

# Monitoring steep rock wall permafrost using electrical resistivity and induced polarisation

## Part 2: preliminary inversion results of a year-round series of measurements

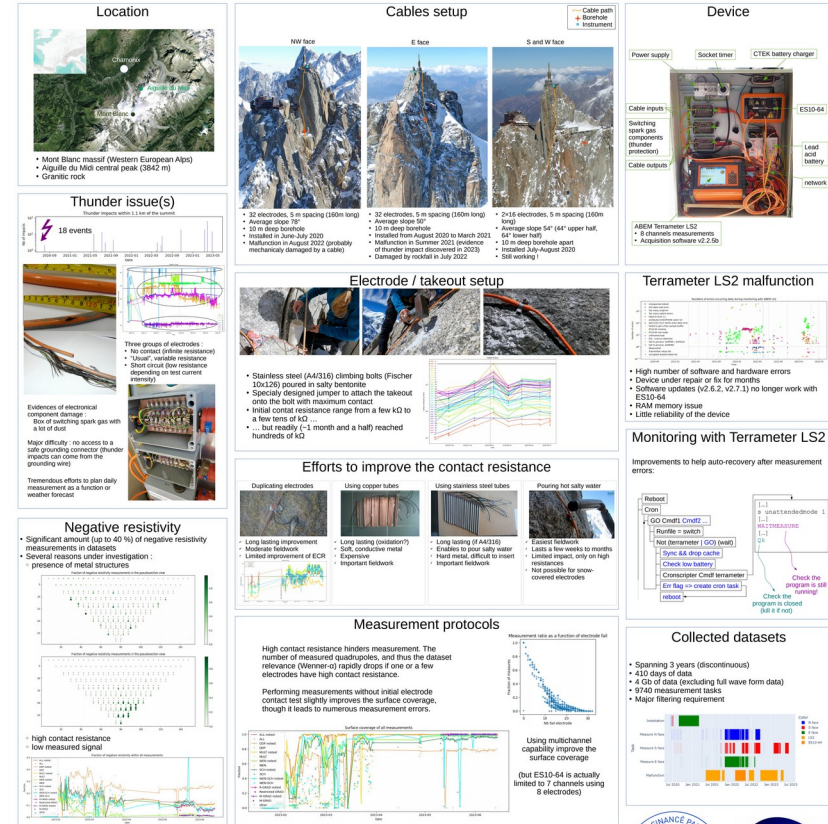
Josué Bock, Florence Magnin, André Revil, Matan Ben-Asher,  
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Laboratoire EDYTEM, Université Savoie Mont-Blanc, CNRS, 73376 Chambéry, France



# Part 1: installation, instrumentation

## poster session B (B30)





# Overview : location and device



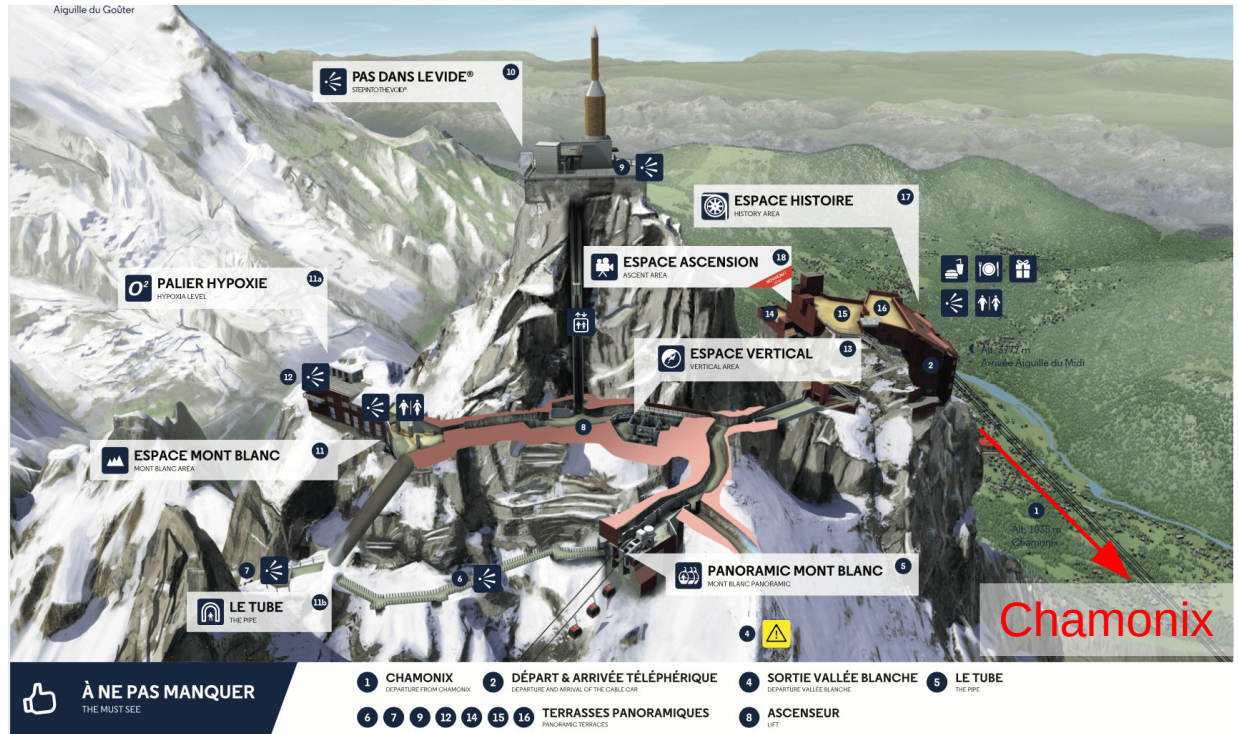
- Mont Blanc massif (Western European Alps)
- Aiguille du Midi central peak (3842 m)
- Granitic rock



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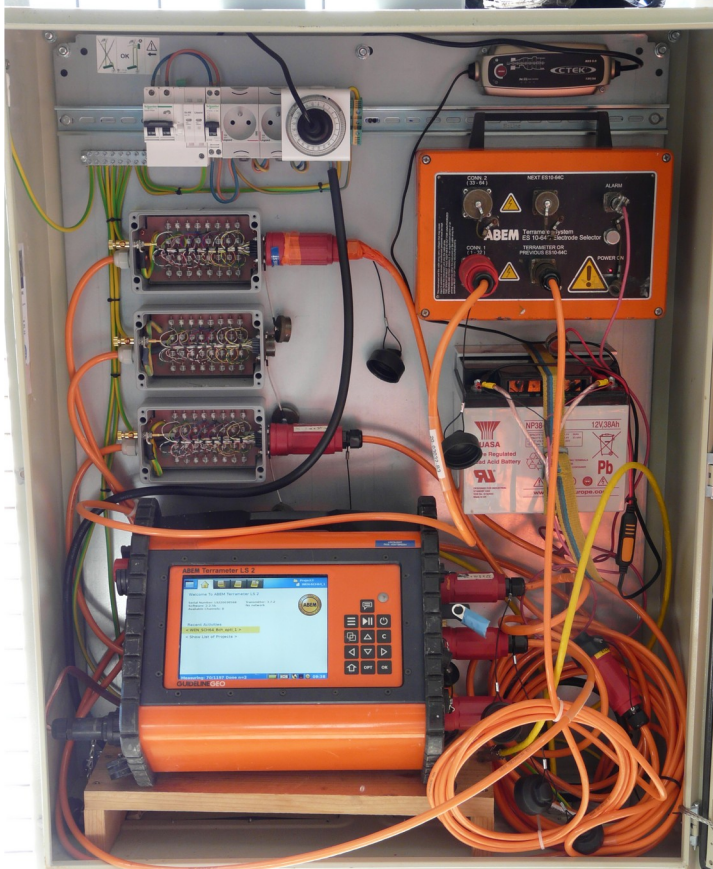
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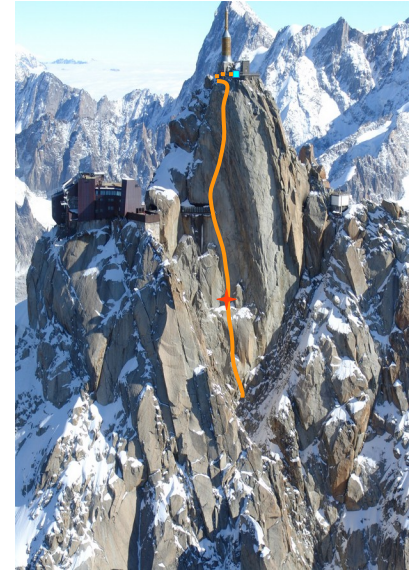
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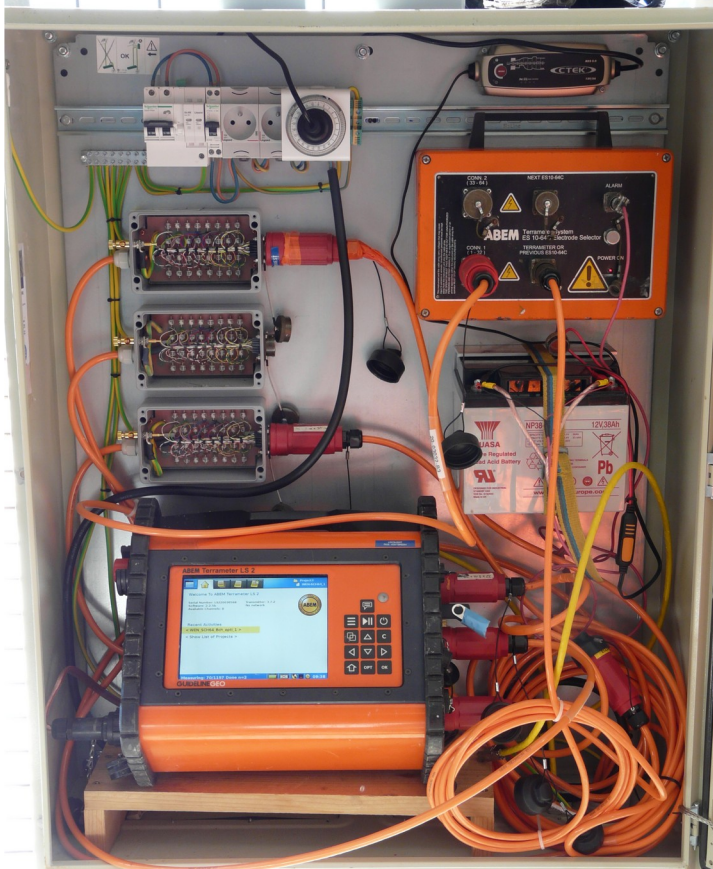
- 3 cables, 96 electrodes
- ABEM Terrameter LS2
- Power supply & network
- Several settings/arrays:
  - Wenner, WS, dipole-dipole, multigradient, ...
  - RES + IP
- From June 2020 to now...  
... with many data gaps



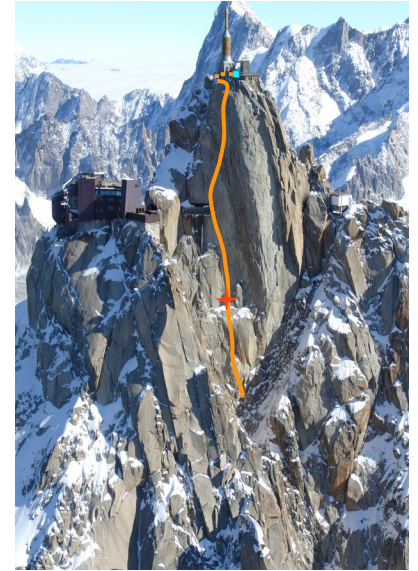
NW face



# Overview : location and device



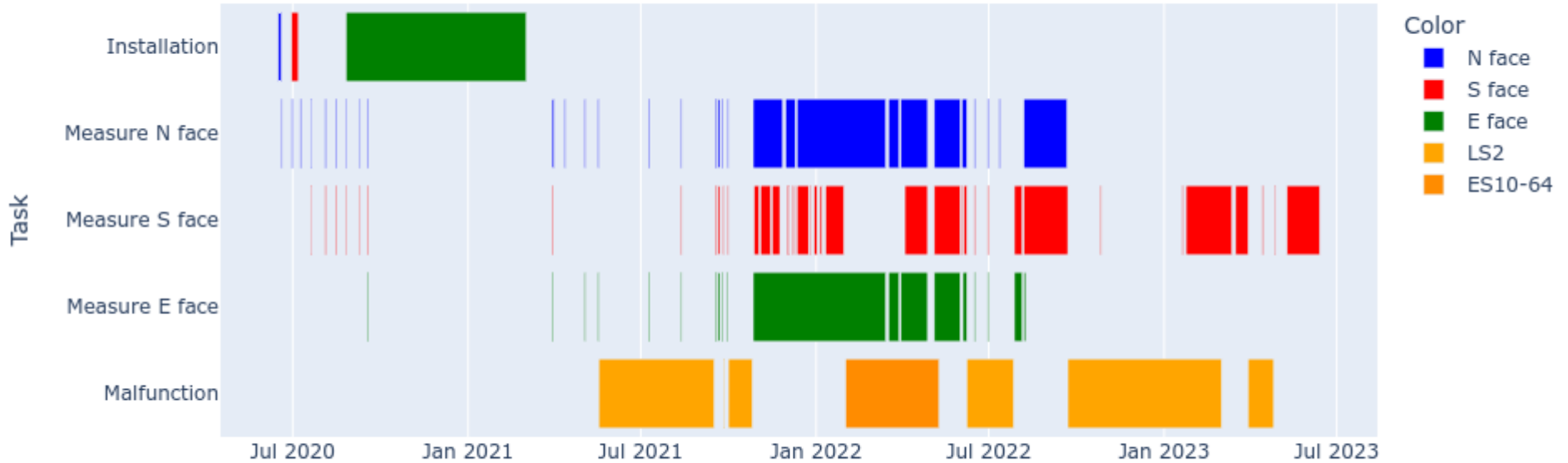
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NW face

- Investigate rockwall permafrost
- 2D (3D) information
  - ALT, its dynamics
  - Spatial heterogeneities
  - Ice content, water circulation

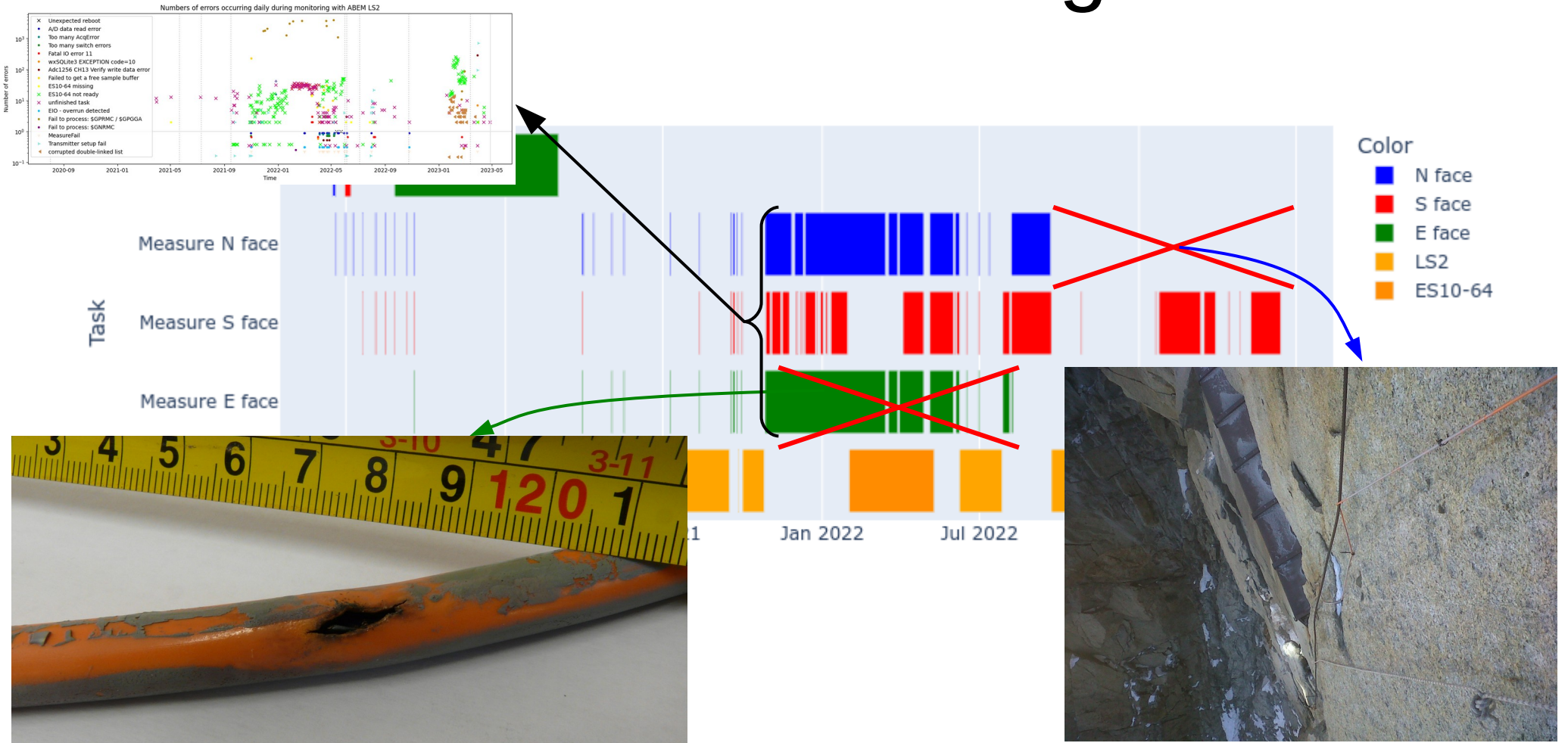
# ERT monitoring







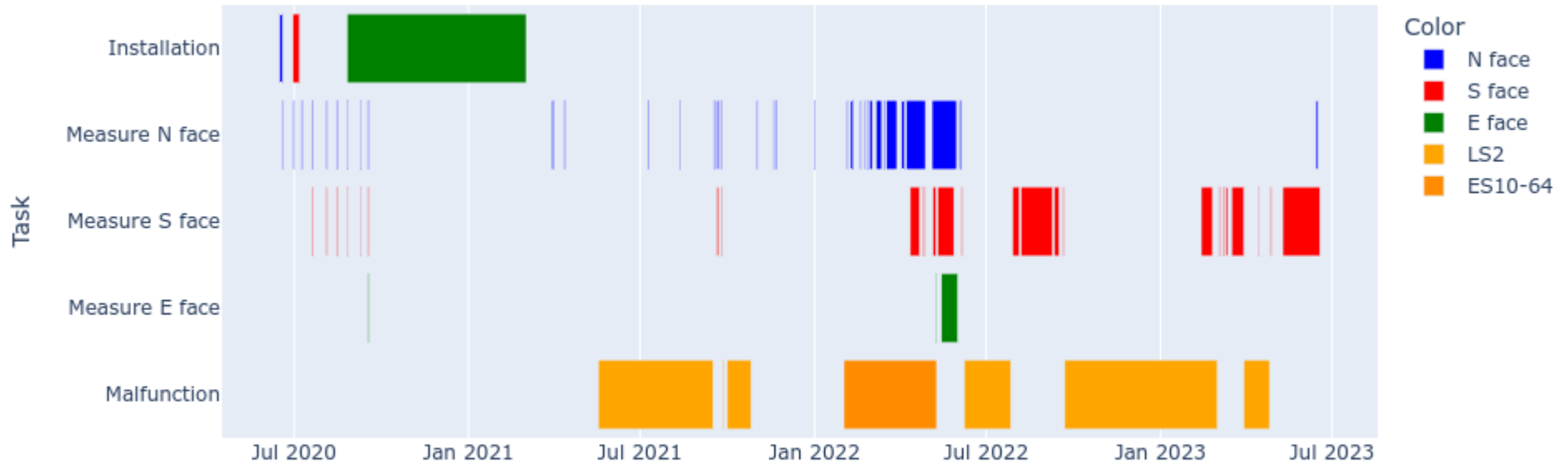
# ERT monitoring







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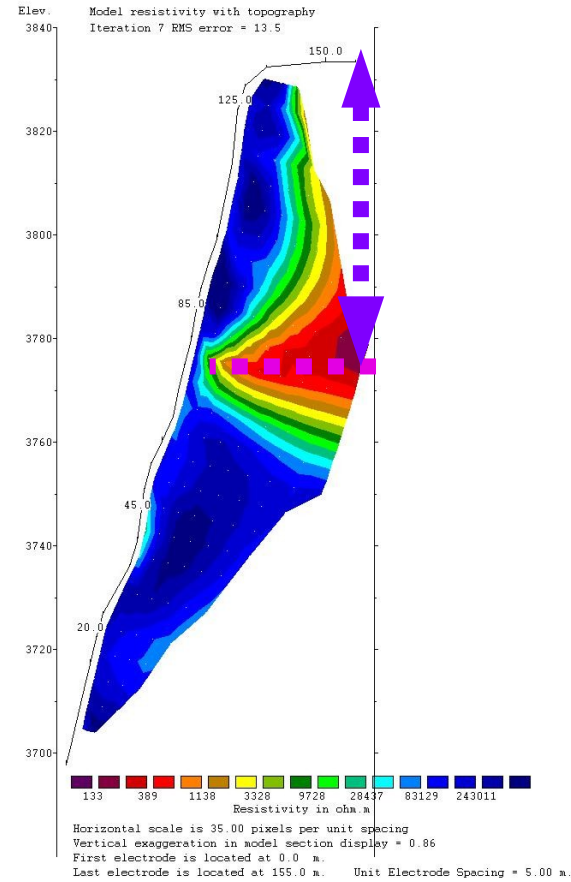
Criterion: 75 % valid measures



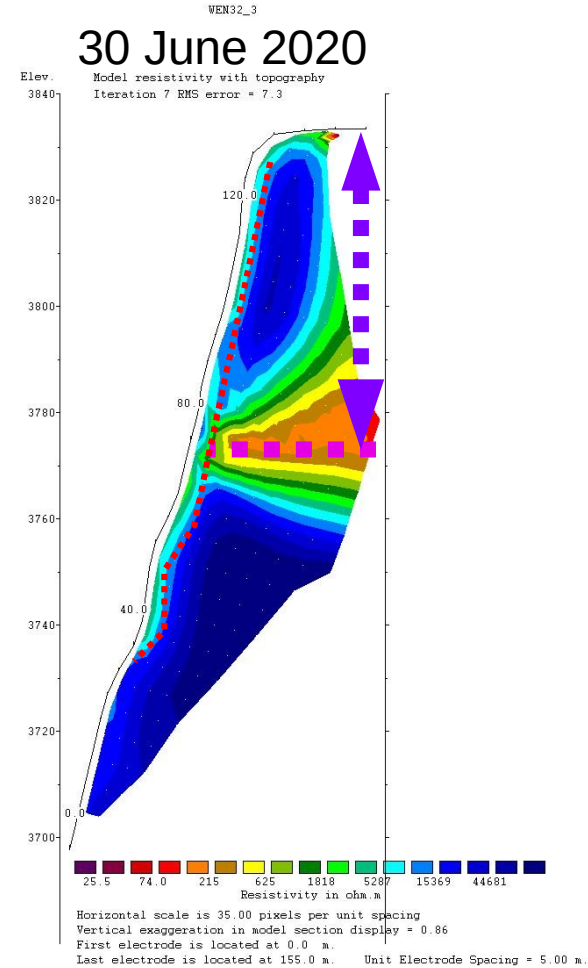
# NW face: winter



VEN32\_6  
30 March 2020

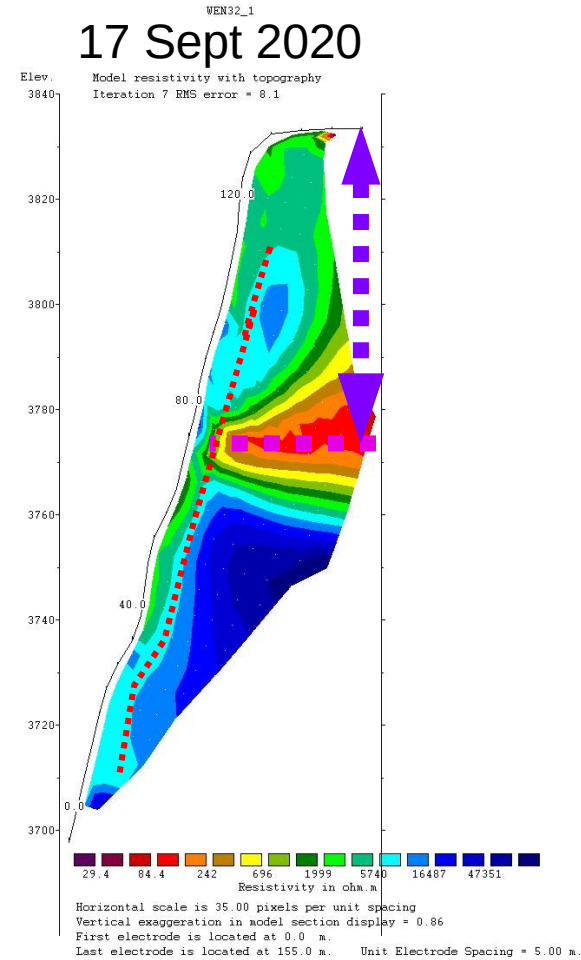


# NW face: early summer





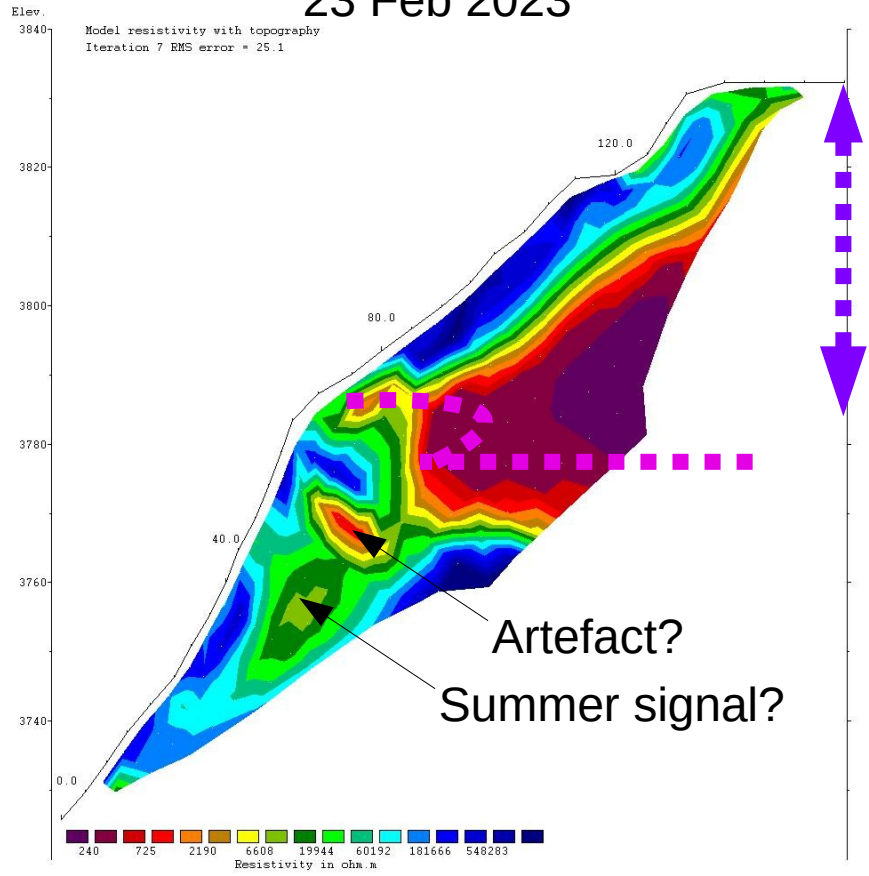
# NW face: late summer



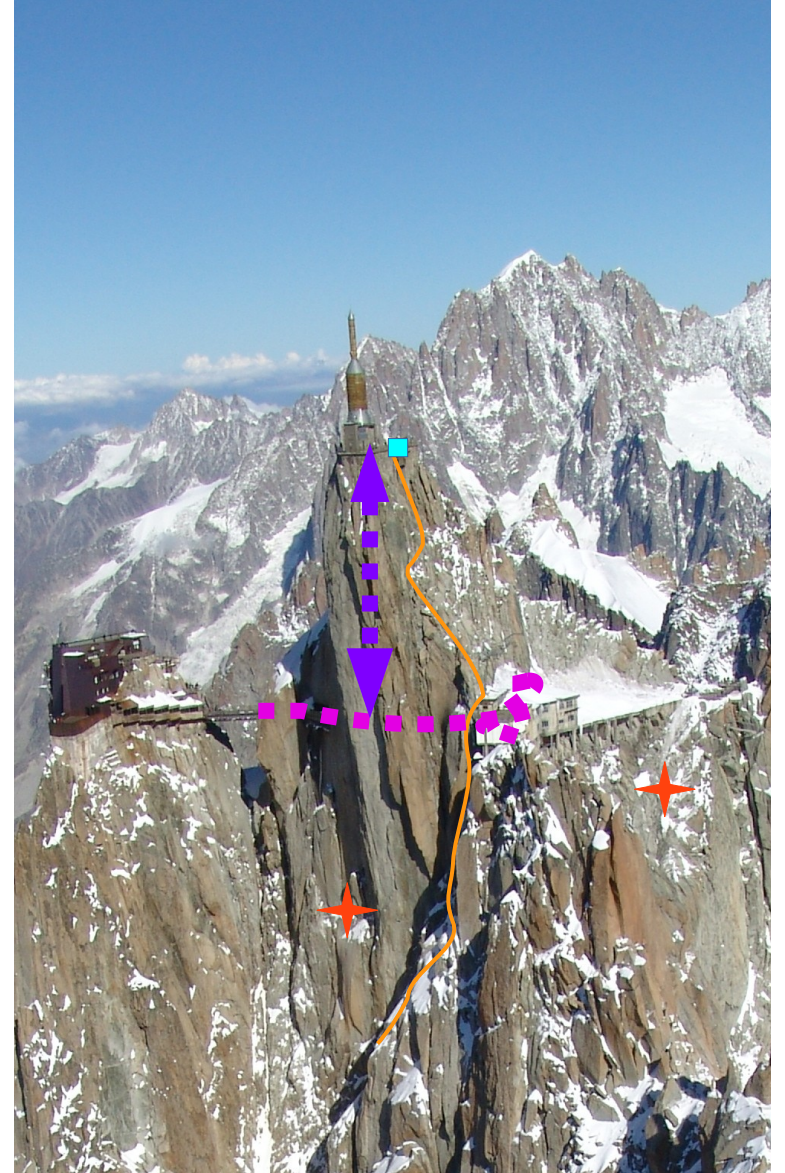
# S-W face: winter

S-WEN\_2

23 Feb 2023

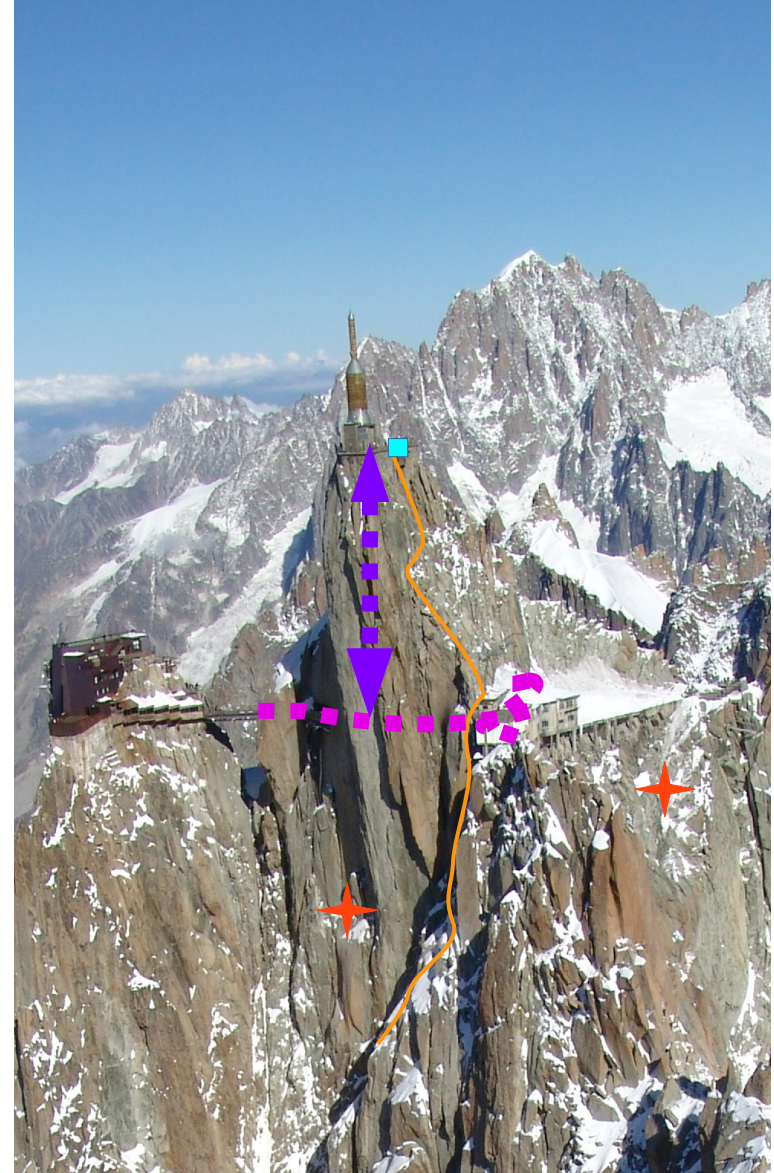
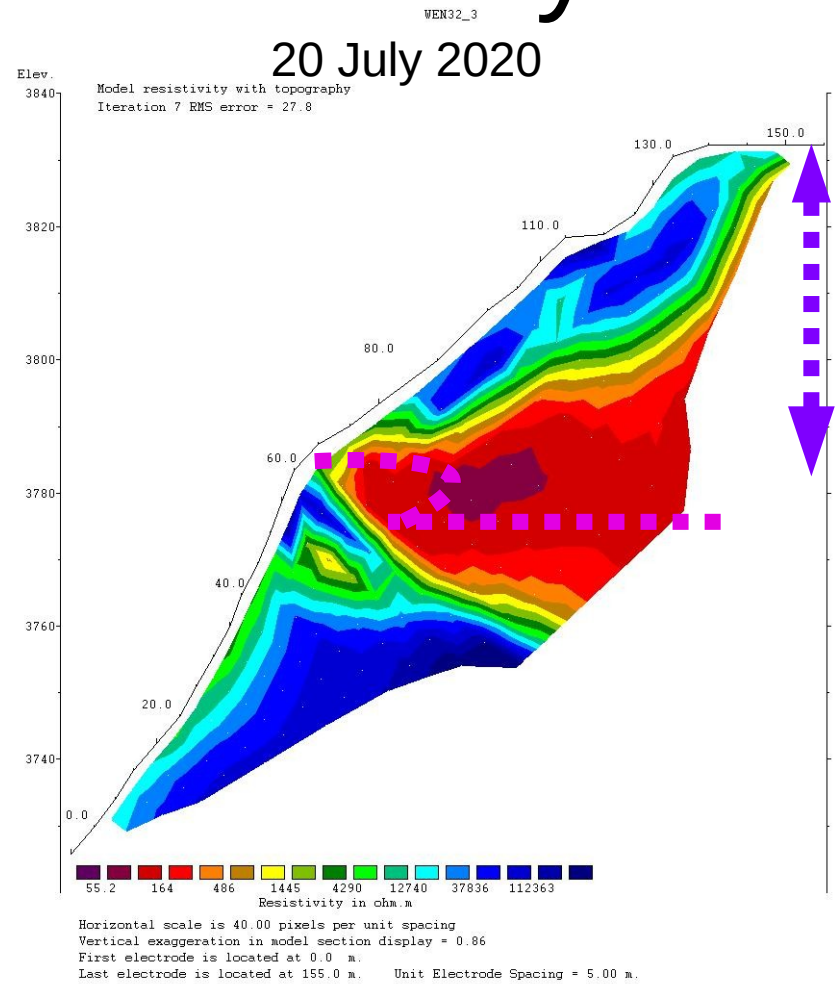


Horizontal scale is 45.00 pixels per unit spacing  
Vertical exaggeration in model section display = 0.86  
First electrode is located at 0.0 m.  
Last electrode is located at 155.0 m. Unit Electrode Spacing = 5.00 m.



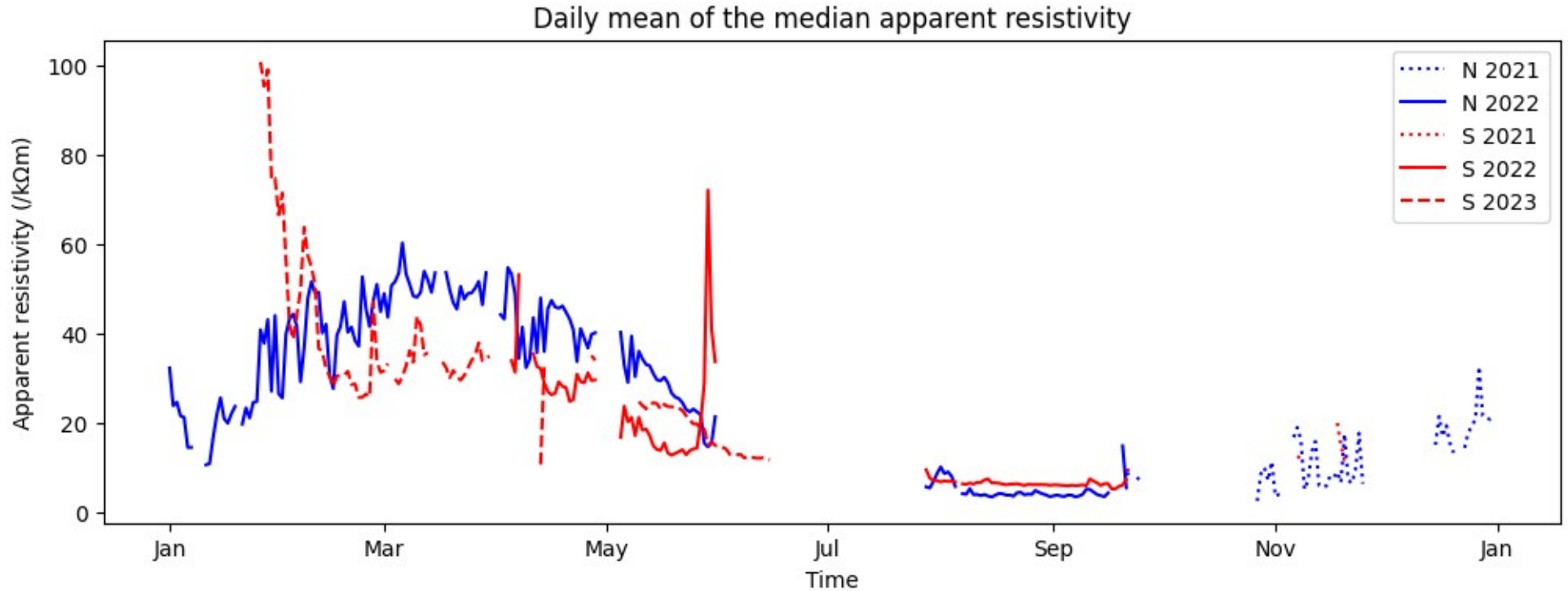


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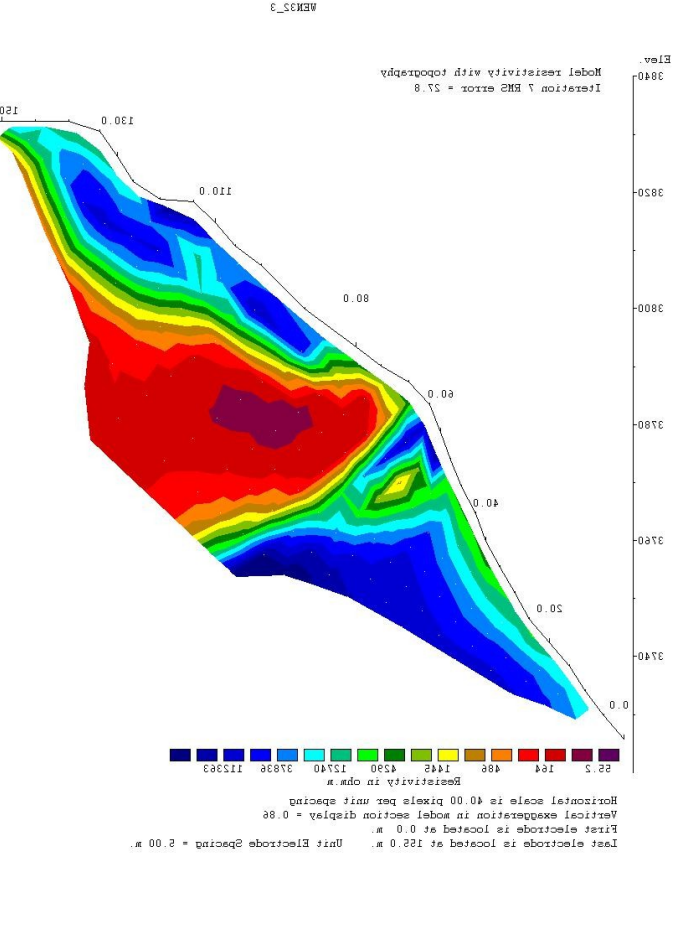
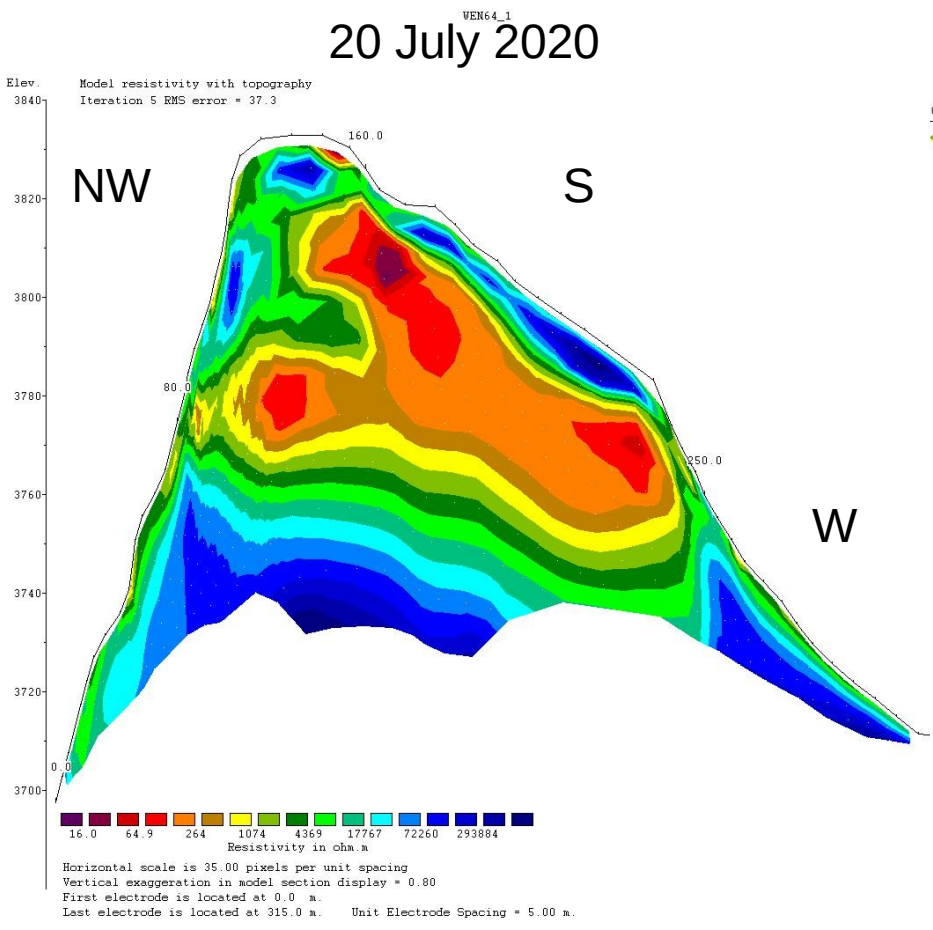
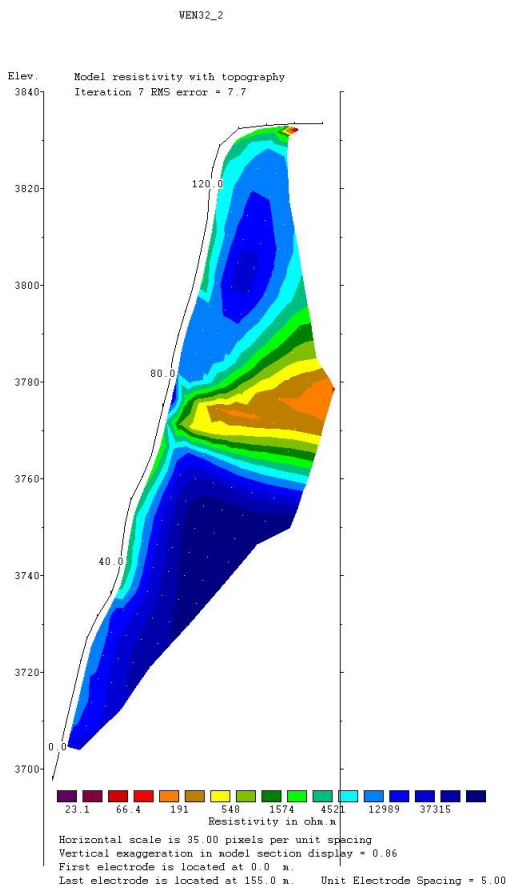


# Temperature and saturation

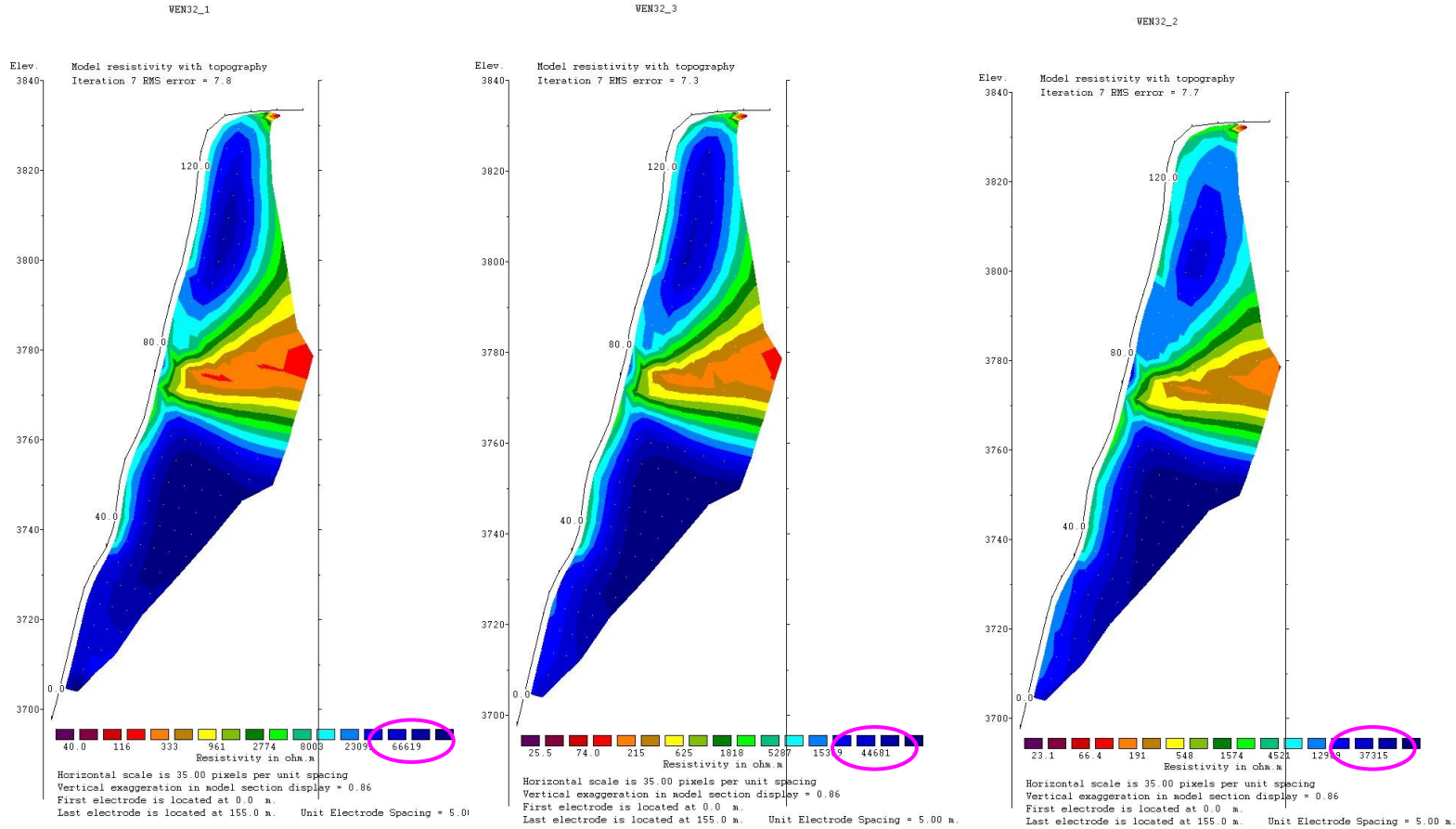


# Dealing with steep topography

20 July 2020



# Dealing with high contact resistances



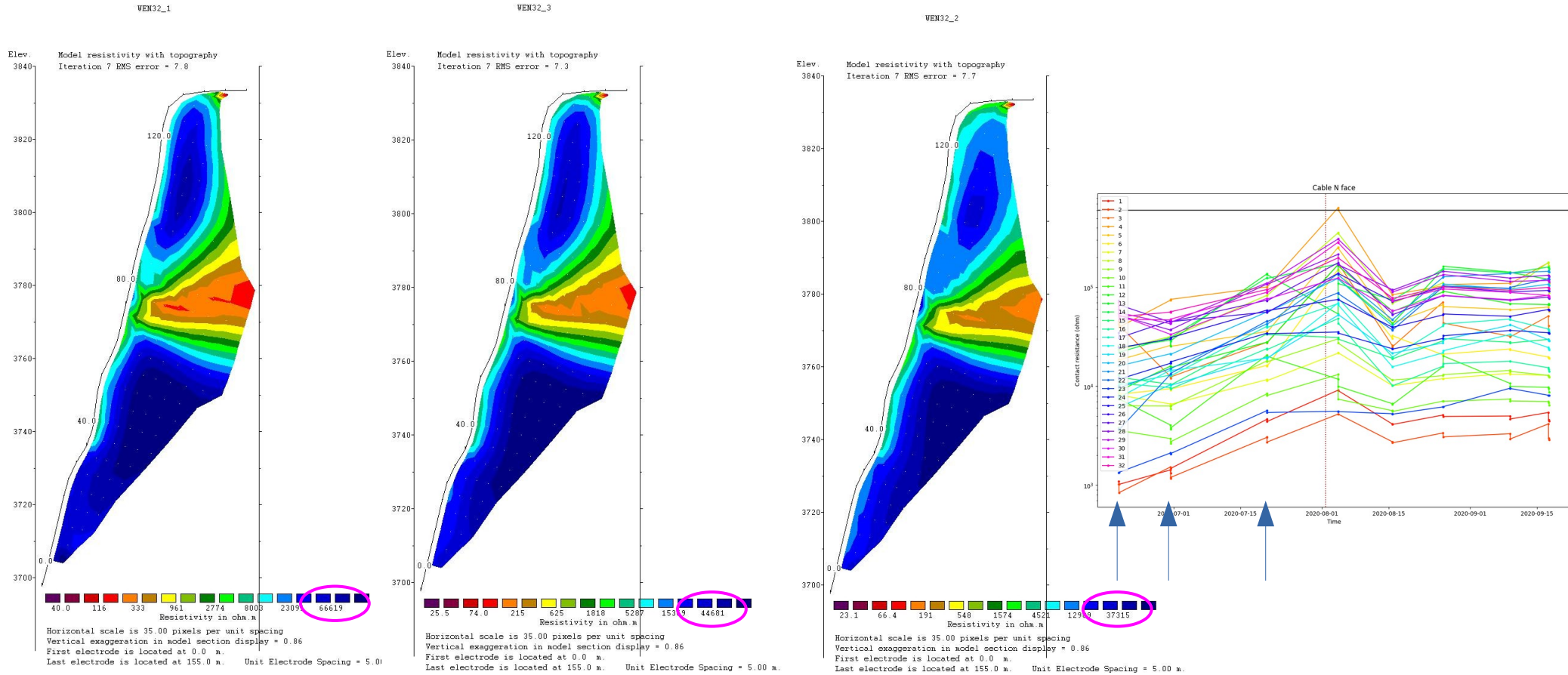
2020-06-19

2020-06-30

2020-07-20



# Dealing with high contact resistances



2020-06-19

2020-06-30

2020-07-20

# Future work

- **Analysis of contact resistance bias (lab / theoretical investigations)**
- **Analyse the IP data (decay curves; filtering requirements)**
- **Thermal state analysis, relate to BH dataset**
- **Investigate the steep topography impact regarding inversion (compare with other softwares)**
- **Carry out 3D inversion**
- **Include full wave form signal analysis**



# Take home messages

- Major efforts to install and maintain device
- Poor reliability of ABEM Terrameter LS2 (especially for monitoring purpose)
- Dataset spanning 3 years, with year round information to document rockwall permafrost
- Importance of data management: automation, analysis, filtering, ...

## Acknowledgements:

- Compagnie du Mont-Blanc for providing access to the site
- People who helped with the installation: S. Alésina, M. Piquand, I. Rico, S. Jaillet, B. Galabertier
- S. Gruber for pictures from helicopter, A. Chabas for Mont-Blanc and N face pictures



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