

Display material for EGU21-9391 vPICO presentation:

Striking differences in lithospheric structure between the north- and south-western Alps: insights from receiver functions along the Cifalps profiles and a new Vs model

by: A. Paul¹, A. Nouibat¹, L. Zhao², S. Solarino³, S. Schwartz¹, M. Malusà⁴, L. Stehly¹, C. Aubert¹, T. Dumont¹, E. Eva³, S. Guillot¹, S. Pondrelli³, S. Salimbeni³, and AlpArray Working Group*

1: ISTerre, Univ. Grenoble Alpes, France (anne.paul@univ-grenoble-alpes.fr)

2: IGG-CAS, Beijing, China

3: INGV, Genova & Bologna, Italy

4: Univ. Milano-Bicocca, Italy

* <http://www.alparray.ethz.ch/>

Aim: probe the structure of the mantle wedge of the W-Alps, in-between the European and the Adriatic lithospheres.

Data:

- Cifalps-2 temporary seismic experiment in the NW Alps (see location in Fig. 1). 14 months duration (2018-2020). 55 temporary broadband stations, from the French Massif Central (FMC) in the NW to the coast of the Ligurian Sea in the SE. Two segments: 1) the Alpine segment crosses the NW Alps from the FMC to the Po basin through the Mont Blanc and Gran Paradiso massifs; 2) the Ligurian segment crosses the westernmost Po basin and the Ligurian Alps (not discussed in that presentation).
- The new Vs model derived from transdimensional ambient-noise tomography by Nouibat et al. (vPICO EGU21-3197 in this session) using data of all permanent stations in W-Europe, of the AlpArray seismic network, of the CIFALPS and CIFALPS-2 experiments

Method: receiver function common-conversion point depth-migrated section of the Alpine segment of Cifalps-2, projected onto the linear profile shown in Fig. 1. The Vs model of Nouibat et al. is used for time-to-depth migration (1-D model at each station location used to migrate RF recorded by the station). Comparison between Cifalps and Cifalps-2 CCP sections.

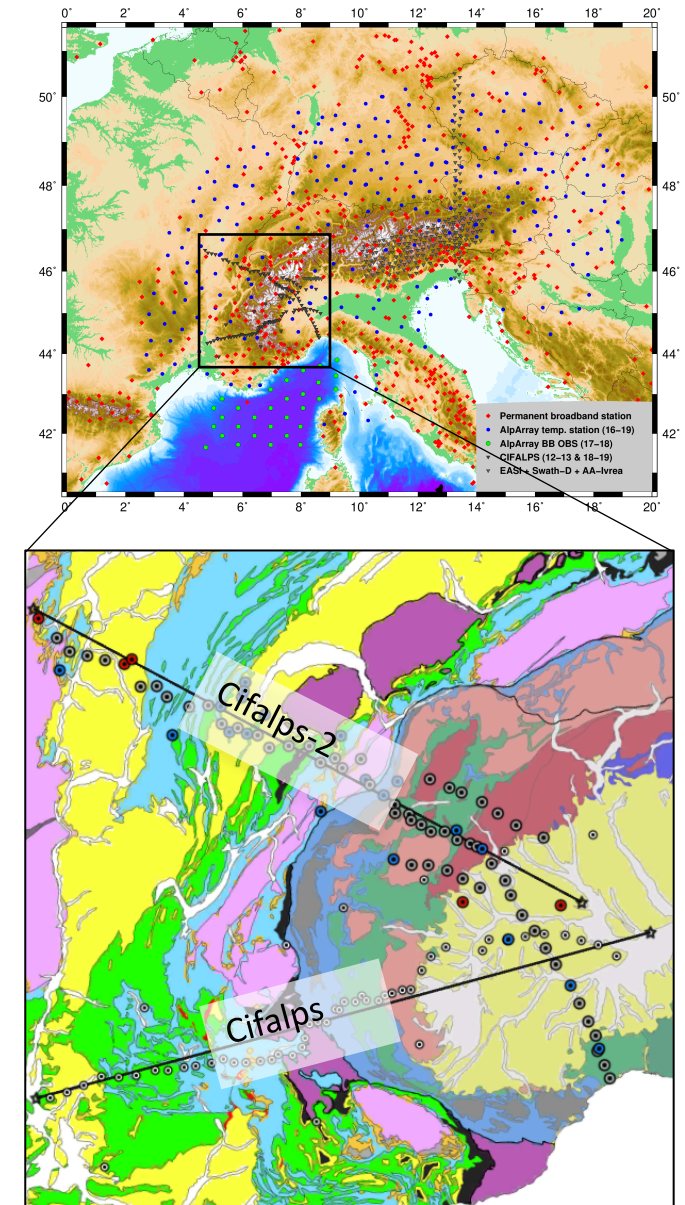


Fig. 1: Location map of the Cifalps temporary seismic experiments in the W-Alps

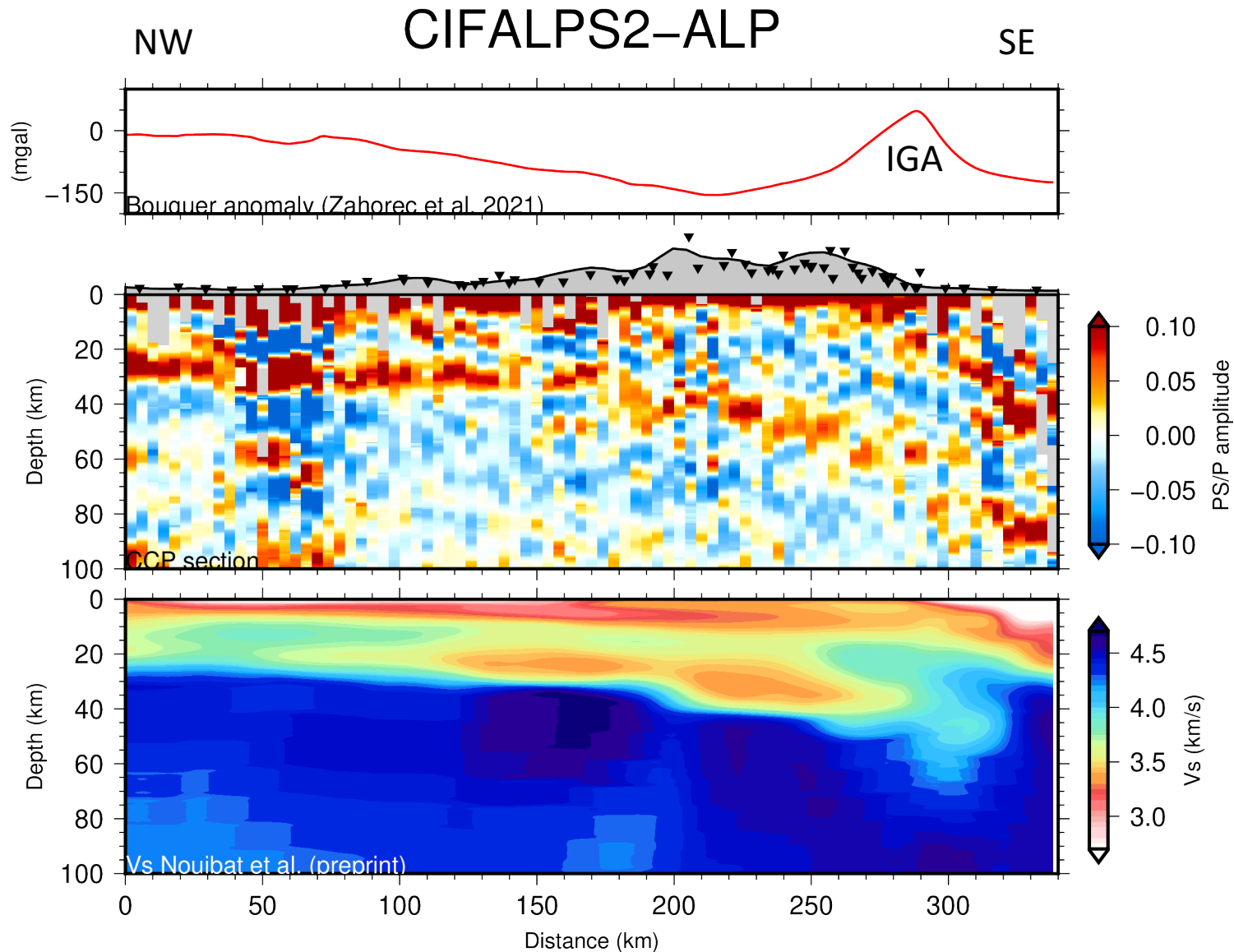


Fig. 2: Depth sections along the Alpine segment of the Cifalps-2 profile (location in Fig. 1). No vertical exaggeration.

(Top) Bouguer anomaly profile along the section (from the new gravity database of Zahorec et al., 2021); The Ivrea gravity anomaly (IGA) is observed in the SE part of the profile.

(Center) CCP migrated section for teleseismic earthquakes of 0-100° backazimuth; The Vs model of Nouibat et al. (bottom) is used for time-to-depth migration and V_p/V_s is assumed to be 1.8. (Bottom): cross-section through the Vs model of Nouibat et al.

CIFALPS

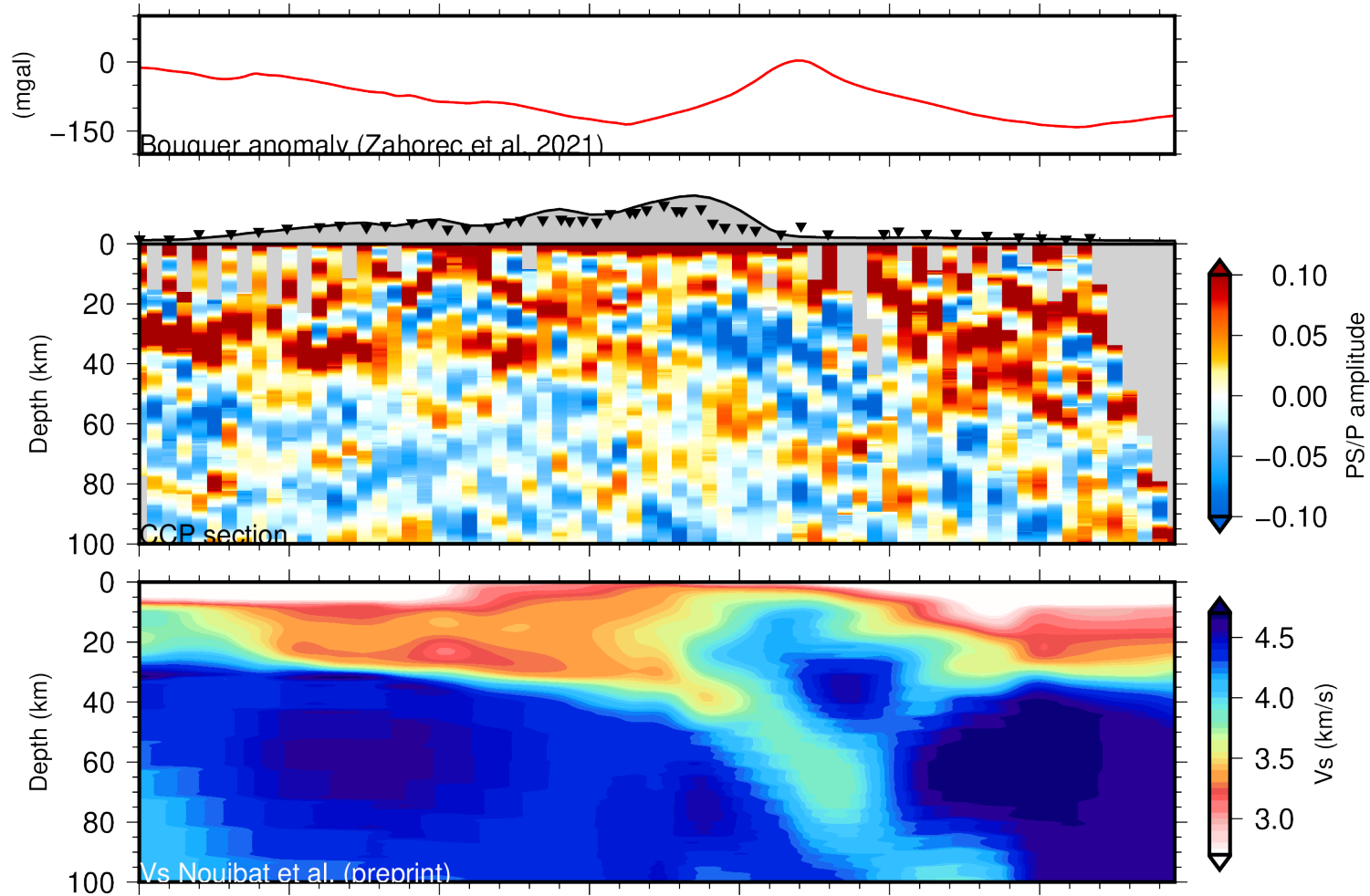


Fig. 3: Same as Fig. 2 for the Cifalps experiment in the SW Alps (see location in Fig. 1). The CCP migrated depth section of this profile was discussed in Zhao et al. (2015), where a simpler Vs model was used for migration. CCP: earthquakes in the 0-100° back-azimuth range; $V_p/V_s=1.7$; Vs model from Nouibat et al. (shown in bottom panel) used for time-to-depth migration.

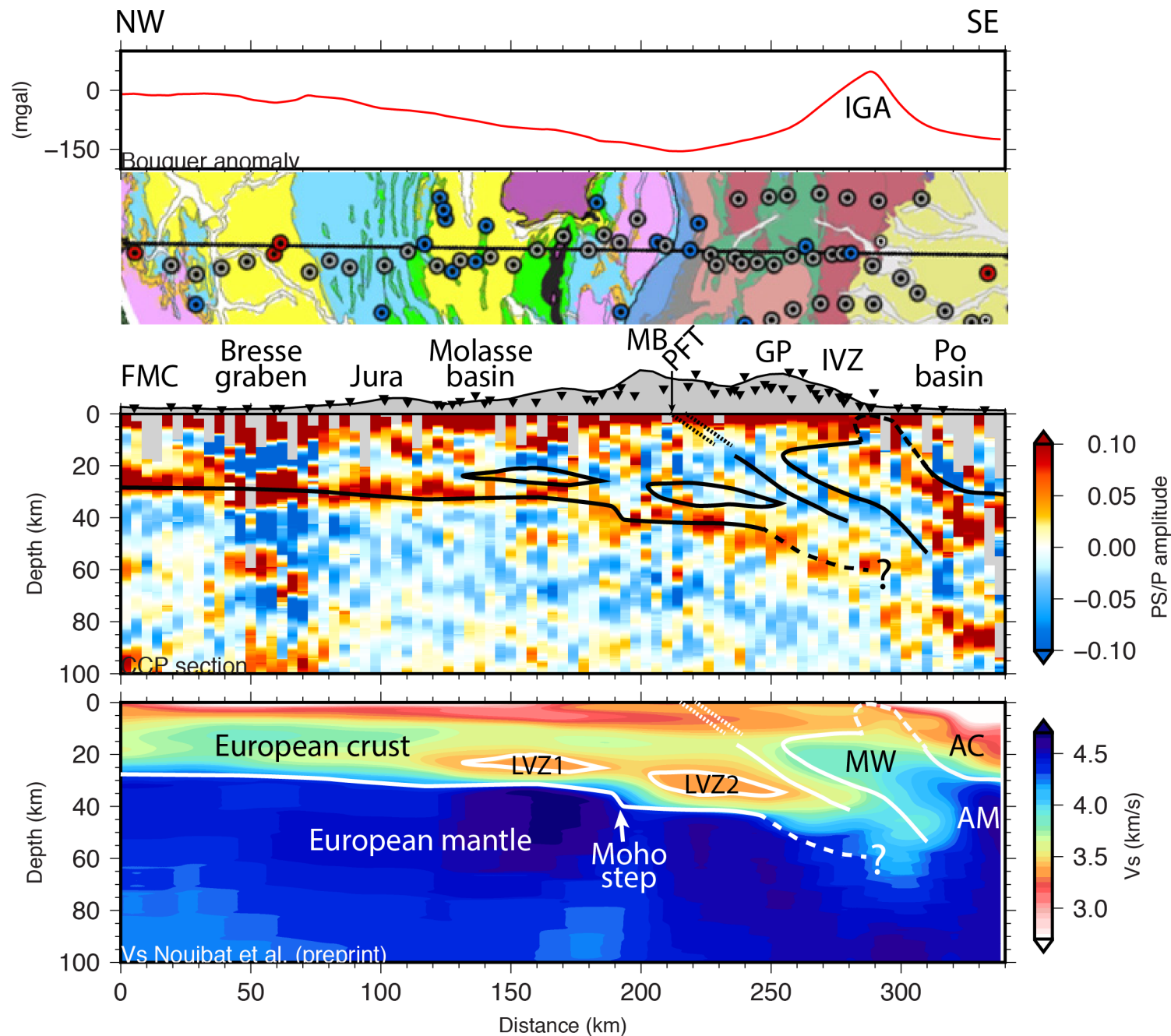


Fig. 4: Same as Fig. 2 (Alpine segment of Cifalps-2) with a geological map along the cross-section, and picks of first-order discontinuities that appear both in the CCP section (black lines) and in the Vs section (white lines).

The dashed line with a « ? » at the deep, SE end of the European Moho is picked from the CCP section (red pixels for P-to-S converted waves of positive polarity), in a location where the contours of Vs are not coherent with the CCP section.

The shallow part of the mantle wedge (MW) displayed with a dashed line is taken from the gravity modelling of Scarponi et al. (2020).

The 2 parallel reflectors of the Penninic frontal thrust (PFT, dotted lines) are from the ECORS-CROP DSS section (Sénéchal & Thouvenot, 1991).

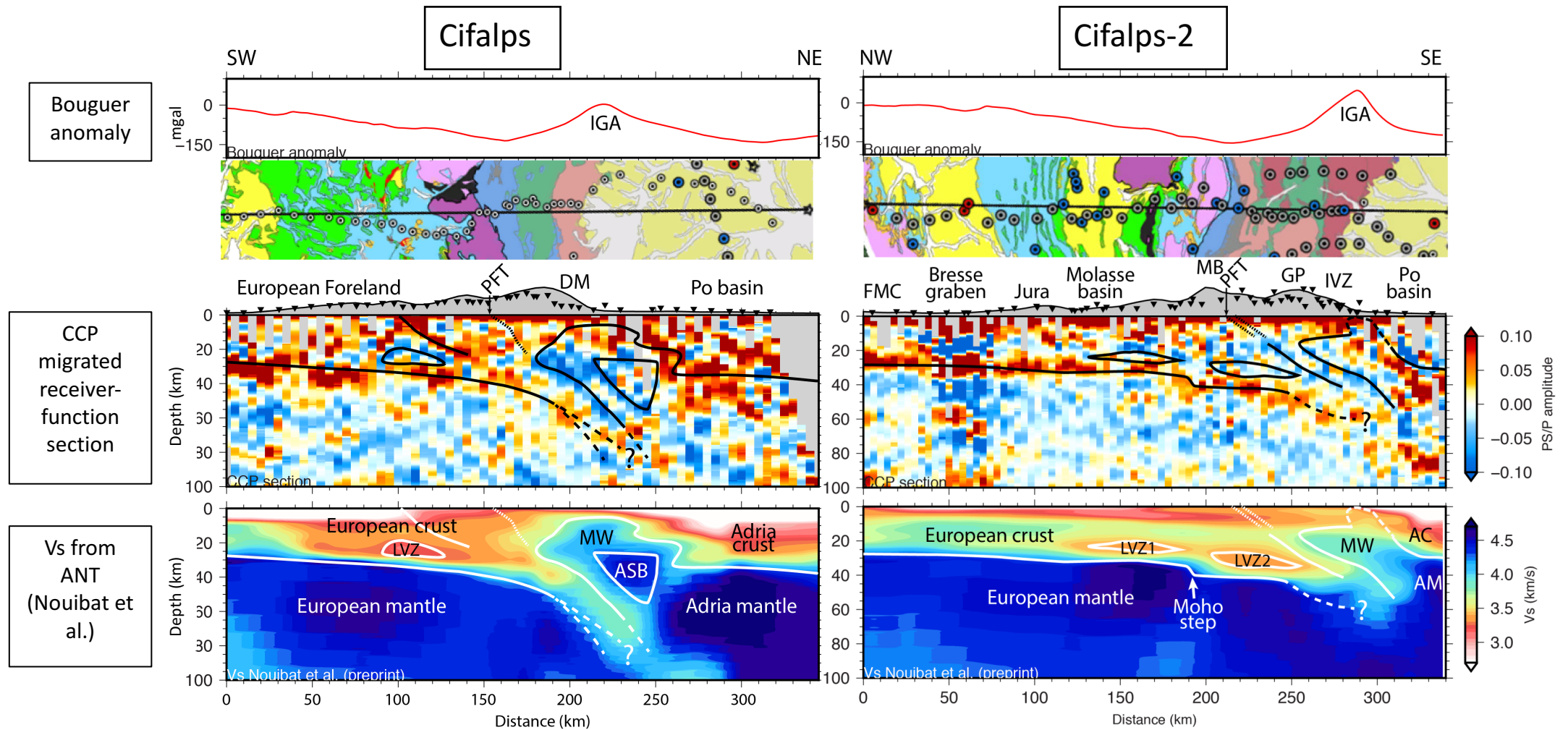


Fig. 5: Comparison between the picked CCP and Vs sections along the Cifalps (left) and Cifalps-2-Alp (right) profiles. Major differences appear between the 2 profiles, in particular in the structure of the mantle wedge (MW)

Abbreviations: **AC:** Adria crust; **AM:** Adria mantle; **ASB:** Adria seismic body; **DM:** Dora Maira; **FMC:** French Massif Central; **GP:** Gran Paradiso; **IGA:** Ivrea gravity anomaly; **IVZ:** Ivrea-Verbano zone; **LVZ:** Low-velocity zone; **MB:** Mont Blanc; **MW:** Mantle wedge; **PFT:** Penninic frontal thrust.

References:

- Bouguer anomaly: Zahorec et al., *ESSD Discussion* (2021), [doi:10.5194/essd-2020-375](https://doi.org/10.5194/essd-2020-375)
- Shallow high-density body on Cifalps-2: Scarponi et al., *Geophys. J. Int.* (2020), [doi:10.1093/gji/ggaa263](https://doi.org/10.1093/gji/ggaa263)
- Ambient-noise tomography (ANT): Nouibat et al., submitted to *Geophys. J. Int.*; vPICO EGU21-3197 in the same session.
- Cifalps CCP section: Zhao et al., *Geology* (2015), [doi:10.1130/G36833.1](https://doi.org/10.1130/G36833.1)
- Geological interpretation of the Cifalps CCP & Vs sections: Schwartz et al., vPICO EGU21-8928 in the same session; Nouibat et al. submitted to *Geophys. J. Int.*
- Depth-migrated ECORS-CROP deep-seismic sounding cross-section: Sénéchal & Thouvenot, 1991.