Fig. 1. (a) Satellite image of Greece highlighting the location of the North Anatolian Fault (NAF). **(b)** Elevation map and major faults of the North Aegean Trough (NAT). Fault kinematics are based on Ferentinos et al. (2018). The studied Alonnisos fault system (f1 and f2) is highlighted with red colour. Earthquake locations with strike-slip focal mechanisms recorded between 1900 and 2020 are marked by yellow circles and are based on Kassaras et al. (2020); GPS data are taken from Hollenstein et al. (2008). SpB = Sporades Basin. **(c)** Schematic 3D structural model of the Sporades Basin and the Alonnisos fault system. Fault geometries are estimated based on Ferentinos et al. (2018). Notice the bathymetry scale that shows the displacement of the seafloor in the hangingwall of the Alonnisos fault by > 1000 meters, which is visually not reflected in the cross section.
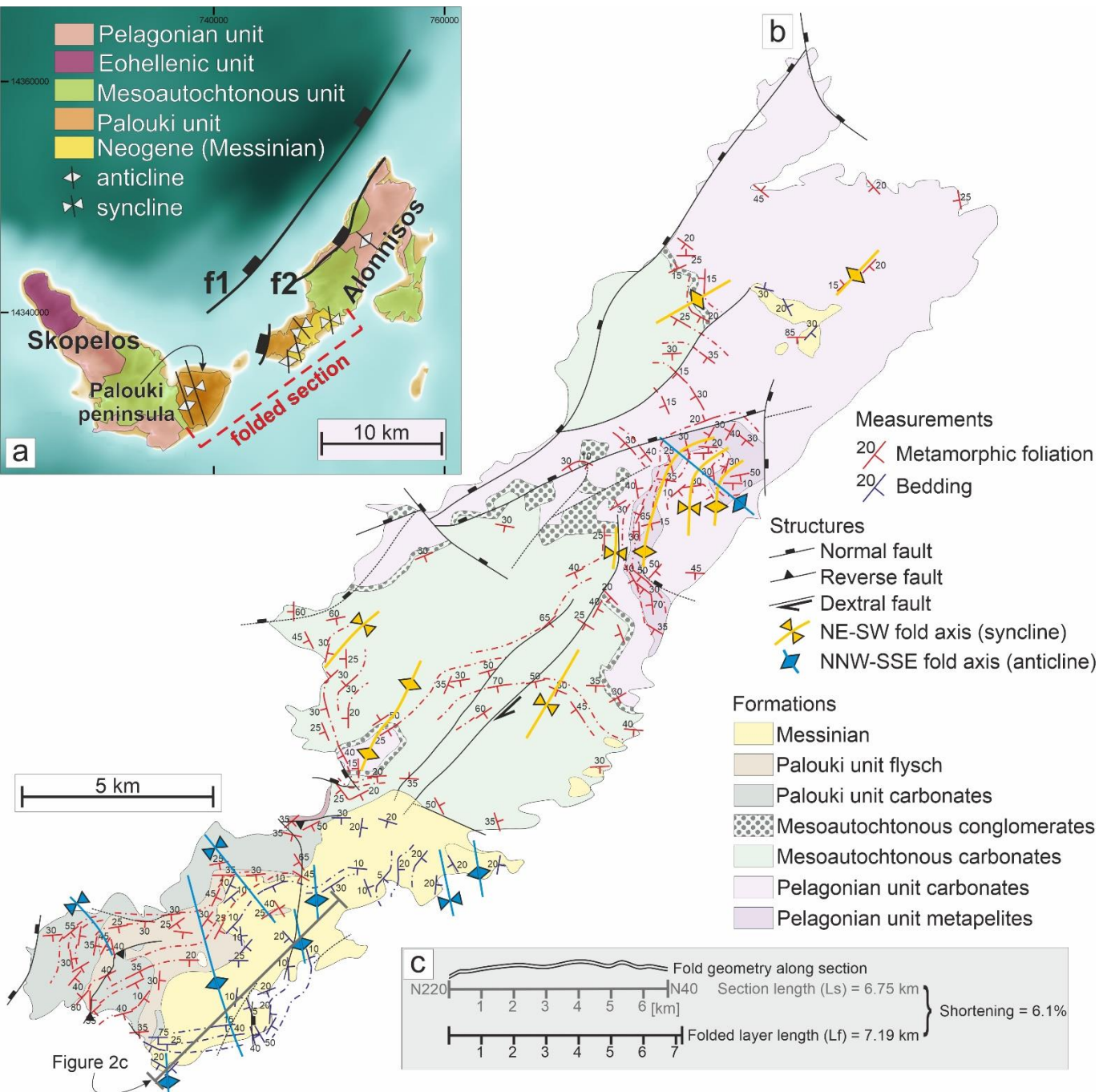
Fig. 2. Geological map of the study area. **(a)** Geological formations of Skopelos and Alonnisos, highlighting the main faults and the area affected by post-Messinian folding. The folded section is ca. 20 km long, and is located at the termination zone of fault f1. **(b)** Geological map of Alonnisos modified after Kelepertsis (1974), showing detailed structural data in terms of faults, foliation measurements, and fold axes. **(c)** Line-length balancing of a representative 6.75 km long section across the Messinian strata that implies shortening of around 6 %.
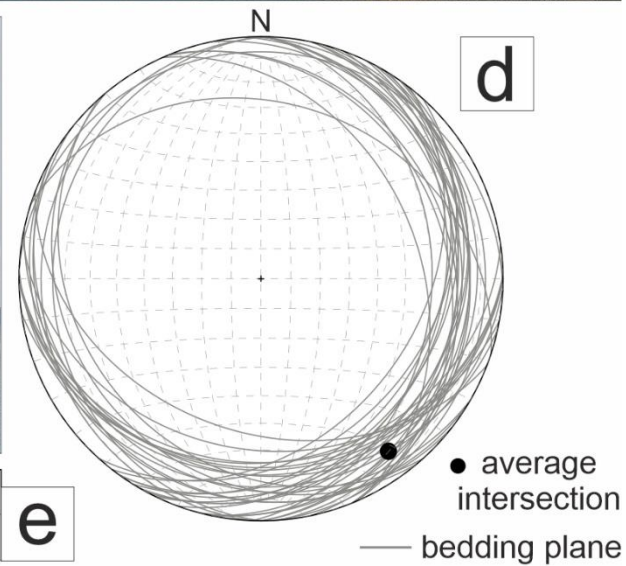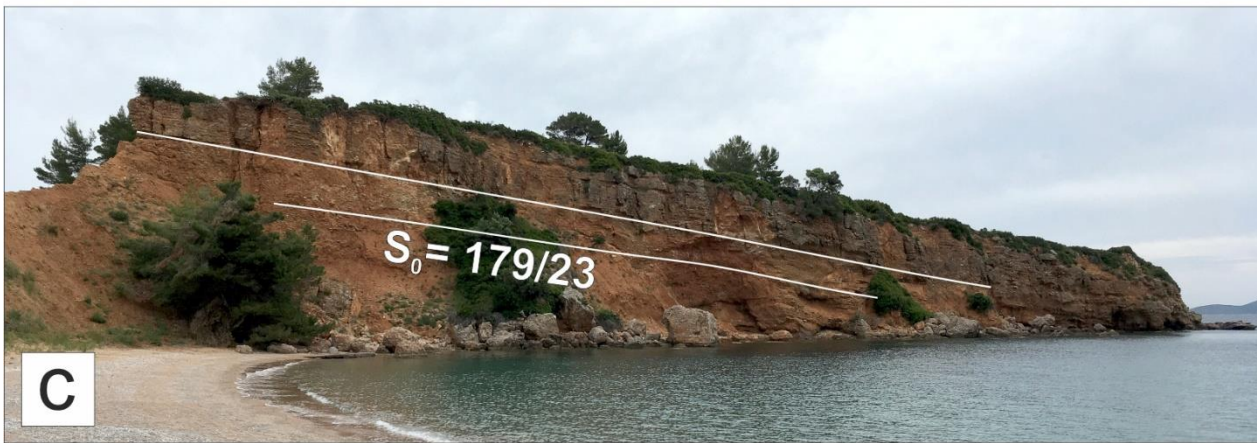
Fig. 3. Field photographs and bedding measurements of the Messinian strata on Alonnisos. **(a)** Hinge of a gentle fold where the Messinian carbonates transition into siliciclastic conglomerates. **(b)** SE-dipping carbonate beds. **(c)** S-dipping conglomerate beds. **(d)** Stereographic projection of the bedding measurements. **(e)** Data of the bedding measurements. The average dip (or tilt angle) of the Messinian strata towards the average azimuth (139.5 °) is 13.5 °.
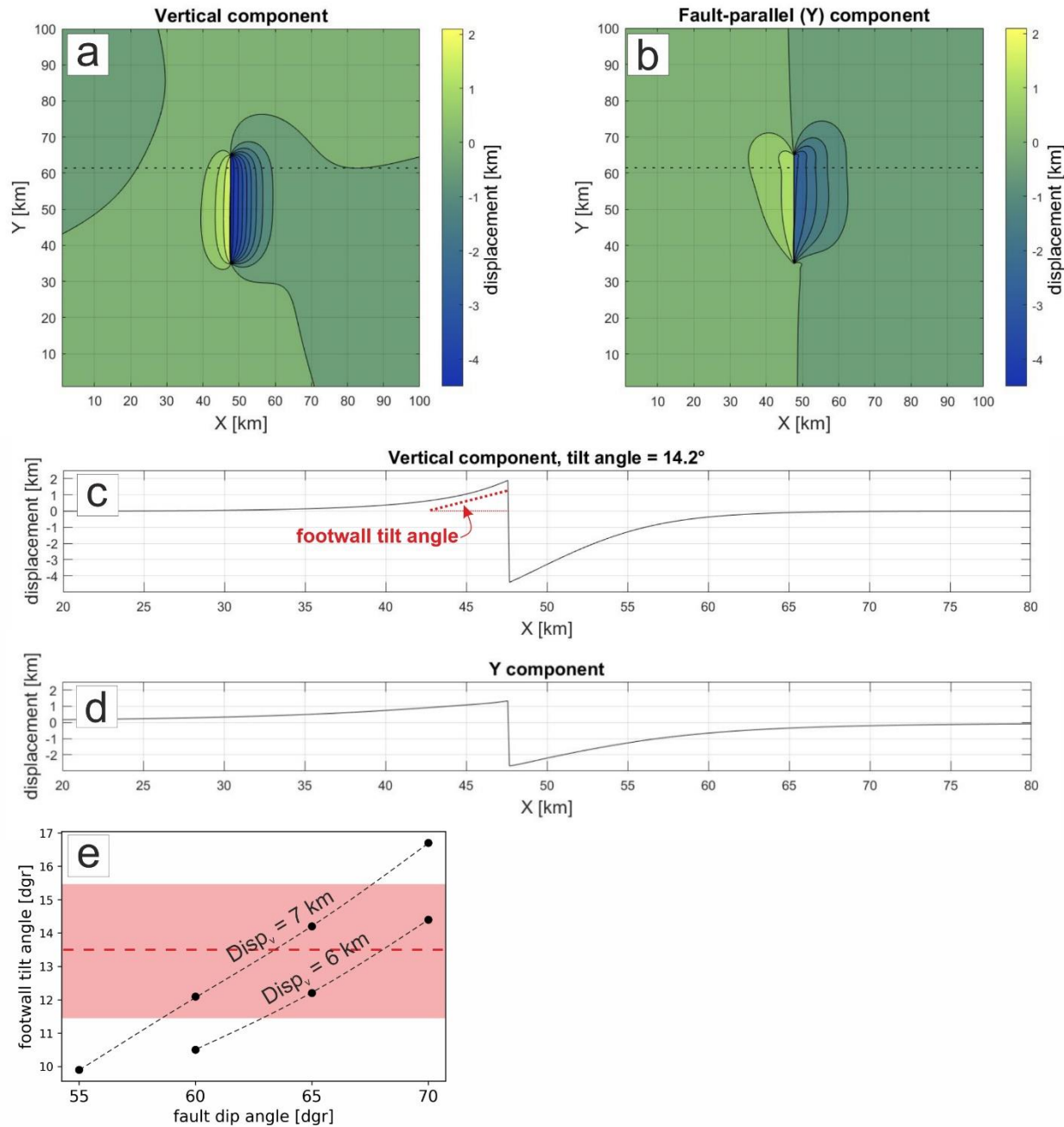
Fig. 4. Results of elastic half-space dislocation models (Okada, 1985; Nikkhoo et al., 2016). The reference model (plots a-d) has a fault dip angle of 65 °, a vertical displacement component of 7 km, and a rake of -120 ° (where -90 ° is pure normal and -180 ° is pure dextral displacement). **(a)** Map-view vertical displacement component of the reference model. Dashed line shows the trace of the cross-section plot on Fig. c. **(b)** Map-view fault-parallel (Y direction) displacement component of the reference model. Dashed line shows the trace of the cross-section plot on Fig. d. **(c)** Cross section (at Y = 62 km) plot of the vertical displacement component of the reference model. The footwall tilt angle (14.2 °) is defined as the average dip of the first 5 km in the footwall measured from the dislocation. **(d)** Cross section (at Y = 62 km) plot of the fault-parallel (Y direction) displacement component of the reference model. **(e)** Footwall tilt angle as the function of the fault dip angle and the amount of vertical displacement (Disp$_v$). Connected dots are model results with the same amount of vertical displacement. Red dashed line represents the observed (average) tilt angle of the Messinian rocks (13.5 °). Dots within the red area are model results that closely approximate the observed tilt angle (within 13.5 ± 2 °).