GROUND-PENETRATING RADAR ORIENTATION EFFECTS ON TEMPERATE MOUNTAIN GLACIER

LANGHAMMER, L., RABENSTEIN, L., BAUDER, A. AND H. MAURER

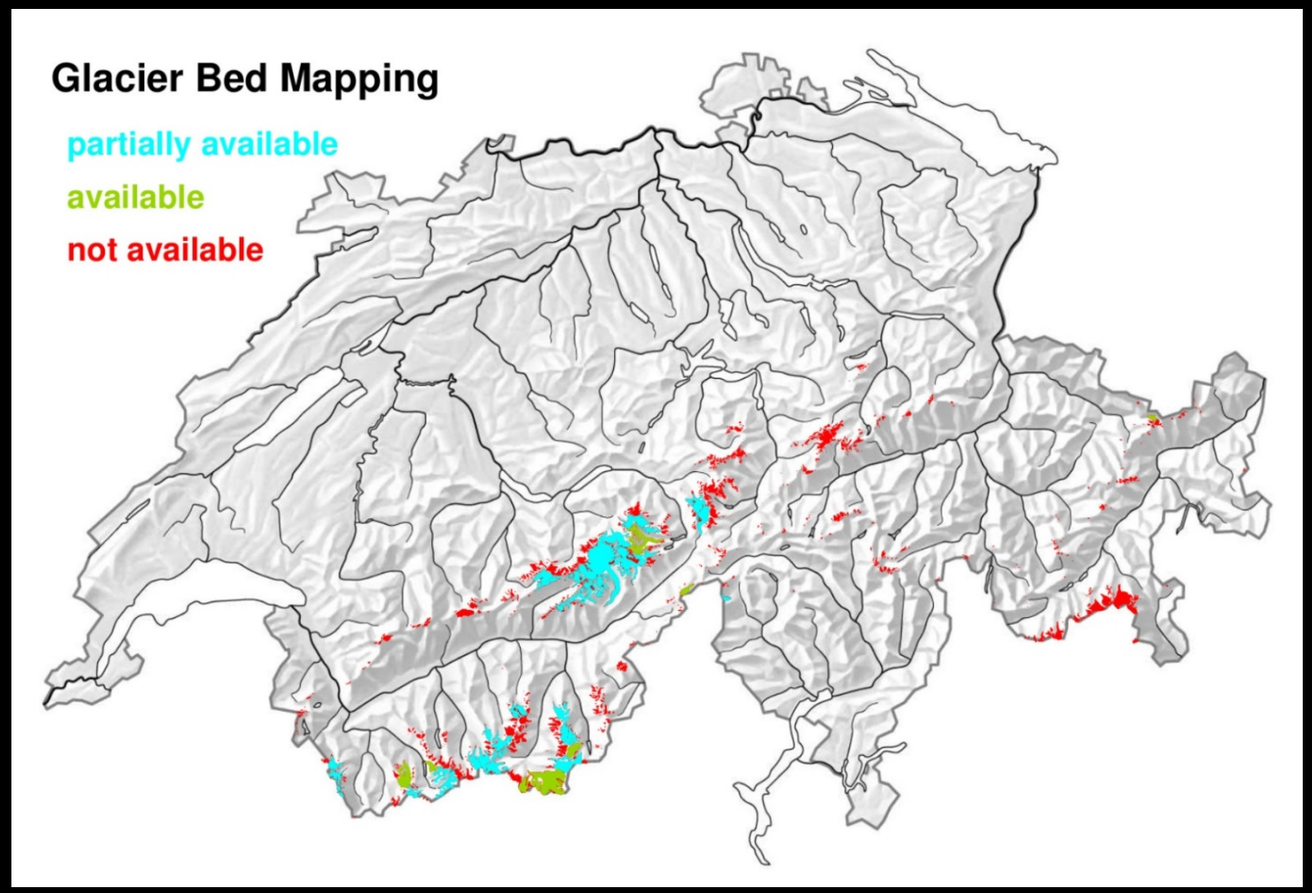
(ACCEPTED IN GEOPHYSICS, 2017)

GLACIER BED MAPPING

Trift Glacier, Switzerland

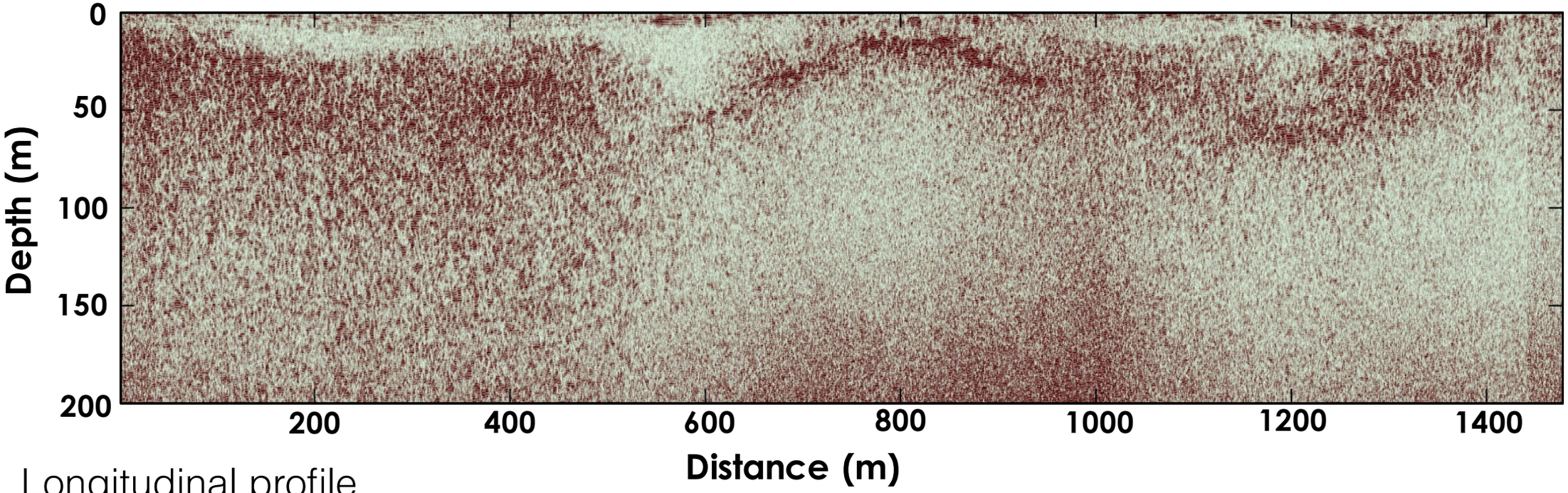
www.gletscherarchive.de

GPR-derived bedrock

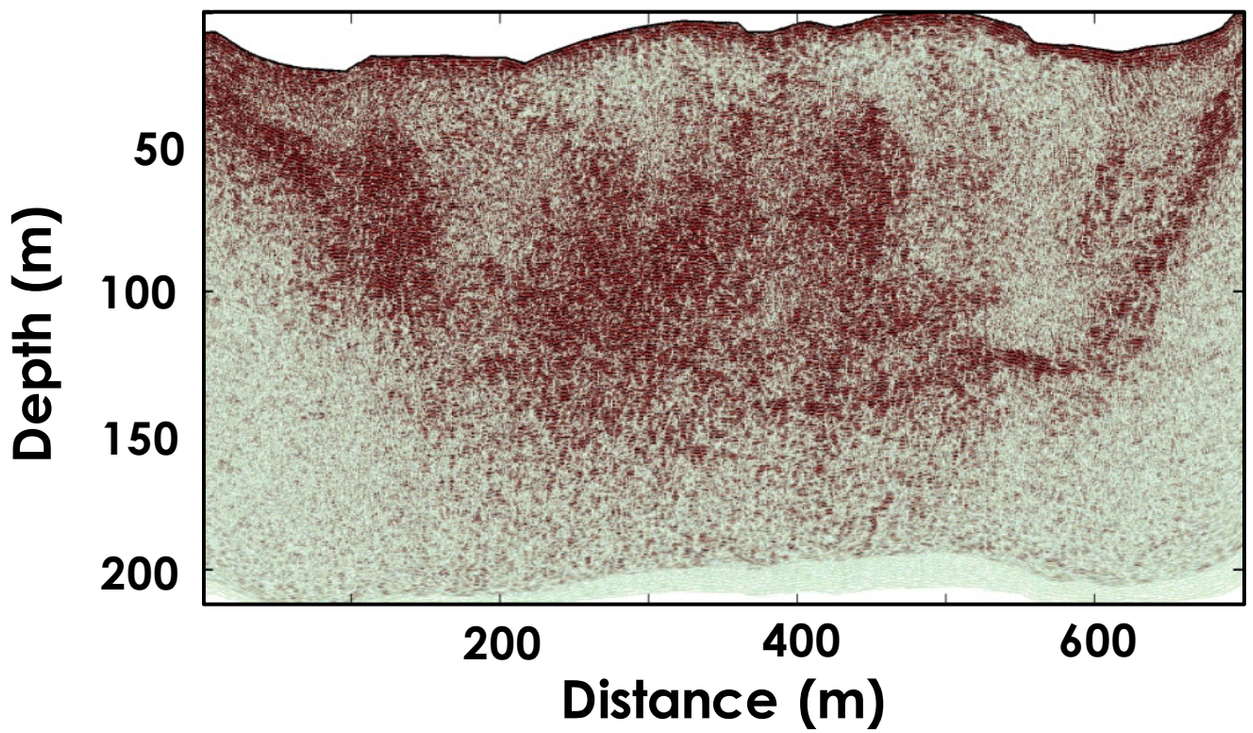


VAW ETHZ

EXISTING DATA

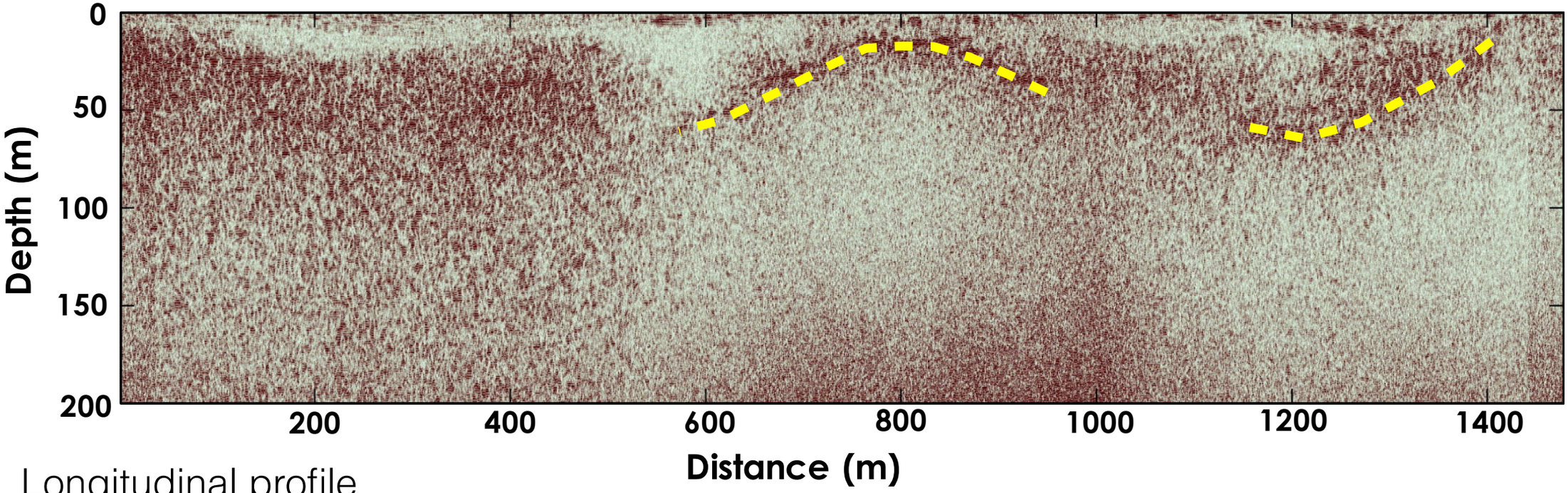


Longitudinal profile

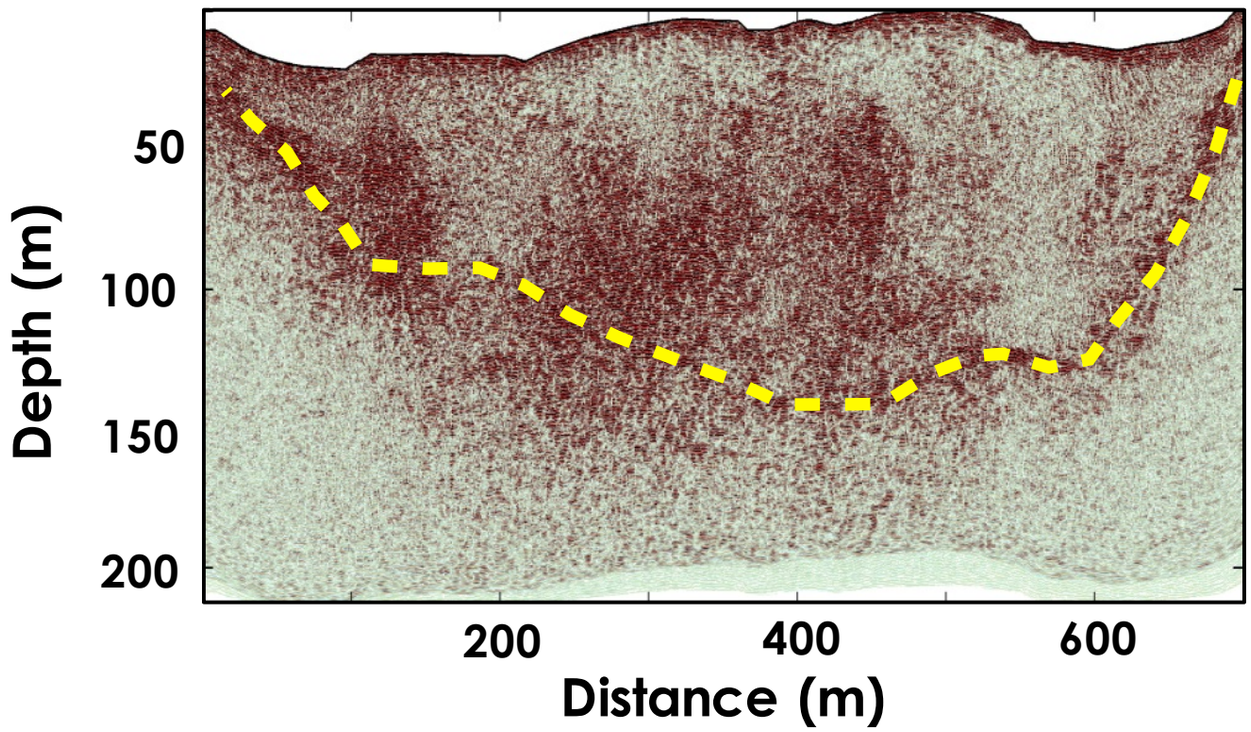


Across profile

EXISTING DATA

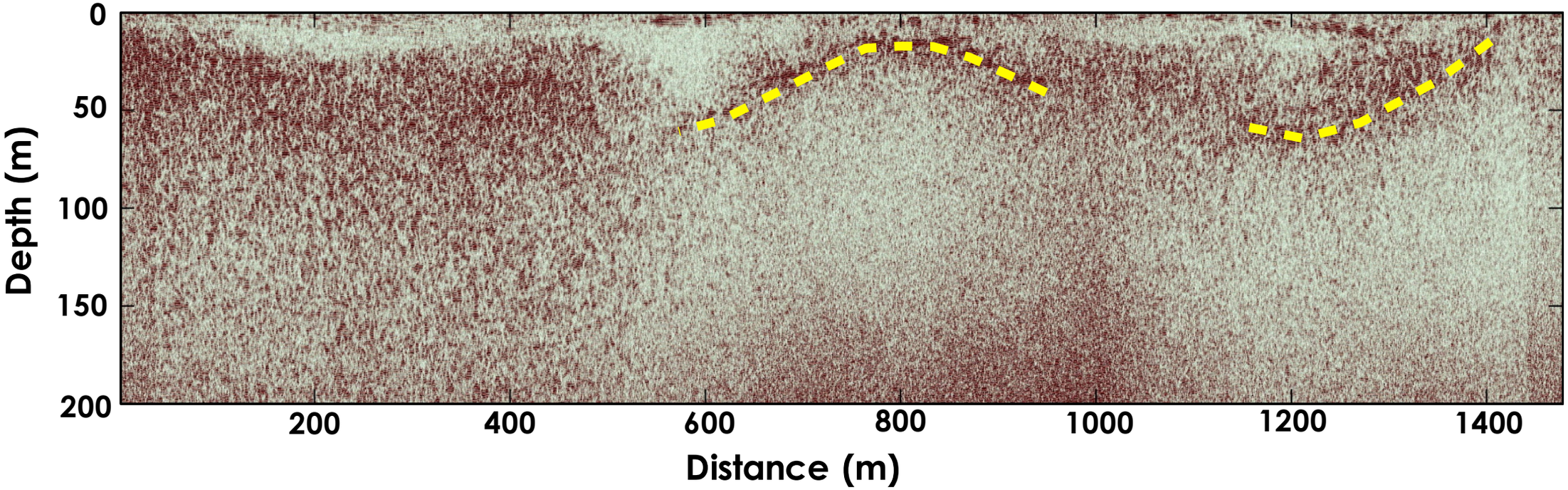


Longitudinal profile



Across profile

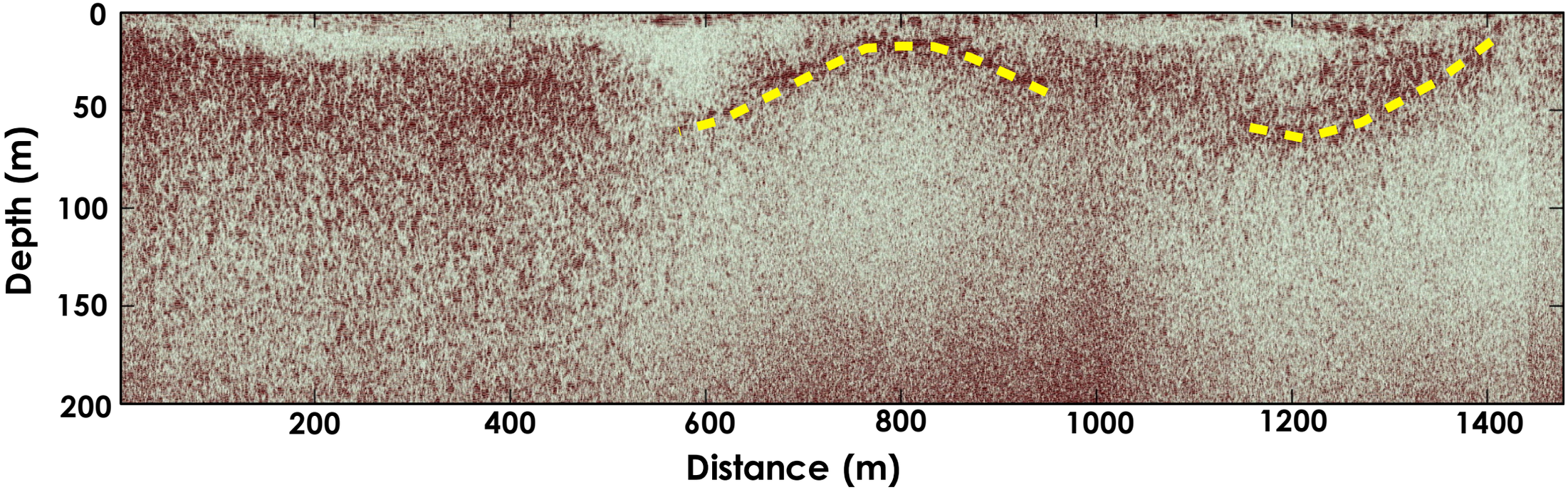
EXISTING DATA



Arising problems:

- Low penetration depth
- Damping due to water
- Directionality of antennas

EXISTING DATA

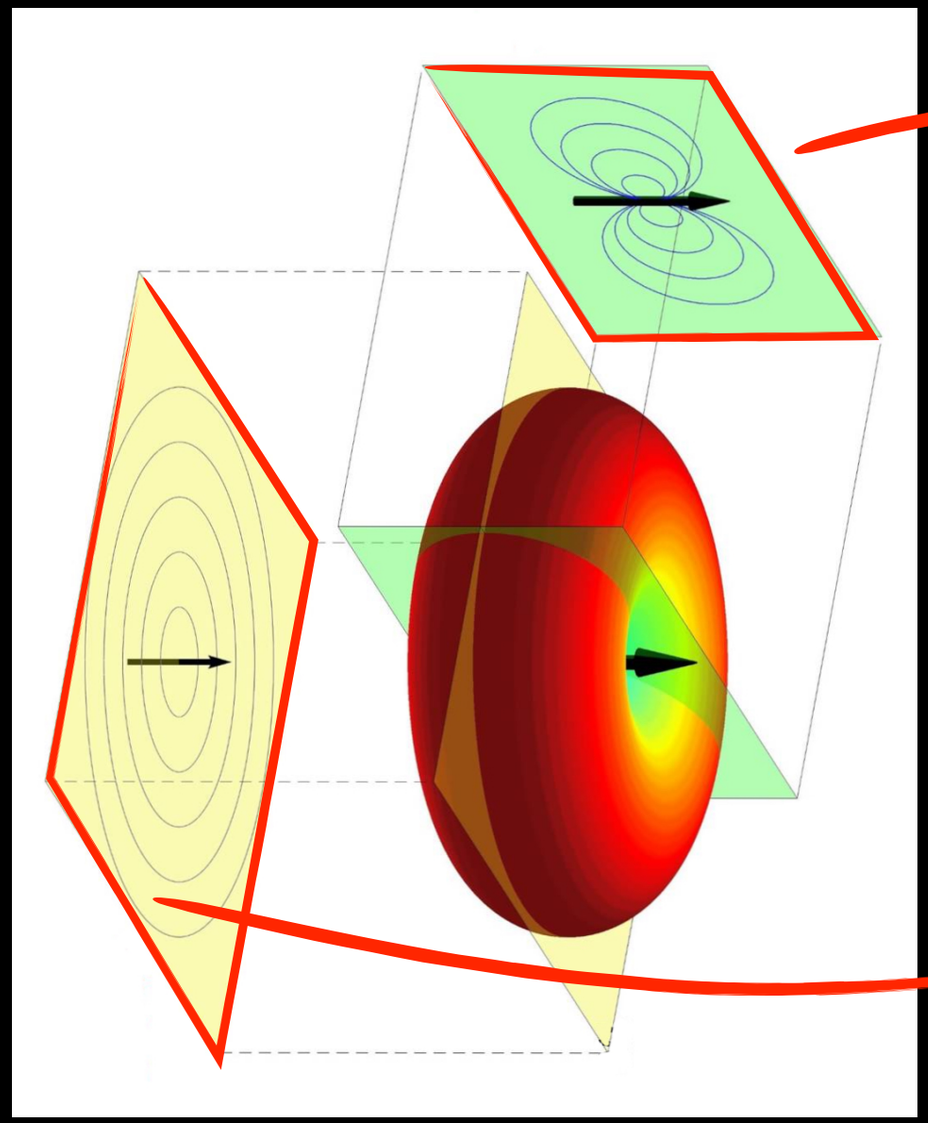


Arising problems:

- Low penetration depth
- Damping due to water
- Directionality of antennas

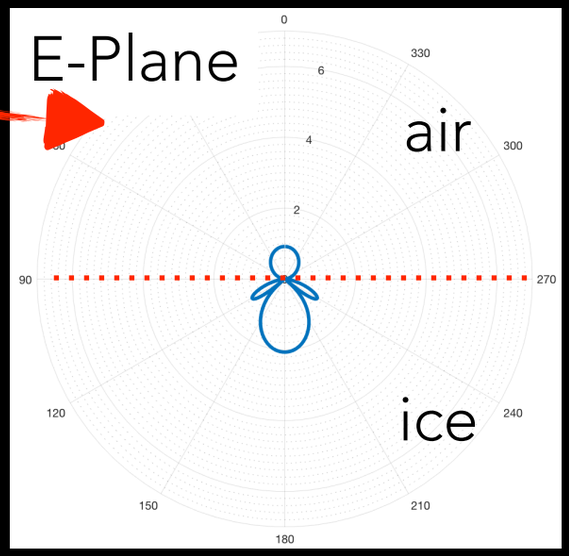
DIPOLE RADIATION PATTERN

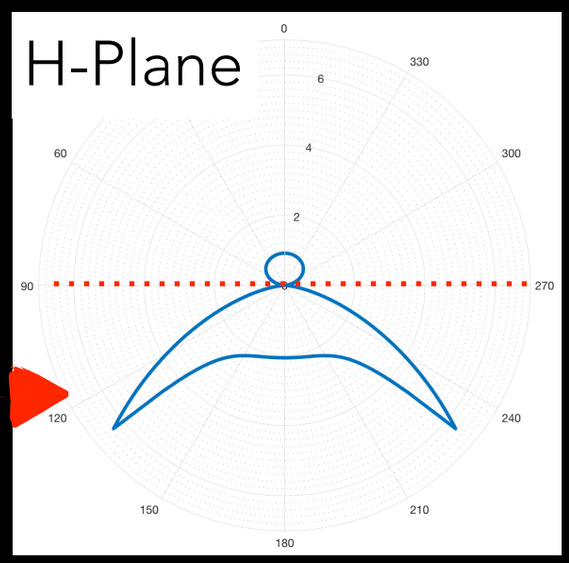
FULL SPACE



https://www.youtube.com/watch?v=Fp26Bjm99VI

ANALYTICAL SOLUTION FOR ICE





Halfspace with

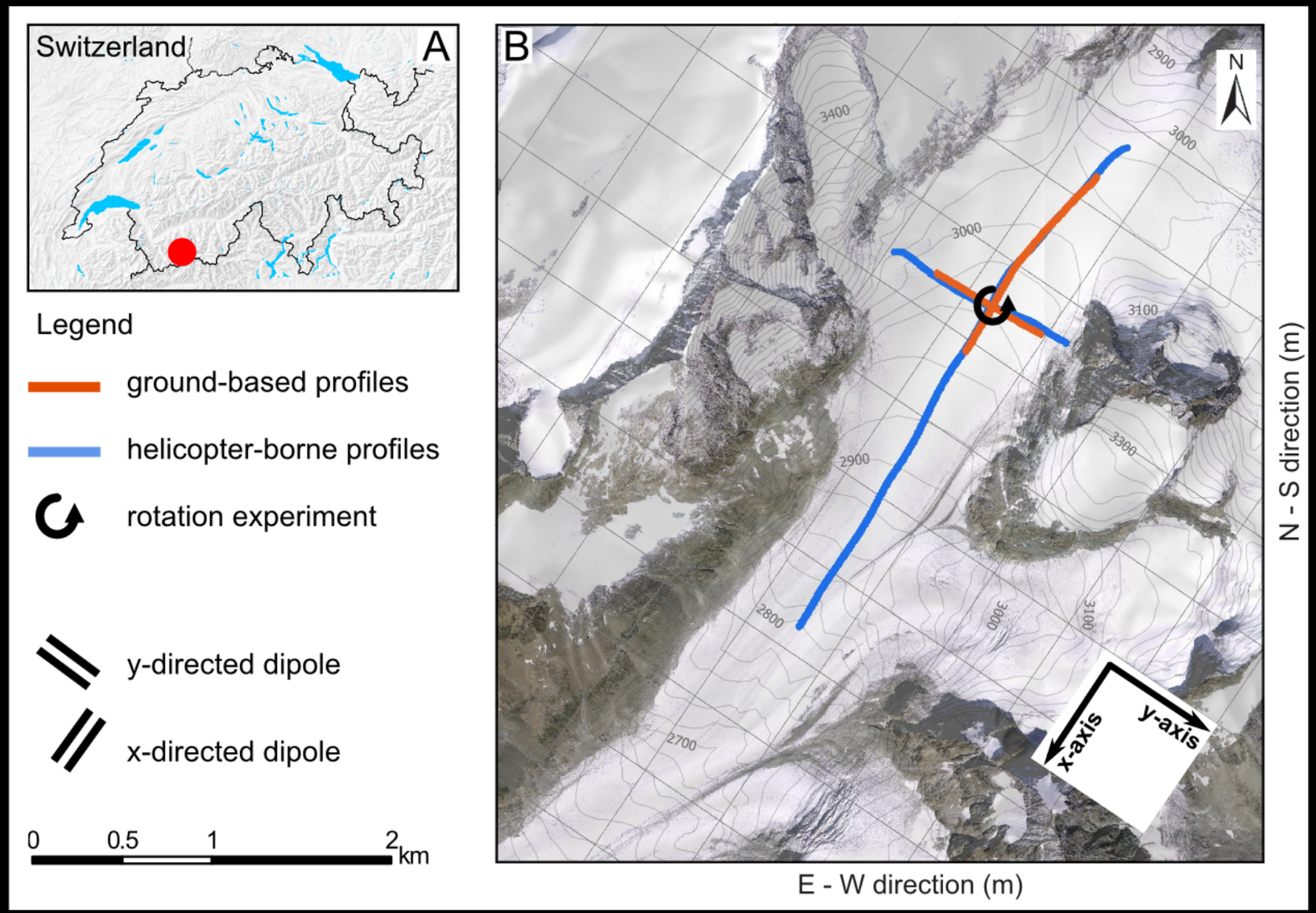
infinitesimal dipole

on interface

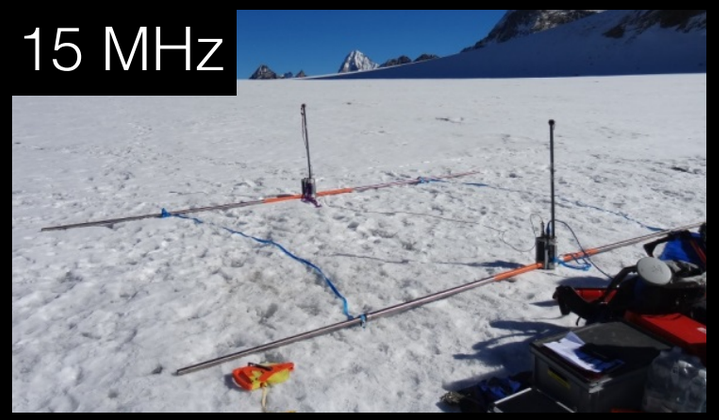
Solution after Engheta and Papas (1982)

FIELD SITE

OTEMMA GLACIER, SWITZERLAND

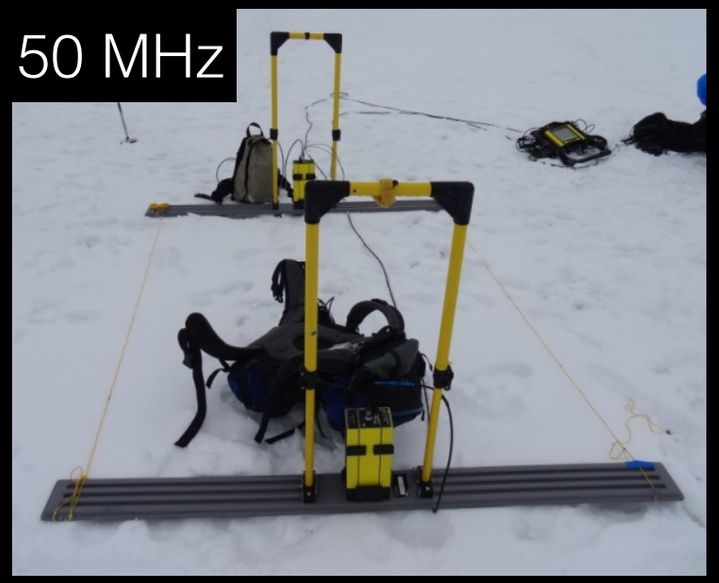


15 MHz



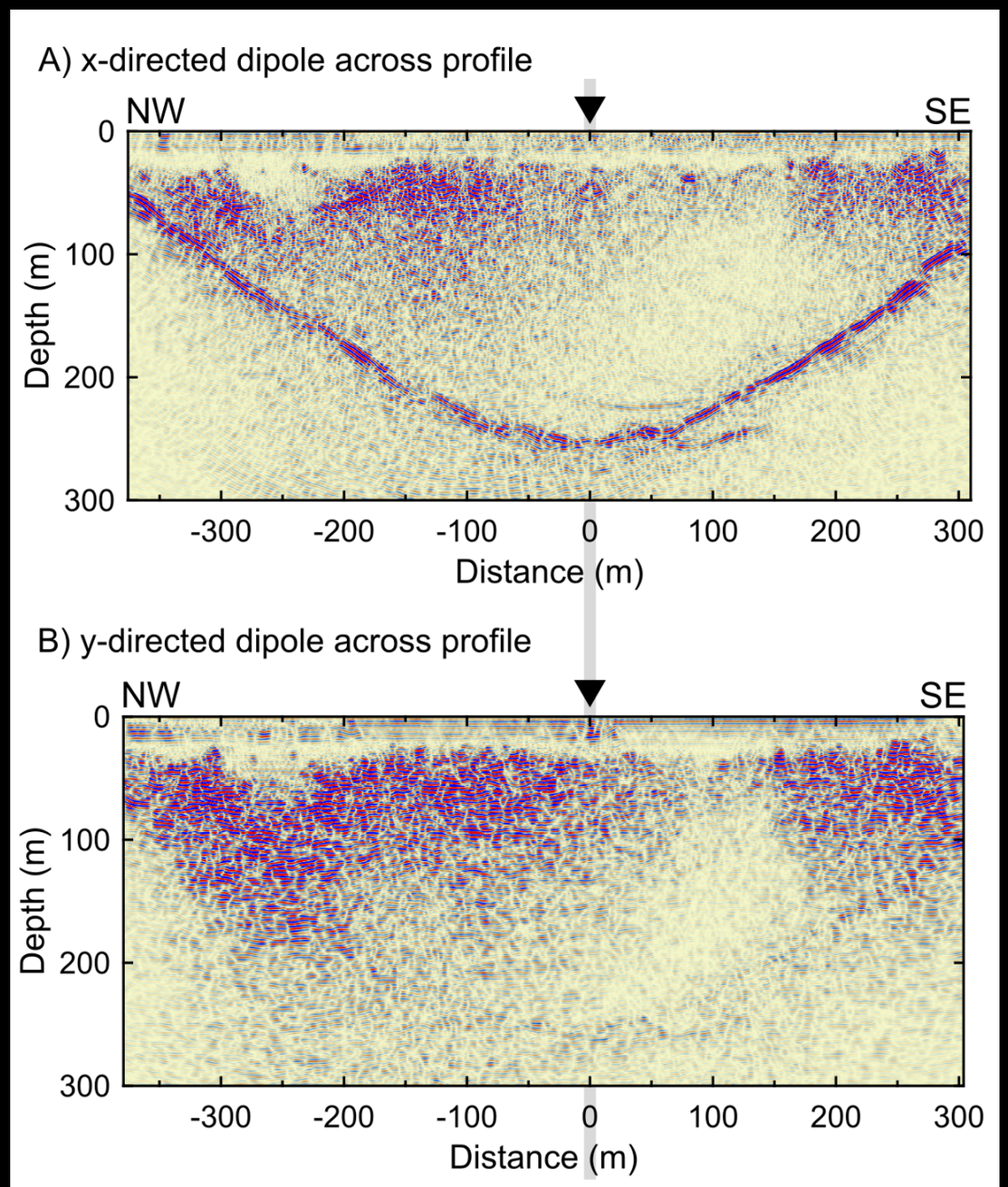
25 MHz

50 MHz

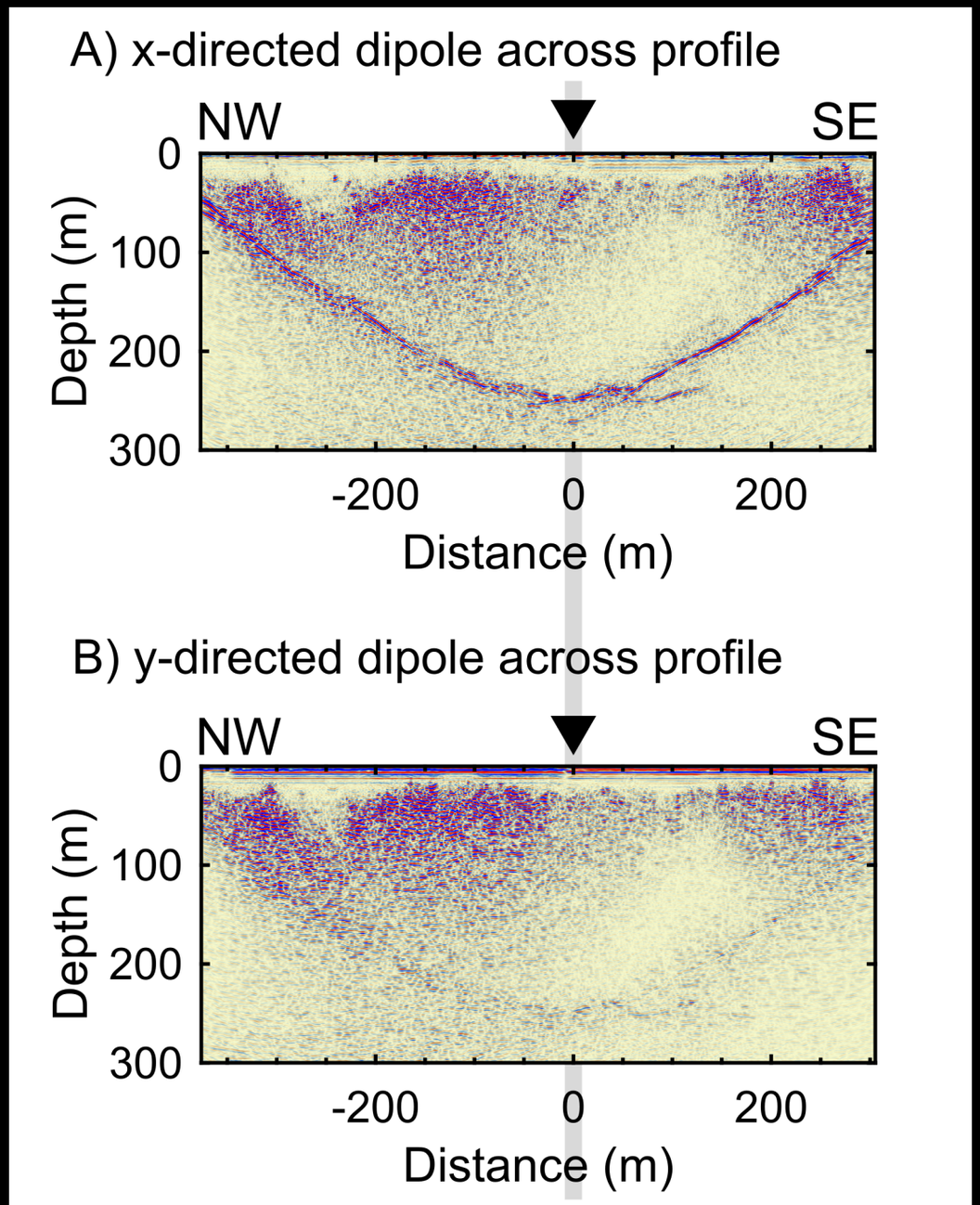


ACROSS PROFILES

15 MHz

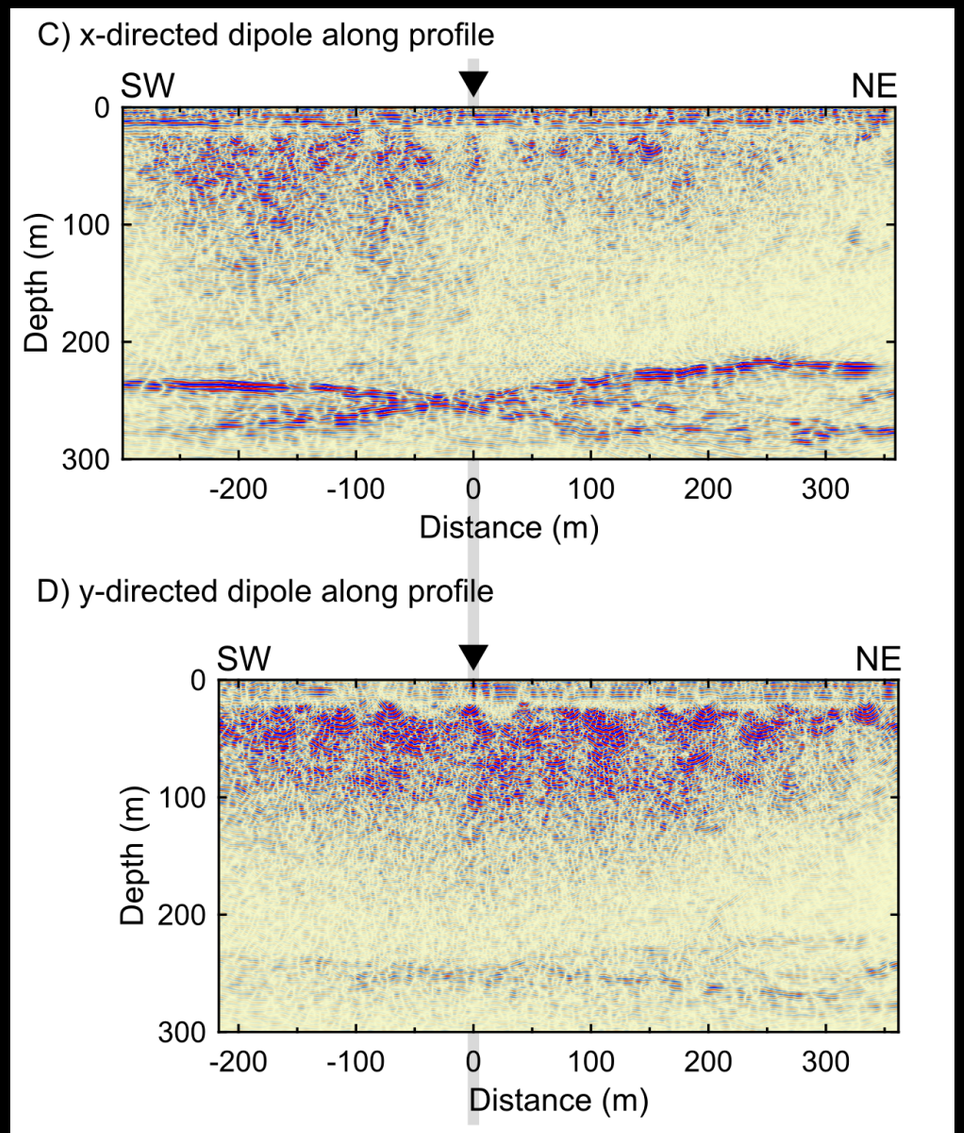


25 MHz

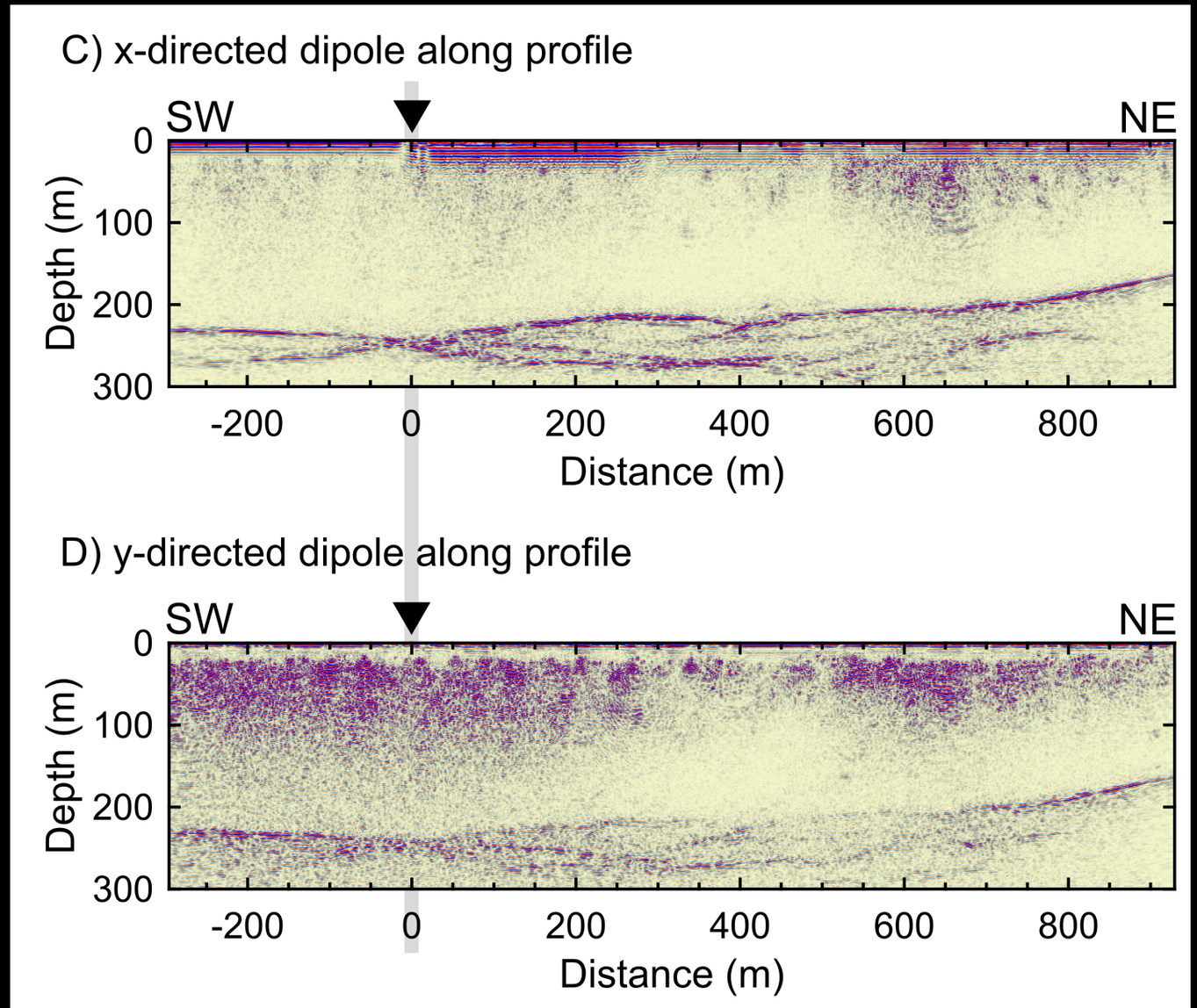


LONGITUDINAL PROFILES

15 MHz

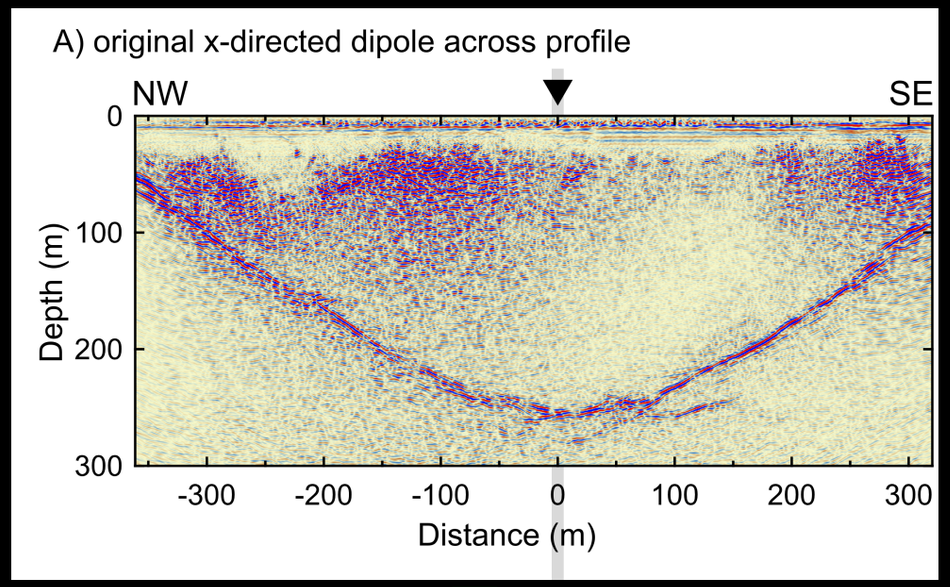


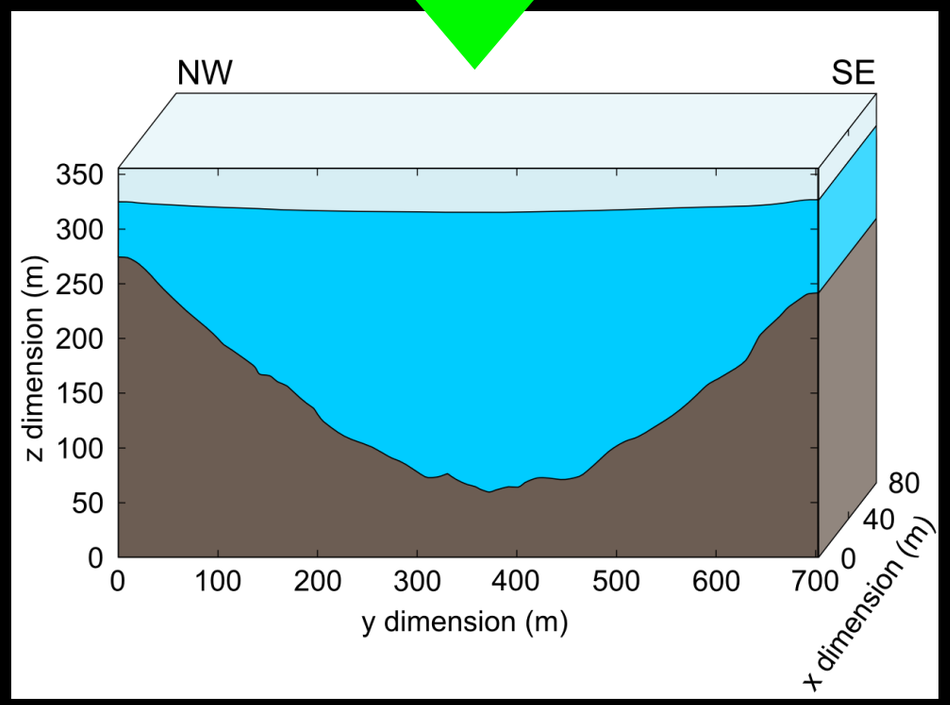
25 MHz

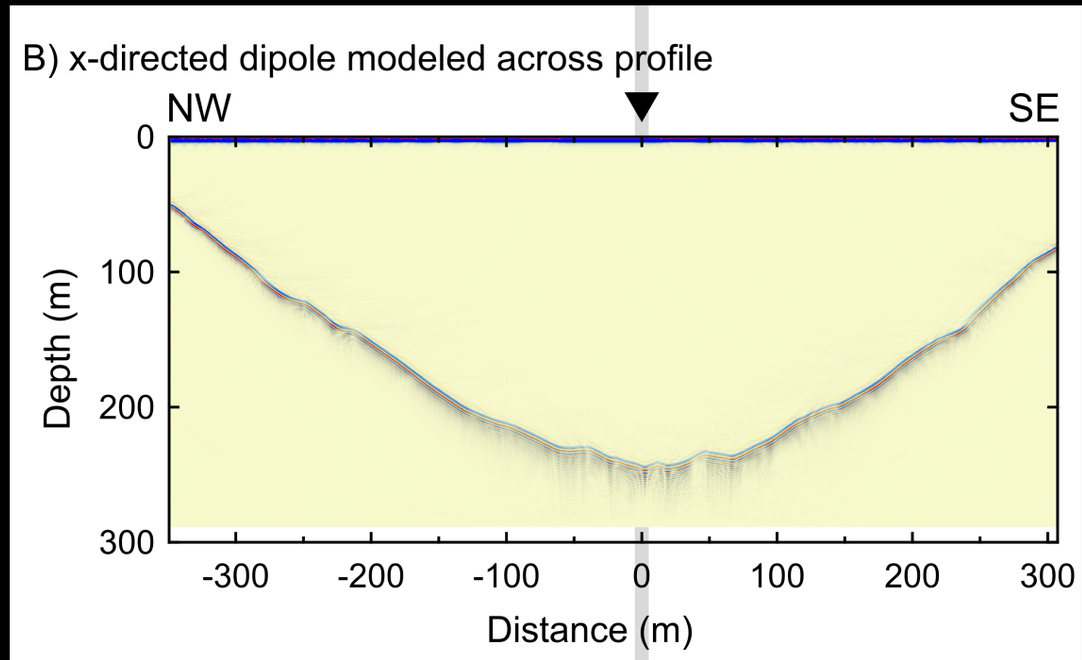


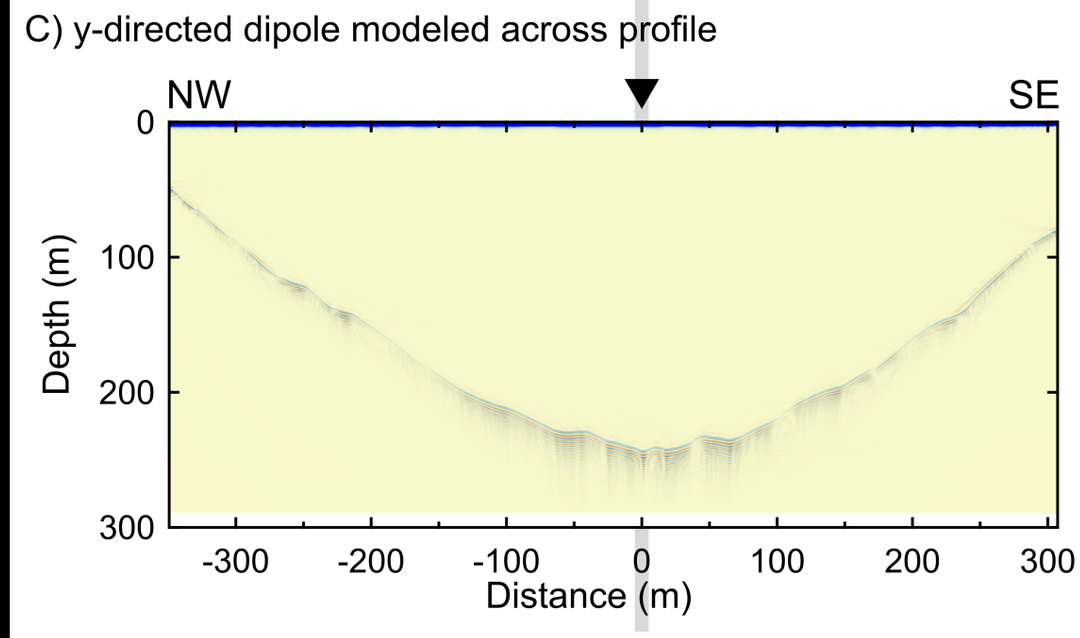
NUMERICAL STUDY

20 MHz



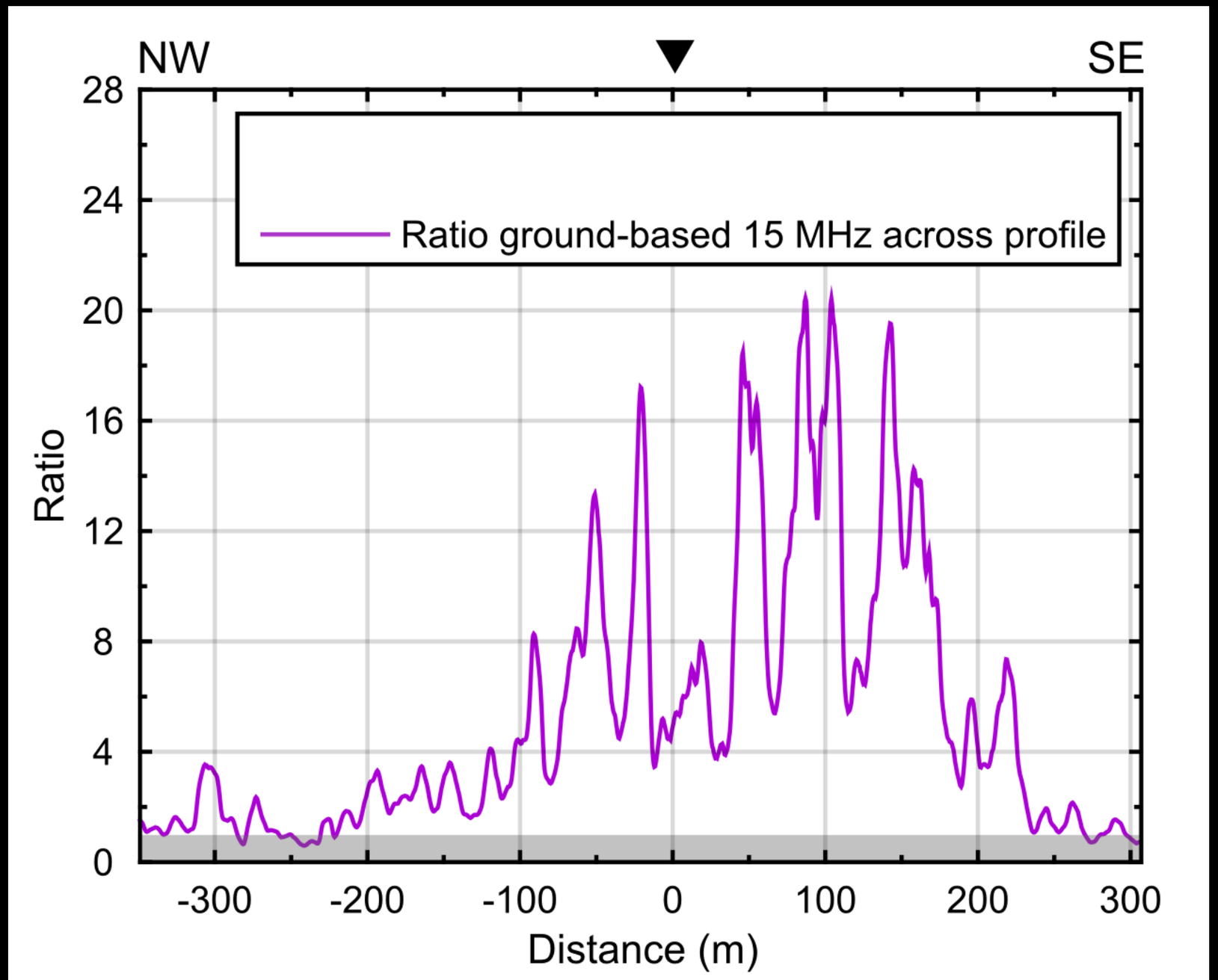




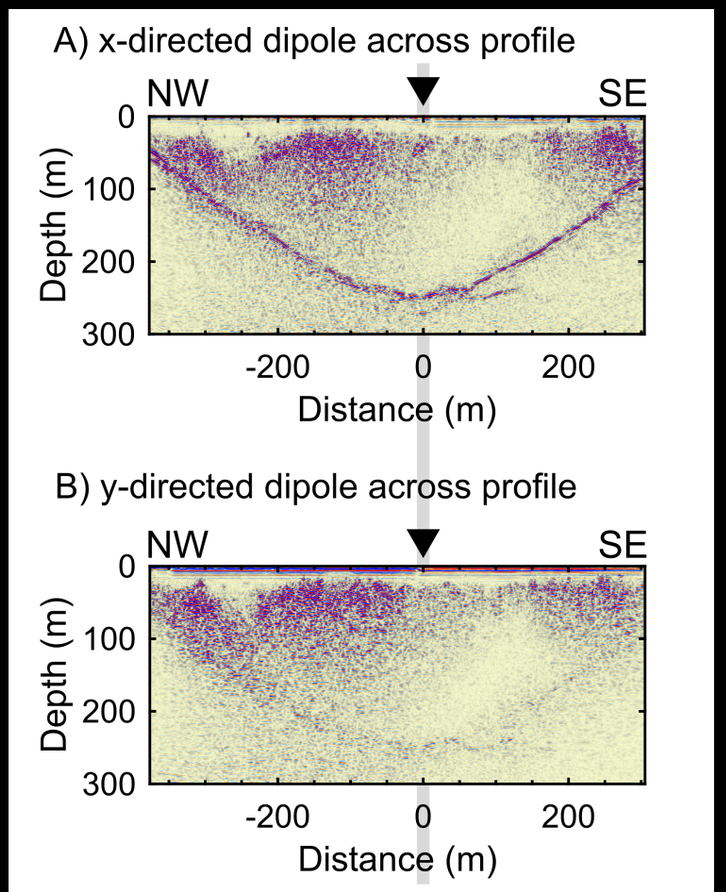


Numerical solution with gprMax (Giannopoulos, 2005)

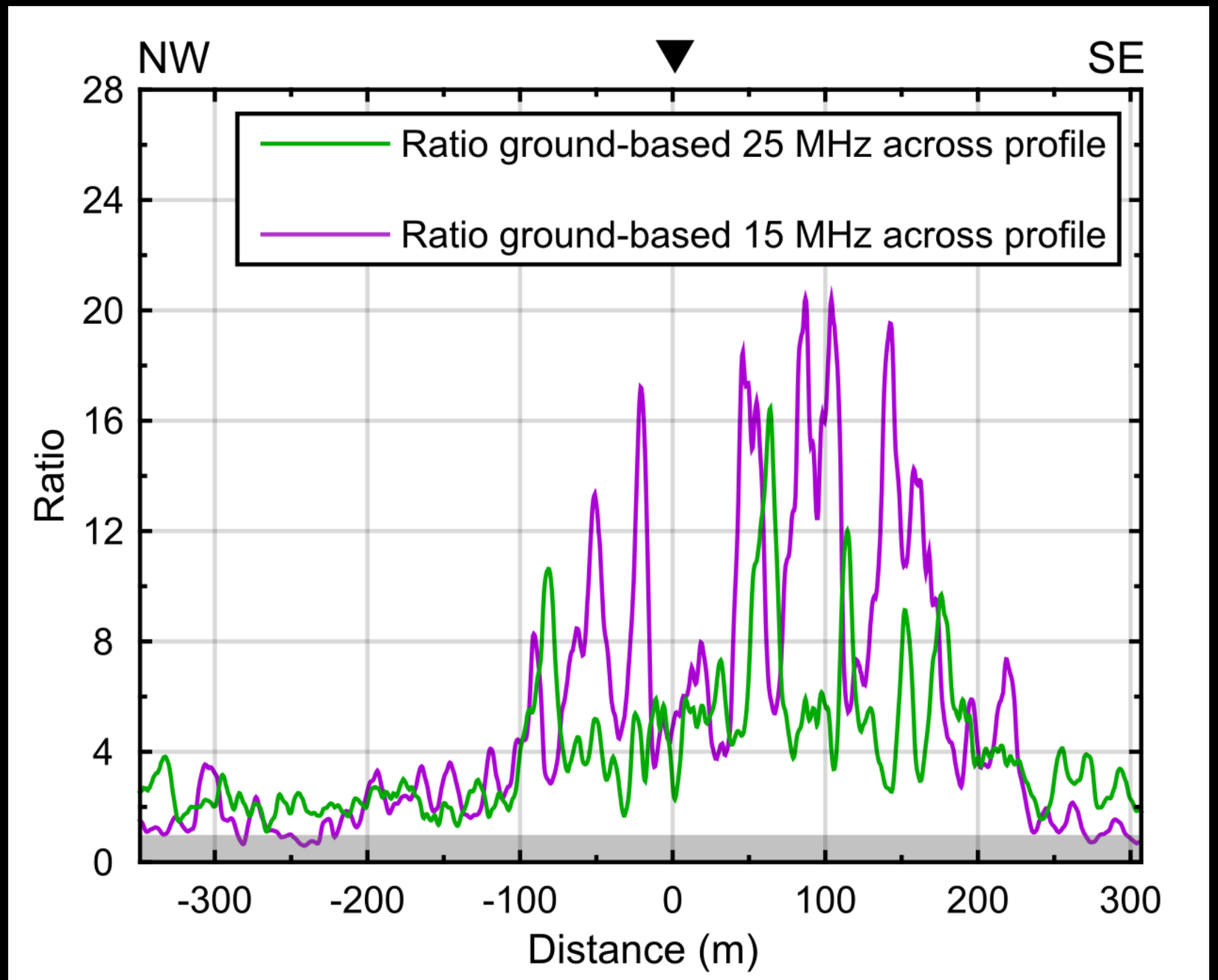
AMPLITUDE RATIOS



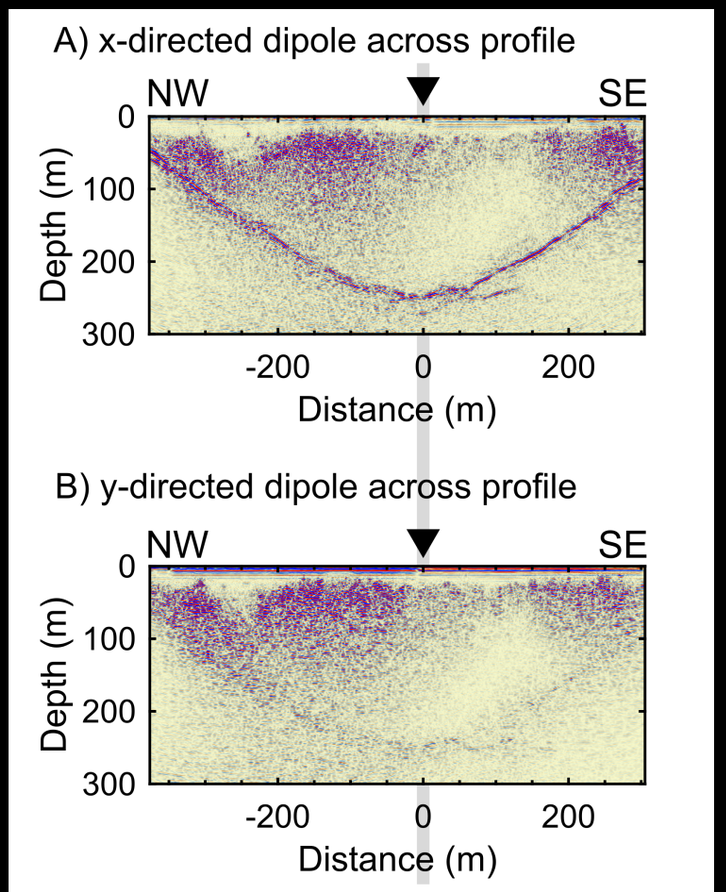
25 MHz



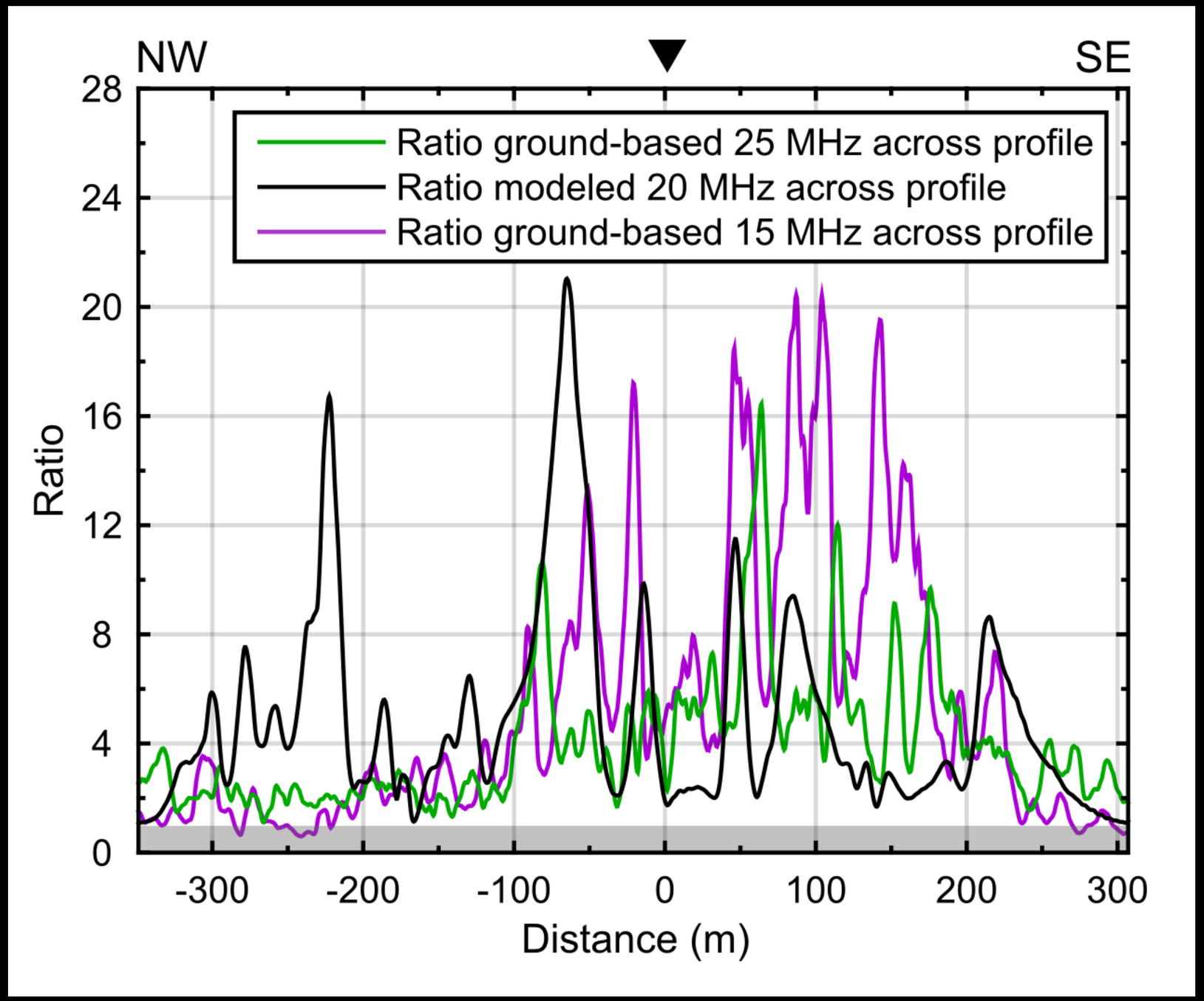
AMPLITUDE RATIOS



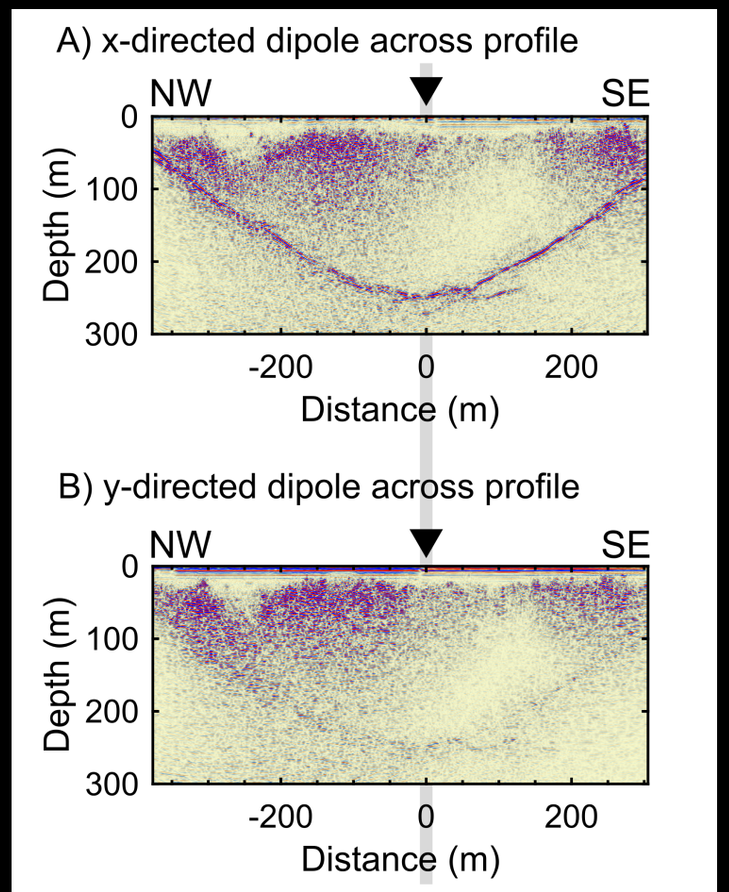
25 MHz



AMPLITUDE RATIOS

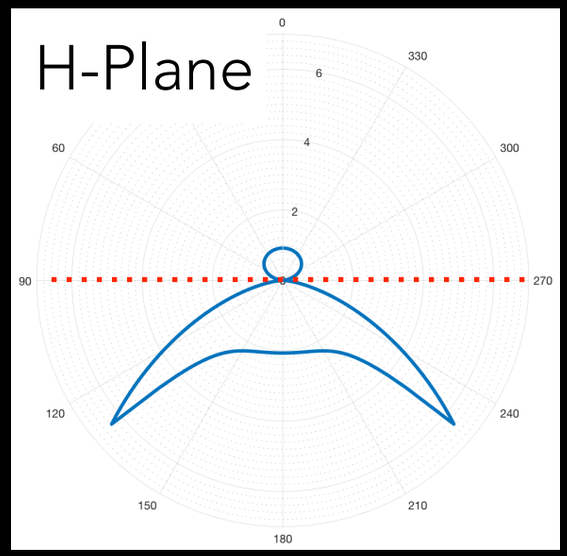


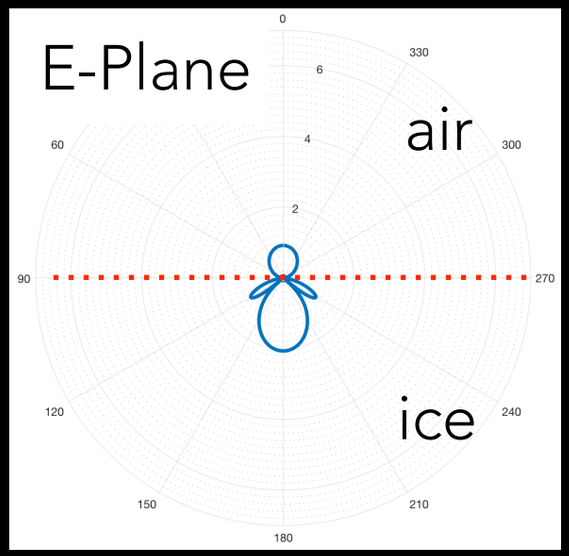
25 MHz



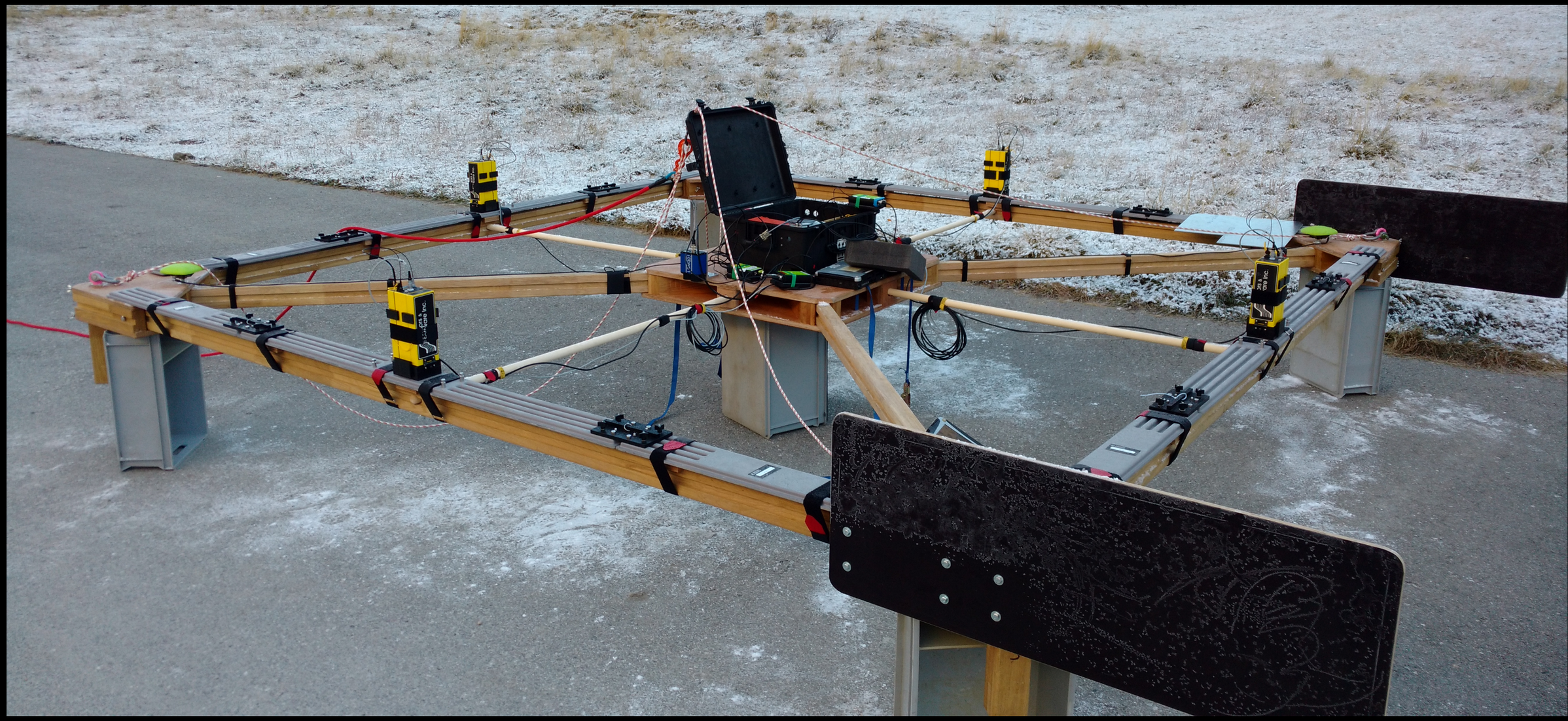
TAKE HOME MESSAGE

- directional dependence is independent of frequency or system
- antenna orientation and bedrock topography primary factors
- Multicomponent GPR systems are preferable





MULTICOMPONENT AIRBORNE GPR



Towards an ice thickness inventory of the glaciers in Switzerland

Lino Schmid[1,2,3], Melchior Grab[1,2,3], Andreas Bauder[3], Hansruedi Maurer[2]
[1]**SCCER-SoE;** [2]Institute of Geophysics, ETH Zurich; [3]Laboratory of Hydraulics, Hydrology and Glaciology (VAW), ETH Zurich