WP 2140: Land validation over temperate and tropical forest
WP 2680: Support CHIME Cal/Val

IDEAS-QA4EO WS#5 Thessaloniki 11.06. – 13.06.2024

Benjamin Brede, Linda Lück, Tim Stassin, Martin Herold (GFZ Potsdam)

Konstantin Schellenberg (Department for Earth Observation, Friedrich-Schiller-University, Jena; Department of Biogeochemical Processes, Max Planck Institute for Biogeochemistry, Jena)

Land validation over temperate and tropical forest

- StrucNet goal
  - Monitor vegetation dynamics through continuous monitoring of vegetation structure
  - GFZ StrucNet design principle: add vegetation structure support to ecosystem networks, primarily ICOS

- GFZ StrucNet instruments
  - LEAF
  - TreeTalker
  - GNSS-T VOD

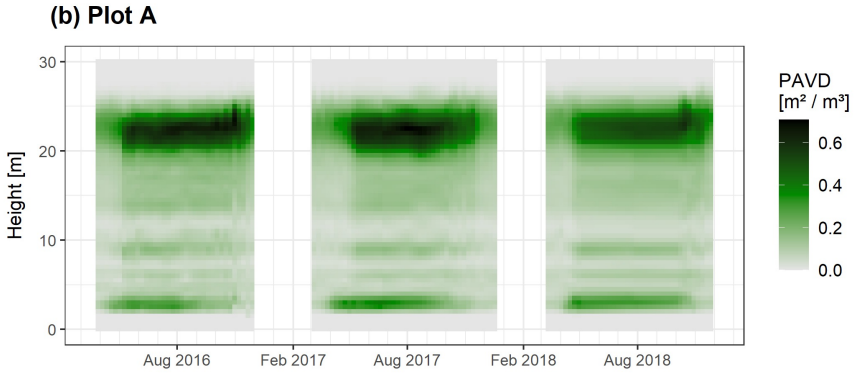
LEAF: monitoring lidar

- Observable: PAD = vertical PAI distribution

- Total delivered: 5
- Installed
  - Oct 2023: 3x ICOS-GF-Guy (Paracou)
- Planned
  - 1 ICOS-DE-Hai (Hainich)
  - 1 travel/intercomparison campaigns

- QA processor for L0 data

LEAF deployed at Paracou

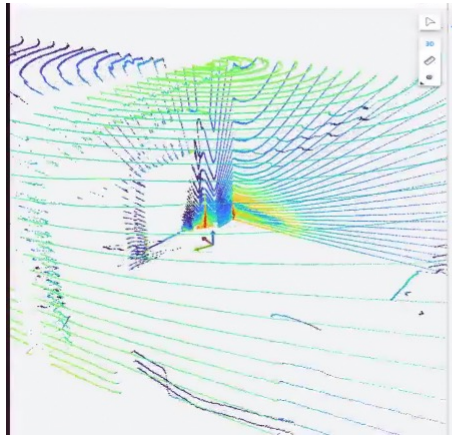


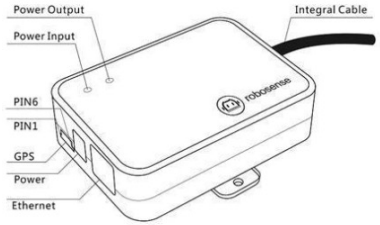
LEAF time series (Calders et al., 2023)

Supported by Max Polzin (EPFL)

LEAF DIY

- Goal: develop monitoring lidar based on off-the shelf lidar sensors
- Robosense BPEARL hemispherical lidar
  - Range 100 m (30 m @10% NIST)
  - 0.1° (horizontal) *
    2.81° (vertical) resolution
  - 576 kHz return rate (single return)
    (LEAF has 20 Hz)
  - Comes with integration box
    (connection to lidar head)
  - 3.6 – 4.0 k€ (+ integration)





TreeTalker: VNIR transmission

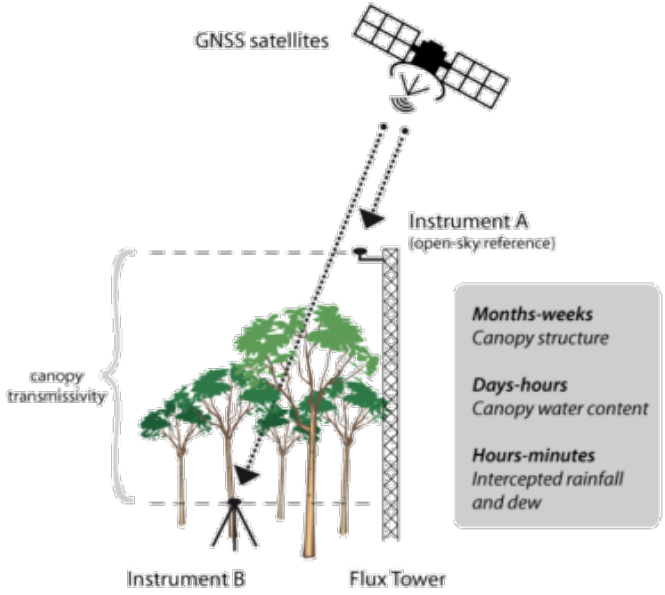
- Low-cost multi-sensor IoT device, incl. spectrometer (450 – 860 nm)
- Systems installed at Demmin + Hainich
  - Failure of spectral reference sensors
- System evolution + spectral characterisation + towards FAPAR/LAI in HE RemoTrees http://remotrees.eu

TreeTalker TT+3.3

GNSS-T VOD: L-band transmission

- Transmissometry via SNR:
  - reference + measurement sensor pair

- Not (yet) implemented: Reflectometry
  - Mainly sensitive to soil moisture



Humphrey & Frankenberg (2023)

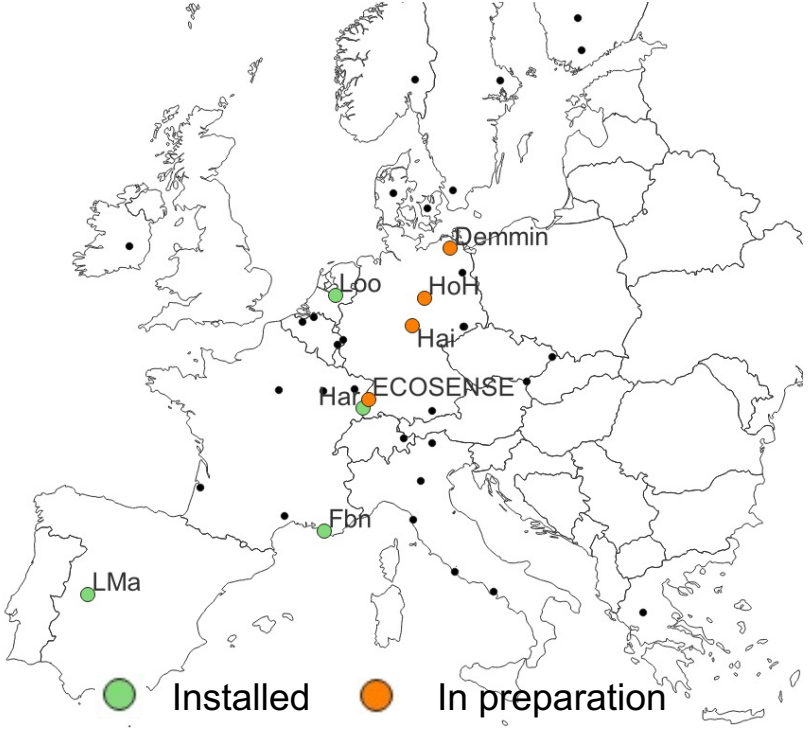
GNSS-T VOD: instrument

- Receiver Septentrio MOSAIC 5 + antenna Harxon GPS1000
  - Multi-constellation (GPS, GLONASS, Galileo, BeiDou)
  - Multi-band (L1, L2, L5) = multi-frequency, 1.2-1.6 GHz
- Typical site sampling design
  - 1 reference + 5 below-canopy sensors
  - Co-locate with physiological measurements
- Local sensor network design
  - PoE for power supply and data downlink
  - Managed switches for remote control (e.g. power-cycling)
  - NRT data access

GFZ GNSS VOD at ICOS Hainich

GNSS-T VOD: GFZ Sites

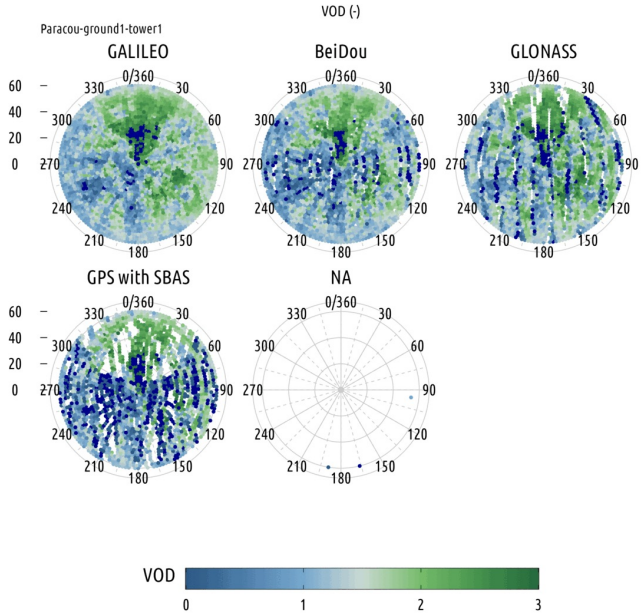
- Site decision: Aim for tree physiological measurements (e.g. sapflow)
- Not on map: GF-Guy (Paracou)
- VODnet: coordination with other VOD users



GNSS-T & LEAF system Paracou

GNSS-T VOD: first results

- Differences between constellations
  - FOV of sensor dependent on latitude: full hemisphere at equator, only low elevation angle at poles
  - Patterns:
    - GALILEO full hemispherical sampling
    - BeiDou full hemisphere with some gaps
    - GPS tendency to repeat orbits/patterns with gaps
    - GLONASS: strong repeat patterns



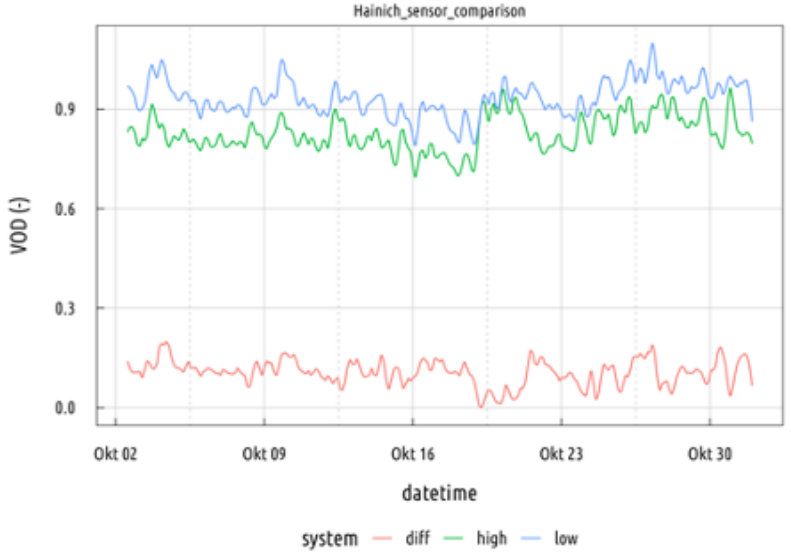
VOD at Paracou split by GNSS constellation

GNSS-T VOD: first results

- Difference between sensors:
  - low cost with lower apparent transmissivity (smaller signal) than high end/survey grade -> $VOD_{low} > VOD_{high}$

Antenna: RS ANT-GPSC
Receiver: ublox NEO-M9N

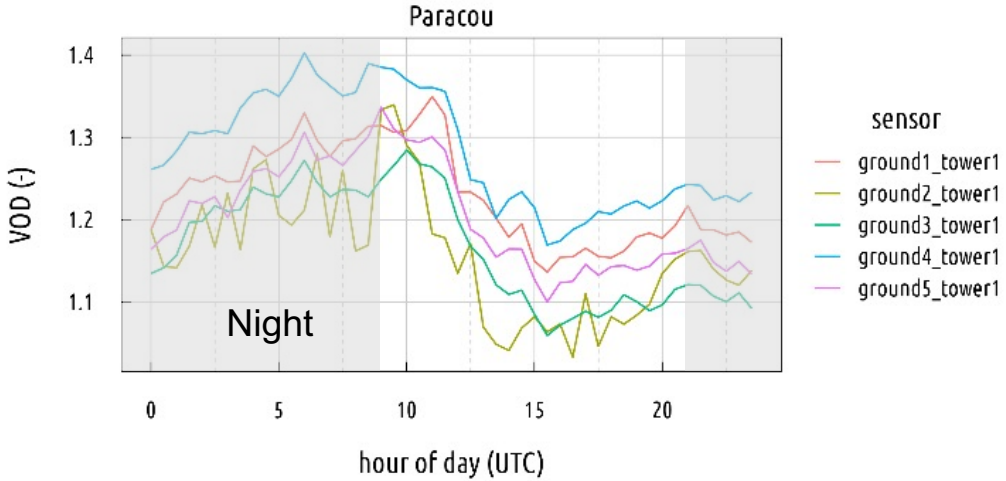
Harxon GPS1000
Septentrio MOSAIC-5



Analysis by Konstantin Schellenberg

GNSS-T VOD: GFZ Sites

- Paracou: Diurnal cycle of tree water status
  - Recharge during night
  - Depletion during the day



Support CHIME Cal/Val

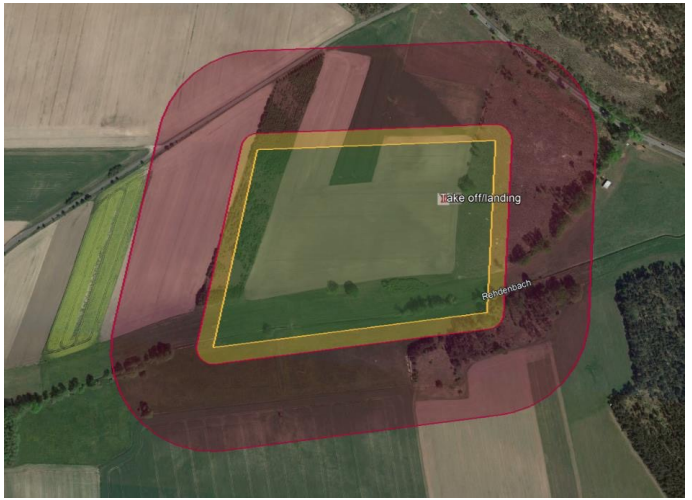
- UAV hyperspectral system
  - System check (e.g. interferences UAV remote control & sensor downlink)
  - Pilot training (without payload)

- UAV Operations Manual for flights in the Specific category (VLOS, sparsely populated areas, >25 kg MTOW)
  - Submitted application 10.01.2024
  - First comments received 07.05.2024
  - Revisions submitted 03.06.2024

GFZ Acecore Noa 6 integrated with HySpex VS-620

Support CHIME Cal/Val

- SOC
  - Rent a field that will be ploughed for our flight mission once permissions are in
  - Multi-level campaign planned for June/July



Outlook QA4EO-2

- Proposed baseline: Continued CHIME support:
  - NPV biomass for crops based on UAV lidar

- Possible:
  - CHIME thematic products cal/val (SOC, LAI, CCC)