310

Cristofari R, Liu X, Bonadonna F, Cherel Y, Pistorius P, Le Maho Y, Raybaud V, Stenseth NC, Trucchi E, Le Bohec C. 2018. Climate-driven range shifts of King Penguins in a fragmented ecosystem. Nature Climate Change, 8, 245-251.

Dahl J, Bertrand M, Pierre A, Curtit B, Pillard C, Tasiemski A, Convey P, Renault D. 2019. Thermal tolerance patterns of a carabid beetle sampled along invasion and altitudinal gradients at a sub-Antarctic island. Journal of Thermal Biology, 86: 102447, doi: 10.1016/j.jtherbio.2019.102447

Grimsrud DJ, Havarstein ES, Whoriskey F, Bordeleau X, Gaudin P, Aulus L, Buoro M, Labonne J. 2020. Marine and freswater temperature data, Kerguelen Islands. https://doi.org/10.15454/HNXEOD, Portail Data INRAE, V1

Harcourt et al. (60 authors including Charrassin, J.-B.). 2019. Animal-Borne Telemetry: an integral component of the ocean observing toolkit. Frontiers in Marine Sciences 6 article 326. 10.3389/fmars.2019.00326.

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Laparie M, Renault D. 2016. Physiological responses to temperature in Merizodus soledadinus (Col., Carabidae), a subpolar carabid beetle invading sub-Antarctic islands. Polar Biology 39: 35-45, doi: 10.1007/s00300-014-1600-0"

Lehnebach C, Winkworth RC, Becker M, Lockhart PJ, Hennion F. 2017. Around the pole: evolution of sub-Antarctic island Ranunculus. Journal of Biogeography 44: 875-886, early view 15th February 2017, DOI: 10.1111/jbi.12952 Biology. 86. 102447. DOI:1016/j.jtherbio.2019.102447.

Nicolai A, Guernion M, Guillocheau S. 2020. Transdisciplinary Bioblitz: Rapid biotic and abiotic inventory allows studying environmental changes over 60 years at the Biological Field Station of Paimpont (Brittany, France) and opens new interdisciplinary research opportunities. Biodiversity Data Journal (8).

Ouisse T, Bonte D, Lebouvier M, Hendrickx F, Renault D. 2016. The importance of relative humidity and trophic resources in governing ecological niche of the invasive carabid beetle Merizodus soledadinus in the Kerguelen archipelago. Journal of Insect Physiology 93-94: 42-49. DOI 10.1016/j.jinsphys.2016.08.006

Pannard A, Guislain A, Chorin M. 2018. Phosphorus more than temperature controls the phytoplankton community in a deep quarry lake: a combined field and laboratory approach. Inland Waters (8), 1: 22-35.

Rapinel S, Rossignol N, Gore O. 2018. Daily Monitoring of Shallow and Fine-Grained Water Patterns in Wet Grasslands Combining Aerial LiDAR Data and In Situ Piezometric Measurements. Sustainability (10), 3.

Renault D, Laparie M, McCauley SJ, Bonte D. 2018. Environmental adaptations, ecological filtering and dispersal central to insect invasions. Annual Review of Entomology 63: 345-368. [10.1146/annurevento-020117-043315]

Renault D, Lombard M, Vingère J, Laparie M. 2016. Comparative salinity tolerance in native flies from the subantarctic islands: a metabolomic approach. Polar Biology 39: 47-56. DOI 10.1007/s00300-014- 1605-8]

Richter, Sebastian, Gerum, Richard C., Schneider, Werner, Fabry, Ben, Le Bohec, Céline & Zitterbart, Daniel P. (2018). A remote-controlled observatory for behavioural and ecological research: A case study on emperor penguins. Methods Ecol Evol in press.

Saucède T, Guillaumot C, Michel L, Fabri-Ruiz S, Bazin A, Cabessut M, García-Berro A, Mateos A, Mathieu O, De Ridder C, Dubois P, Danis B, David B, Díaz A, Lepoint G, Motreuil S, Poulin E, Féral JP. 2019. Modelling species response to climate change in sub-Antarctic islands: echinoids as a case study for the Kerguelen plateau. In: Welsford, D., J. Dell and G. Duhamel (Eds). *The Kerguelen Plateau: marine ecosystem and fisheries. Proceedings of the Second Symposium*. Australian Antarctic Division, Kingston, Tasmania, Australia, pp. 95-116. ISBN: 978-1-876934-30-9, doi : 10.5281/zenodo.3251680.

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Viblanc VA, Smith AD, Gineste B, Groscolas R. 2012. Coping with continuous human disturbance in the wild: insights from penguin heart rate response to various stressors. BMC Ecology 12:10. https://doi.org/10.1186/1472-6785-12-10

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LTSER ZATA teams are feeding the following repositories with their long term data monitorings.

- Native and introduced plants in the French Austral and Antarctique Territories in the taxonomical referential (TaxRef) of the National Inventory for Natural Heritage:

http://inpn.mnhn.fr/accueil/index

- Medata of the French programmes funded by the French Polar Institute, feeding directly the Global Change Master Directory:

http://gcmd.nasa.gov/index.html

- MEMO observatory on Southern Ocean, recorded by remote sensors equipped elephant seals (temperature, salinity, fluorescence, oxygen):

http://www.coriolis.eu.org/Observing-theOcean/Marine-Mammals

- Marine ecosystems status in Southern Ocean:
  - Convention on the Conservation of Antarctic Marine Living Resources: http://www.ccamlr.org
  - Antarctic biodiversity information system: http://www.biodiversity.aq/
- Sea Birds Tracking data:
http://www.seabirdtracking.org/
- Retrospective Analysis of Antarctic Tracking Data, SCAR initiative:
https://data.aad.gov.au/metadata/records/SCAR_RAATD
- BirdLife Database ; Tracking Ocean Wanderers :
http://www.birdlife.org
- Barcoding data in “Barcode of Life Data Systems” :
http://www.boldsystems.org/
- Field campaign and sampling data :
http://expeditions.mnhn.fr/
- Introduced Fishes scales informations in the COLISA database (RARe Research Infrastructure, BRC4Env) :
https://colisa.fr/
- Long term monitoring of salmonids colonization for French subantarctic Islands :
https://data.inrae.fr/dataverse/ecobiop

4. Collaborations

Collaborator name	Organism	Country	City	Status	Speciality	Orcid	Personal web site
Vincent Favier	Institut des Géosciences de l'Environnement	France	Grenoble	Engineer/technician	climatology, hydrology, meteorology	0000-0001-6024-9498	https://www.researchgate.net
Eric Lefebvre	institut des Géosciences de l'Environnement	France	Grenoble	Engineer/technician	computer engineer		http://pp.ige-grenoble.fr/annu ige/lefebver.htm

5. Links with national and international projects or structures

Project / Structure	Organism	International or National	National country	web site	Description	Evaluati endorse
Antarctic Near-Shore and Terrestrial Observation System (ANTOS)	Scientific Committee on Antarctic Research (SCAR)	International		https://www.scar.org/science/antos/about/	The SCAR ANTOS Expert Group aims to establish a biologically focussed, integrated and coordinated Antarctic-wide observation, to identify and track environmental variability and change at biologically relevant scales, and to use this information to inform biological, physical, and earth science studies. It was established in response to the need identified in multiple sectors for long-term commitment to acquire basic information	

					to underpin identification of trends and changes in iconic Antarctic ecosystems. Such information transcends short-term national funding regimes, yet is crucial for informing management approaches and strategies that national bodies must address.	
Integrated Science for Sub-Antarctic (ISSA)	Scientific Committee on Antarctic Research (SCAR)	International		https://www.scar.org/science/issa/about/	The SCAR Action Group on Integrated Science for the Sub-Antarctic (ISSA) was formed in 2014. The objectives are to: Provide a comprehensive overview of past and current sub- Antarctic science, Identify pressing science questions for current and future work based on national priorities, strengths, and 1 SCAR Horizon Scan questions, Identify key lessons for science, conservation, and policy across the region, Develop a network of scientists across the region, including support for early career researchers.	
Zone Atelier Antarctique et Terres Australes (ZATA)	CNRS	National	France	https://zaantarctique.org	ZATA is part of the French Zone Atelier network (RZA), a French Research Infrastructure that is also part of eLTER Europe, a European Research Infrastructure. This project will have linkage with the joint OZCAR and RZA EQUIPEX PIA program called "Terra Forma" on sensoring, which may provide substantial funding resources in the second part of the coming decade (2025-2030). We will also have technical exchanges with our international partners of the SCAR groups ISSA (Integrated Science for Sub-Antarctic) and ANTOS (Antarctic Near-shore and Terrestrial Observation System) so to ensure compatibility of measurement protocols, and therefore implement an international strategy for data acquisition, management, and sharing.	

6. Outreach (projects including media, schools, artists...)

The French Polar Institute has to be systematically associated to all outreach projects from the start of the project, failing which they will not be deployed.
Preliminary information for outreach projects aiming on the field operations:

- On the field missions for people part of an outreach project (artist, journalist, documentary maker, etc...) associated to the scientific

project are subject to polar conditions contingencies. Priority will be given to the smooth running of logistics and scientific missions meaning that the outreach missions may be canceled up to the day before departure;
- People part of an outreach project must imperatively have a status giving them a social security cover;
- For Subantarctic Islands or Antarctica, travel and stay require a more or less one month availability; Preliminary information for all outreach projects:
- For media, a broadcaster has to be engaged for diffusion;
- An agreement between IPEV and the institutes/organizations involved will be drawn up prior outreach project start;
- IPEV does not cover any related costs to outreach projects (including on the field transport, food and accommodation for outreach projects going on the field);

Leader of outreach projects are invited to describe their project with 3000 characters maximum, indicating the detail of the project, the involved participants, the potential need for a trip on the field, the necessary equipment that he/she has to brought, the planned dissemination, communication and the partners involved.

Outreach

Project outcomes will be disseminated to a wider audience through the dedicated ZATA website (https://zaantarctique.org) and ZATA twitter (https://twitter.com/za_antarctique) Additionally, the ZATA will foster and fund an outreach and dissemination long term action starting in 2020, with E. Bataillou and F. Bondex, in relationship with IPEV, to better use scientific knowledge for children education.

7. Research team resources

Staff involved in the research project (Do not include IPEV staff)

Status	First name	Last name	Function	% (year)	% (year+1)	% (year+2)	% (year+3)
Engineer/technician	Guillaume	Bouger	PI, fieldwork, network set up and test	10	10	10	10
Scientist	Françoise	Binet	PlantAdapt IPEV 1116, data analysis	5	5	5	5
Scientist	Stéphane	Bétoulle	PI ImmunoToxKer IPEV 409, data analysis	5	5	5	5
Scientist	Philippe	Gaudin	PI SALMEVOL IPEV 1041	5	5	5	5
Scientist	Françoise	Hennion	PlantAdapt IPEV 1116, fieldwork, data analysis	5	5	5	5
Scientist	Jacques	Labonne	ZATA PI	5	5	5	5
Scientist	Céline	Le Bohec	PI Ecophy IPEV 137, fieldwork, data analysis	5	5	5	5
Scientist	David	Renault	Pi Subanteco IPEV 136	5	5	5	5
Scientist	Jean-Patrice	Robin	ZATA PI	5	5	5	5
Scientist	Thomas	Saucède	PI, fieldwork, sensor set up, data analysis	10	10	10	10
Scientist	Vincent	Viblanc	PI Econergy IPEV 119, fieldwork, data analysis	5	5	5	5

Equipment from the research team (for each year of the project)

Year	Equipment	Available or Requested	On site or Not
2021	air/soil/water sensors	Requested	Not on site
2021	Data loggers	Requested	Not on site
2021	LoRa gateways	Requested	Not on site
2022	air/soil/water sensors	Requested	Not on site
2022	Data loggers	Requested	Not on site
2022	LoRa gateways	Requested	Not on site
2023	air/soil/water sensors	Requested	Not on site
2023	Data loggers	Requested	Not on site
2023	LoRa gateways and relays	Requested	Not on site
2024	air/soil/water sensors	Requested	Not on site

2024	Data loggers	Requested	Not on site
2024	LoRa gateways and relays	Requested	Not on site

8. Support requested to IPEV and other agencies

Staff (for each year of the project)

Year	Number	Source	Function	Fieldwork duration
2021	2	Other	2 scientists are requested to help set up sensors, weather stations and LoRa networks in the field in close connection with IPEV staff (technicians and computer engineers). Also to be coordinated with the respective IPEV ZATA projects.	2 months
2022	2	Other	2 scientists are requested to help set up sensors, weather stations and LoRa networks in the field in close connection with IPEV staff (technicians and computer engineers). Also to be coordinated with the respective IPEV ZATA projects.	2 months
2023	2	Other	2 scientists are requested to help set up sensors, weather stations and LoRa networks in the field in close connection with IPEV staff (technicians and computer engineers). Also to be coordinated with the respective IPEV ZATA projects.	2 months
2024	2	Other	2 scientists are requested to help set up sensors, weather stations and LoRa networks in the field in close connection with IPEV staff (technicians and computer engineers). Also to be coordinated with the respective IPEV ZATA projects.	2 months

Arctic funding (for each year of the project and only for implementation of the field campaigns)

Year	Source	Other funding agency	Type	Requested (€ including V.A.T.)	Secured	Comment

Equipment funding (for each year of the project and only for implementation of the field campaigns)

Year	Source	Other funding agency	Requested (€ including V.A.T.)	Secured
2021	IPEV		5000	No
2021	Other funding agency	respective project fundings	30000	No
2021	Other funding agency	ZATA	5000	Yes
2022	IPEV		5000	No
2022	Other funding agency	Respective project fundings	6000	No
2022	Other funding agency	ZATA	5000	Yes
2023	IPEV		5000	No
2023	Other funding agency	respective project fundings	60000	No
2023	Other funding agency	ZATA	5000	Yes
2024	IPEV		5000	No
2024	Other funding agency	ZATA	5000	Yes
2024	Other funding agency	respective project fundings	30000	No

Consumable funding (for each year of the project and only for implementation of the field campaigns)

Year	Source	Other funding agency	Requested (€ including V.A.T.)	Secured
2021	IPEV		5000	No
2021	Other funding agency	ZATA	5000	Yes
2021	Other funding agency	respective project fundings	10000	No
2022	IPEV		5000	No
2022	Other funding agency	ZATA	5000	Yes

2022	Other funding agency	respective project fundings	10000	No
2023	IPEV		5000	No
2023	Other funding agency	ZATA	5000	Yes
2023	Other funding agency	respective project fundings	10000	No
2024	IPEV		5000	No
2024	Other funding agency	ZATA	5000	Yes
2024	Other funding agency	respective project fundings	10000	No

9. National and/or international permits to be requested

Organism or organisation	Type of permits

10. Suggestions of reviewers

Campaign

Bouger + Saucède - WiSeNet - 1258

2021/2022

New **1/4**

1. Location Selection

Polar area

Zone / District / Location : Period	Comment
Sub-Antarctic / Kerguelen : Summer	Port-aux-Français. The project will be first implemented in Kerguelen, at Port au Français for the initial testing phase (2021-22).

2. Operational Implementation

Description and chronology of operations

Fieldwork will consist in (1) setting up soil sensors, weather station, and water sensors at Port aux Français along with (2) the LoRa gateways and check for (3) the network efficiency and data to be forwarded to the local server for the testing phase.

- (1) Two weather stations (one CR1000X and one CR3000) will be positioned behind BCR building at the beginning of the fellfield and connected to soil sensors (to be implemented in close connection with staff of project #1116). Two marine sensors will be set up near La Flotille by scuba divers of project #1044.
- (2) A LoRa gateway + large gain antenna will be deployed at the IPEV shelter at PAF.
- (3) The wireless network will be tested for data transfer to the local IPEV server with the help of IPEV computer engineers/technicians.

Stations, fixed camps or routes

Port aux Français base only.
Soil and air sensors and weather station will be set up at Port aux Français behind BCR, at start of the fellfield. Sea water sensors will be deployed near La Flotille.

Infrastructures

Accomodation and catering for the project staff at Port aux Français.

Working room for the staff to assemble and prepare the equipment to be deployed.

Logistics on the field

No transportation to be scheduled at this stage.

Possible field cooperation with other IPEV or international projects

The present project is the embodiment of cooperation between projects, since it was thought and organized at the ZATA level. More specifically, IPEV projects more directly involved in this first testing phase at Port aux Français will be projects #1116 (Plantadapt: soil and air sensors) and #1044 (Proteker: coastal marine sensors).

3. Research project staff and equipment involved in the field campaign

Staff involved

Location	First name	Last name	Status	Function	Start date	End date	Duration	Justification
Sub-Antarctic / Kerguelen : Summer	Thomas	Saucède	Scientist	co-PI, fieldwork	2020-11-01	2020-12-31	2 months	One scientist of the project team is needed in the field to help testing the sensor network and fullfilment of scientific objectives.
Sub-Antarctic / Kerguelen : Summer	Guillaume	Bouger	Engineer/Technician	co-PI, fieldwork	2020-11-01	2020-12-31	2 months	One engineer of the project team is needed in the field for equipement set-up and test

Equipment involved

Location	Type	Available/Requested	On site or not
Sub-Antarctic / Kerguelen : Summer	data loggers	Requested	Not on site
Sub-Antarctic / Kerguelen : Summer	LoRa gateways	Requested	Not on site
Sub-Antarctic / Kerguelen : Summer	sensors	Requested	Not on site

4. Support requested to IPEV for the field campaign

Staff

Location	Function	Start date	End date	Duration	Justification
Sub-Antarctic / Kerguelen : Summer	technician and computer engineer	2021-11-01	2021-12-31	2 months	The sensor network will be set up by the project team (2 people) in close cooperation with IPEV technicians and engineers for connecting the LoRaWAN architecture to the local server, ensure correct data transfer to the local server and forward to the end server in mainland France.

VSC Before campaign training (Not for Arctic)

Location	Quantity	Duration

VSC Stay in research team laboratory after campaign (Not for Arctic neither Concordia)

Location	Quantity	Duration

Request for new equipment

Location	Designation	Quantity	Total (€ including V.A.T.)	Justification
Sub-Antarctic / Kerguelen : Summer	data server and satellite communication	1	5000	The project team will be in charge of setting up the sensor network (set up of sensors and LoRa gateway) and data storage on the end server in mainland France. Data transfer to a local server and data forward to the end server (satellite communication) is requested to IPEV.

Request for consumables

Location	Designation	Quantity	Total (€ including V.A.T.)
Sub-Antarctic / Kerguelen : Summer	hard drives, computing equipment (server, backup and connectors) and backups	1	5000

Staff travel, material transport, field and running costs (only for Arctic)

Location	Designation	Details	Total (€ including V.A.T.)	Justification

5. Status of national and/or international permits/licenses to be requested for this campaign

6. Comments from the head of unit

The head of the ZATA fully supports the present initiative, as it is clearly aligned with several of its goals : mutualisation of resources, increased appraisal of environmental variation with reduced environmental impact, implementation of FAIR principles in to polar science, and in fine, increased integration between scientific projects. We also welcome the prospect of a technical collaboration with the Polar Institute to help improve the quality of our protocols in the field.

Saint-Pée sur Nivelle, July 14th 2020

Object: Endorsement of IPEV technical Program WiSeNet 1258

The WiSeNet program is a shared initiative to develop an intelligent network of sensors in sub-Antarctic and Antarctic research areas. It is part of the Zone Atelier Antarctique et Terres Australes strategy for its 2020-2025 plan, and will contribute to the implementation of the LTER framework (IR RZA, INEE, CNRS). It is aimed at maximizing collaboration and data sharing between research programs, and optimizing the synergy with the Polar Institute support and skills.

As such, we fully endorse this technical project, and hope that the Polar Institute will support the present initiative

To whom it may concern,

Jacques Labonne

Jean-Patrice Robin