

# *SenseLife*

Remote sensing of living organisms with full-Stokes  
spectro-polarimetry

Brice-Olivier Demory

*Center for Space and Habitability (CSH)*  
*Space Research and Planetary sciences (WP)*  
University of Bern



European Research Council  
Executive Agency



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Secrétariat d'État à la formation,  
à la recherche et à l'innovation SEFRI

*u<sup>b</sup>*

<sup>b</sup>  
UNIVERSITÄT  
BERN

CSH  
CENTER FOR SPACE AND  
HABITABILITY

# SenseLife team



**Dr. Mathilda Fatton**  
**Microbiologist**



**Dr. Lucas Patty (1.1.23)**  
**Physicist**



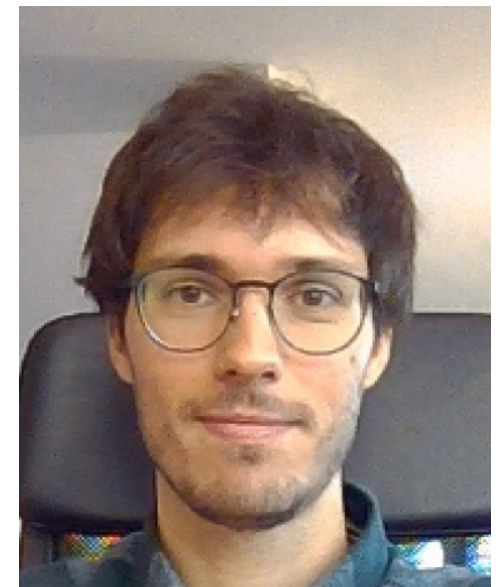
**Dr. Romain Cerubini**  
**Physicist**



**Mr. Urs Schroffenegger**  
**Software engineer**



**Ms. Empar Meyer**  
**Microbio Lab technician**

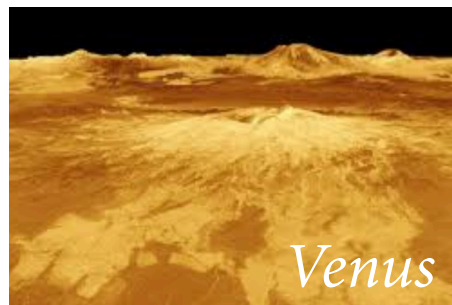


**Mr. Jonatan Wicht**  
**Optical engineer**

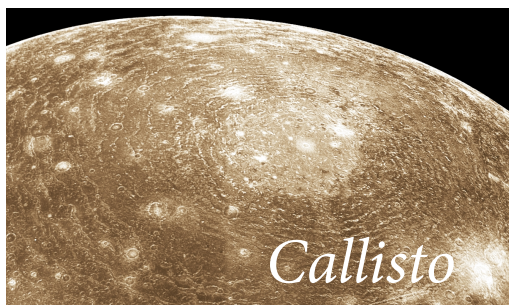
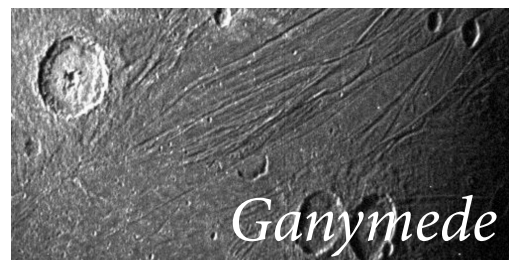


# Can we *reliably* and *remotely* detect living organisms in the solar system?

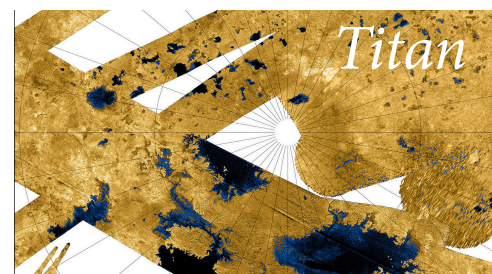
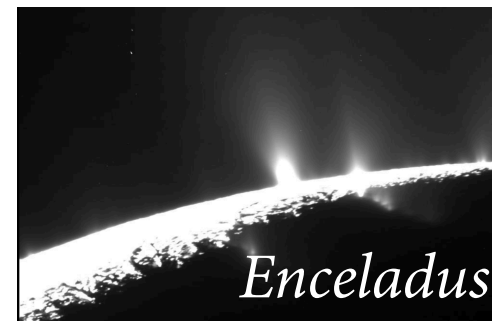
## Ocean relicts



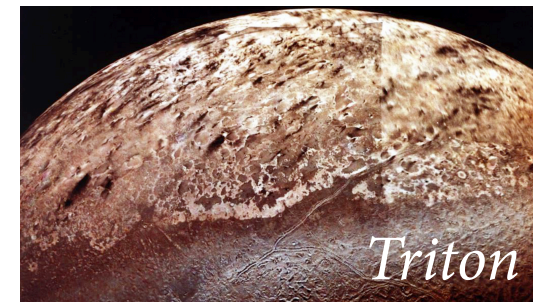
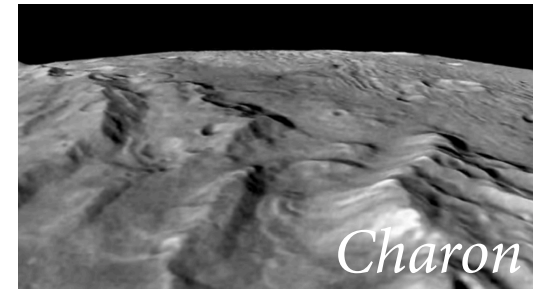
## Jupiter icy moons



## Saturn icy moons

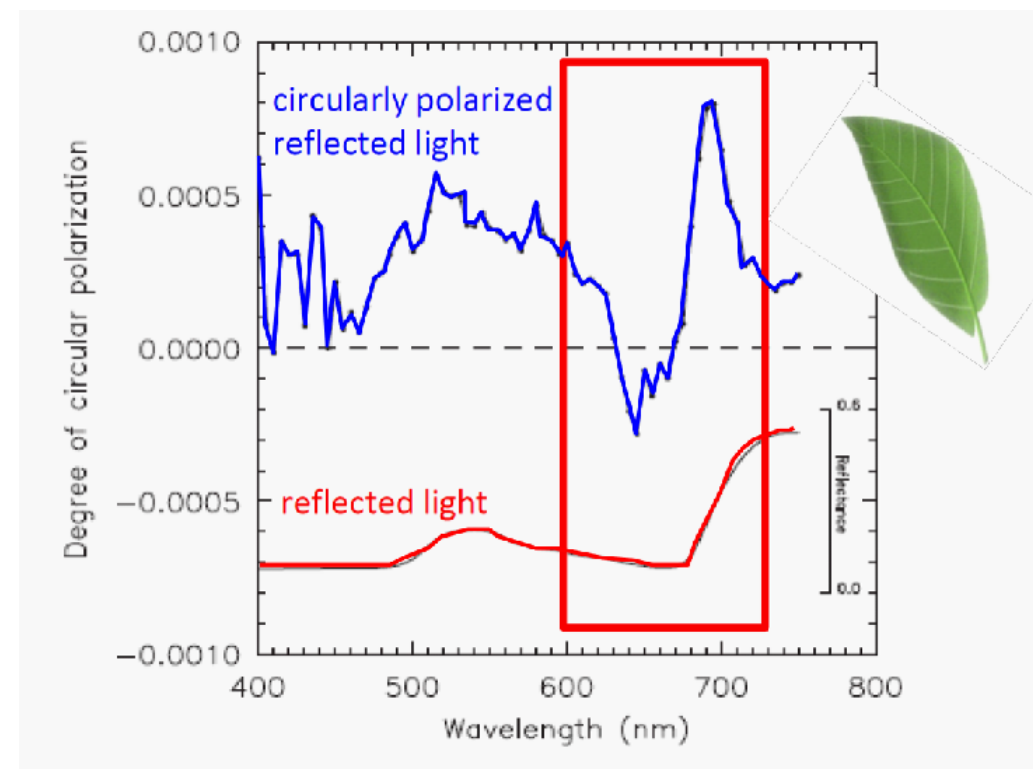
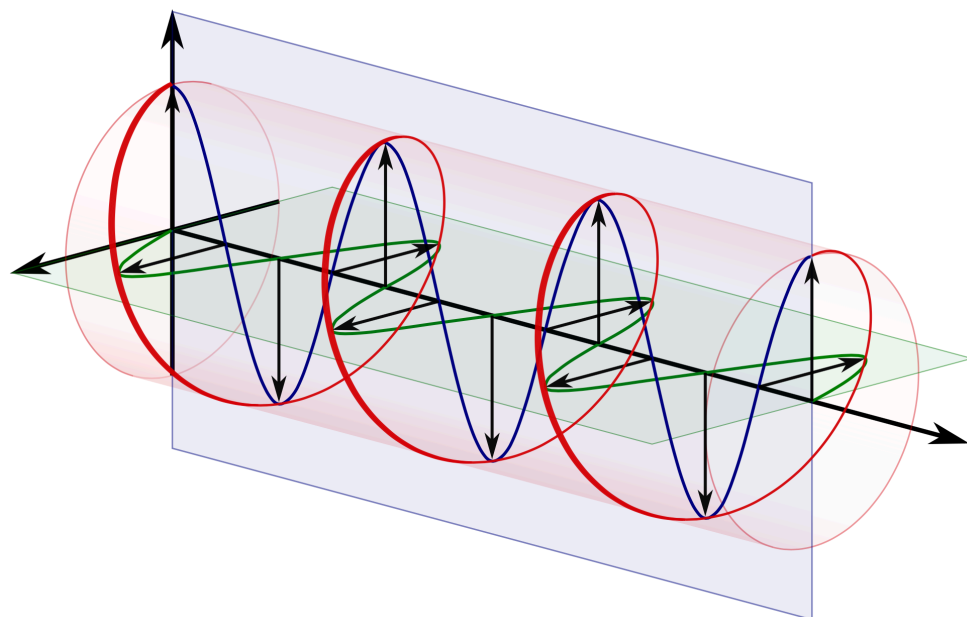
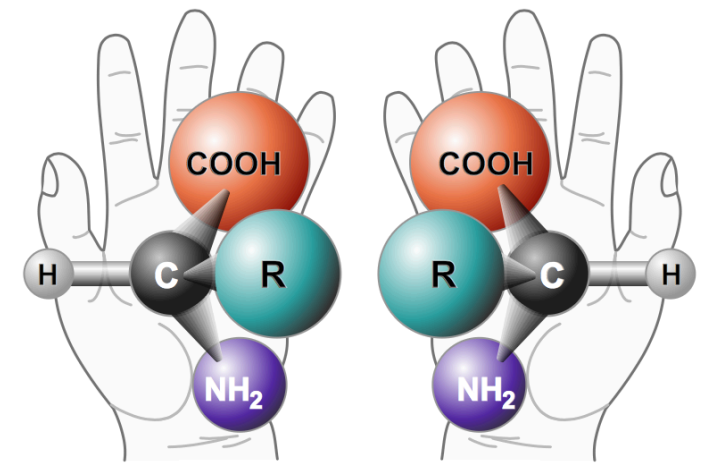


## Kuiper belt objects

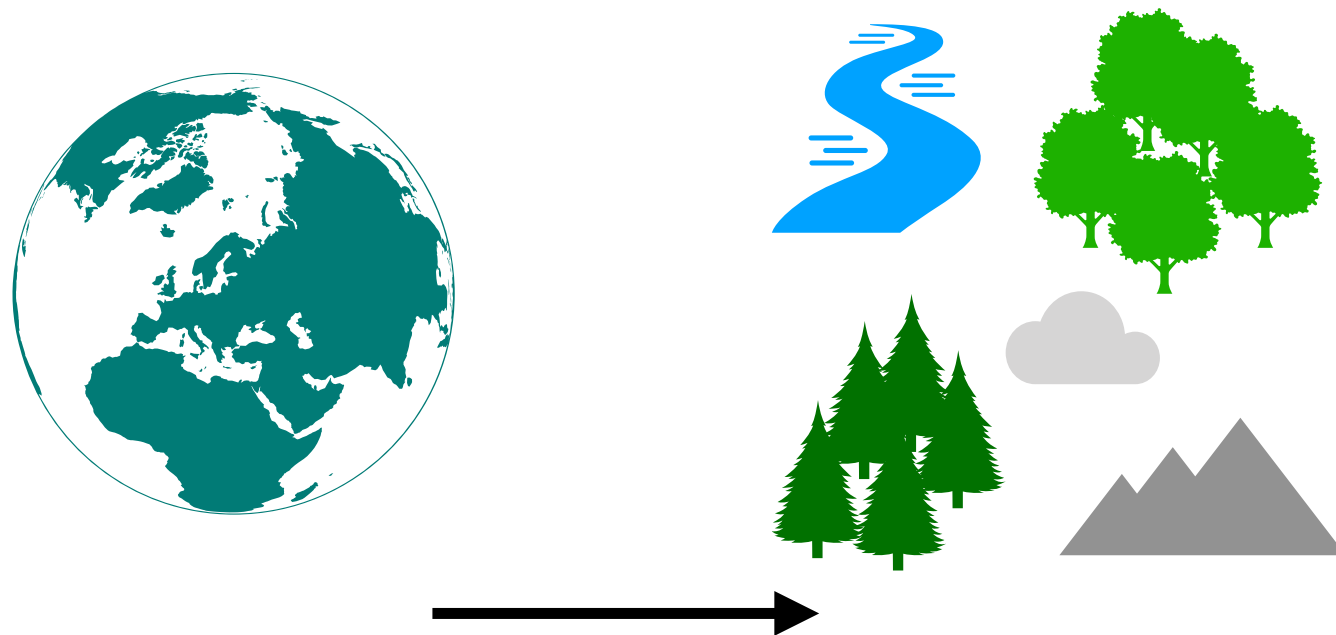


# Using homochirality to *characterise* life

- All known molecules used by life have a single handedness (homochirality)
- Light scattered off homochiral material is partially circularly polarised
- Circular polarisation may thus be used to infer the presence of chiral molecules (biosignature)



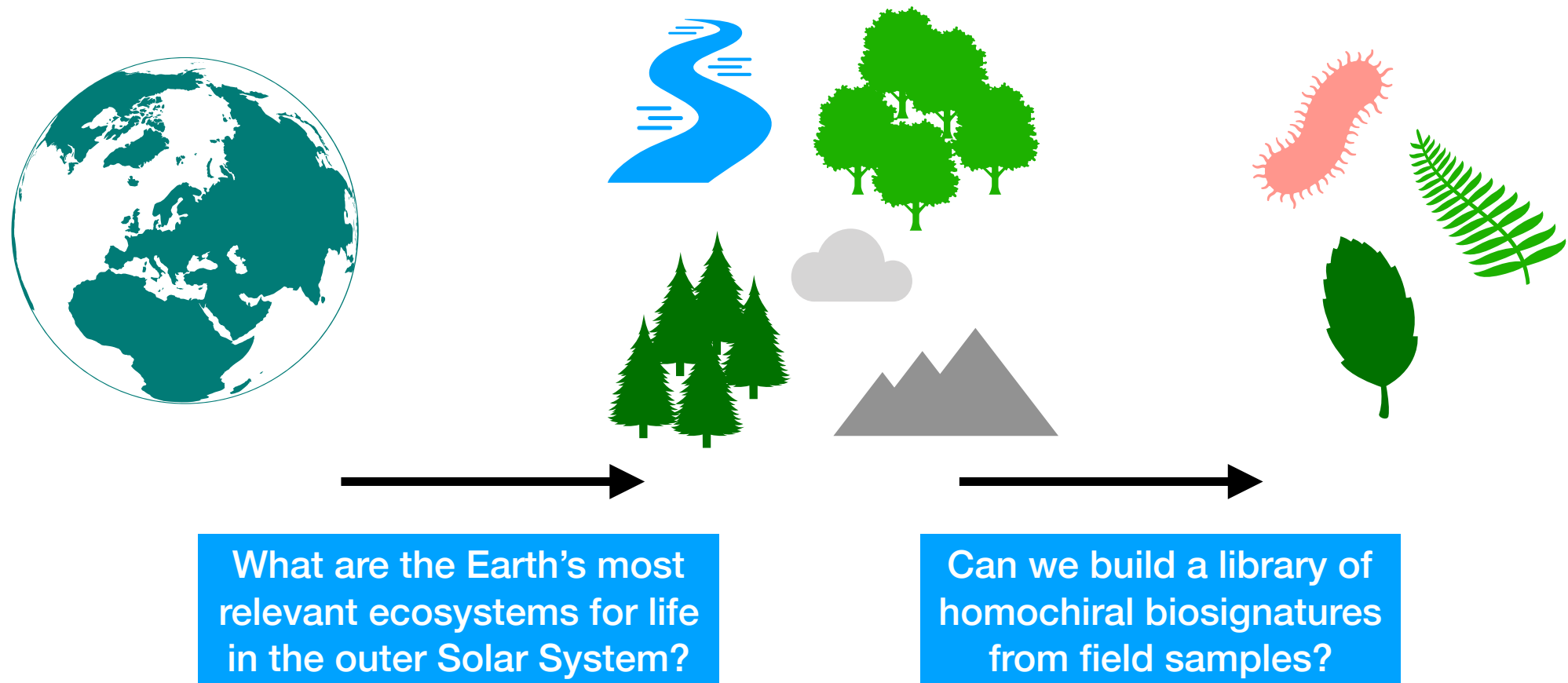
# *SenseLife*: from the lab to space



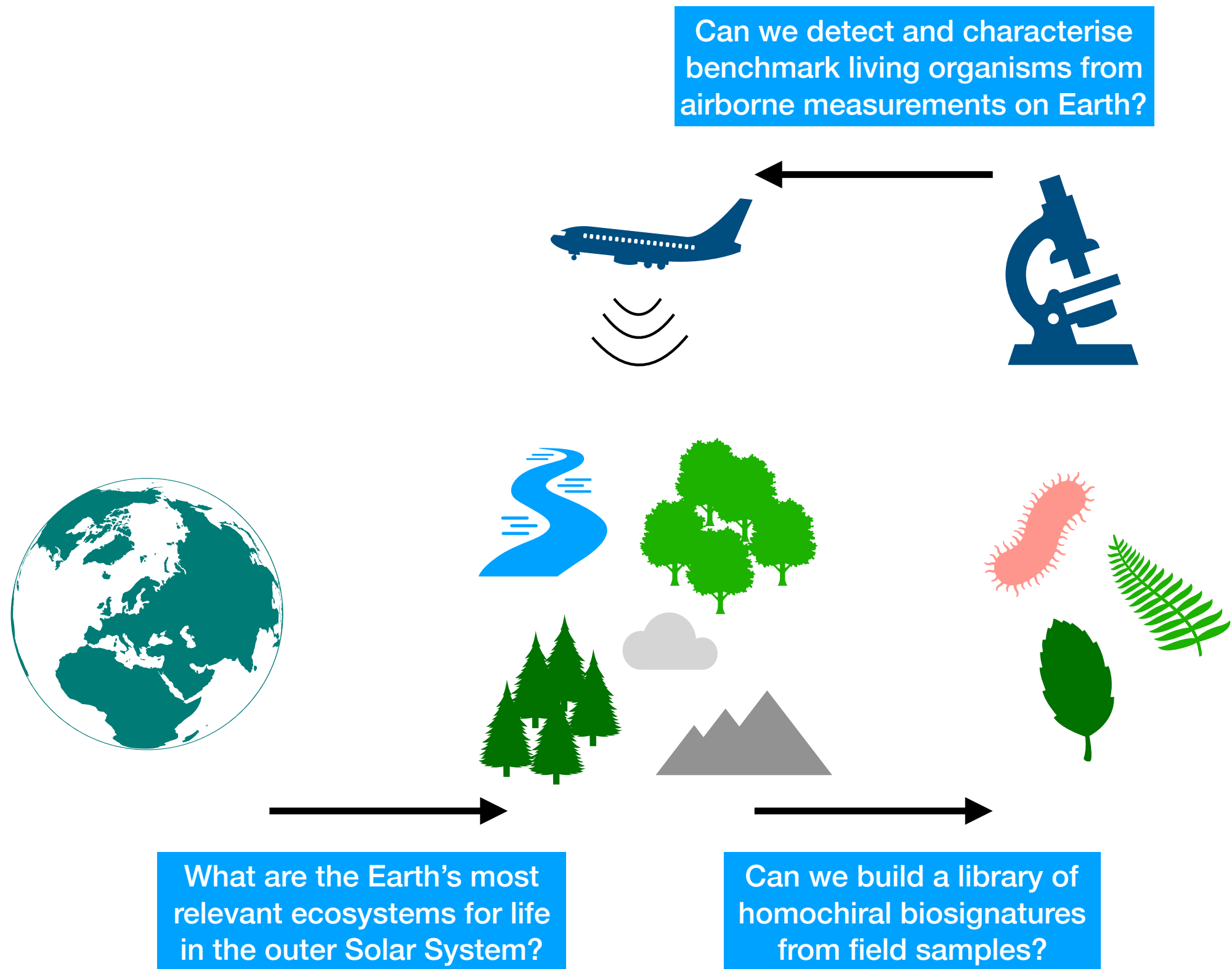
What are the Earth's most relevant ecosystems for life in the outer Solar System?



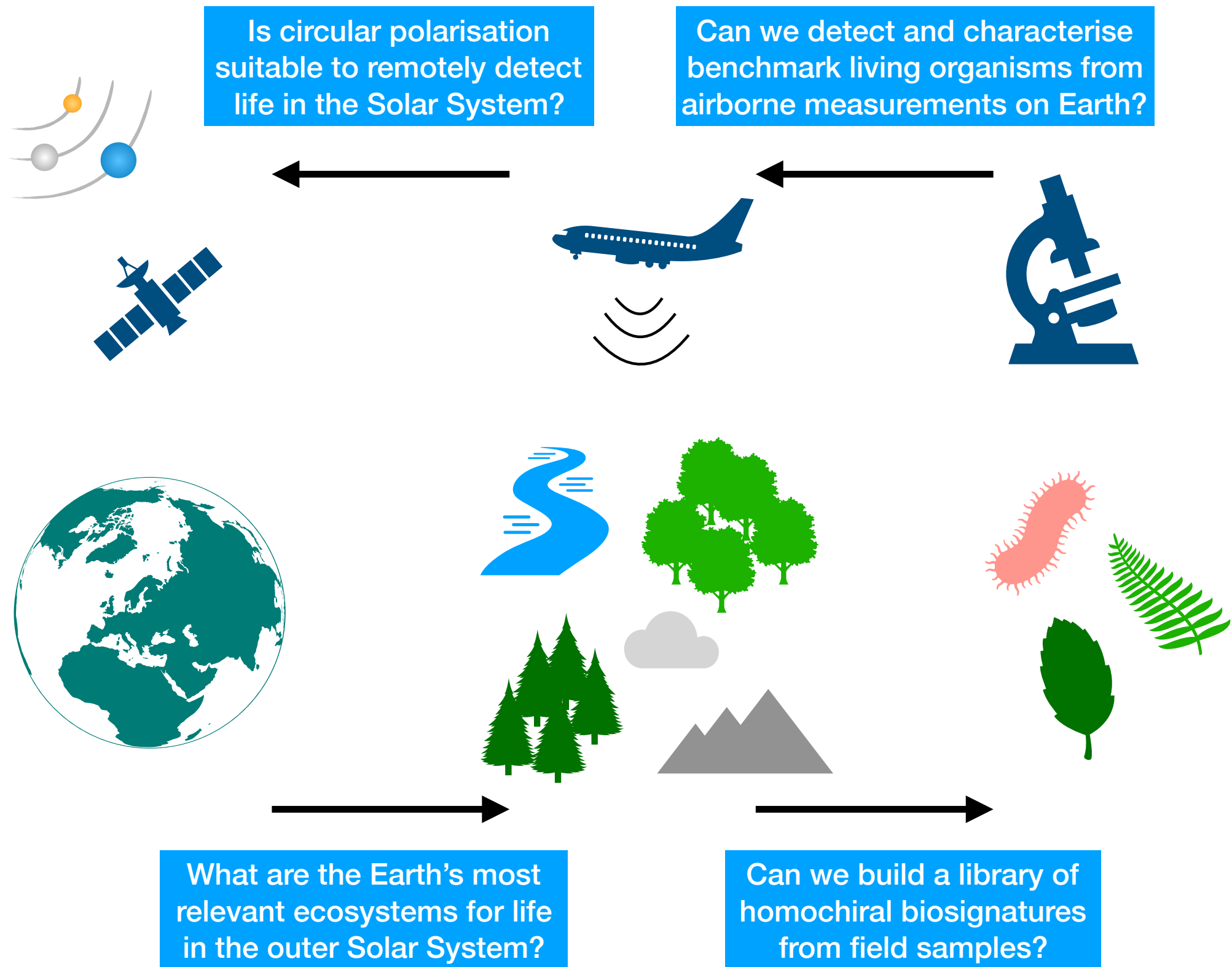
# *SenseLife*: from the lab to space



# *SenseLife*: from the lab to space

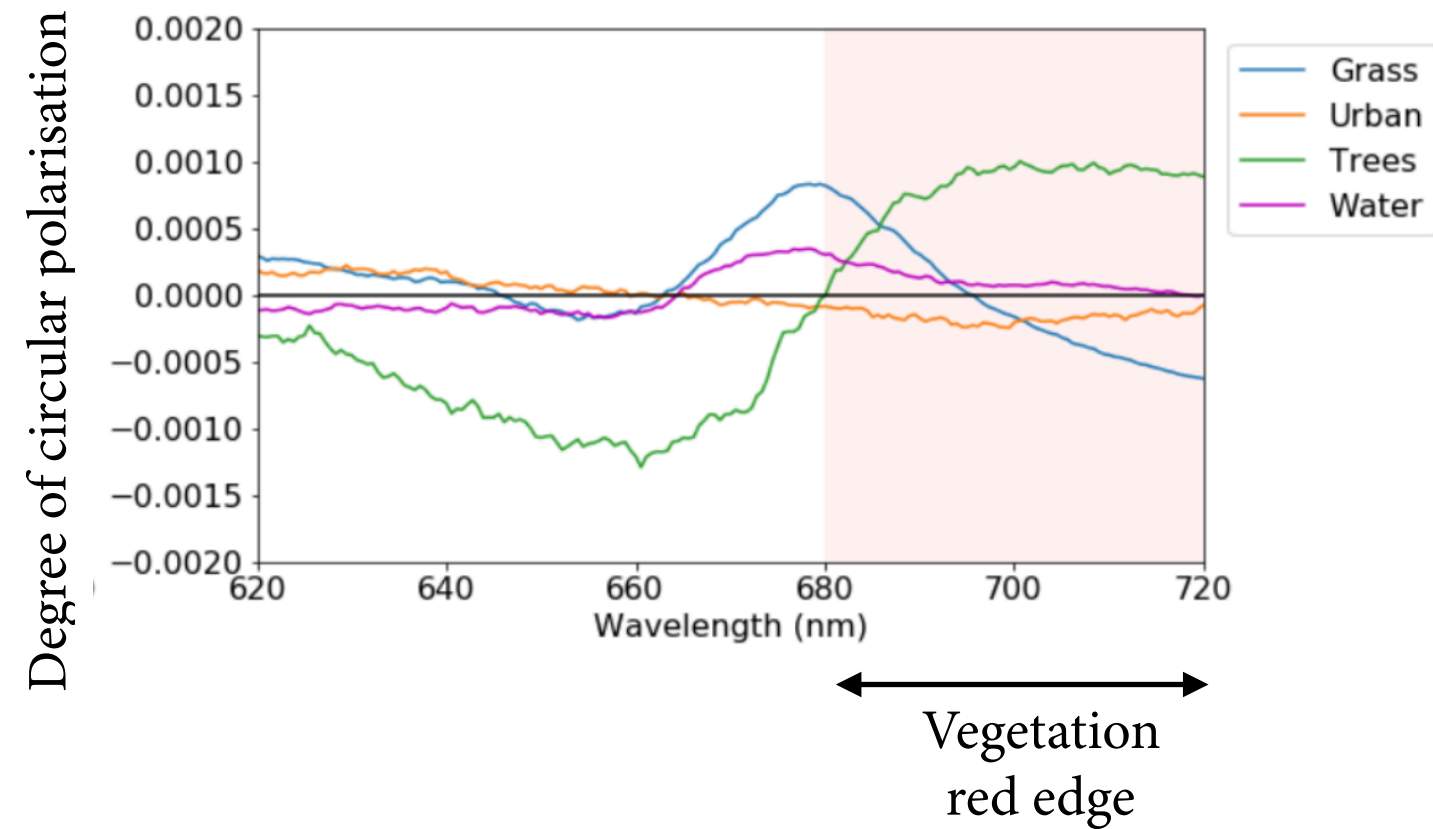
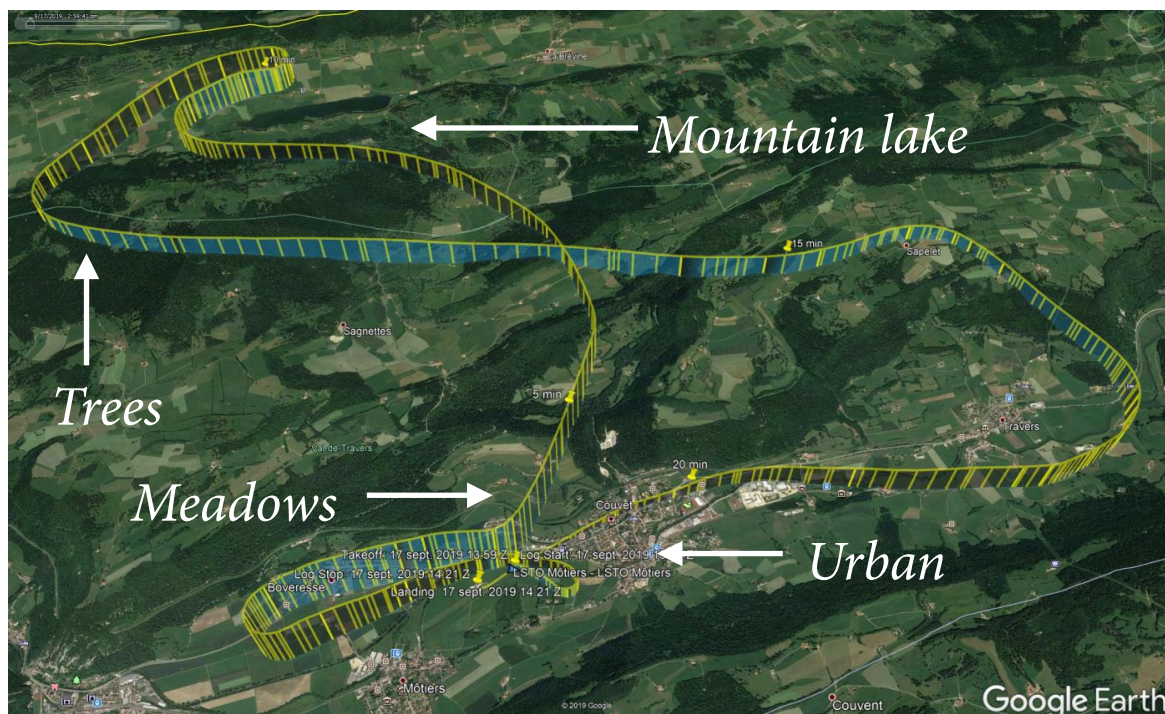


# *SenseLife*: from the lab to space



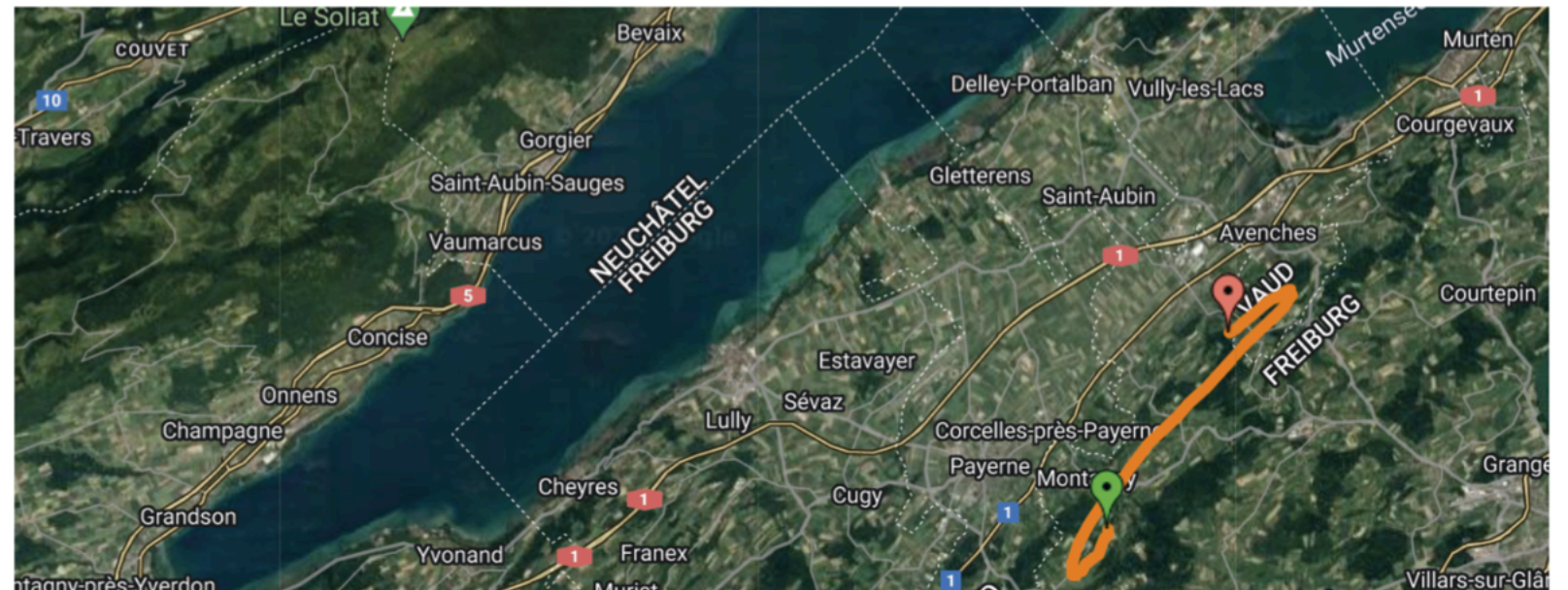


# Airborne distinction between biotic and abiotic sources



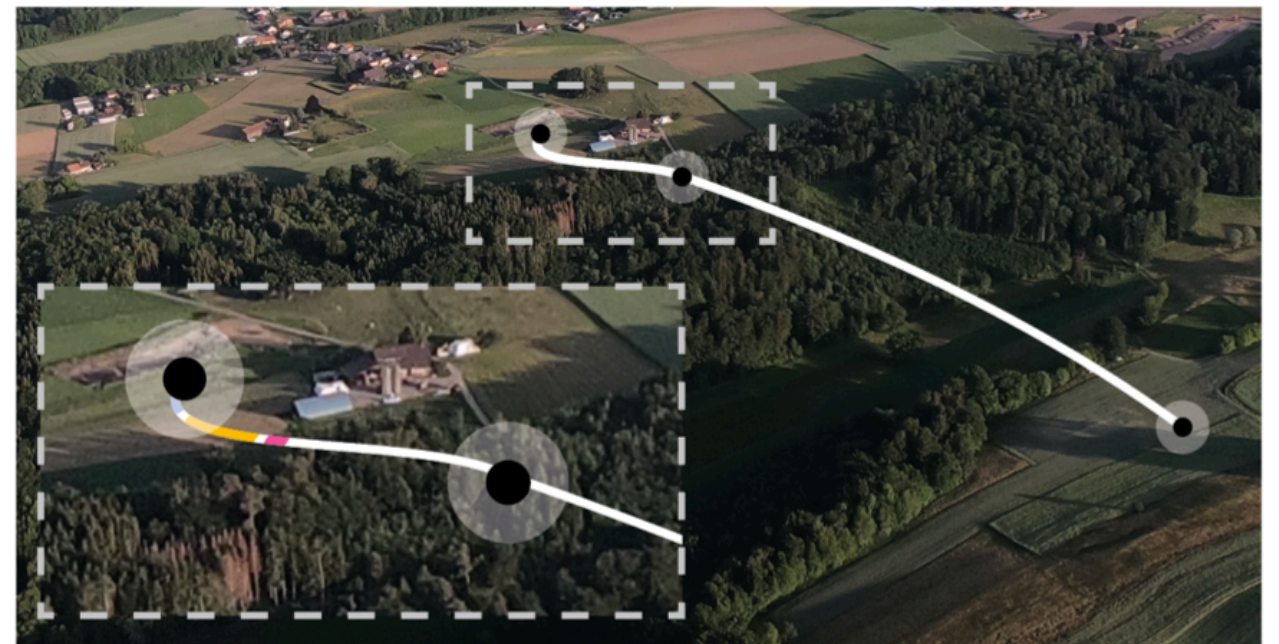
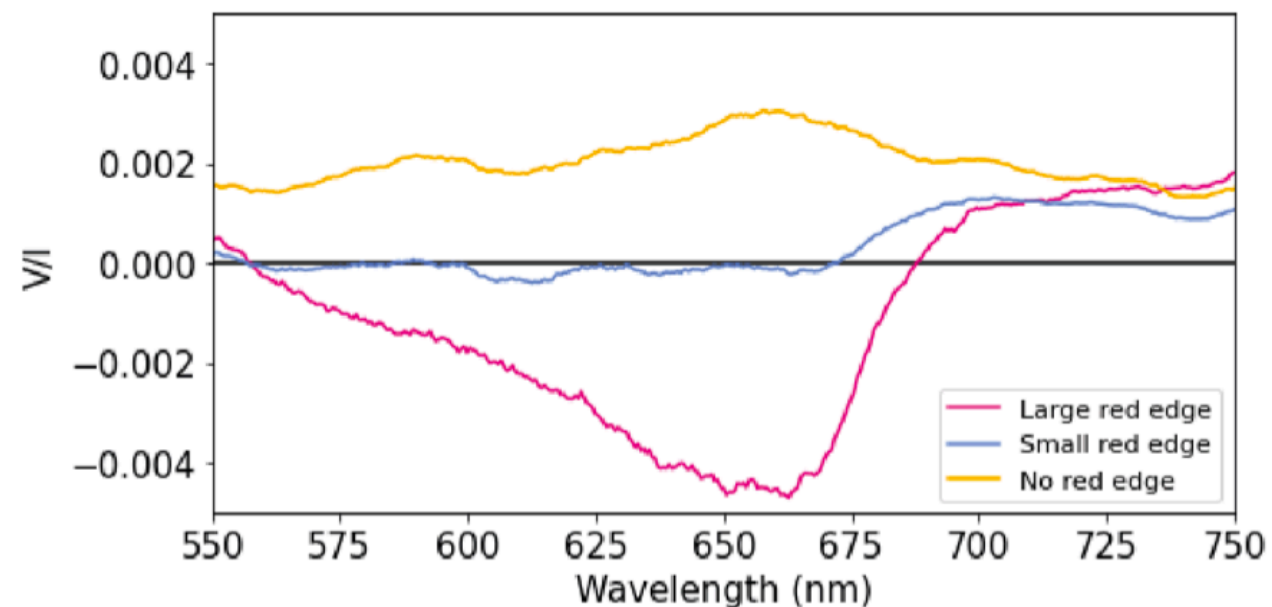
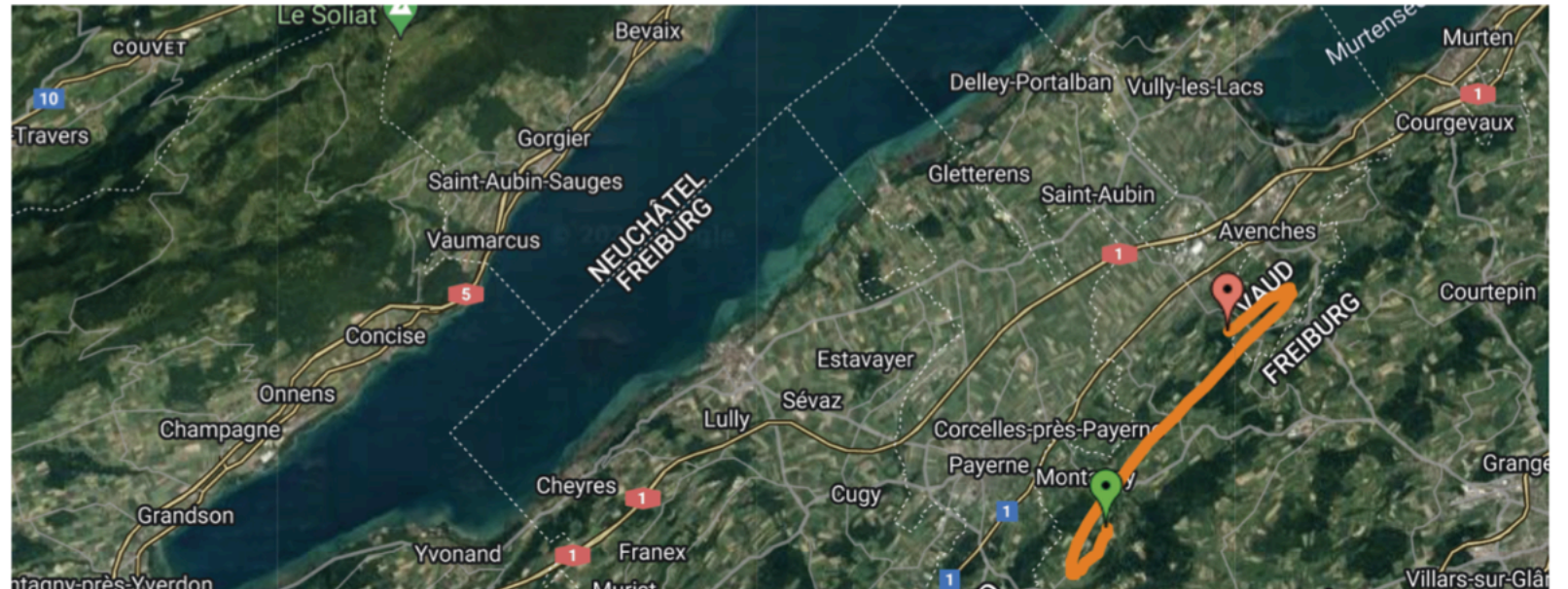


# Resolving different scenes from an hot air balloon

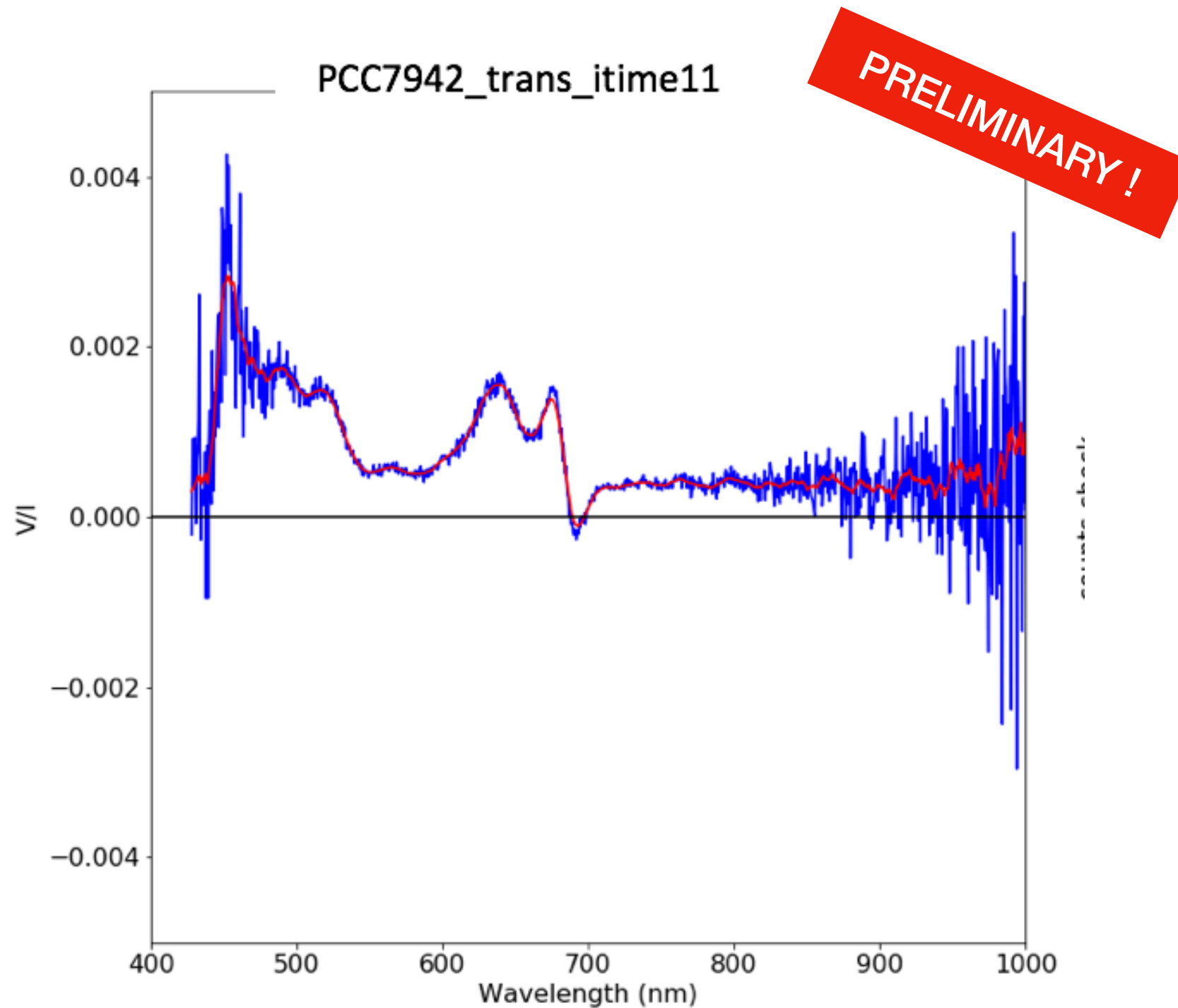




# Resolving different scenes from an hot air balloon

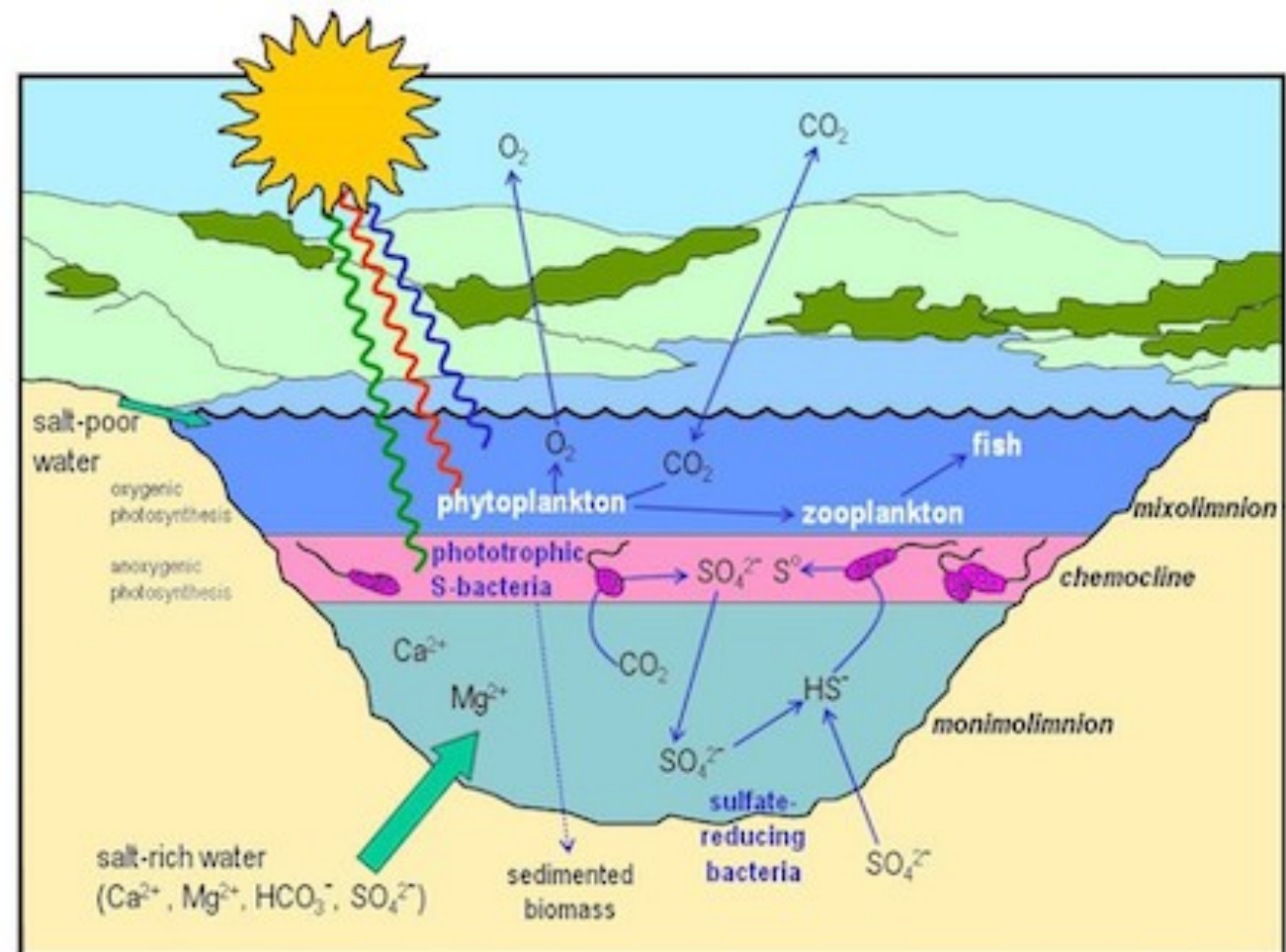


# Cyanobacteria (lab)





# Upcoming field campaign



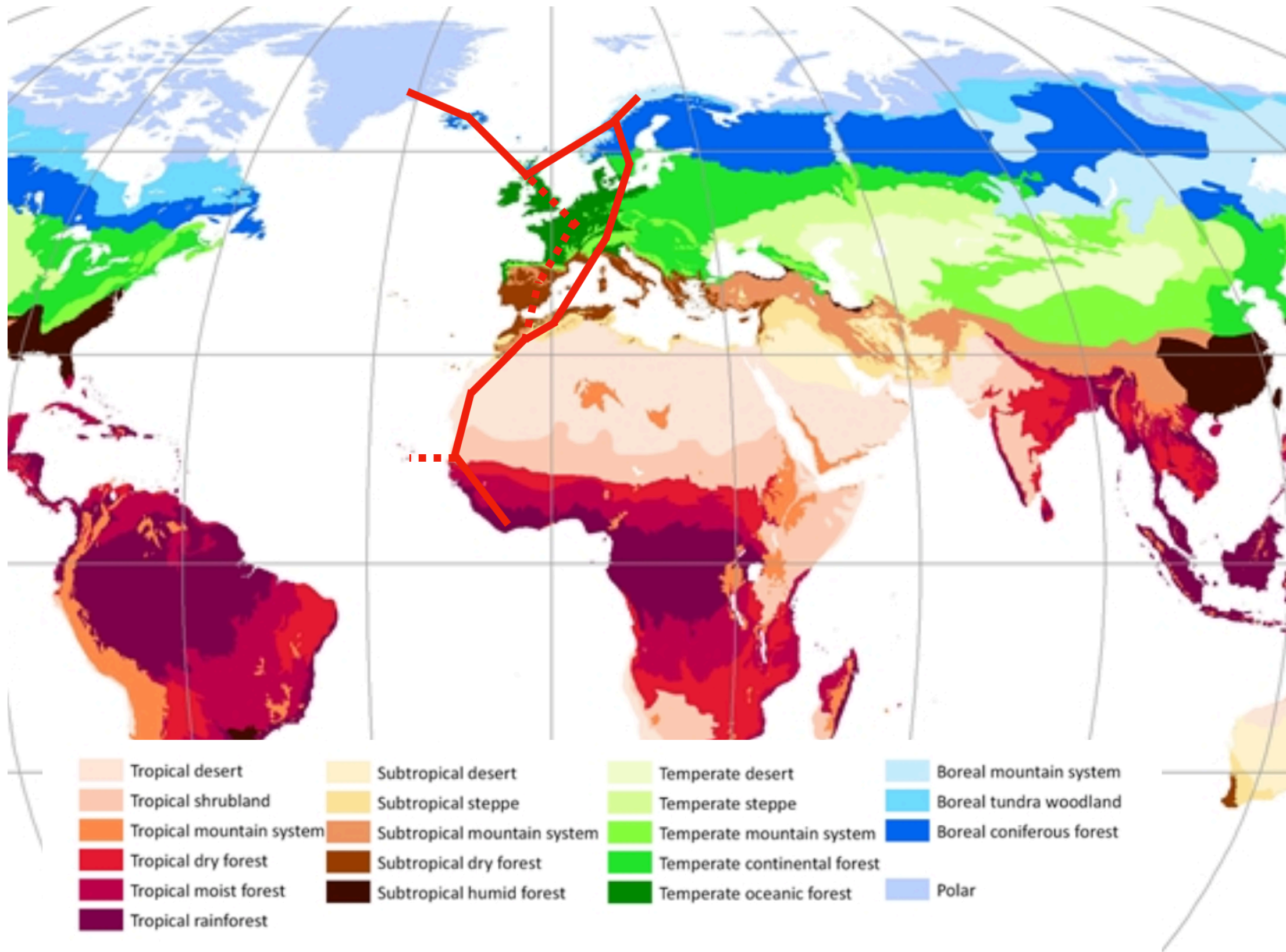


# Flight campaign: 2 months, 14 800 nm



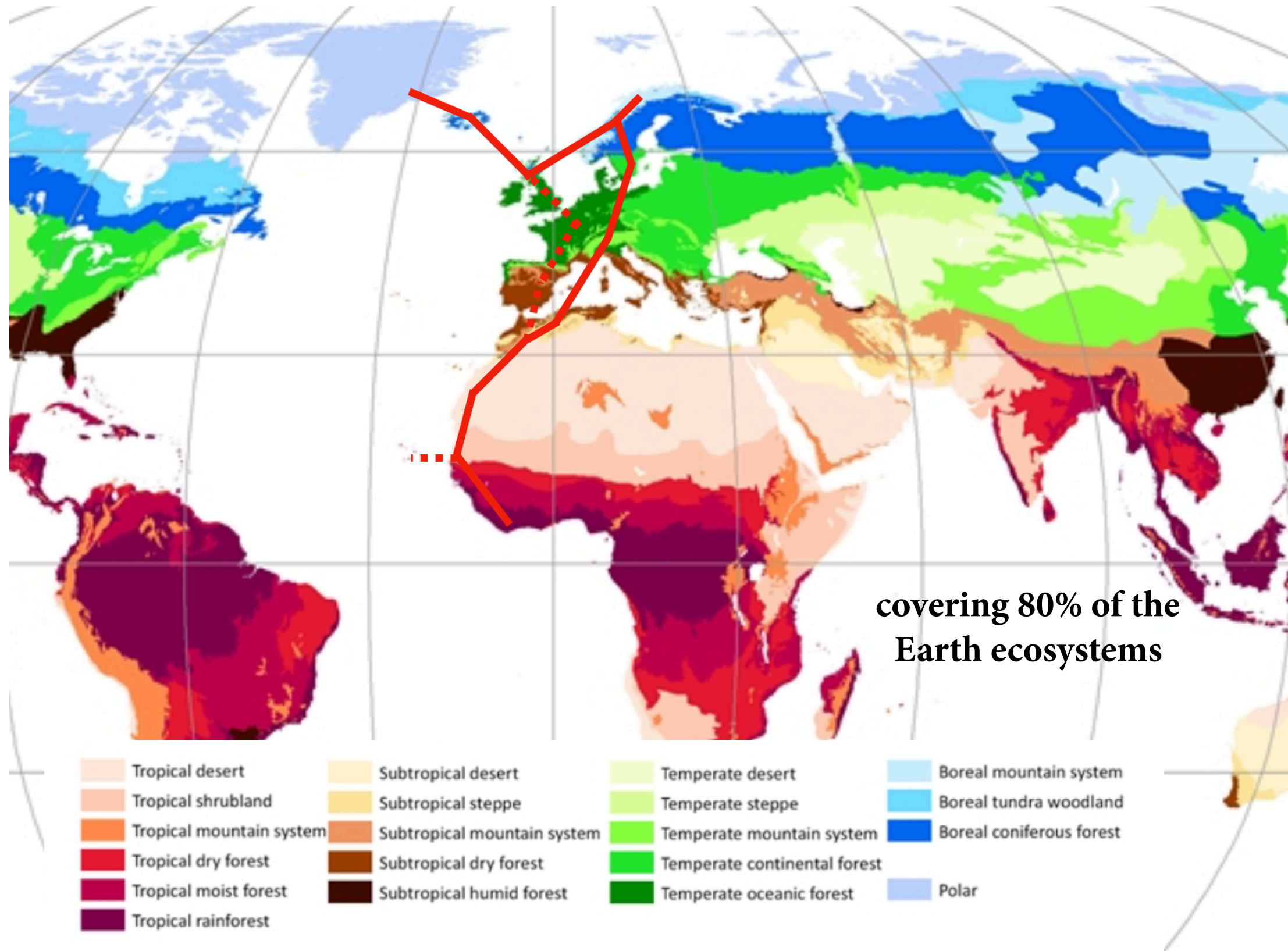


# Flight plan - Summer 2024



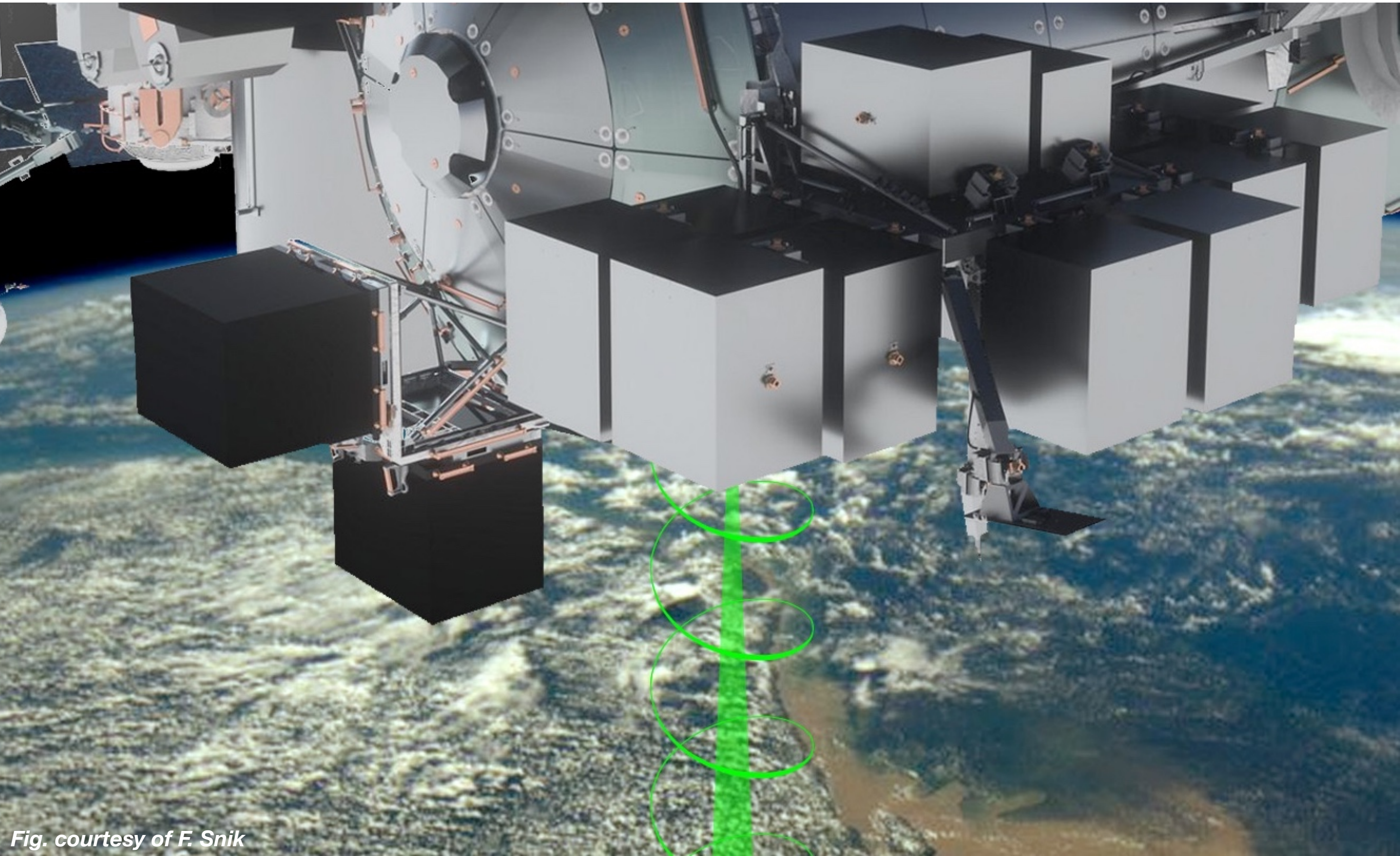


# Flight plan - Summer 2024





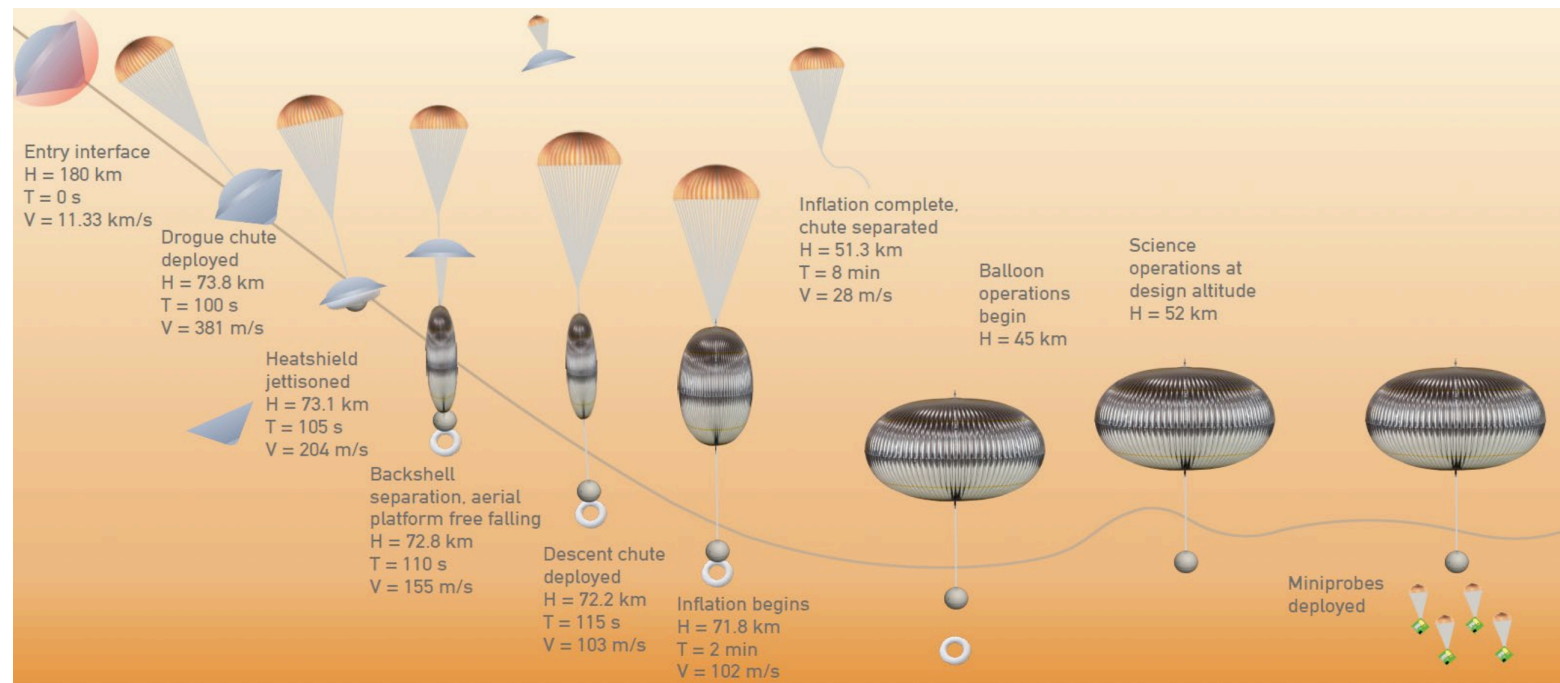
# From airborne to space: a pathfinder



*Fig. courtesy of F. Snik*



# The next decade and beyond



*Venus life finder mission concept*

- Demonstrate **reliability** and **detectability** of homochirality as biosignature
- Contribute **instrumentation** to detect life beyond our Earth