



TERRA FORMA – 2021-2028

« Investment for Future » program



Designing and testing a smart observation platform
of socio-ecosystems in the Anthropocene

EGU meeting, May 24th, 2022

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The TERRA FORMA Team

Innovative sensor networks to understand the Planet Habitability

Scientific challenges

Study biotic-abiotic interactions

Human-non-human interactions

Water resources



Chemical pressure

Soil capital



Biodiversity and habitats

Innovative sensor networks to understand the Planet Habitability

Technical Approach:

Develop a « multi-messenger » approach at the scale of the « place of living » or « territory »

- (1) Smart sensors
- (2) Communication infrastructure
- (3) Social infrastructure



Innovative sensor networks to understand the Planet Habitability

Technical challenges

In-situ and mobile sensors

Low consumption

Embedded intelligence : relevant information?

Data harvesting

Small, light

Low impact

Socially approved

Build on emerging technologies

Optical sensors, Internet of things, 3D printing, artificial intelligence

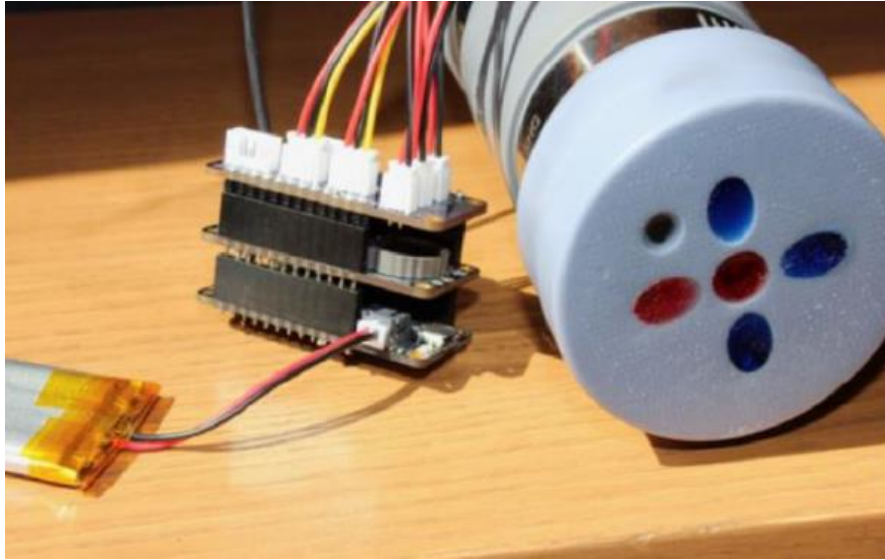
New paradigm

Collective intelligence



Innovation at the heart of interdisciplinarity

Multiparameter probe



© Vincent Raimbault, LAAS, Toulouse

Existing fluorimeter (chlorophyll-a)

3D printing, Lora communication
embedded, résolution Chl.-a : 0,1 µg/L.

Open source / Cost : 50 €



TERRA FORMA multiparameter probe

Discharge, temperature, conductivity, pH, O₂,
CO₂, Chl-a, turbidity, DOC, Nitrate

Open source / Cost : 500-2000 €

Off the shelf : 20 k€ !

Innovation at the heart of interdisciplinarity

Capture dynamic interfaces

In situ Carbon isotopes

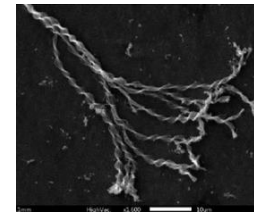


Trace metallic elements, emerging contaminants

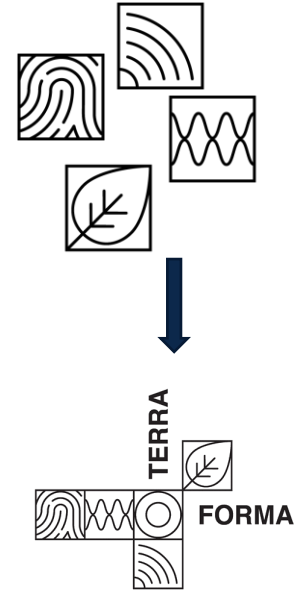


Biologging

Hyperspectral camera



Microbiological activity
Biogeophysics

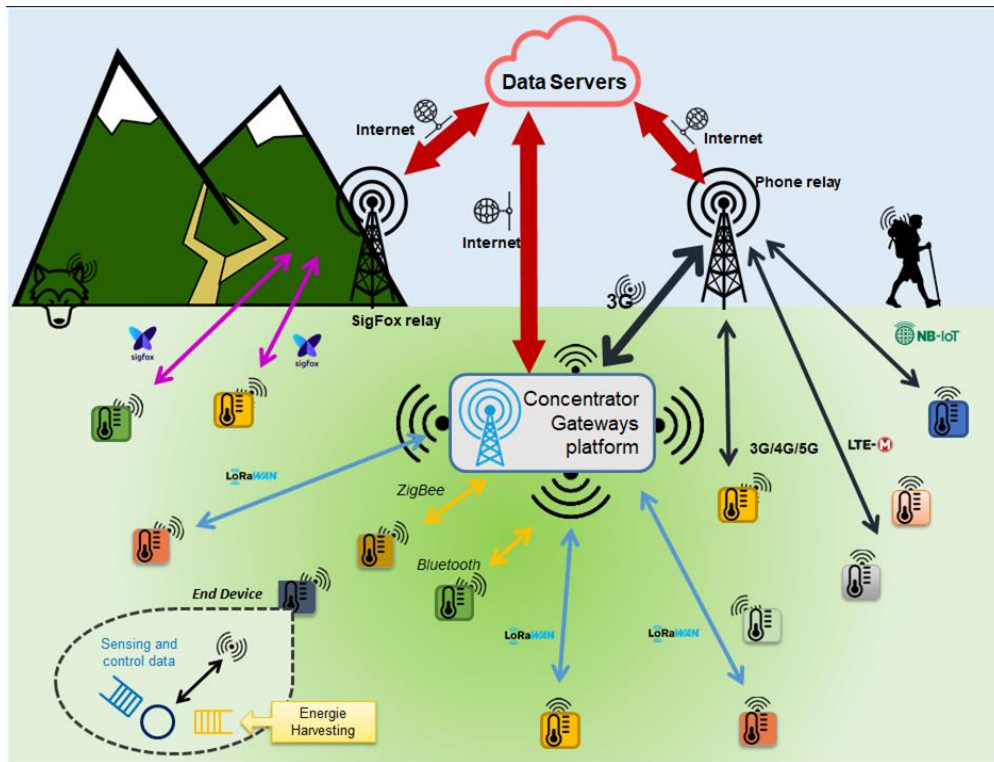


Instrumentation ends when data is FAIR

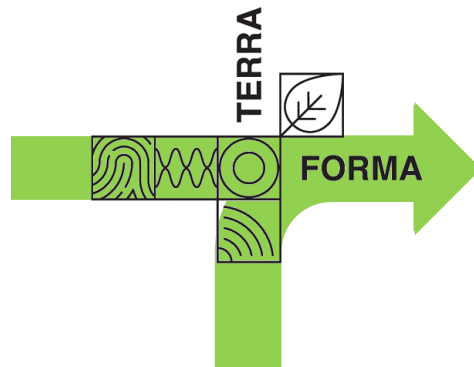
Dense and
scalable networks
of heterogeneous
sensors

Create data
pipelines to process
data as close as
possible of the
sensor

Support repetitive
tasks



A co-construction of Earth, Natural Sciences with ...



- Engineering and System Sciences
- Information science and computer Sciences
- Social Sciences

Joining efforts for pioneering observation systems

Partners : CARTEL, CEBC, CEFE, Centre de Géosciences, CERFE, CESBIO, Chrono-environnement, CRAL, CReSTIC, DT-INSU, Dynafor, ECOBIO, ECOLAB, EVS, GET, GR, GSMA, HABITER UR, IGE, IM2NP, IPAG, IPGP, IRISA, IRT, ISM, ISTO, LAAS, LECA, LEMAR, LHYGES, LIG, LIRMM, LMGE, LPC, LRP, LSIS, RiverLy, SAS, Subatech.

Institutions : CNRS : INSU, INEE, INSIS, IN2P3, INP, INS2I, INSHS, INSB.
Research Organisms : IRD, INRAE, IPGP. **Engineer Schools** : Mines ParisTech. **Universities** : Grenoble, Savoie-Mont-Blanc, Toulouse, Rennes, Clermont-Auvergne, Montpellier, Reims, Toulon, Franche Comté, Orléans, Strasbourg, Aix Marseille. **EPIC** : INERIS. **PME** : Extralab

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<https://mitpress.mit.edu/books/terra-forma>

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