

# INNOVATIVE SOLUTIONS FOR IN-SITU CAL/VAL OF SATELLITE ALTIMETRY OVER INLAND WATERS BASED ON UAV AND NEW AUTONOMOUS MICRO-GAUGES

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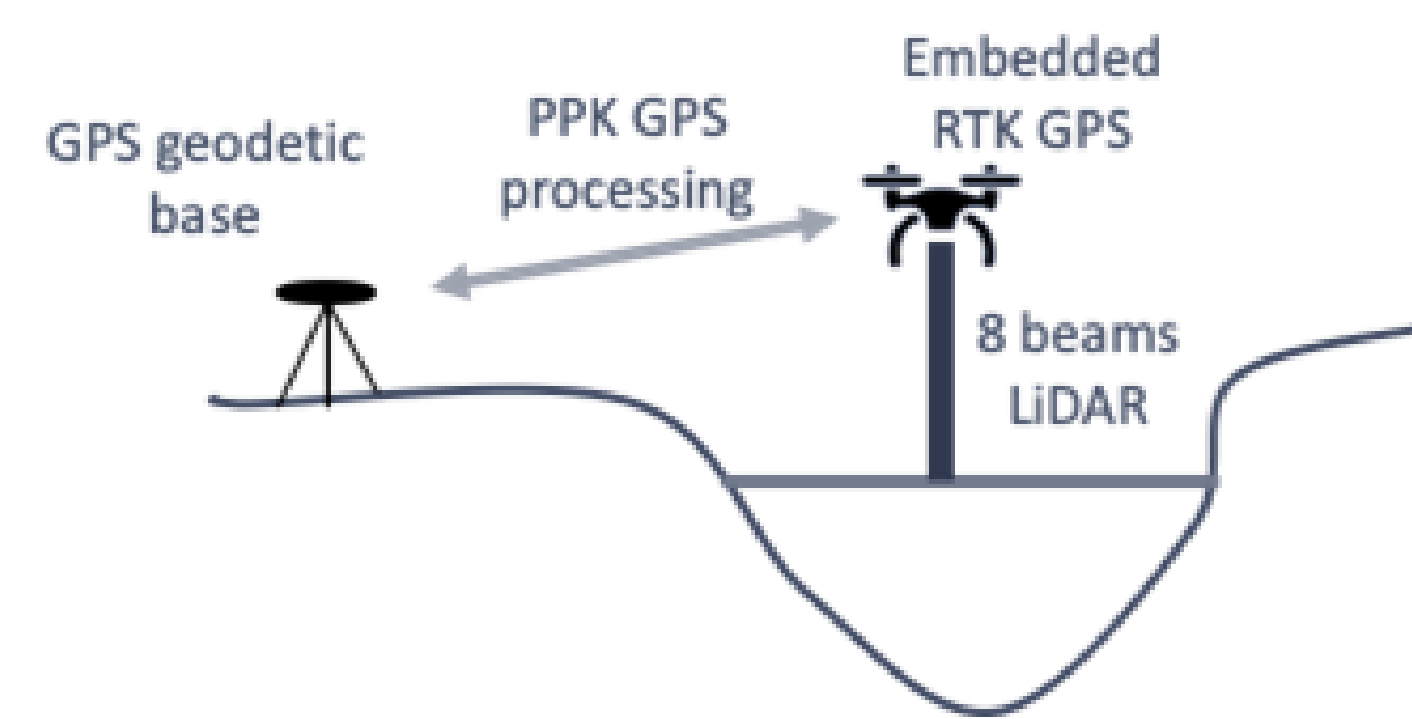


## THE DRONE SOLUTION



### What is it?

- **LiDAR**
  - cm-level accuracy
  - from 50 cm to 90 meters range
- **8 Mpx Camera**
  - water mask
  - orthophotos
- **900 gr**
- **Compatible with all drones capable of carrying 1kg**
- **Autonomy of the lightweight altimeter: 3h**

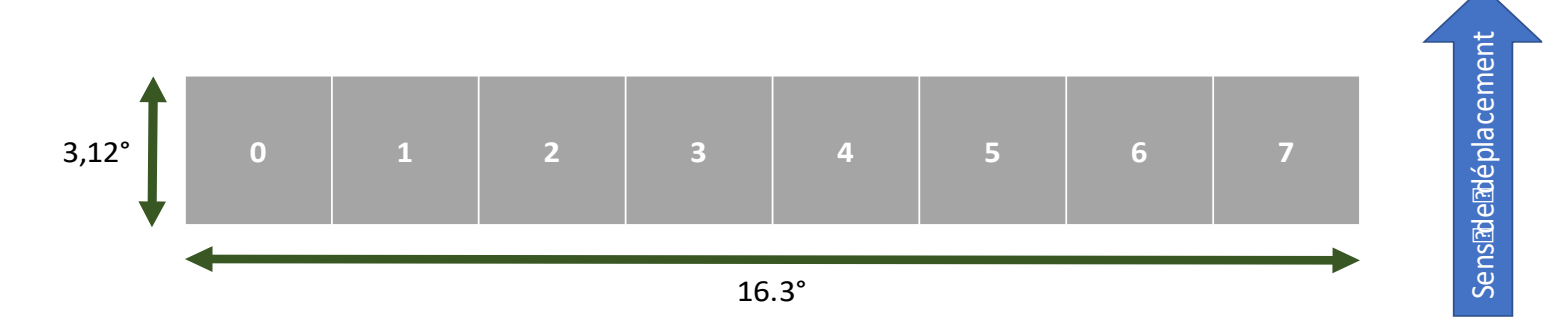


### How does it work?

Measurements performed by a specific LiDAR with a wide swath: **8 beams** spread over a **swath of 16.3°** in order to guarantee the correct measurement of the surface during the flight of the UAV.

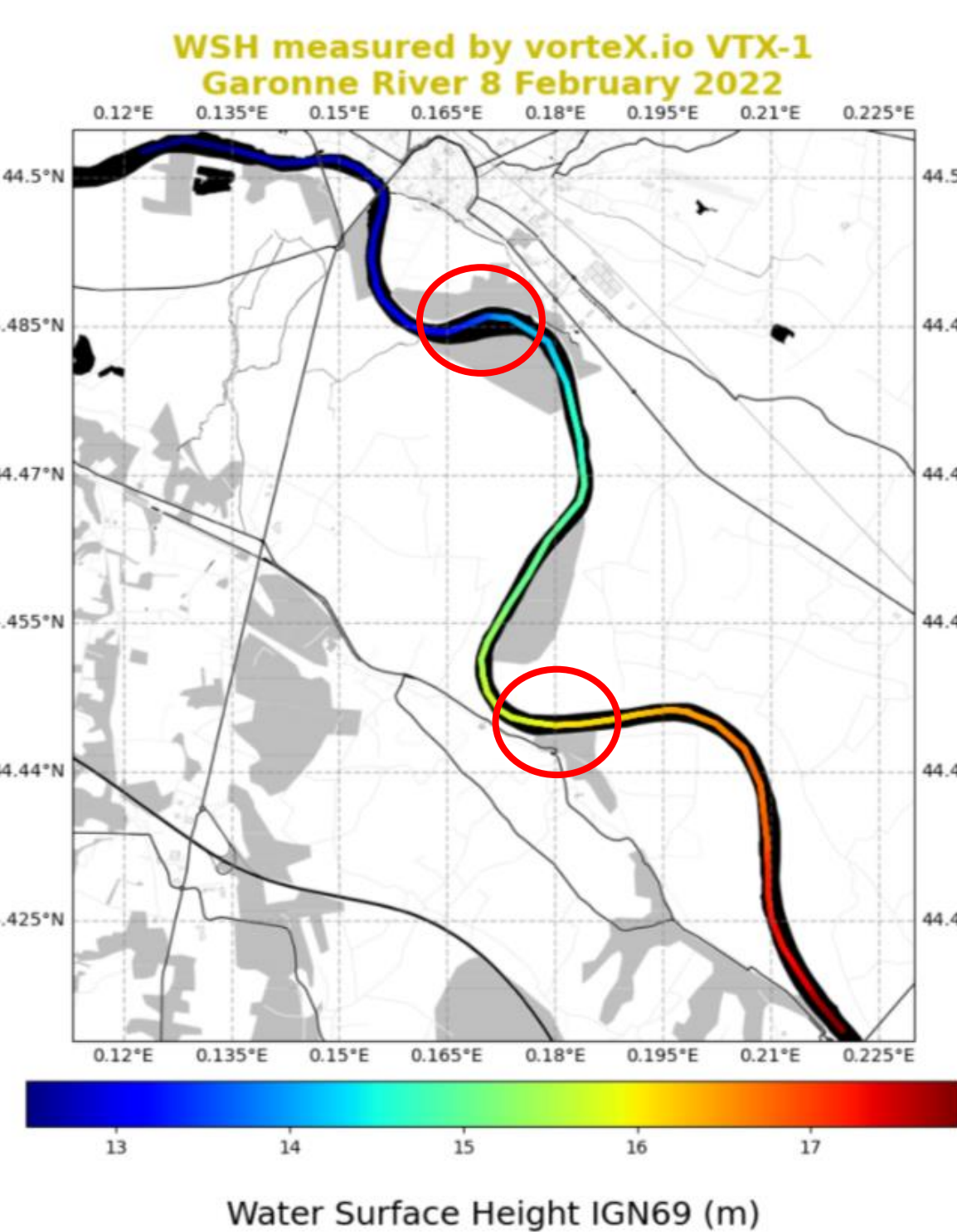
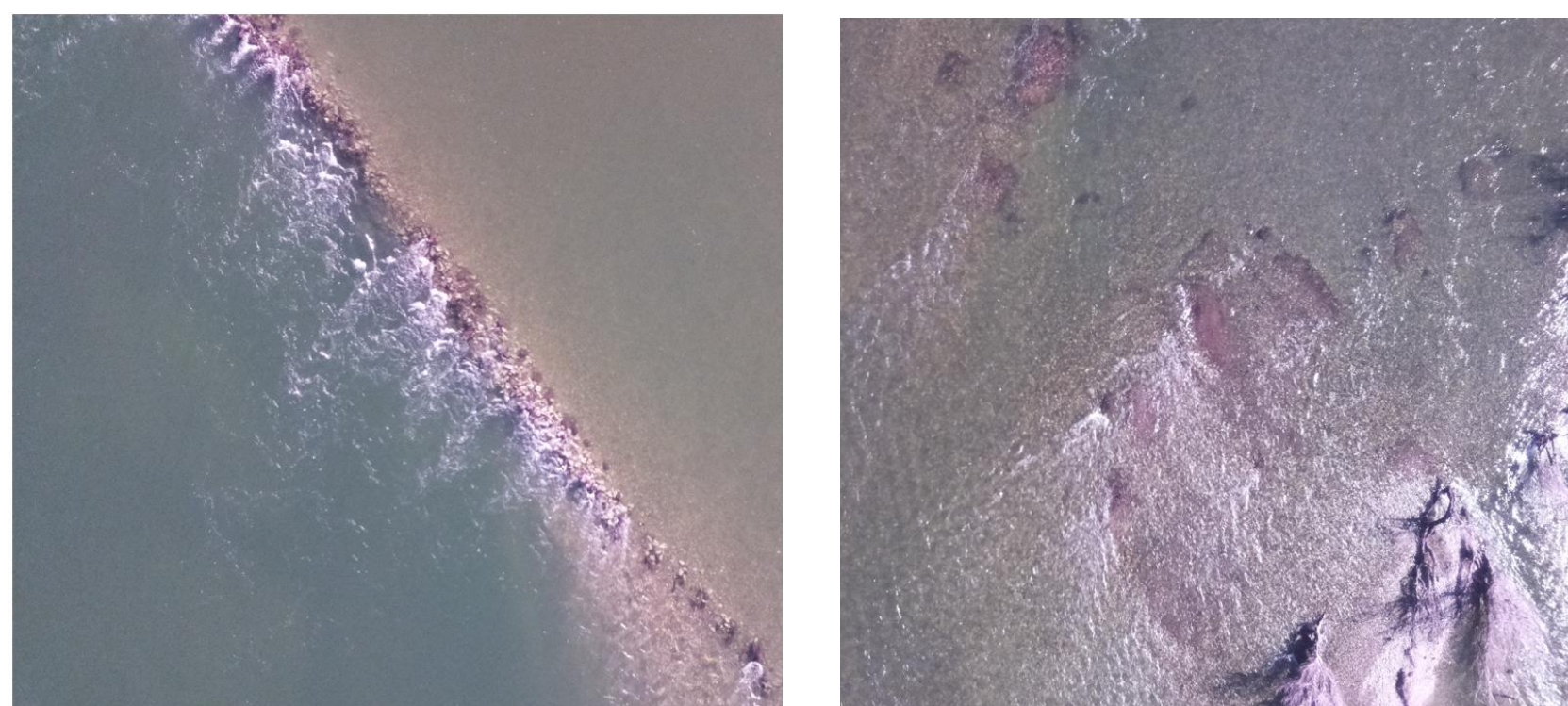
### Precise positioning using a GNSS PPK processing

- Need a GNSS base
- valid until 70km from the base

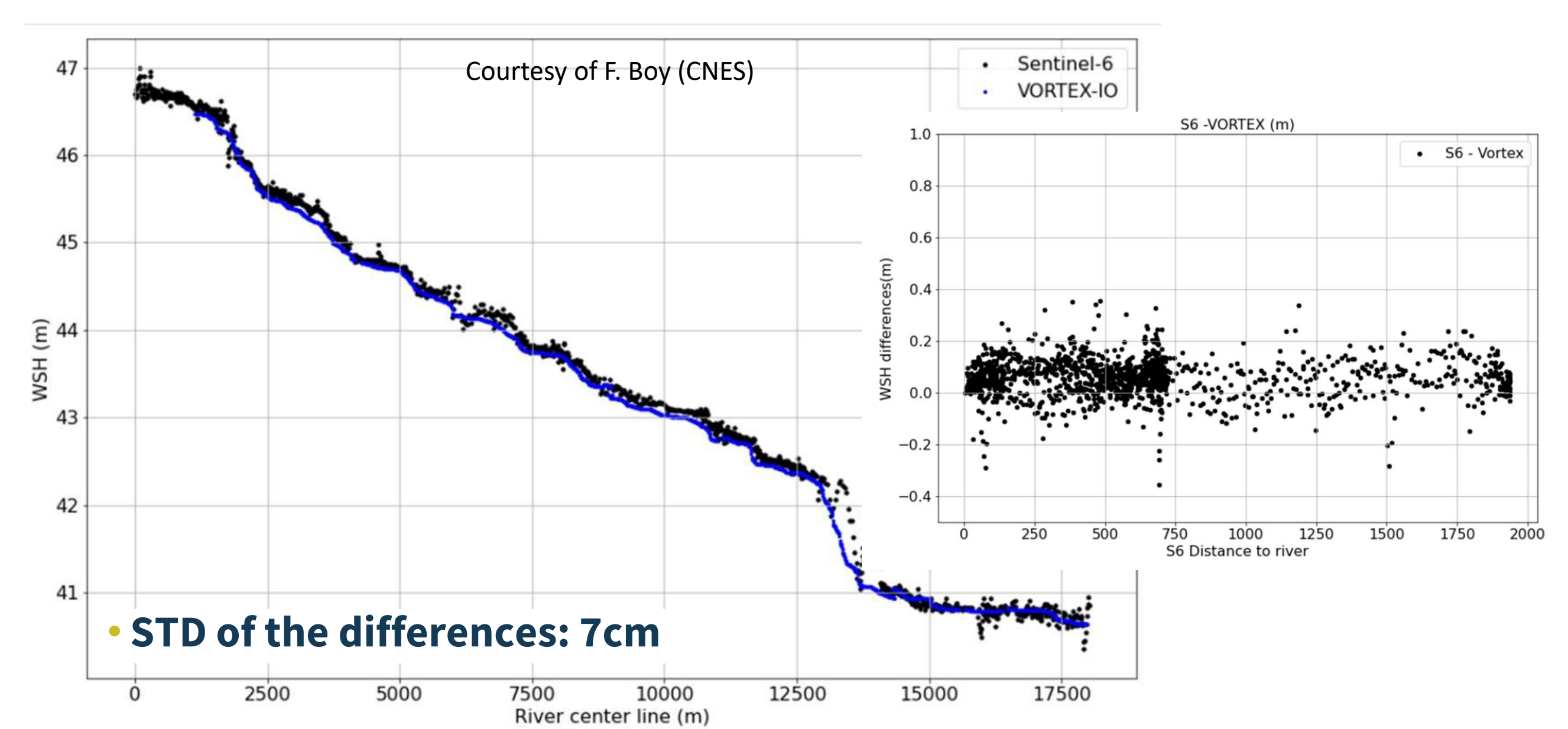


## WSH linear measured by the LiDAR lightweight altimeter

- Drone flights following the stream
- Direct link between WSH signals and images taken by the vortexX.io LiDAR altimeter  
→ useful to understand measurements



## Comparison with Sentinel-6 over the Garonne River near Marmande (South of France)



## THE VORTEX.IO MICRO-STATION

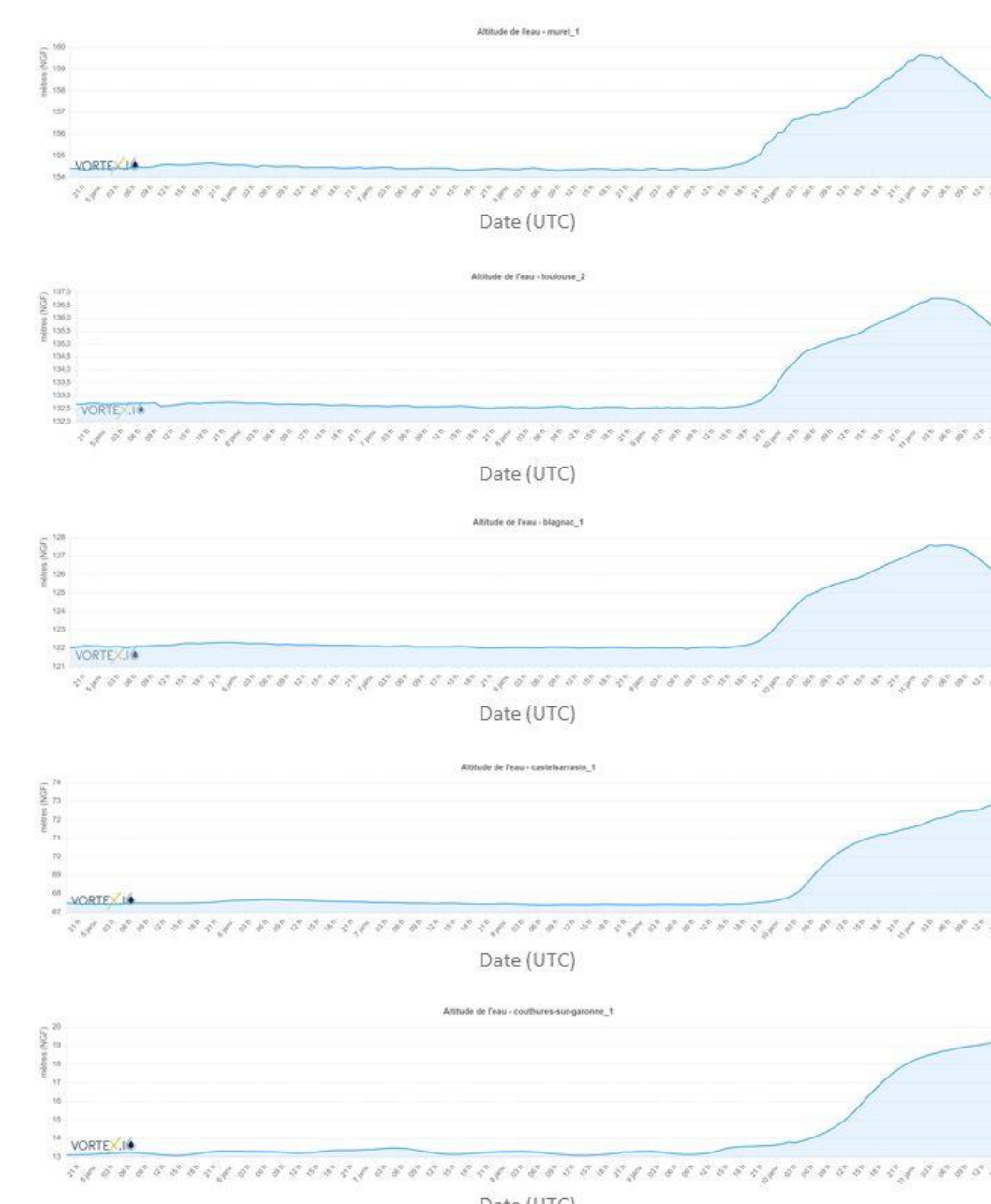
### What is it?



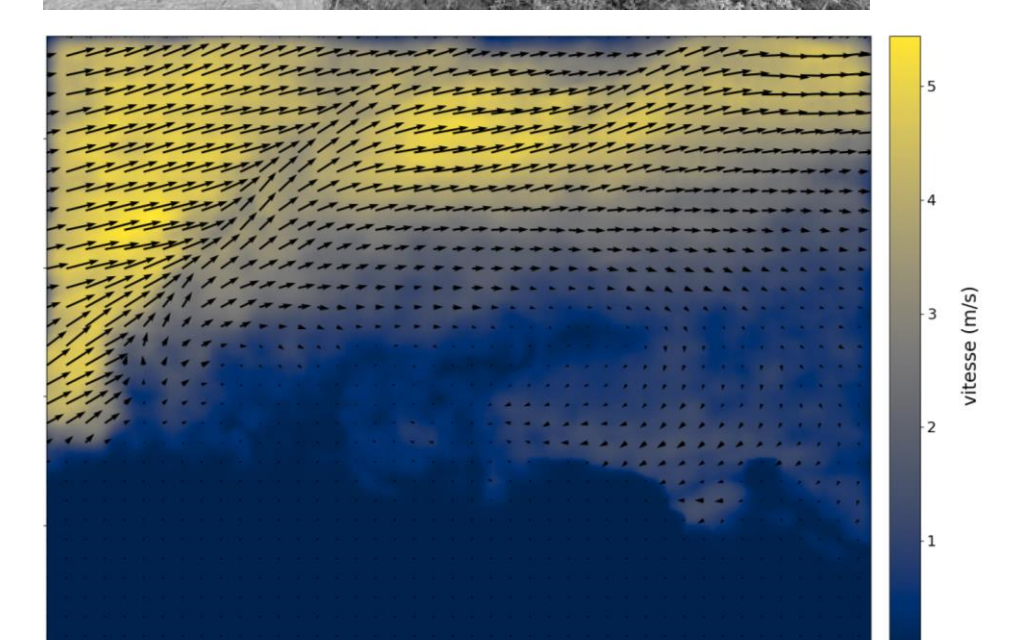
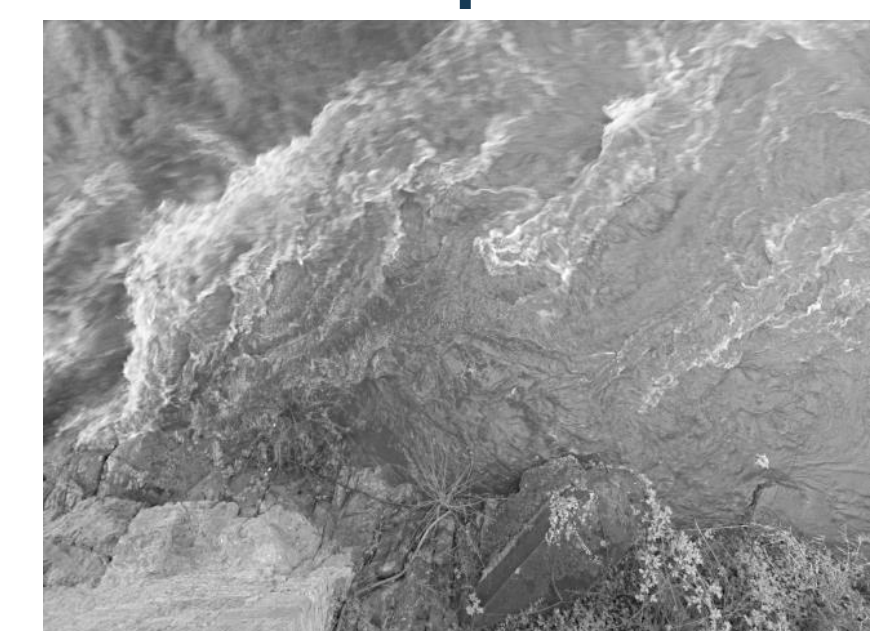
- **LiDAR**
  - cm-level accuracy
  - from 50 cm to 25 meters range
- **8 Mpx Camera**
  - Water surface velocity
  - Contextual images and video
- **Fully autonomous**
  - Energy (solar panel and battery)
  - Network (GSM)
- **Fully connected**
  - Real time measurements
  - Full House Keeping telemetry
  - Remote control
- **Lightweight and compact**
  - Fast installation and commissioning
  - very discreet

### The measurements

#### Water surface height

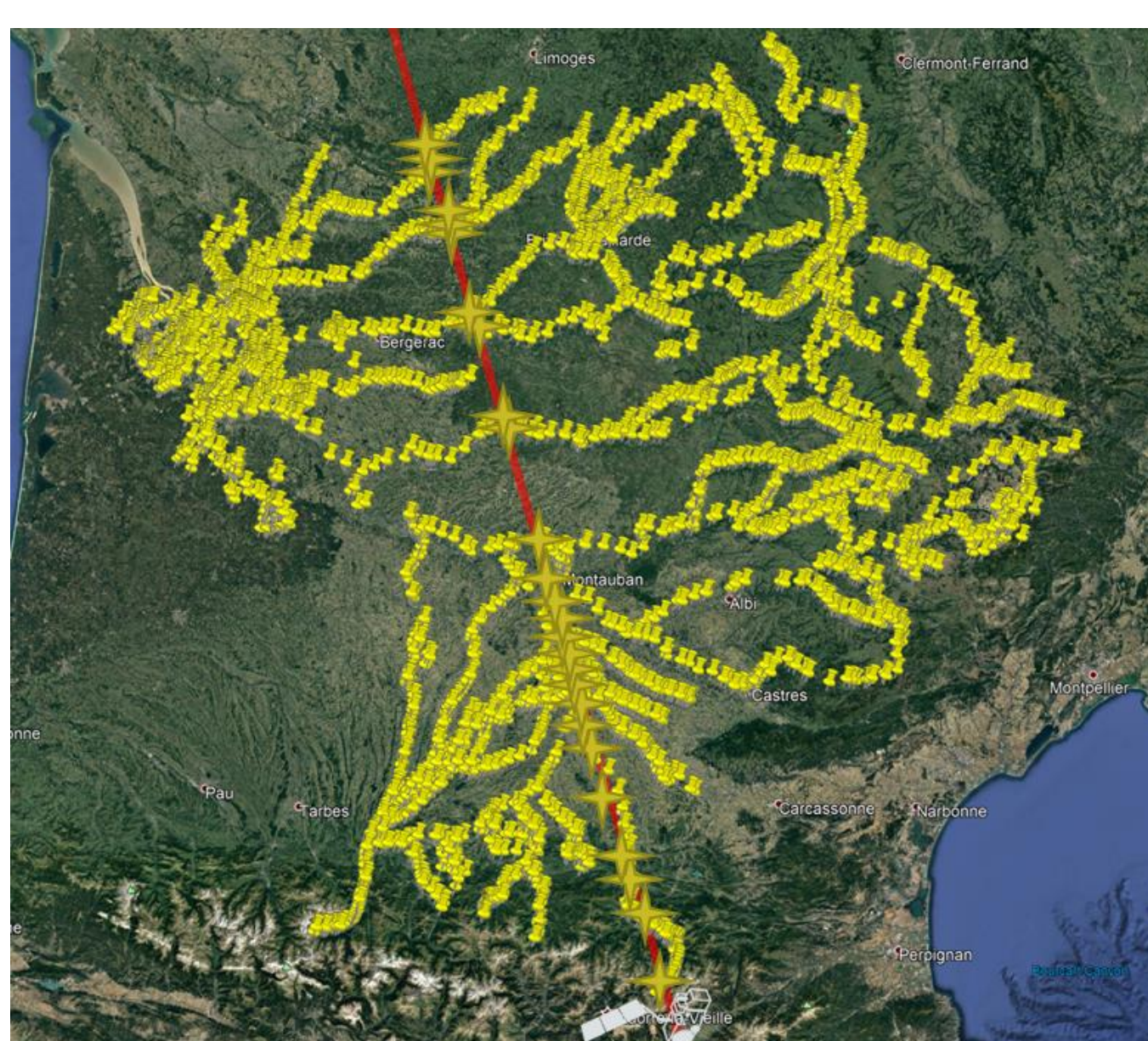


#### Snapshot

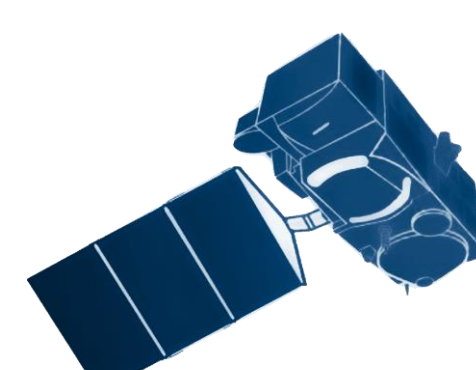


#### Water surface velocity

## Using micro-station for Cal/Val activities



- **Collocation:** micro-stations are positioned on bridges under satellite tracks
- **Synchronization:** micro-stations are programmed to perform measurements at the time of the satellite pass
- **Used in different CNES and ESA projects:**
  - SWOT Cal/Val over the Garonne River
  - ESA St3TART
  - FFSAR-Coastal



## Example in Trèbes (Canal du Midi) and Sentinel-3A

### WSH Comparison between vortexX.io and Sentinel-3A (Canal Du Midi)

