PROGETTO UNIMPRESA 2019 – TITANO

SISTEMI INNOVATIVI DI MONITORAGGIO GEOTECNICO MEDIANTE SENSORI IN FIBRA OTTICA

SALA AUDITORIUM DELL'ORTO BOTANICO
28 GIUGNO 2022, ORE 9.00/17.30

DEFORMAZIONI TERMICHE DI DIGHE IN CALCESTRUZZO

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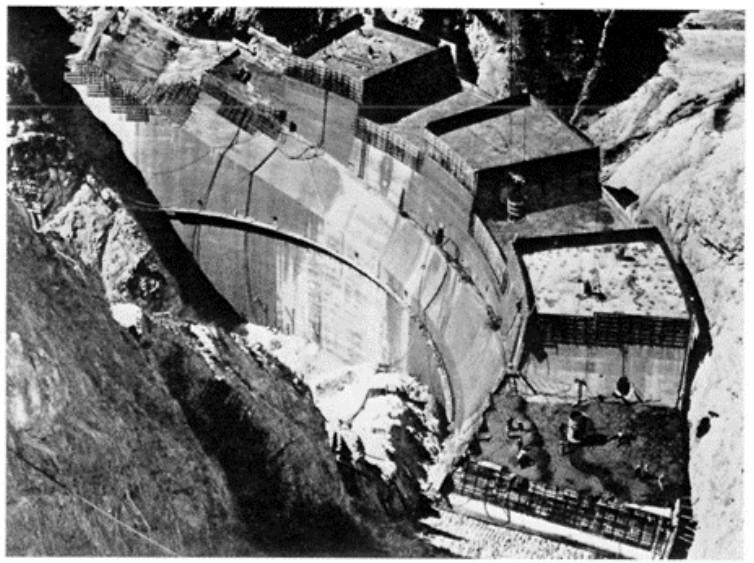
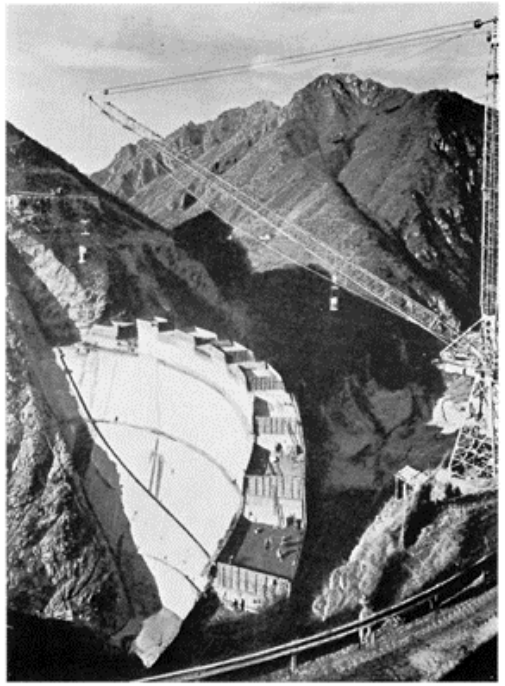
Ponte Cola dam

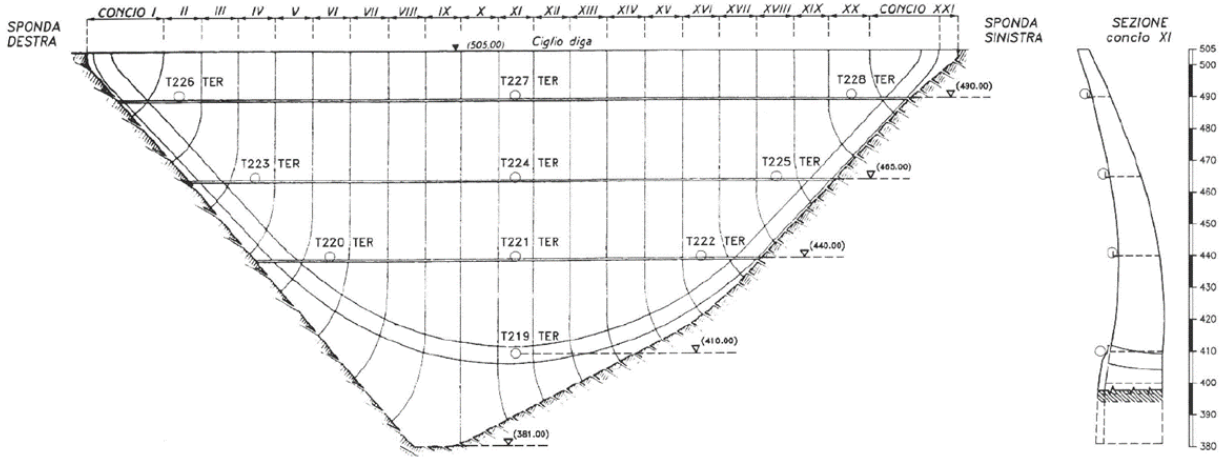




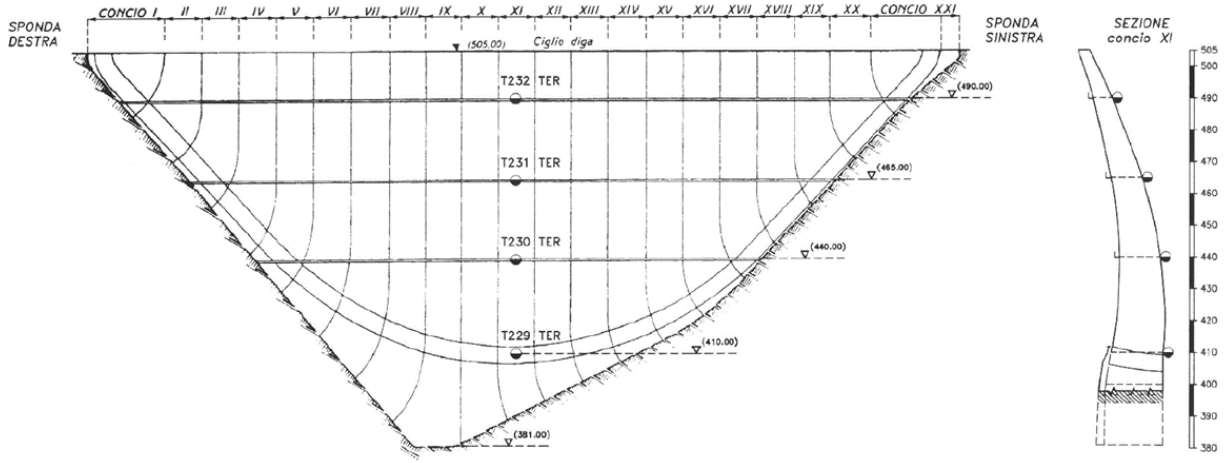
Construction: 1960-1962

Traditional monitoring system: temperature

TERMOMETRI SUL PARAMENTO DI VALLE
Sviluppata vista da valle



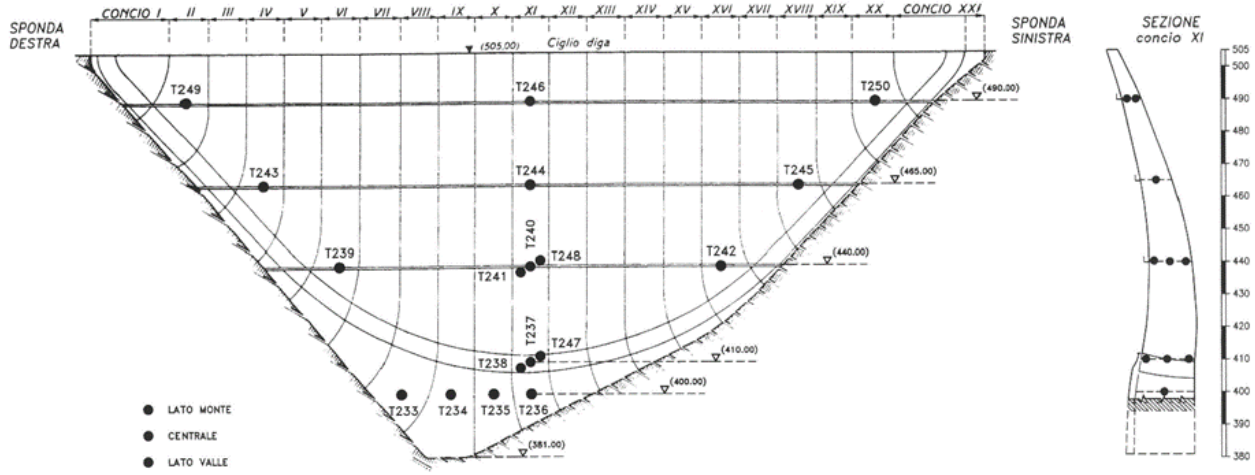
TERMOMETRI SUL PARAMENTO DI MONTE
Sviluppata vista da valle



Termometers:

- 10 on the down-hill face
- 4 on the up-hill face
- 18 in the concrete corp

TERMOMETRI NEL CORPO MURARIO
Sviluppata vista da valle



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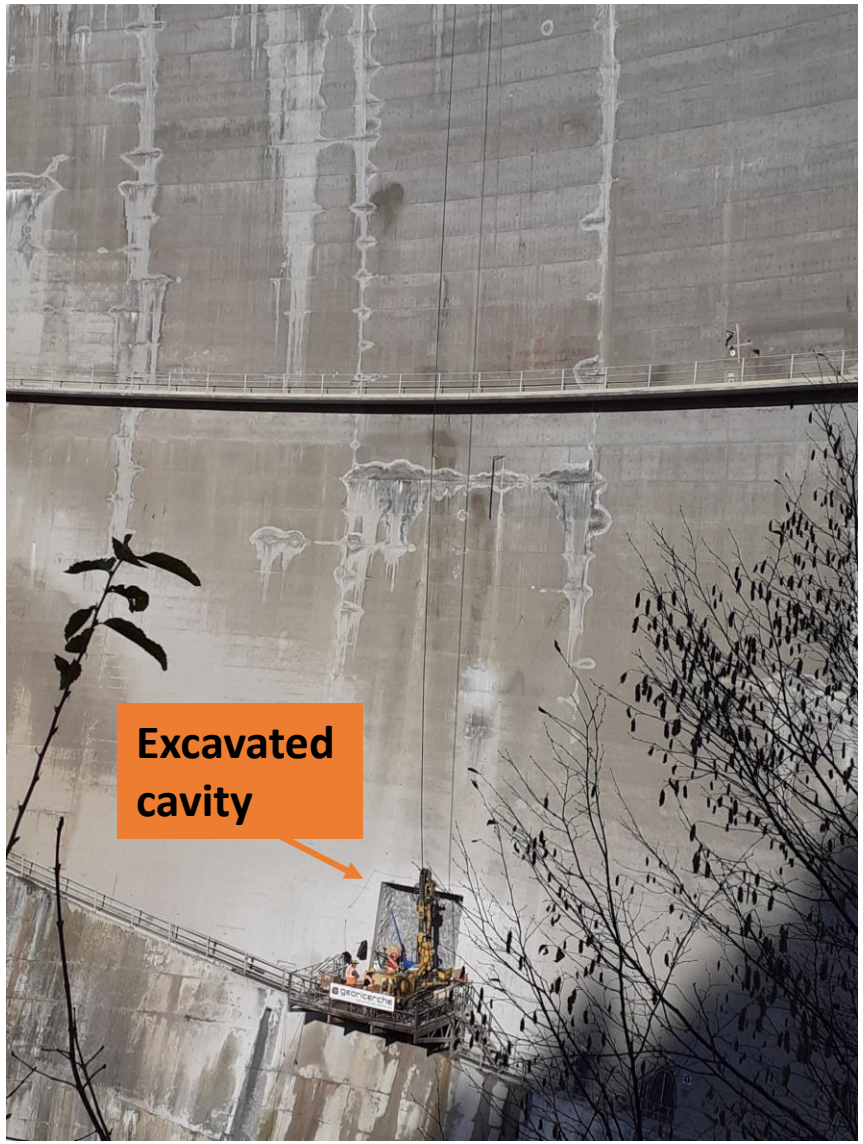
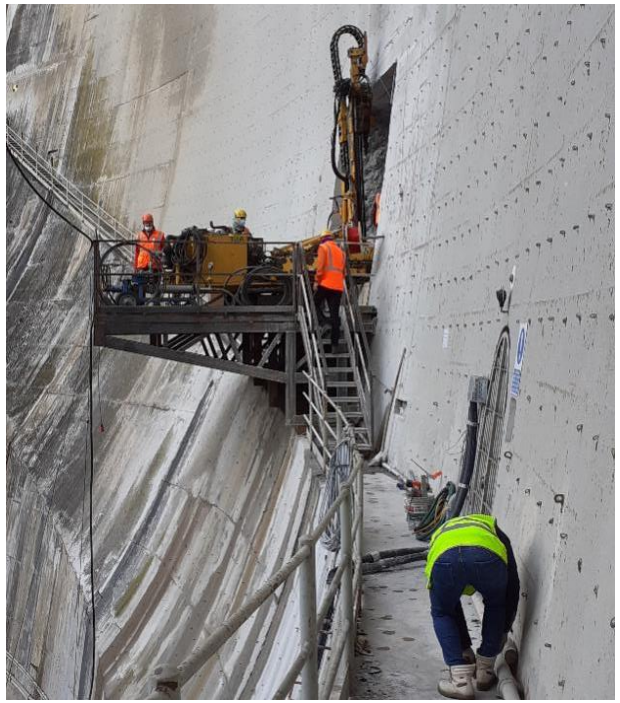
Traditional monitoring system: displacements

Topographic targets on the valley face of the dam:

- **7 targets on the crest at 505 m a.s.l.**
- 4 targets at 490 m a.s.l.
- 4 targets at 465 m a.s.l.
- 3 targets at 440 m a.s.l.
- 1 target on the pump at 412.5 m a.s.l.

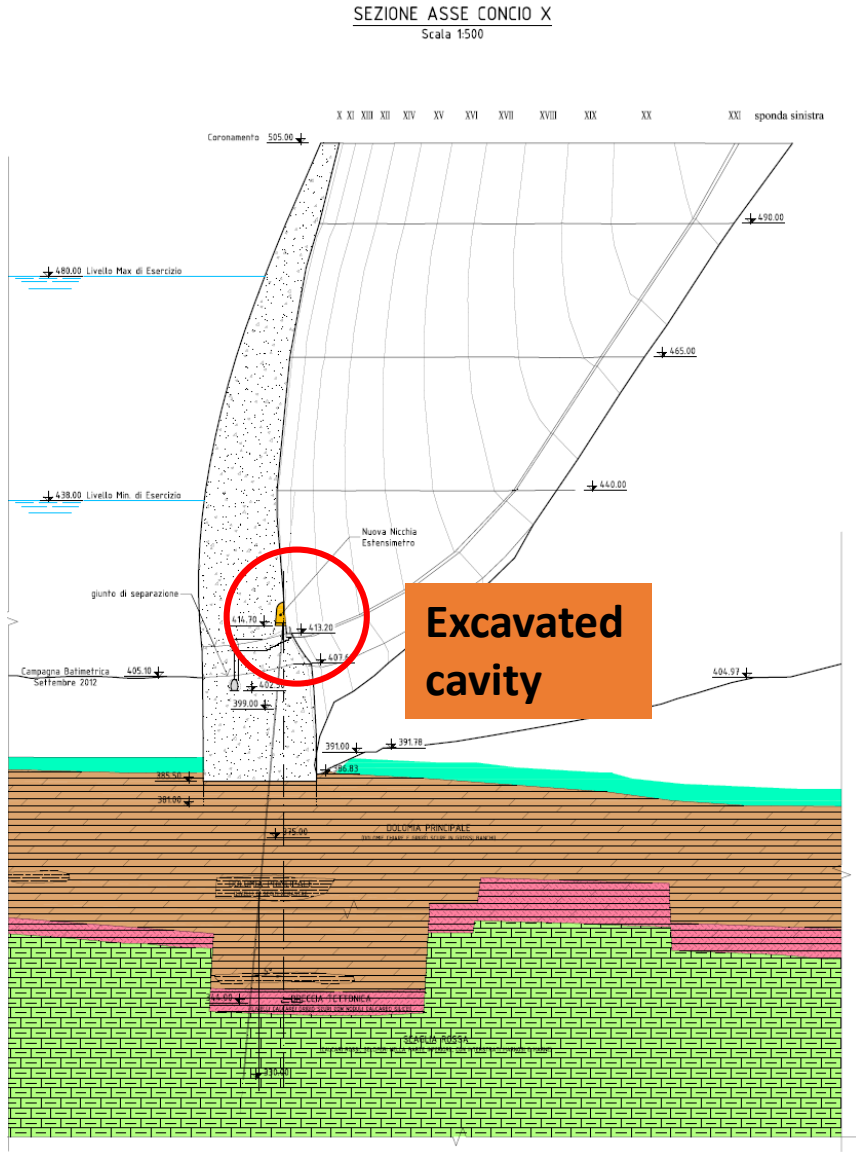
Traditional monitoring system: displacements





Extensometer lengths:

- 3.2m
- 16.25m
- 40.5m
- 59m
- 85.5m



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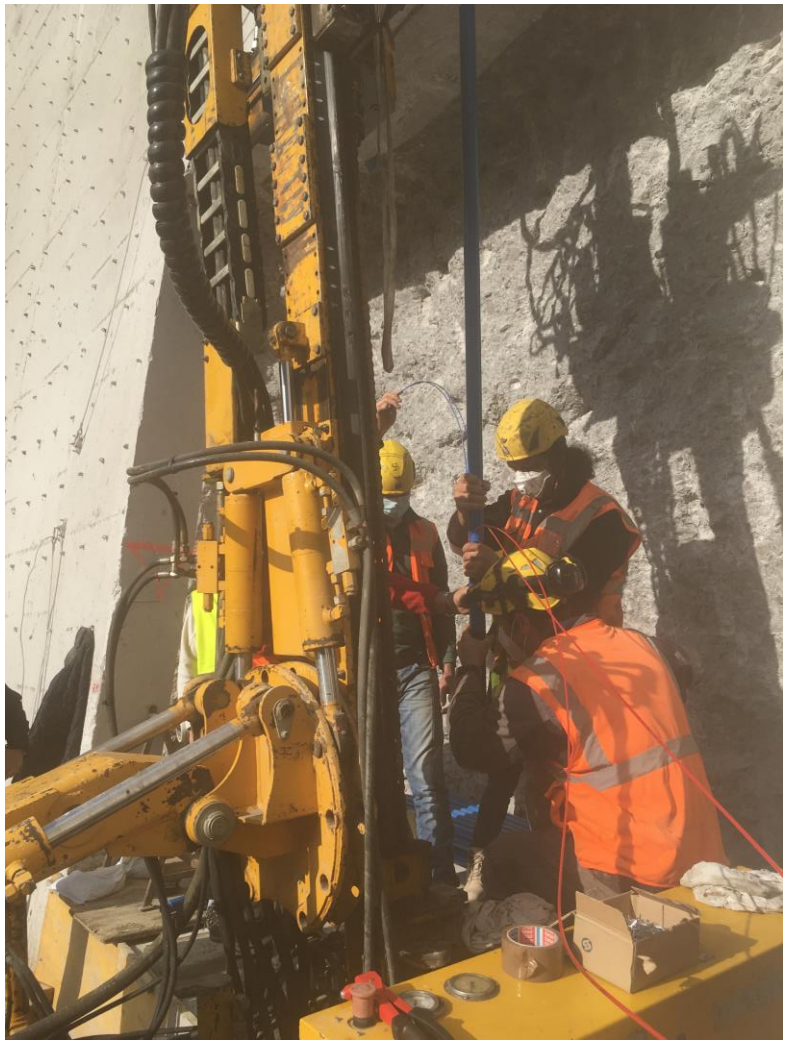
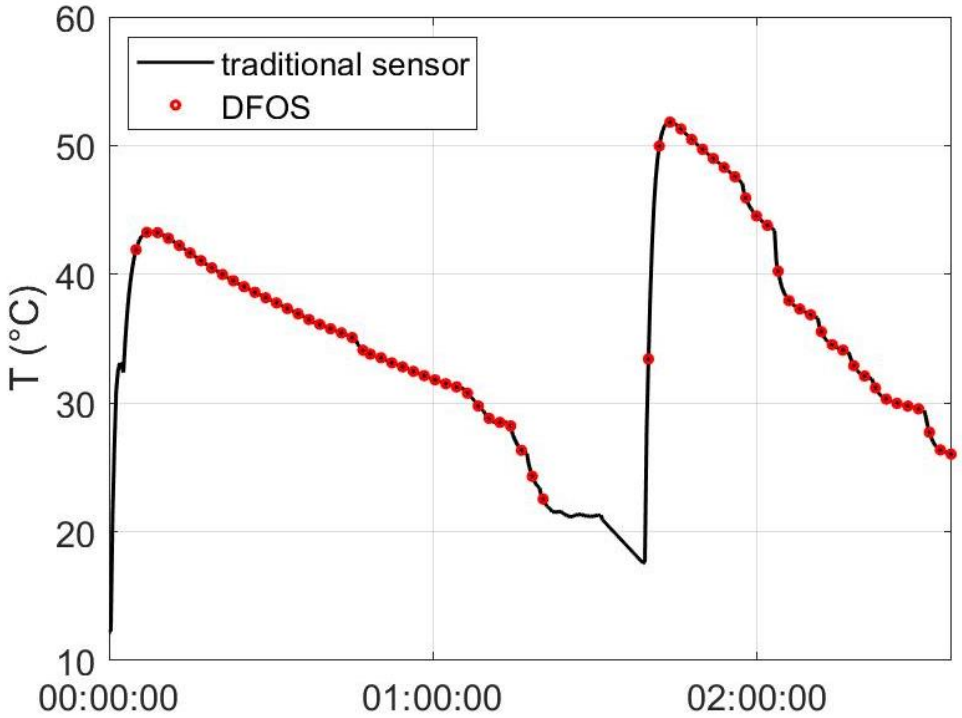
Distributed Optical Fiber Sensors: installation

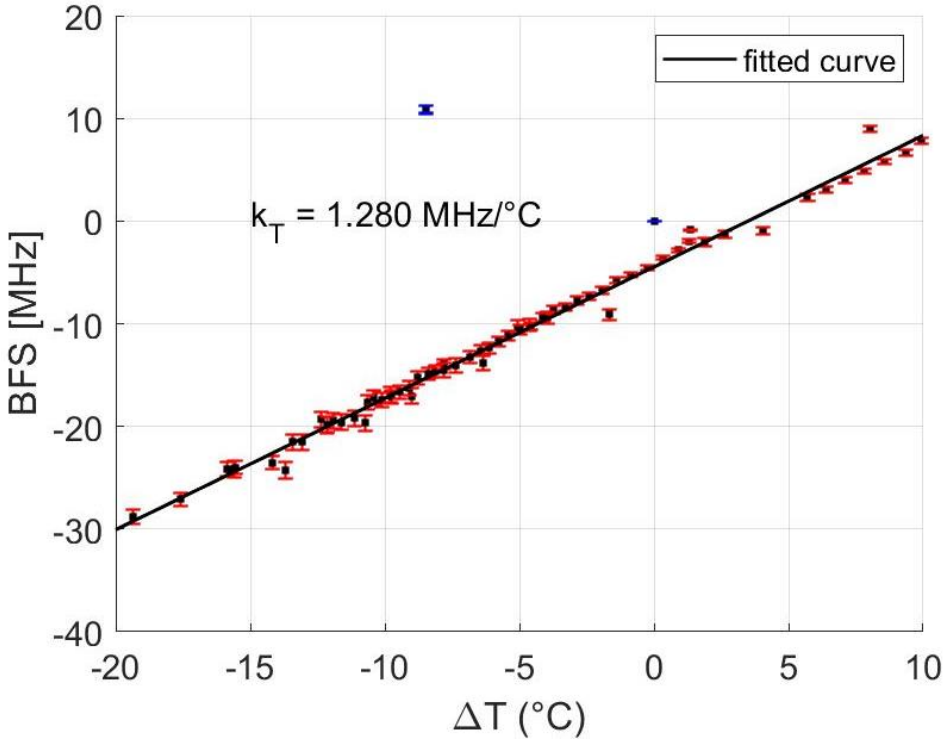


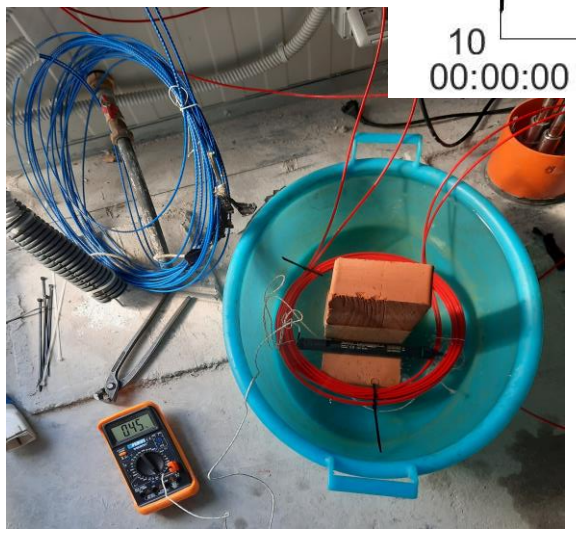
Distributed Optical Fiber Sensors: installation

Distributed Optical Fiber Sensors: first manual measurements

Distributed Optical Fiber Sensors: calibration





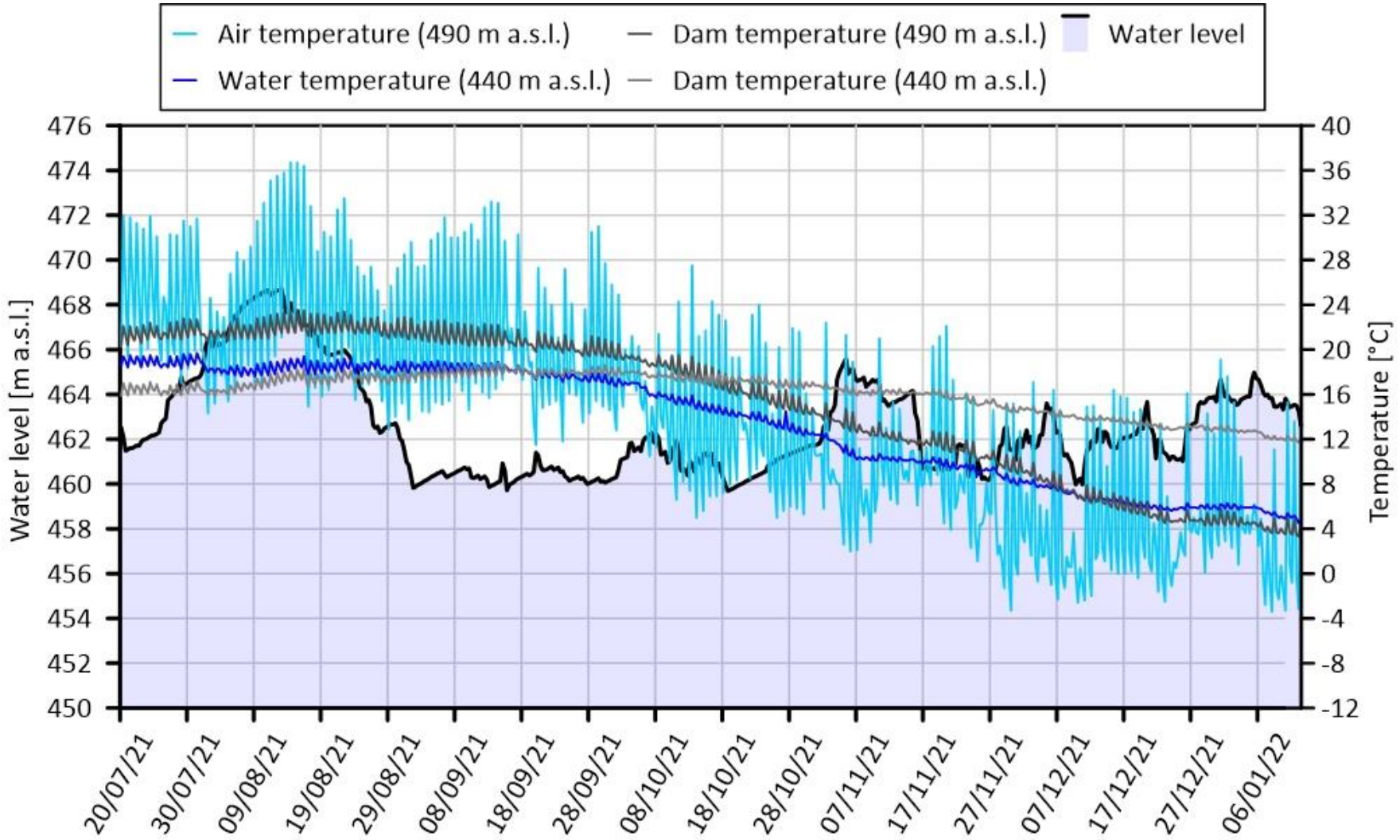


Calibrated thermal coefficient of DFOS: kT = 1.280 MHz/°C

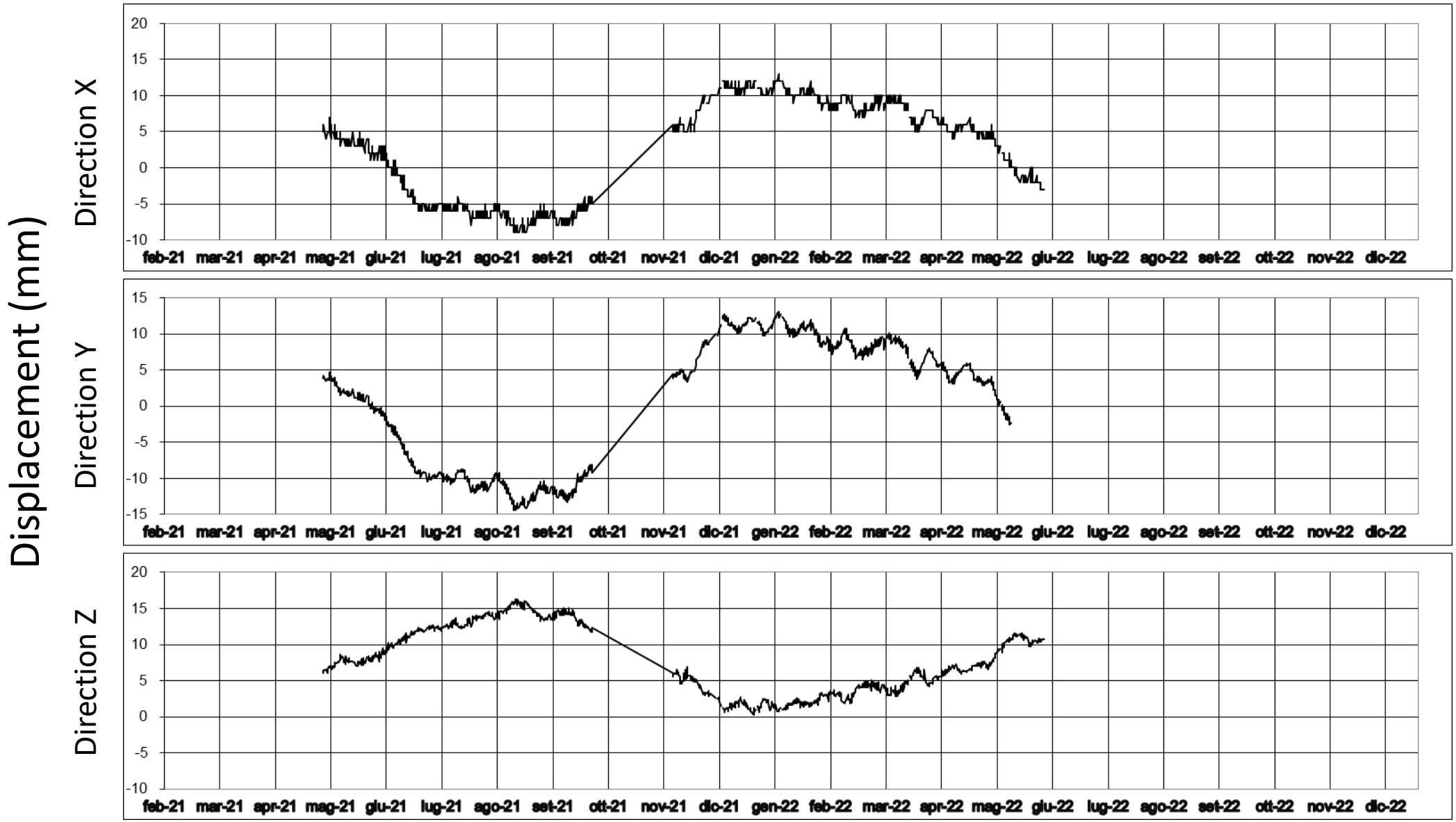
Calibrated optical strain correction due to temperature variation

1°C = 23 με (against 1°C = 44 με declared by the producer)

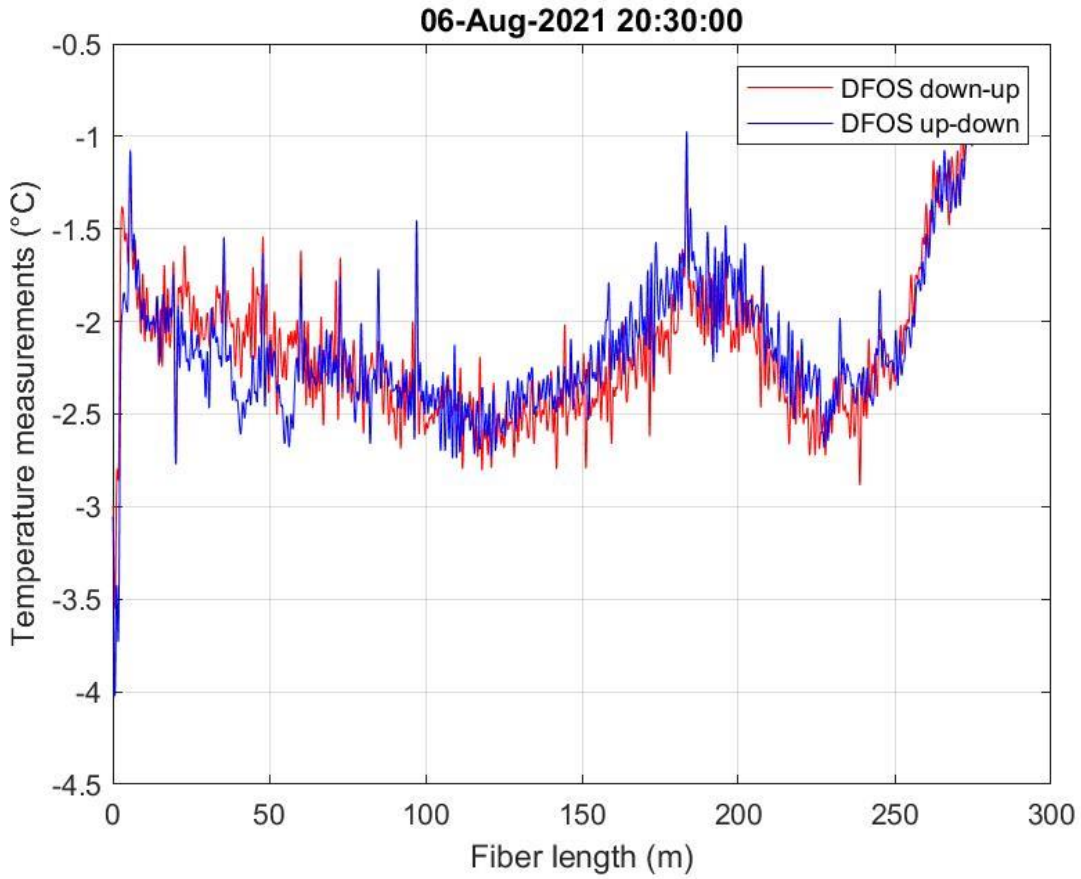
Temperature July 2021 – January 2022

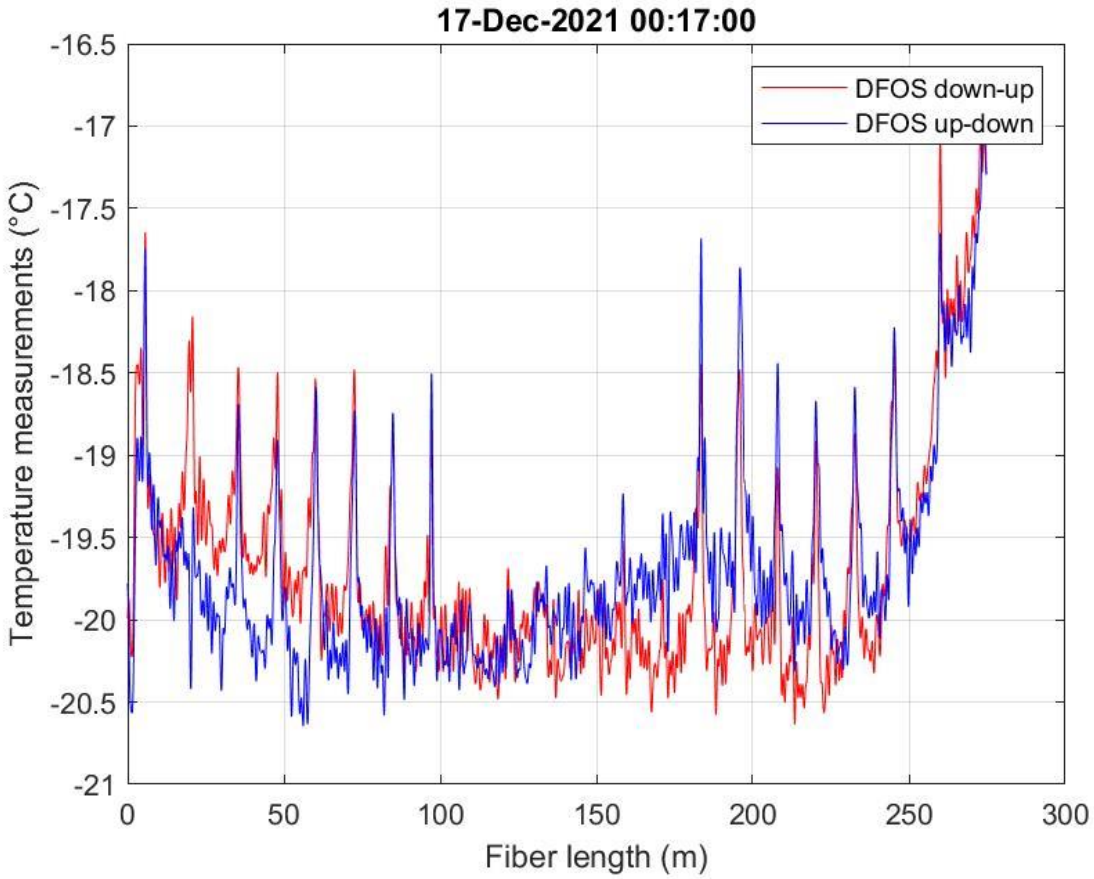


Topographic target displacements at 505 m a.m.s.l.



Temperature by DFOS at the crest – single measure





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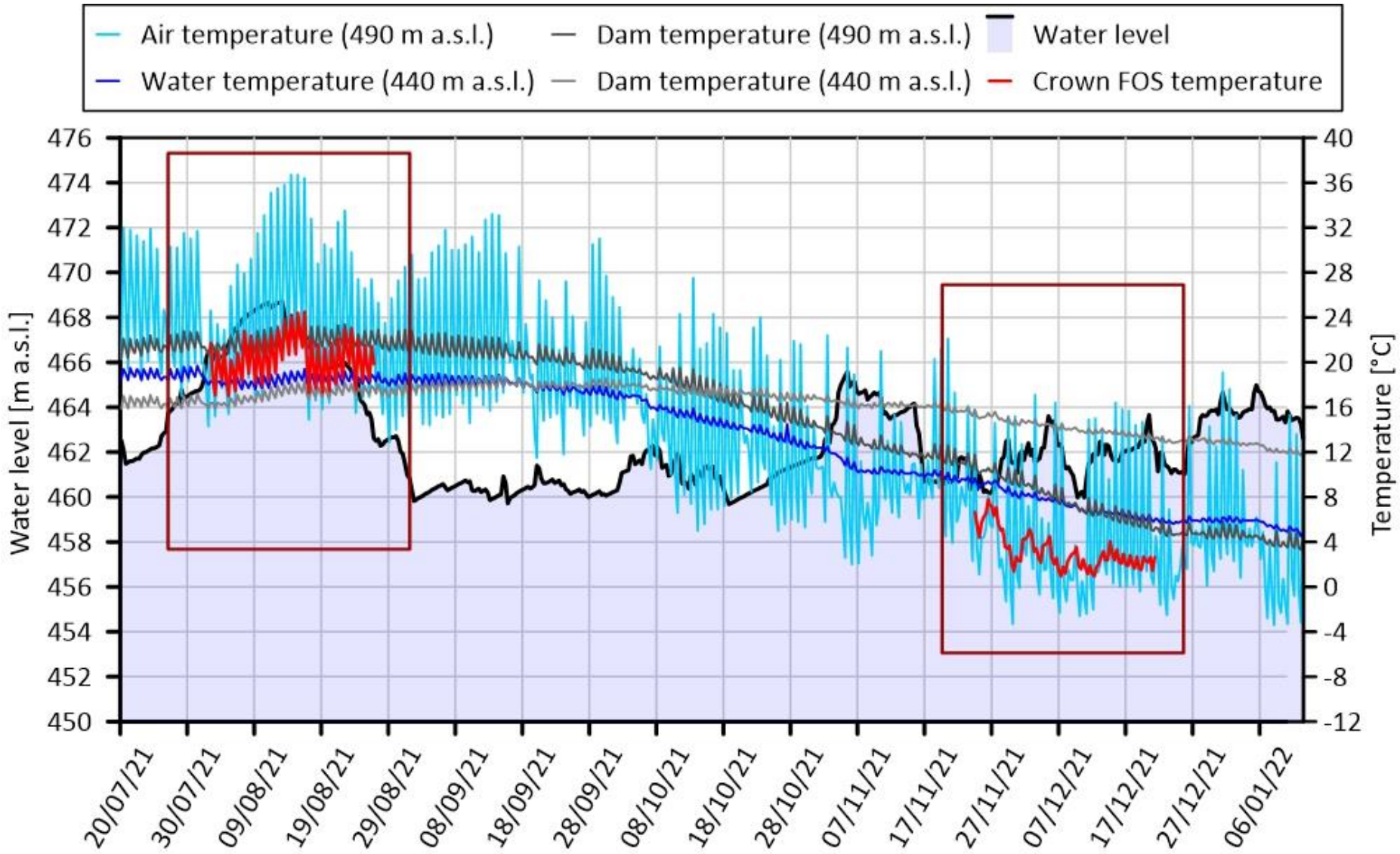
Temperature by DFOS at the crest – continuous measure



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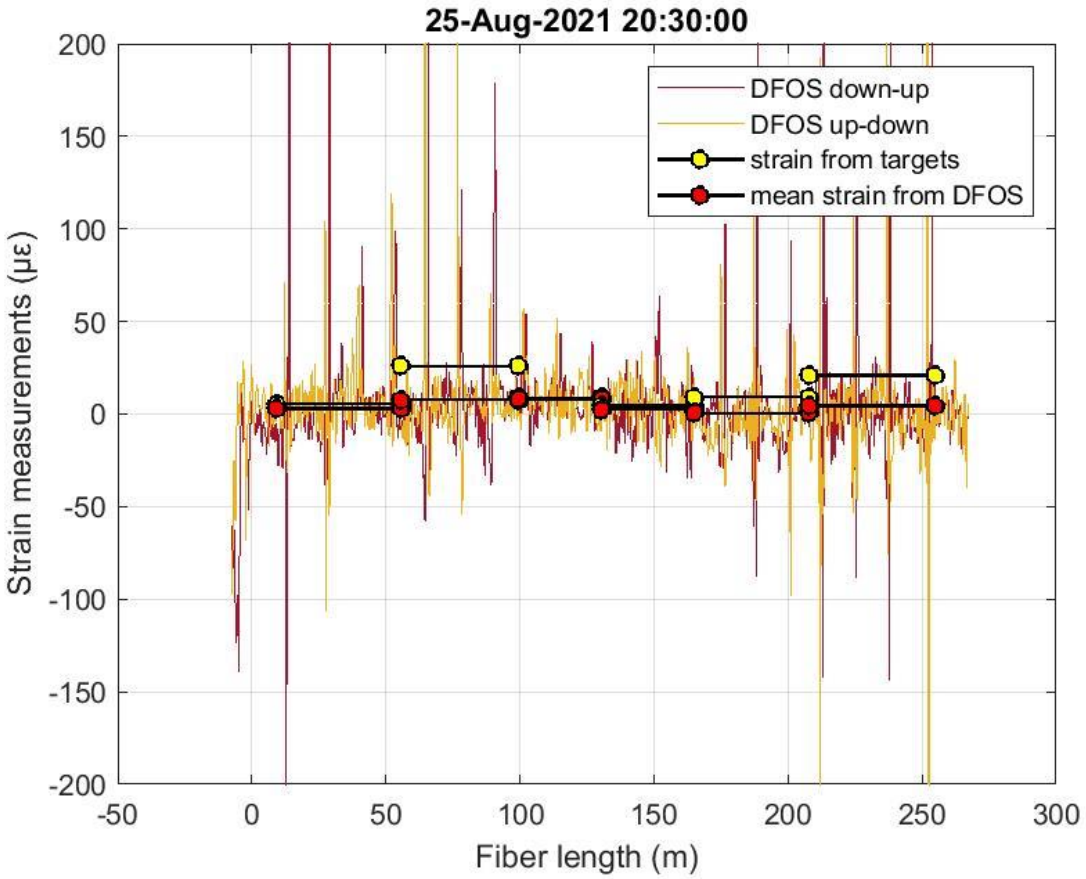
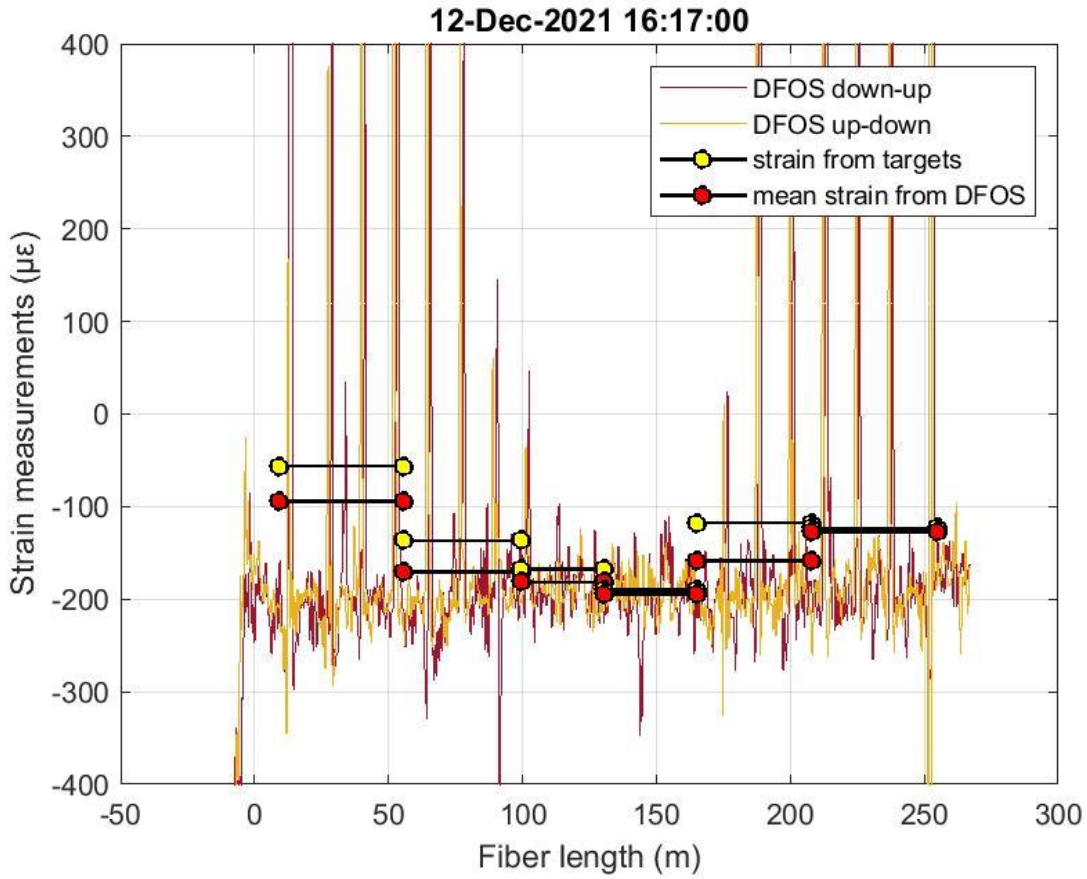
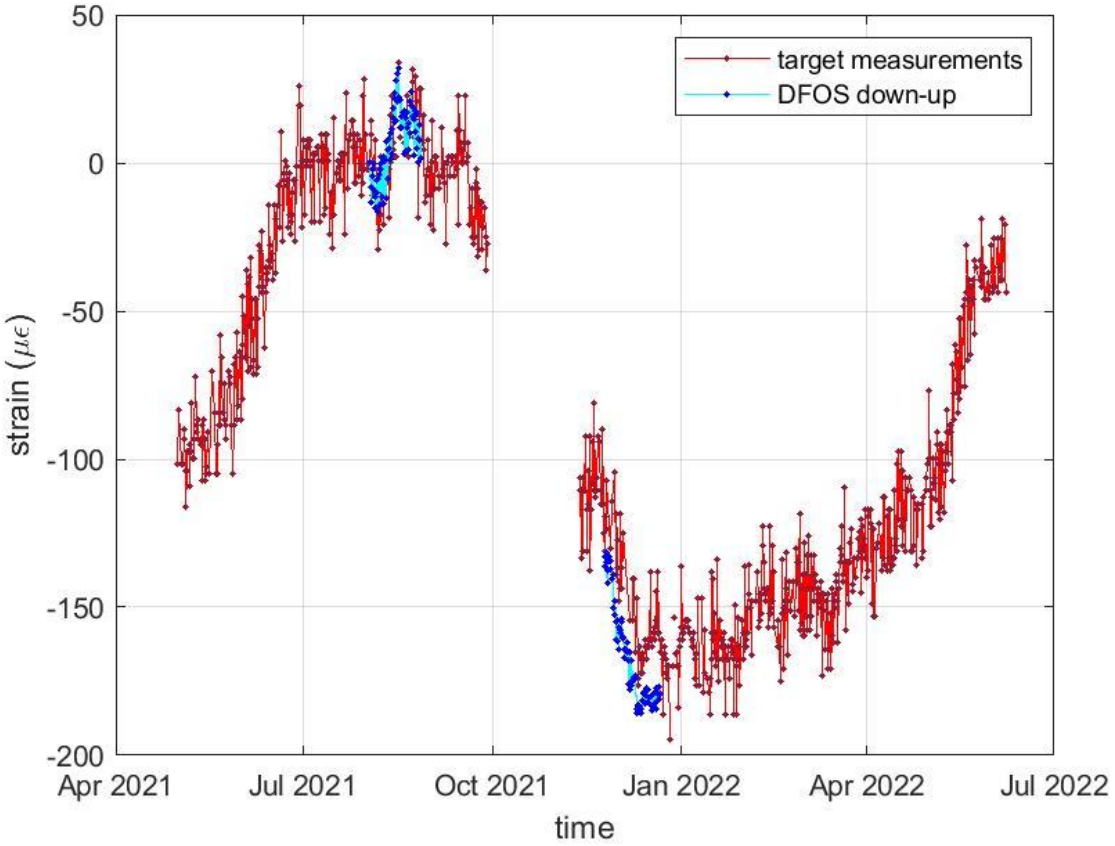
Strain by DFOS at the crest – single measure

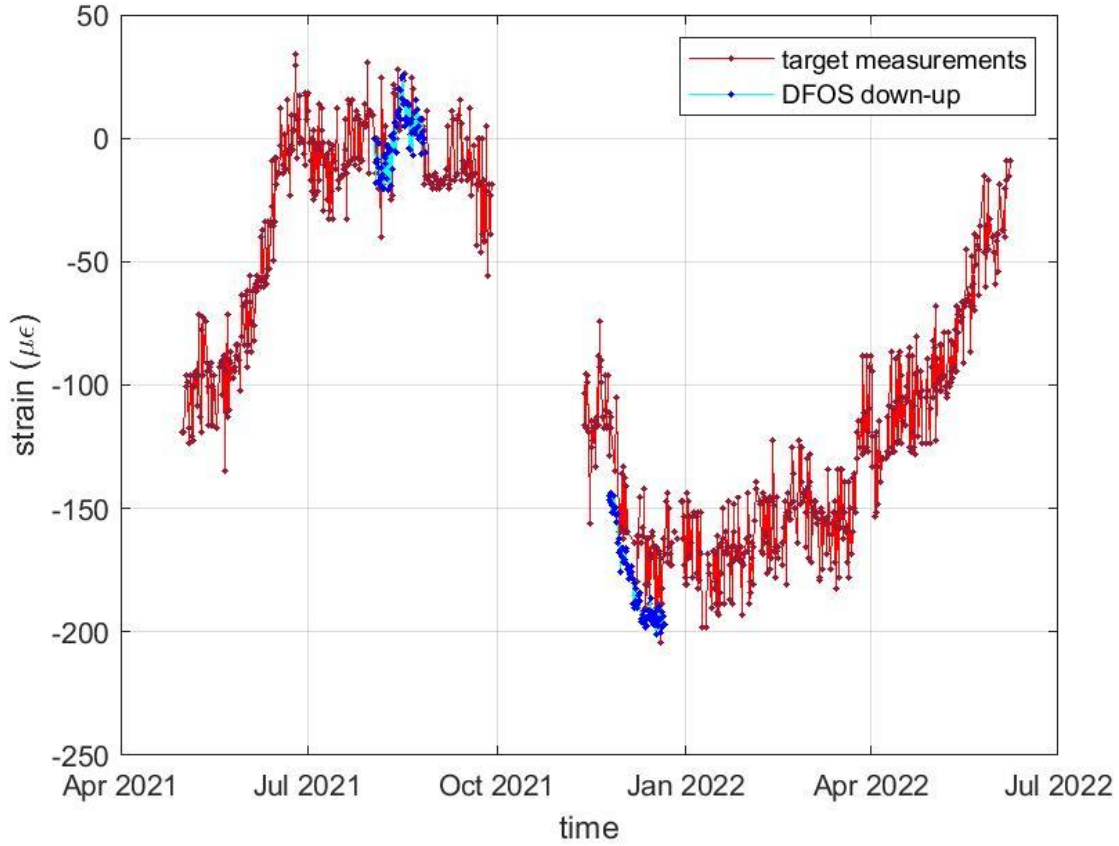




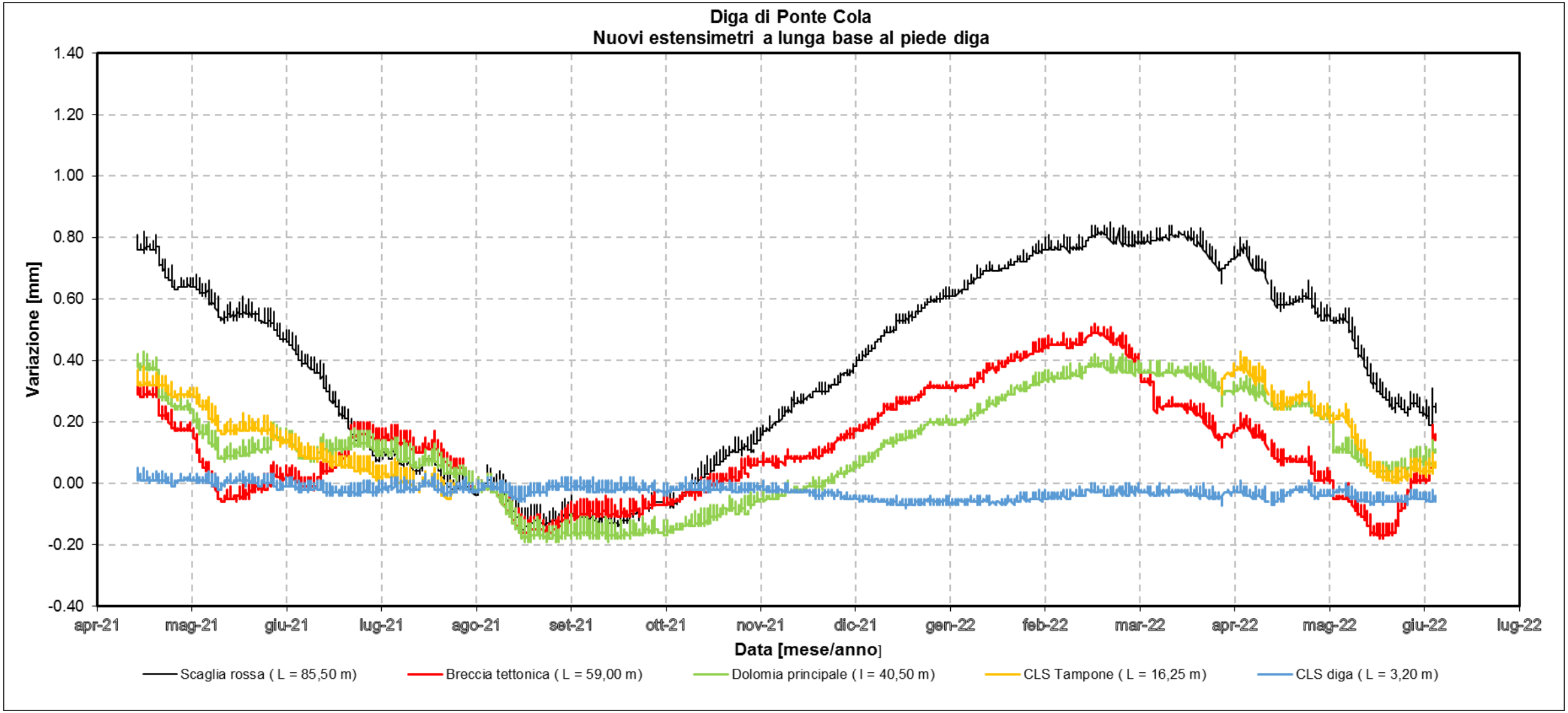
Strain by DFOS at the crest – continuous measure

Comparison DFOS and topographic measures for the two central sertors





Extensometer elongations



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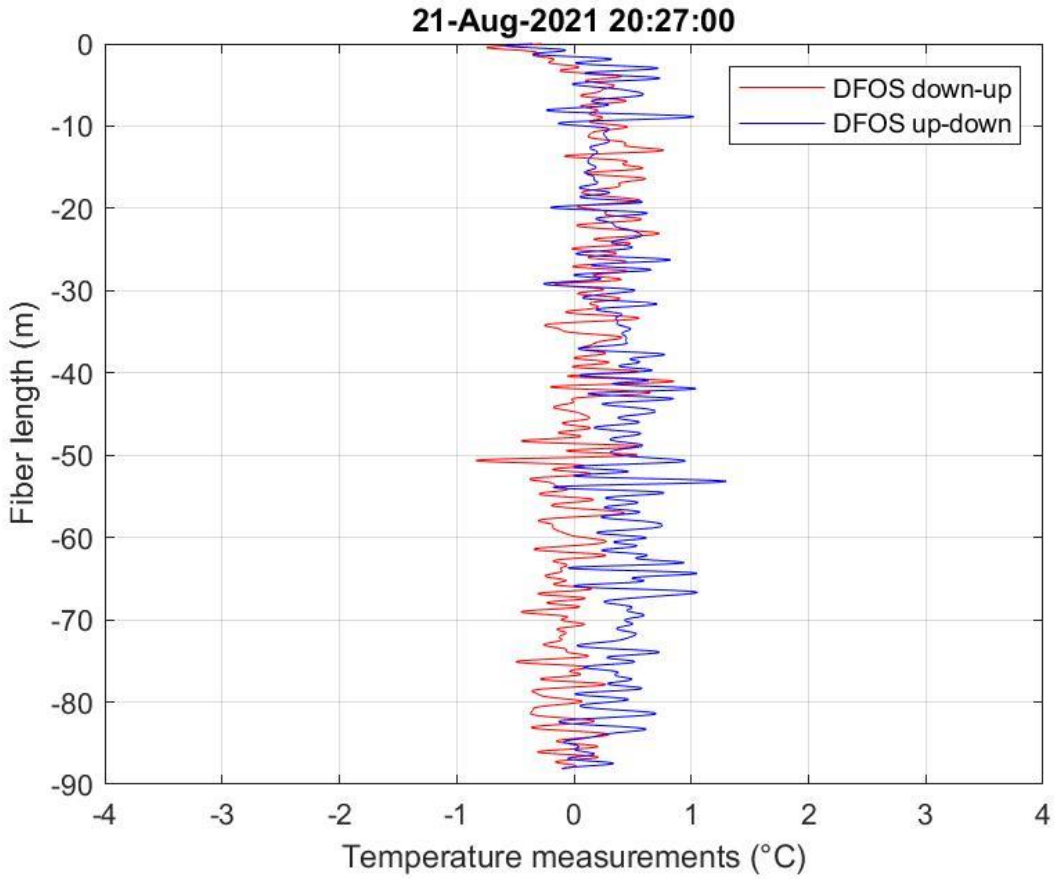
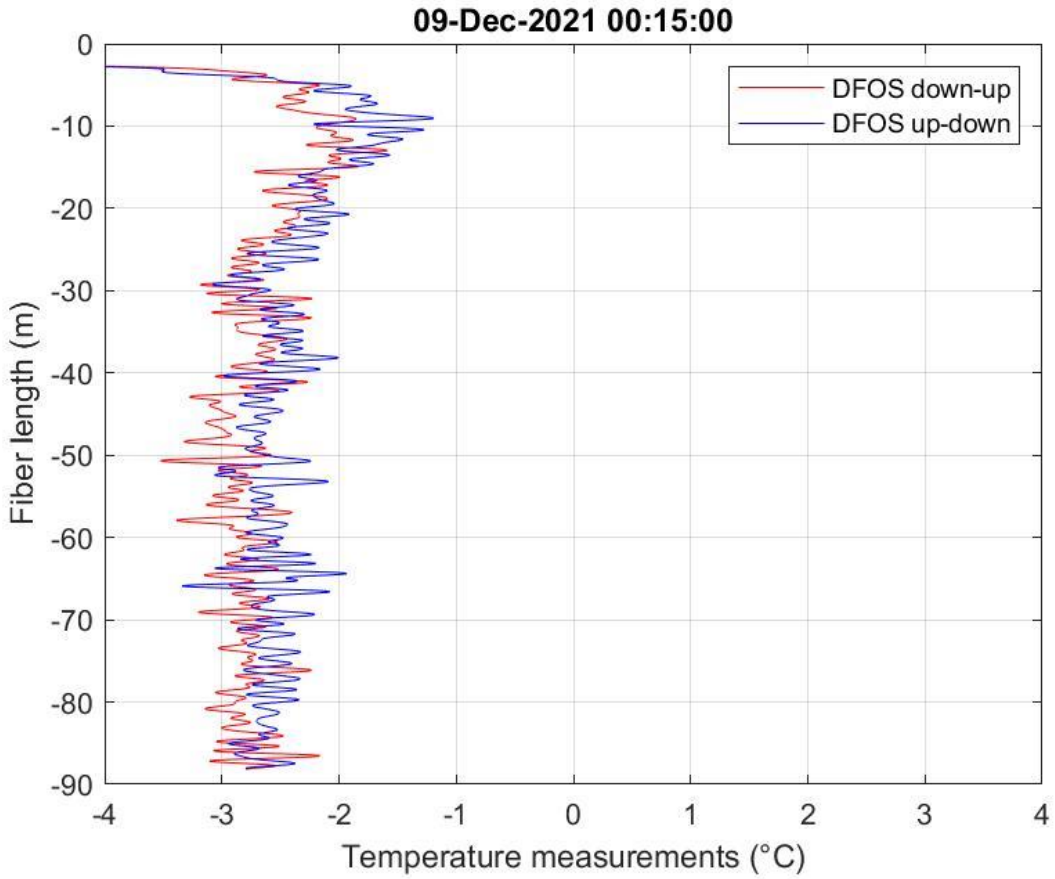
Temperature by DFOS in the foundation – single measure





Reference measure: at 12.00 of 2 August 2021

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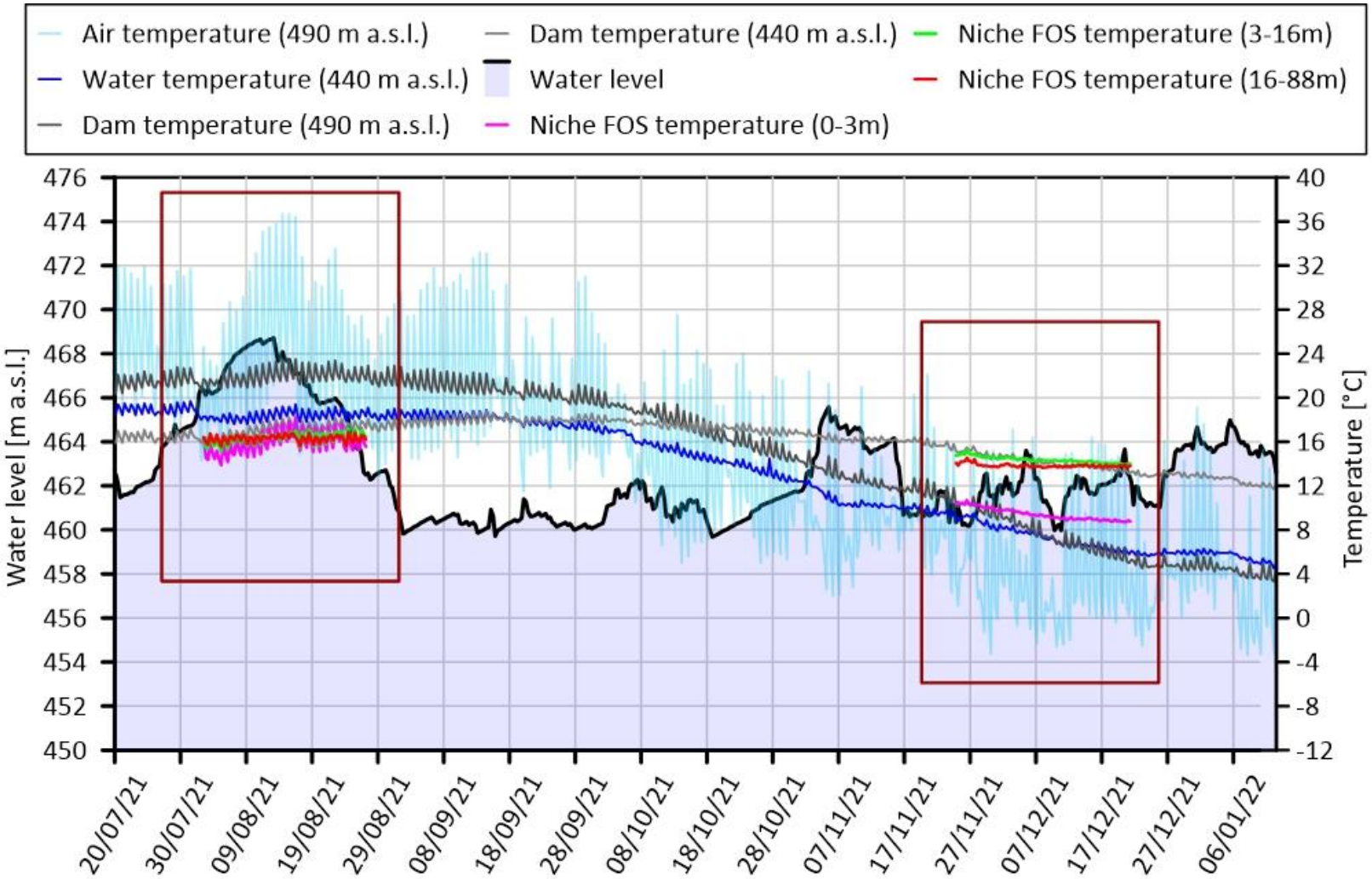
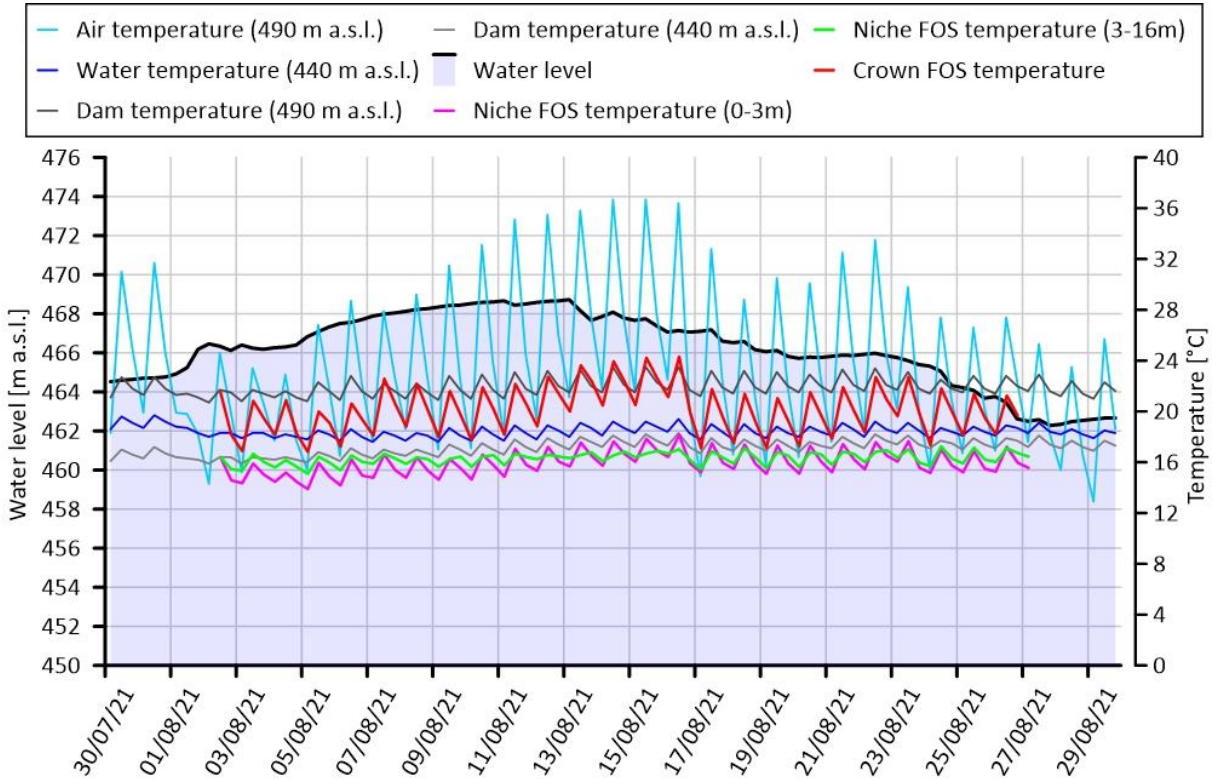
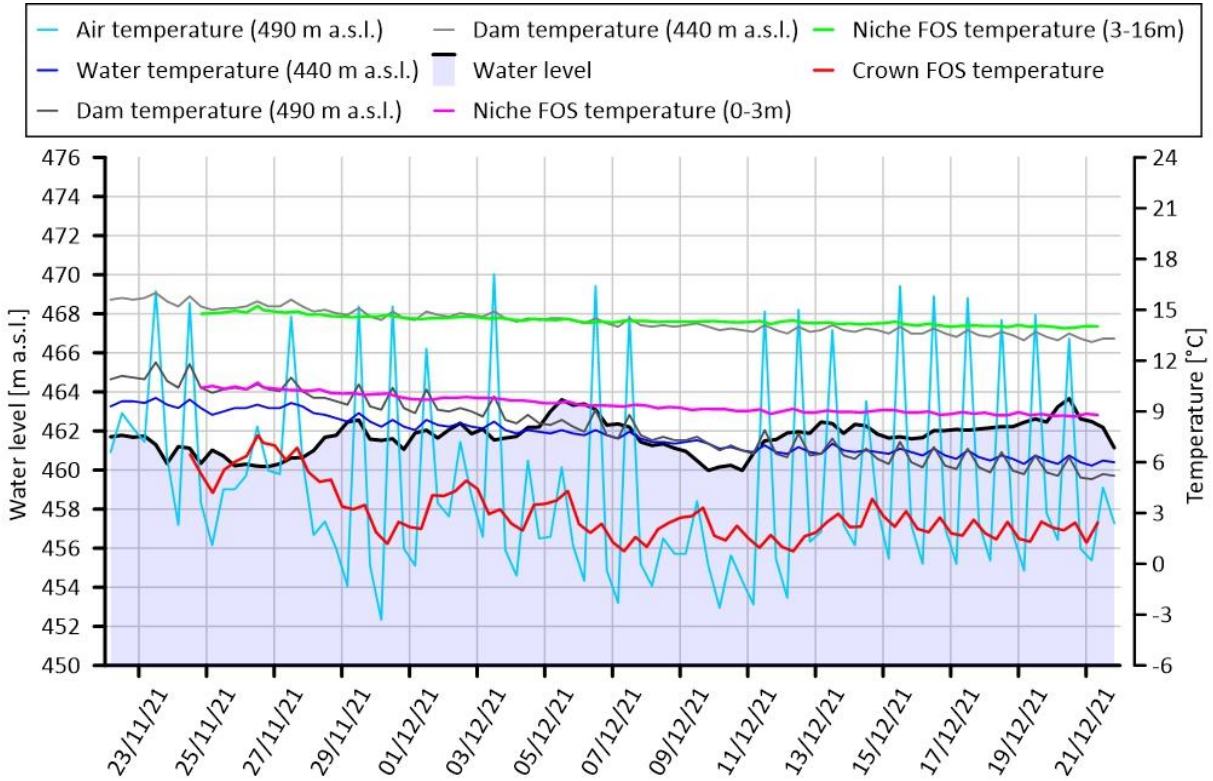
Temperature by DFOS in the foundation – continuous measure

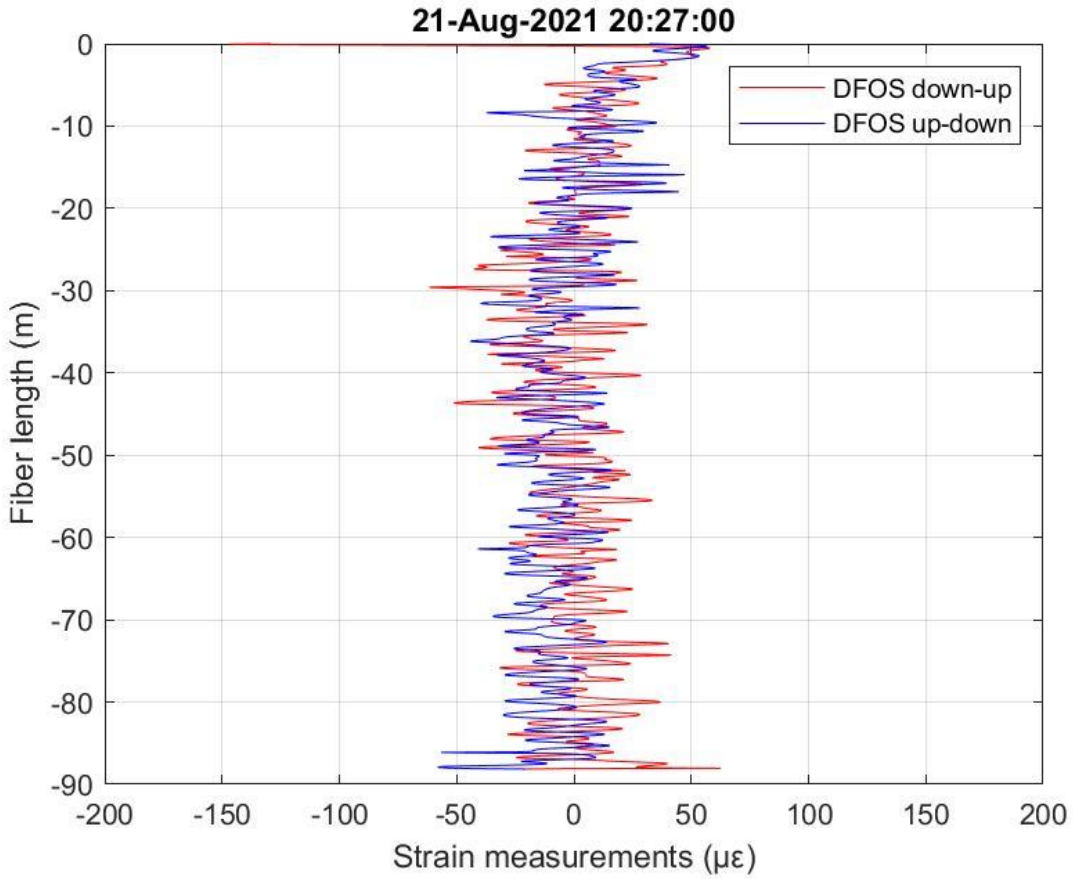


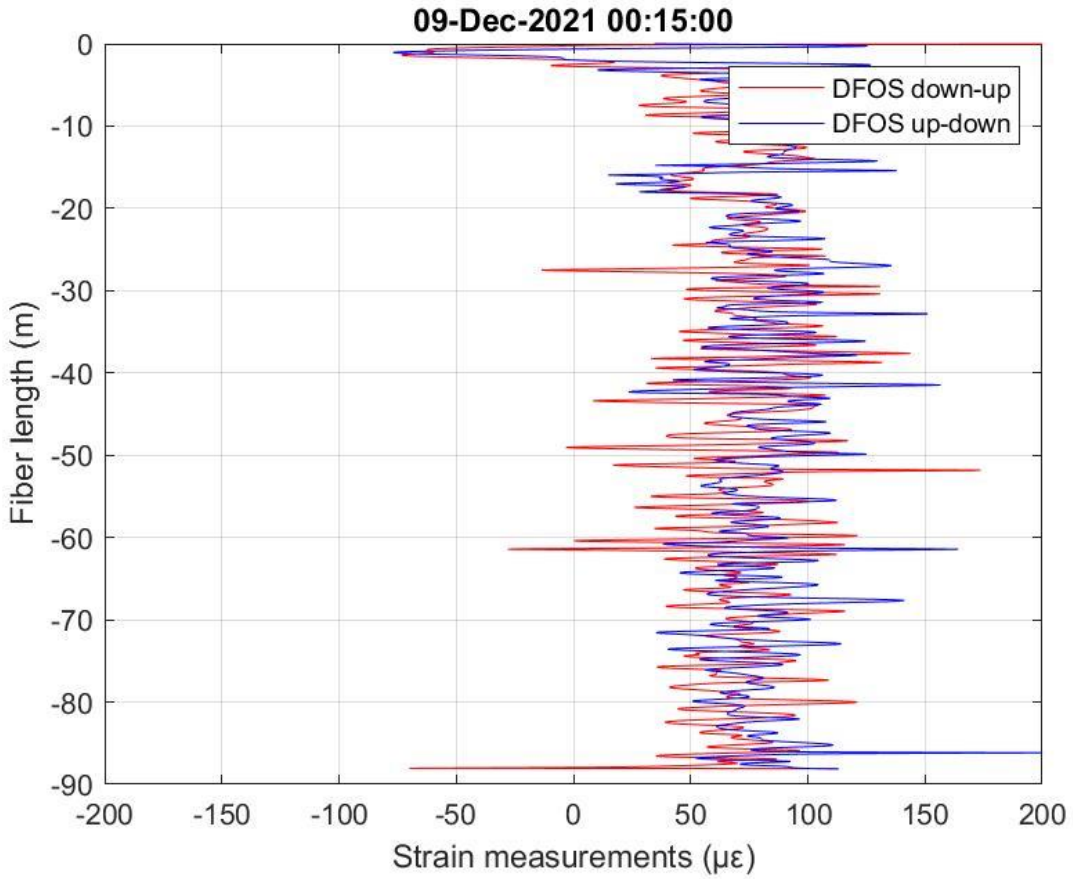
Temperature by DFOS in the foundation – continuous measure: detailed view





Strain by DFOS in the foundation – single measure





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Final remarks

Temperature measurements

- After calibration, DFOS obtain measures congruent with those of traditional sensors, both in foundation and at the crest
- At the crest the temperature excursions are above 20°C
- In the foundation the annual variation of temperature is less (4°C), even if the thermal response changes according to the depth

Strain measurements

- The strain measured by DFOS at the crest, in the range 200-300 με, are in good agree with the topographic survey, even with small overestimation on the lateral sectors
- DFOSs detect the irregular response of the joints in the crest
- In the foundation about 50-100 με, but larger than those measured with the extensometers (10-30 με)
- Due the very small strain developed by the dam it is crucial to carry out the calibration