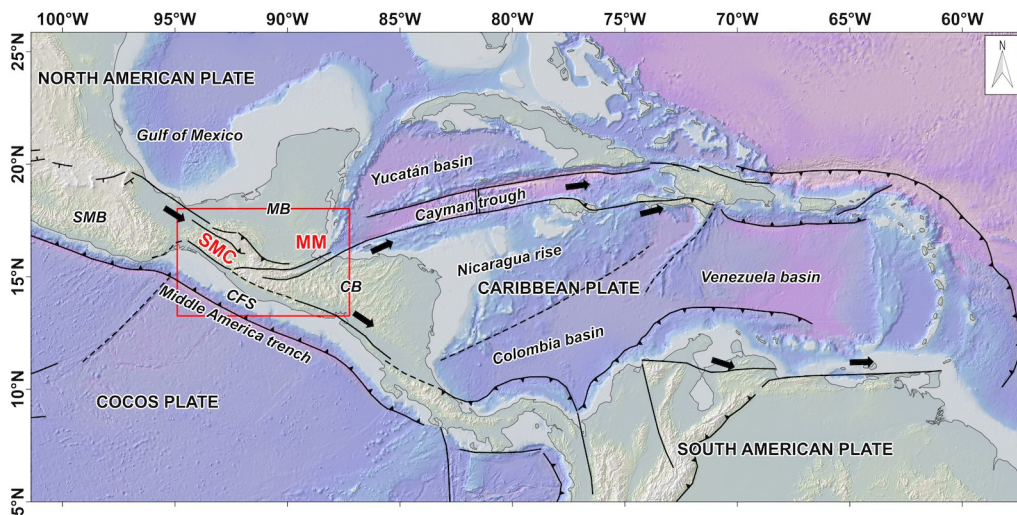


## Figures and captions

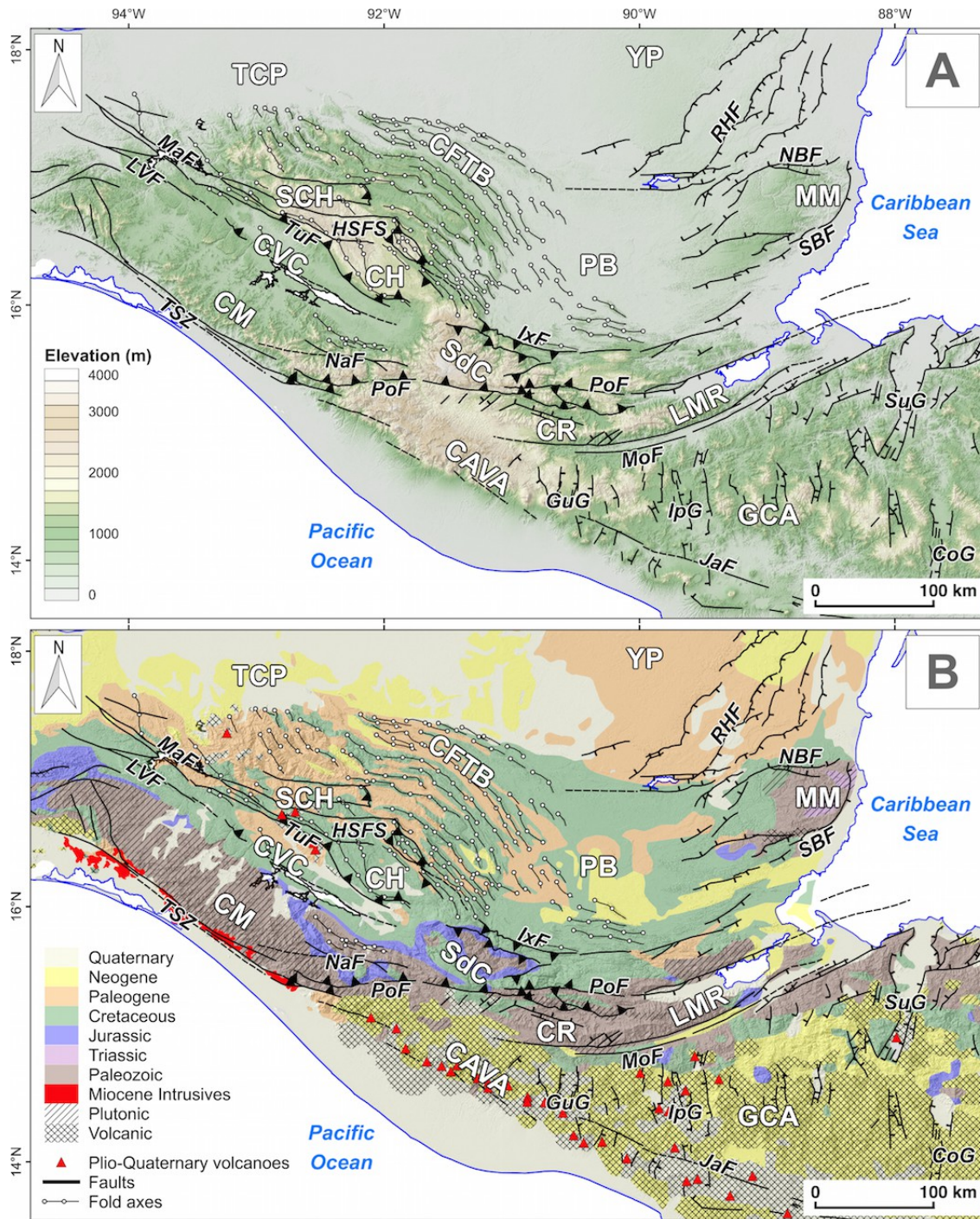
### Notes:

- 2 figures were added (Fig. 9 and 10)

- 3 figures were modified (Fig. 2, 5 and 6)

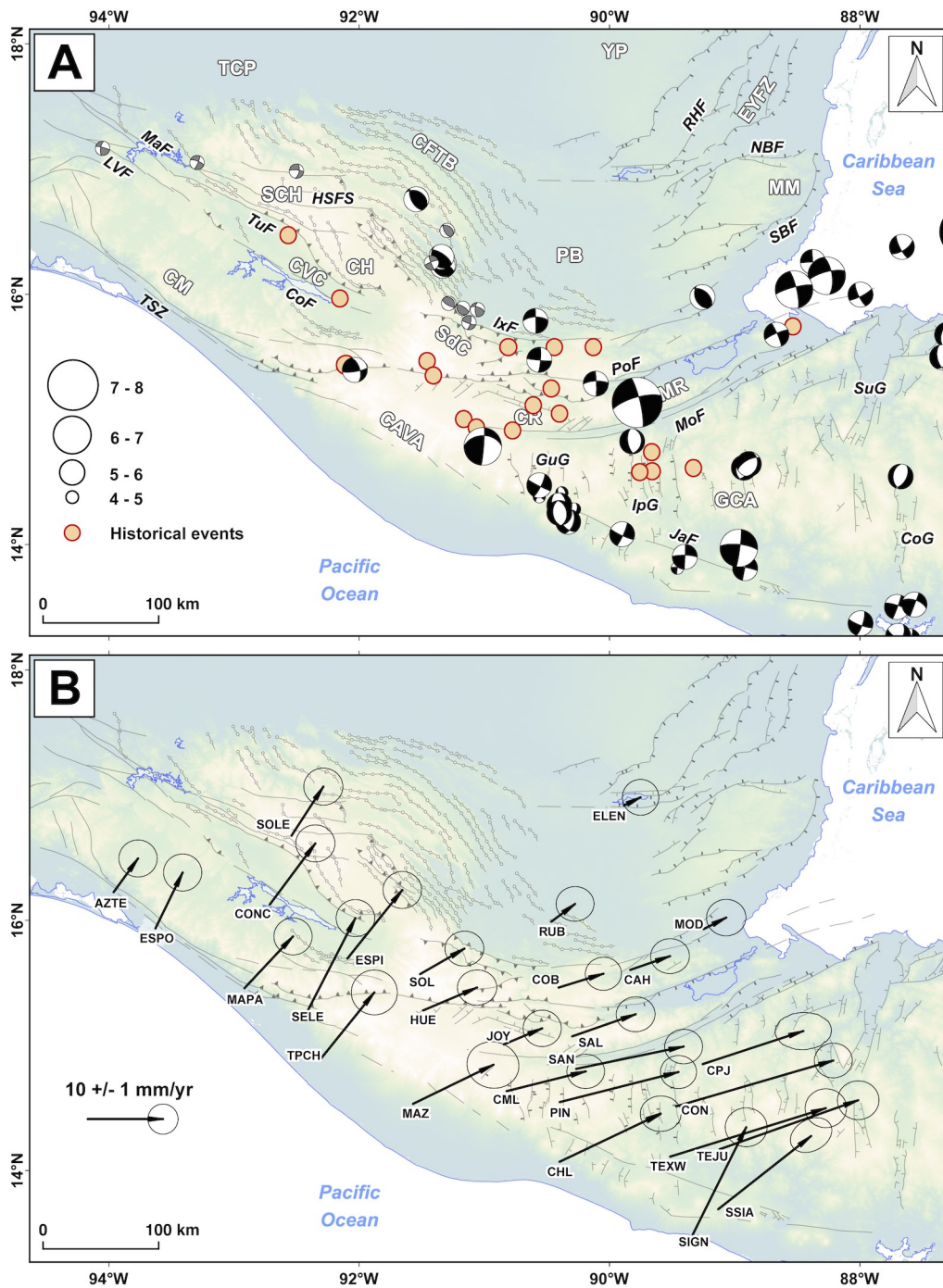


**Figure 1.** Main plate boundaries in Central America (black lines) and location of the Sierra Madre de Chiapas (SMC) and Maya Mountains (MM) in red. The red box shows the extend of Fig. 2. Abbreviations: CB – Chortis block, CFS – Central America forearc sliver, MB – Maya block, SMB – Southern Mexico block. Topography and bathymetry from the General Bathymetric Chart of the Oceans (GEBCO, <http://www.gebco.net/>).

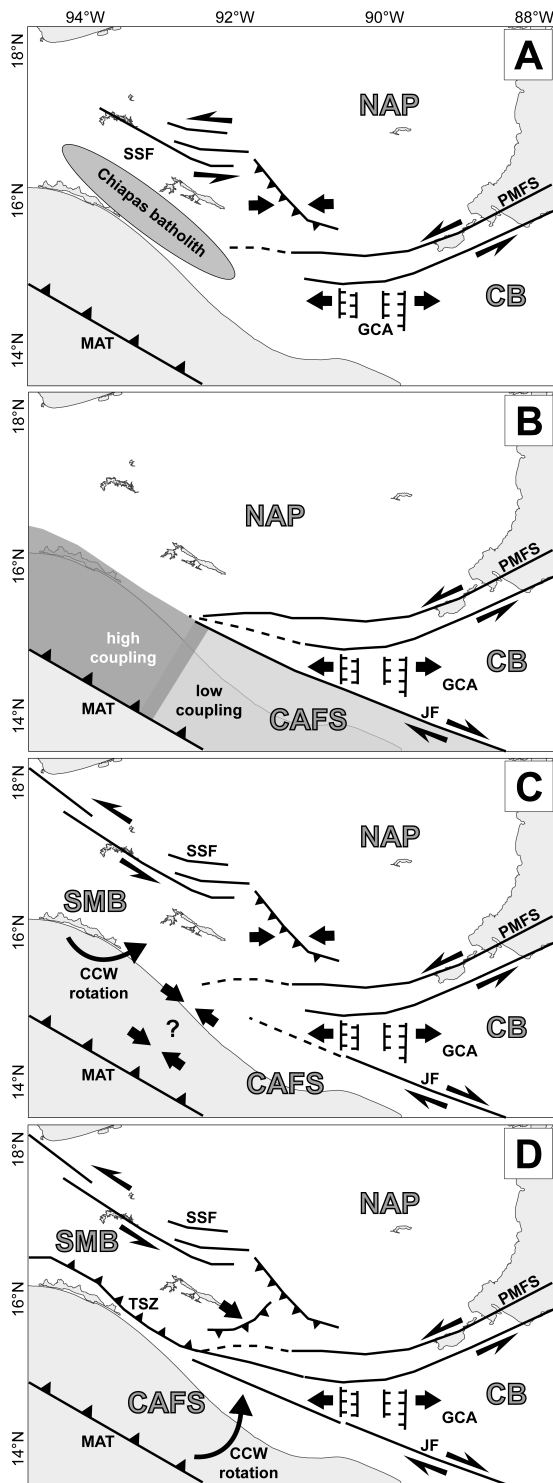


**Figure 2. Topography (A) and simplified geological map (B) of northern Central America. Geological contours from Garrity and Soller (2009).** Structures compiled from GuzmánSpeziale (2001); Meneses-Rocha (2001); Rogers et al. (2002); Purdy et al. (2003); Ratschbacher et al. (2009); Authemayou et al. (2011) and Witt et al. (2012b). Morpho-tectonic domains: CAVA – Central America volcanic arc, CFTB – Chiapas fold-and-thrust belt, CH – Comitán High, CM – Chiapas Massif, CR – Chuacus range, CVC – Central Valley of Chiapas, EYFZ – East Yucatán fault zone, GCA – Grabens of Central America, LMR – Las Minas range, MM – Maya Mountains, PB – Petén basin, SCH – Sierra de Chiapas, SdC – Sierra de los Cuchumatanes, TCP – Tabasco coastal plain, YP – Yucatán platform. Main structures: CoF – Concordia fault, CoG – Comayagua graben, GuG – Guatemala City graben, HSFS – High Sierra fault system, IpG – Ipala graben, IxF – Ixcán fault, JaF – Jalpatagua fault, LVF – La Venta fault, MaF – Malpaso Fault, MoF – Motagua fault, NaF – Necta fault, NBF – Northern boundary fault, PoF – Polochic fault, RHF – Rio Hondo fault, SBF – Southern boundary fault, SuG – Sula graben, TSZ – Tonalá shear zone, TuF – Tuxtla fault.



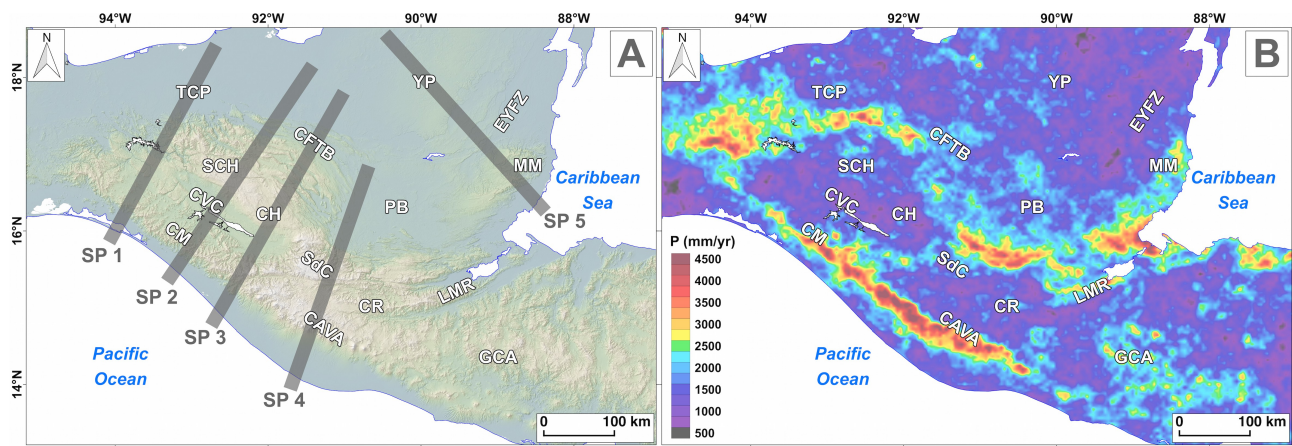


**Figure 3.** Superficial (depth < 40 km) seismicity in northern Central America (a) and GPS velocities with respect to the fixed North American plate (b). Focal mechanisms from Guzmán-Speziale et al. (1989); Guzmán-Speziale (2010) (in greys) and Global CMT Catalog (in black, <http://www.globalcmt.org>). Historical earthquakes (red circles) from White (1984); Singh et al. (1984) and Guzmán-Speziale (2010). GPS velocities are from Franco et al. (2012). See Fig. 2 for abbreviations.

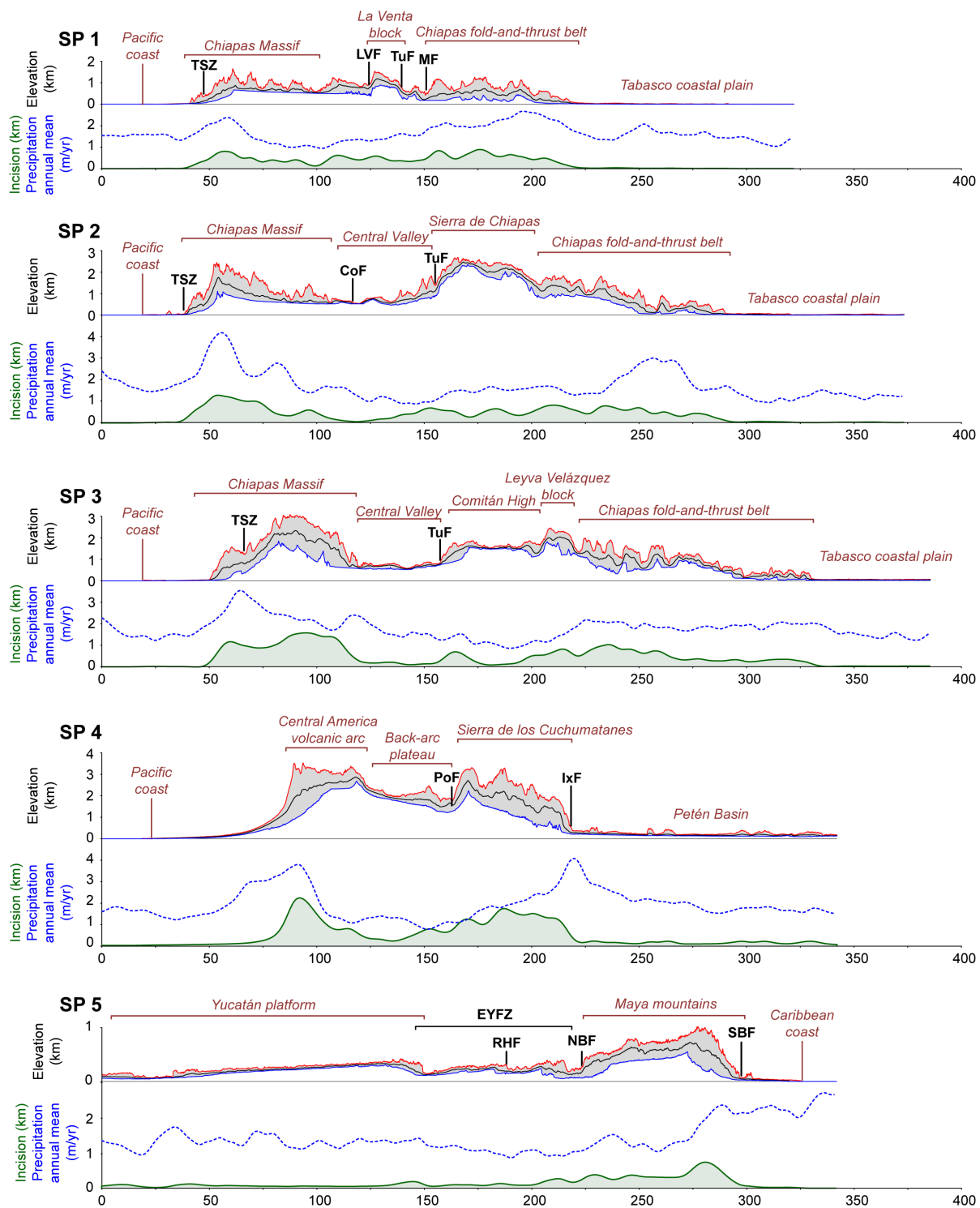


**Figure 4.** Recent models for the North American–Caribbean–Cocos plate boundary in northern Central America. (a) “fault-jog” model from Guzmán-Speziale and Meneses-Rocha (2000) and Guzmán-Speziale (2001). (b) model from Lyon-Caen et al. (2006) and Franco et al. (2012). (c) model from Andreani et al. (2008a). (d) “zipper” model from Authemayou et al. (2011). Main plates and blocks: CAFS – Central America forearc sliver, CB – Chortis block (part of the Caribbean plate), NAP – North American plate, SMB – Southern Mexico block. Main structures: JF – Jalpatagua fault, GCA – grabens of Central America, MAT – Middle America trench, PMFS – Polochic-Motagua fault system, SSF – strike-slip faults of Chiapas, TSZ – Tonalá shear zone.

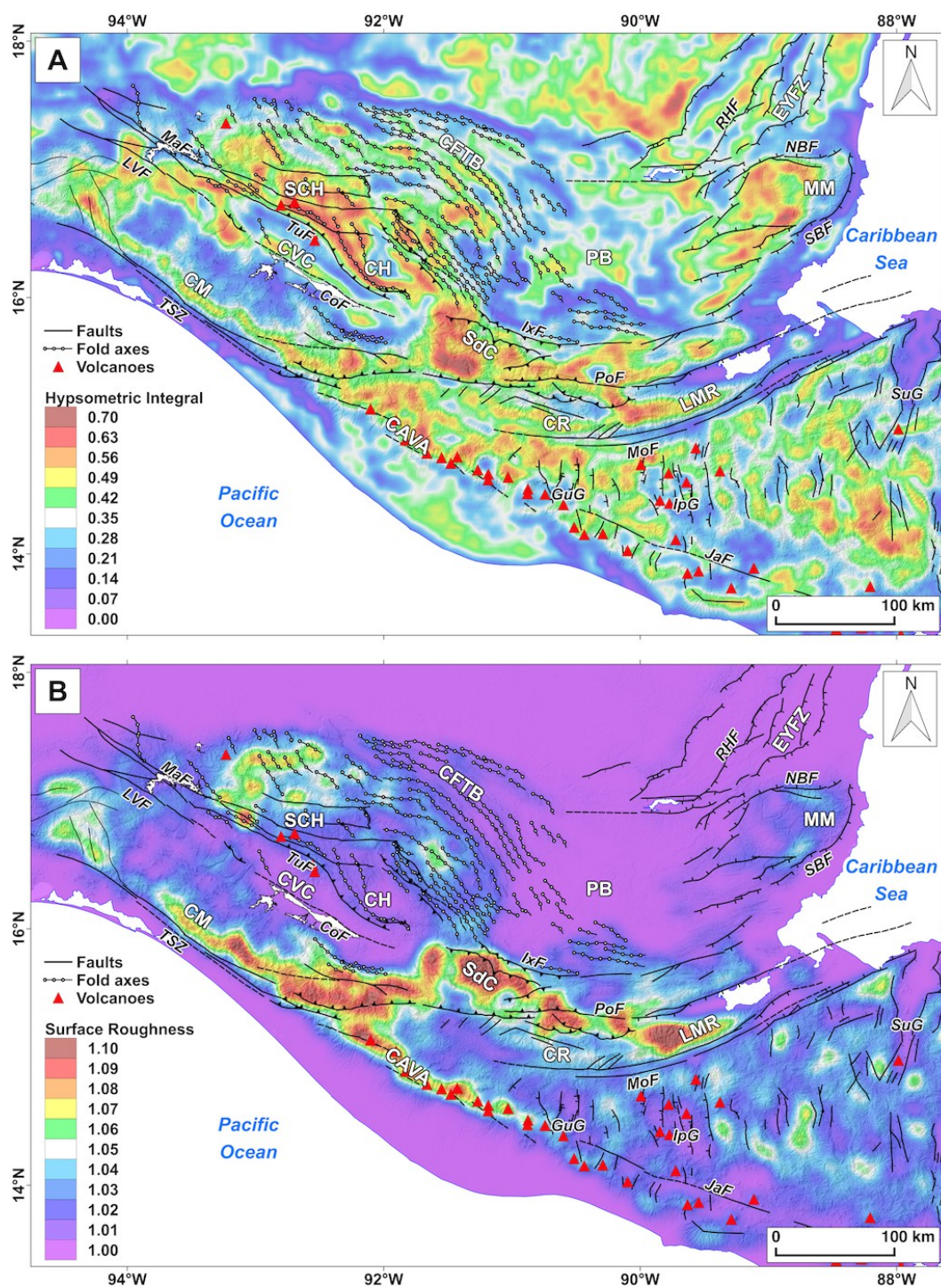




**Figure 5. Swath topographic profiles. Swath width is 20 km. Distances and elevations are in km. Vertical exaggeration is 10. Red, black and blue curves represent the maximum, mean and minimum elevations, respectively. Green line represent the local incision (subtraction of minimum and maximum elevations). See Fig. 2 for abbreviations. Location of swath topographic profiles (A) and annual averaged precipitations for the 1998 to 2009 period (B). Precipitation data were derived from the Tropical Rainfall Measuring Mission (TRMM) and processed by Bookhagen (2009).**

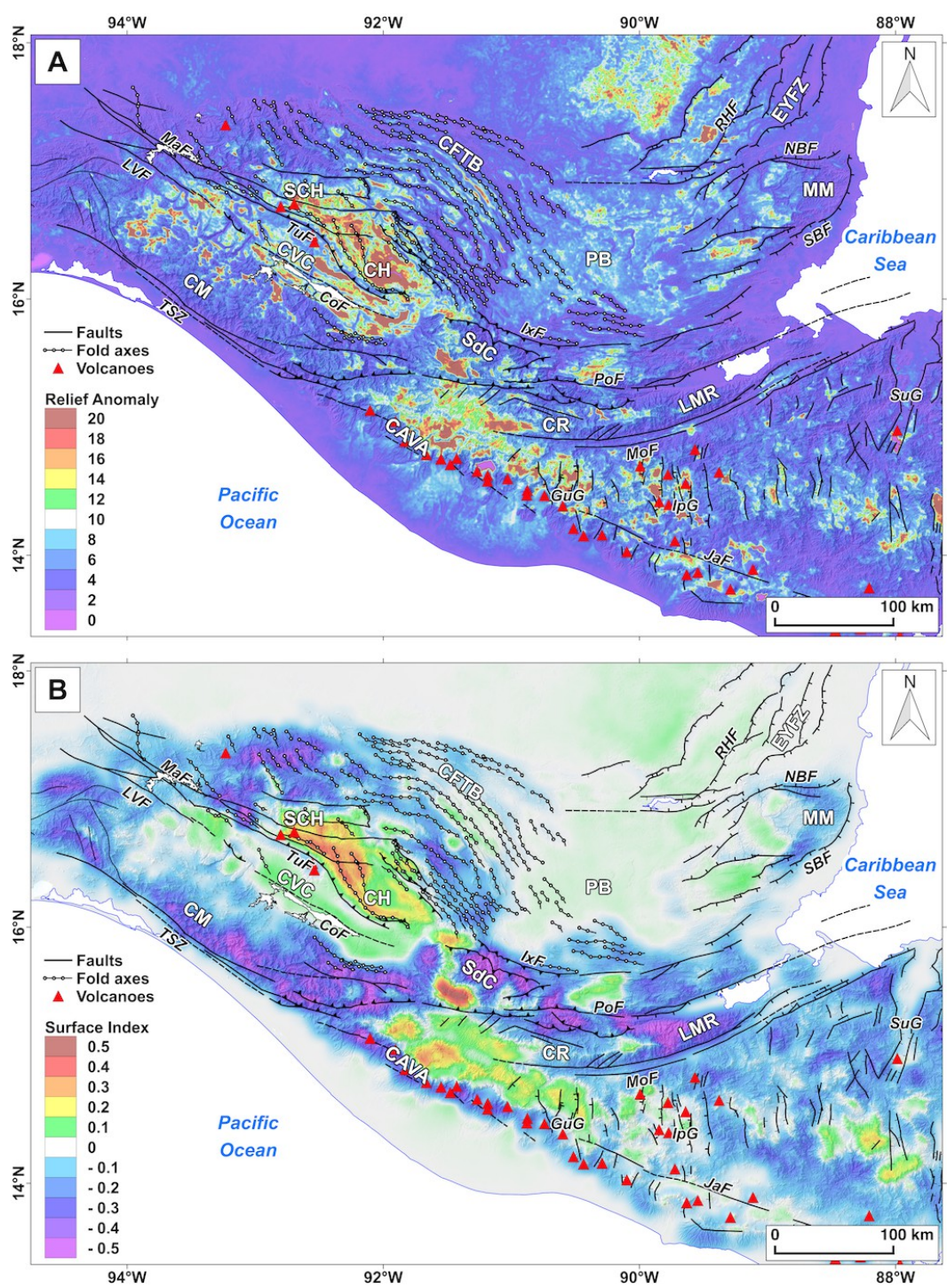


**Figure 6.** Swath topographic profile across the Maya Mountains and the Yucatán platform. Swath width is 20 km. Distance and elevations are in km. Vertical exaggeration is 20. Red, black and blue curves represent the maximum, mean and minimum elevations, respectively. Green line represent the local incision (subtraction of minimum and maximum elevations). See Fig. 2 for abbreviations. Swath profiles across the Sierra Madre de Chiapas, volcanic arc, and Maya Mountains. Upper plots: topographic profiles (swath width is 20 km). Vertical exaggeration is 10 for profiles 1 to 4 and 25 for profile 5. Red, black and blue curves represent the maximum, mean and minimum elevations, respectively. Lower plots: Green lines represent the local incision in km (subtraction of minimum and maximum elevations). Blue dashed lines represent annual averaged precipitations (from TRMM data) in m/yr. See Fig. 2 for faults abbreviations.

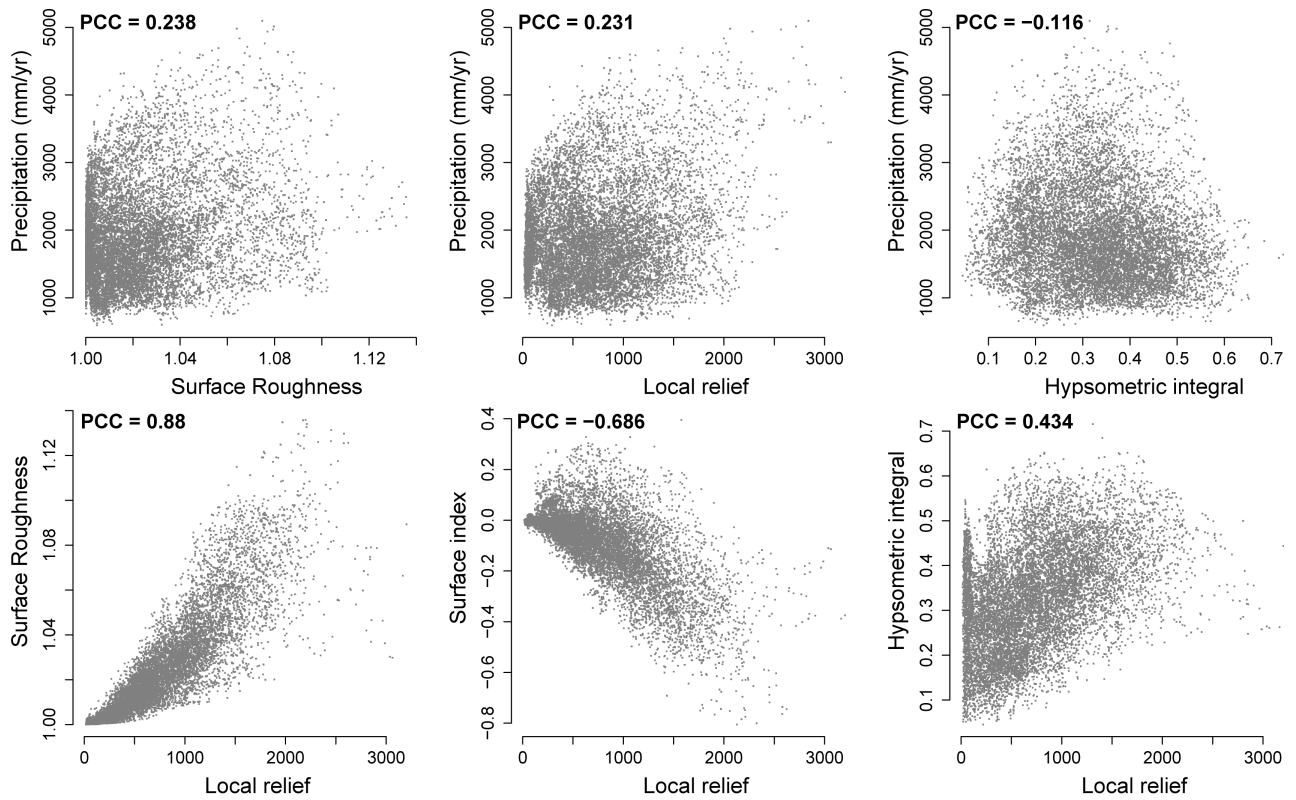


**Figure 7.** Hypsometric integral (a) and surface roughness (b) for northern Central America. See Fig. 2 for abbreviations.

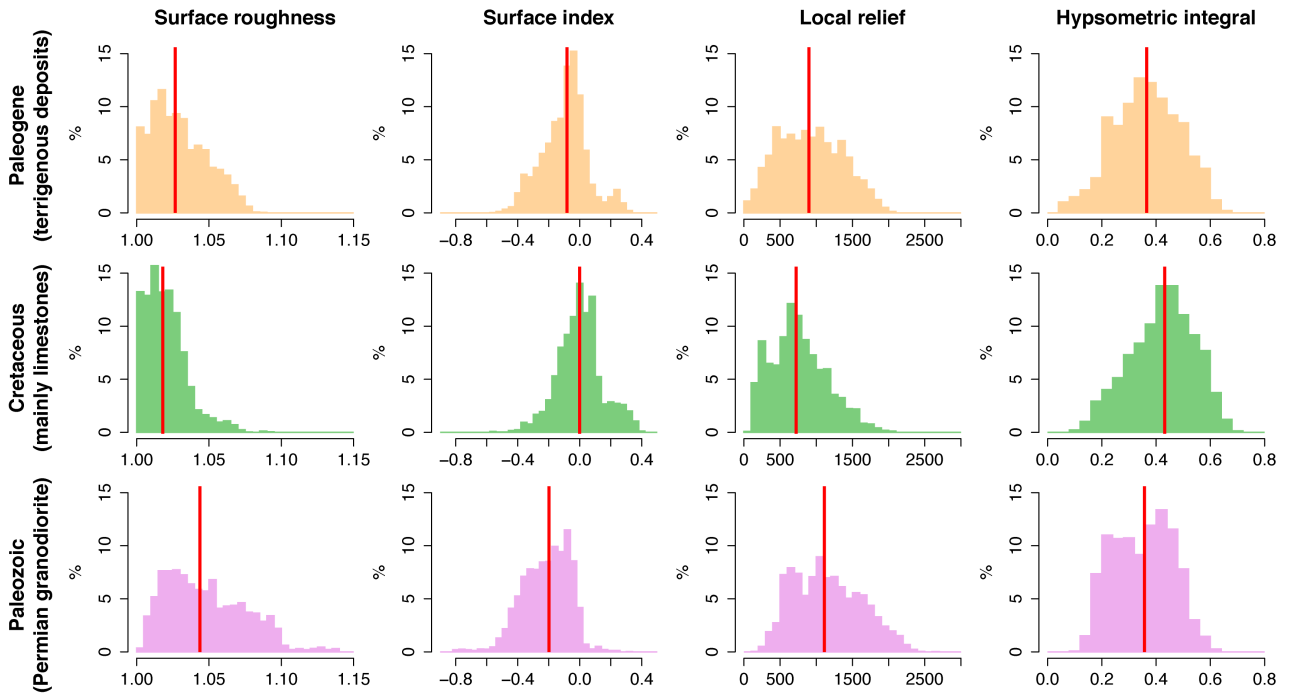




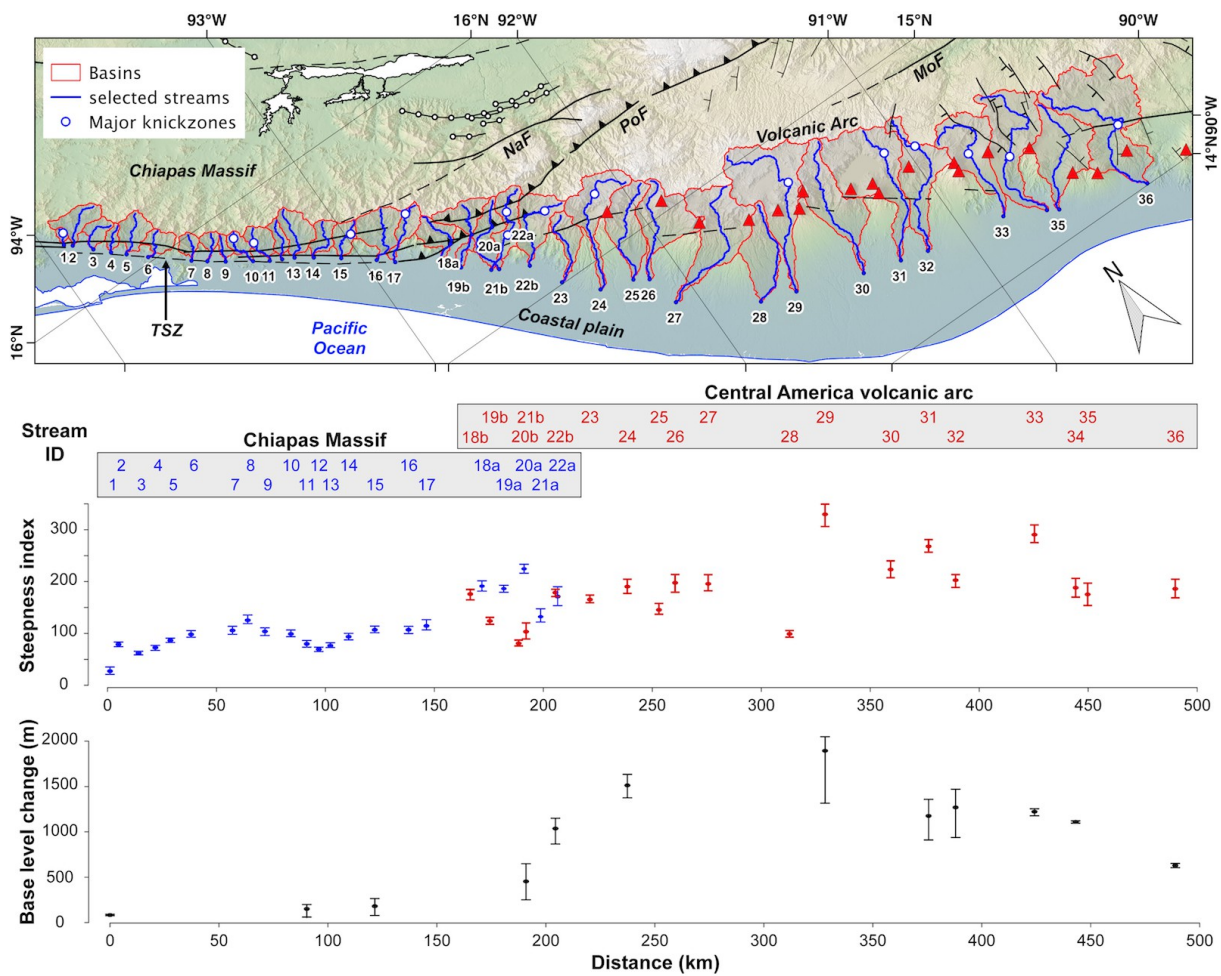
**Figure 8.** Relief anomaly (a) and surface index (b) for northern Central America. See Fig. 2 for abbreviations.



**Figure 9.** Comparison between precipitations (derived from TRMM data) and morphometric indices within the Sierra Madre de Chiapas. Points represents pixel values extracted from the precipitation and morphometric maps. The linear correlation between the variables was estimated using the Pearson correlation coefficient (PCC).

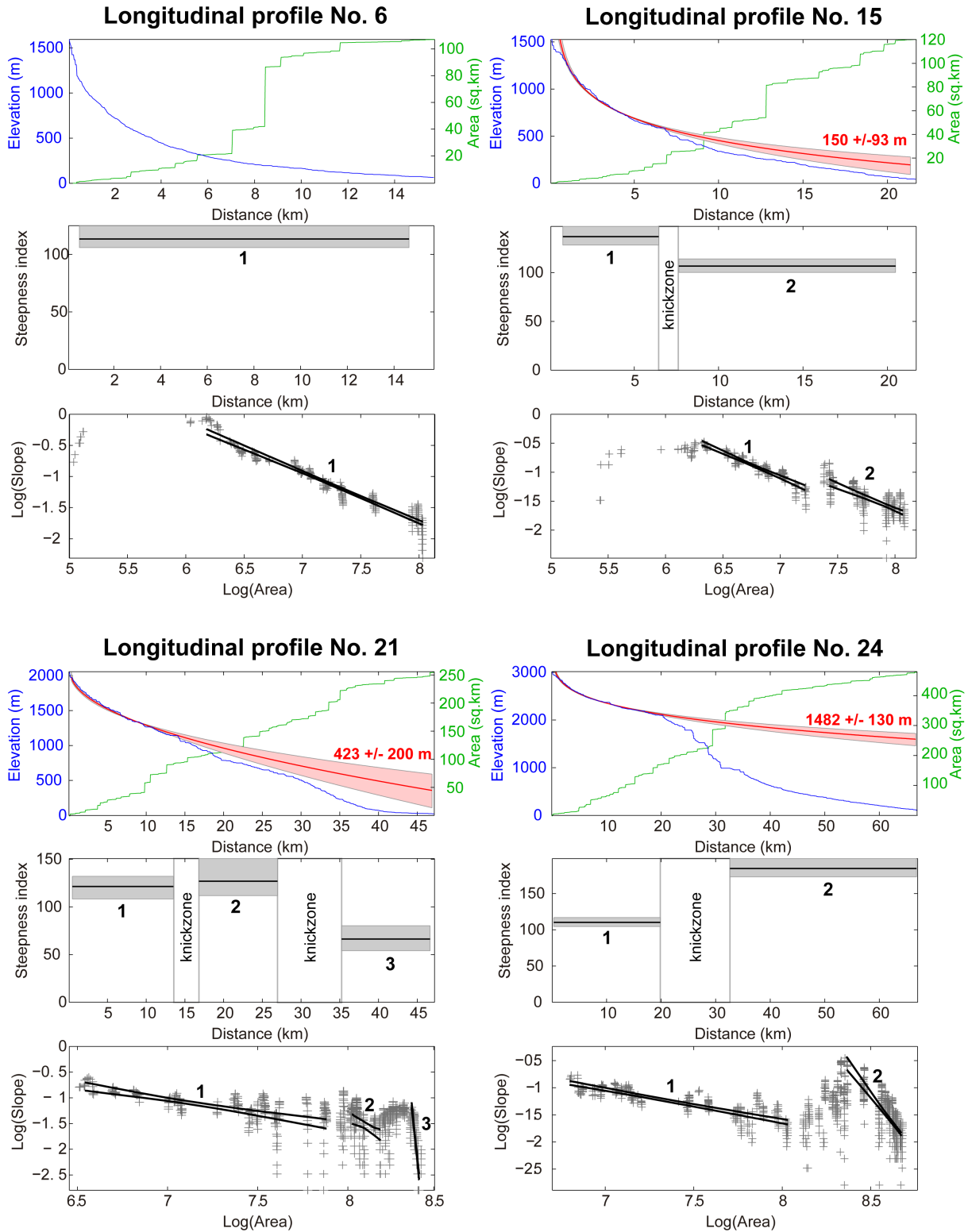


**Figure 10.** Distribution of morphometric indices for the main lithological groups of the Sierra Madre de Chiapas. Histograms are based on three sets of 5000 pixel values extracted from the morphometric maps (Fig. 7 and 8). Red line represents the median.

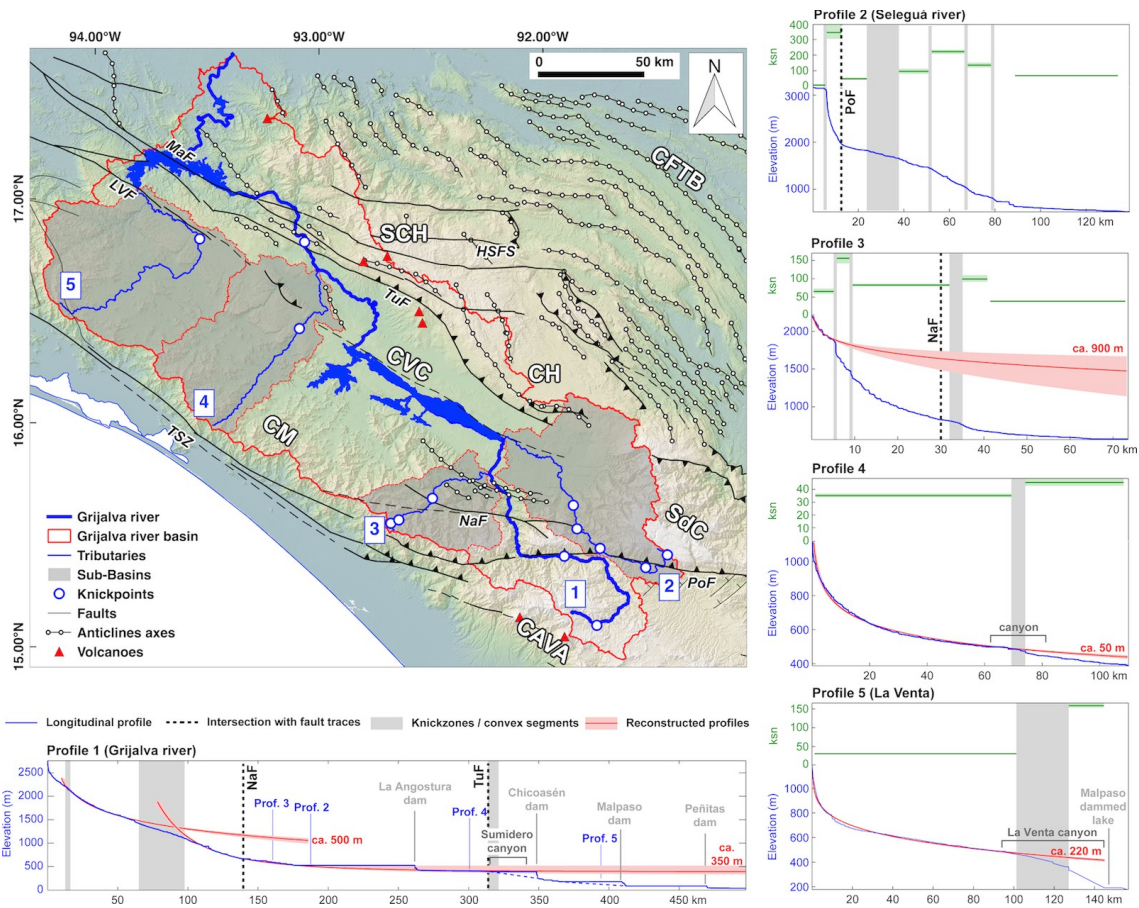


**Figure 11.** Analyzed streams in Chiapas Massif and **Central** Central America volcanic arc. Top: location map. Blue lines represent channels extracted from the modeled drainage network. White dots represent major knickzones. Red lines show limits of catchments. Black lines and red triangles represent main faults and active volcanoes, respectively. Bottom: plot of steepness index (ksn) values and estimated base-level changes along a profile passing through the outlet of each catchment. Abbreviations: MoF – Motagua fault. NaF – Nectia fault. PoF – Polochic fault. TSZ – Tonalá shear zone.

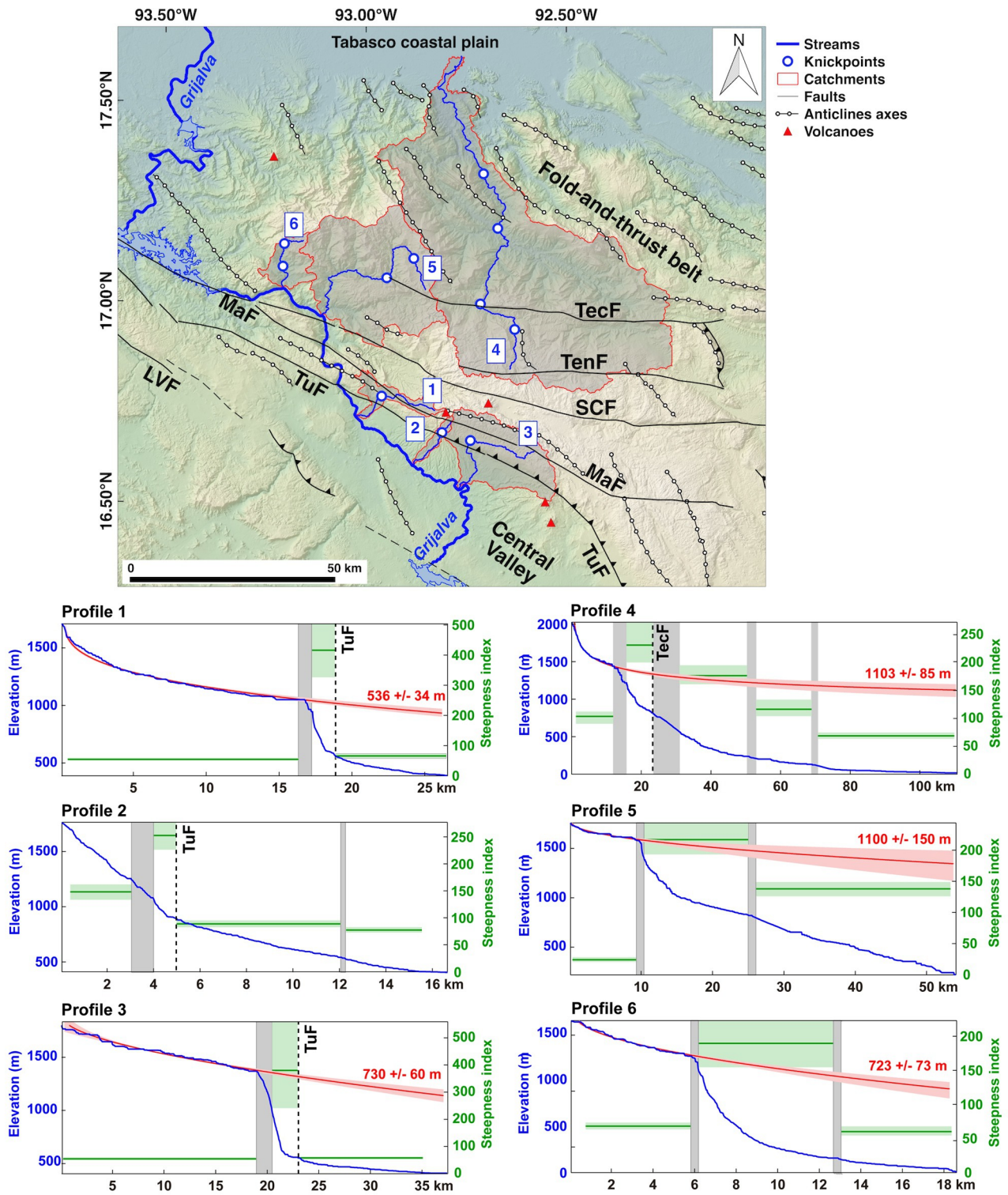




**Figure 12.** Examples of stream profiles extracted from the modeled drainage network in Chiapas Massif and volcanic arc. Upper plots: blue lines represent longitudinal profiles, green lines show the contributing area (flow accumulation), red lines show reconstructed profiles (interpolation of the slope-distance relation from segments above the upper knickzones, see Eq. 7) and pink polygons represent the uncertainties (based on a bootstrapping method). Central plots: black lines represent extracted steepness index (ksn) values for a given segment and grey polygons show the uncertainties (based on a bootstrapping method). Lower plots: logarithmic plots of slope vs area (grey crosses) and envelopes of regressions (black lines) used to estimate the ksn values.

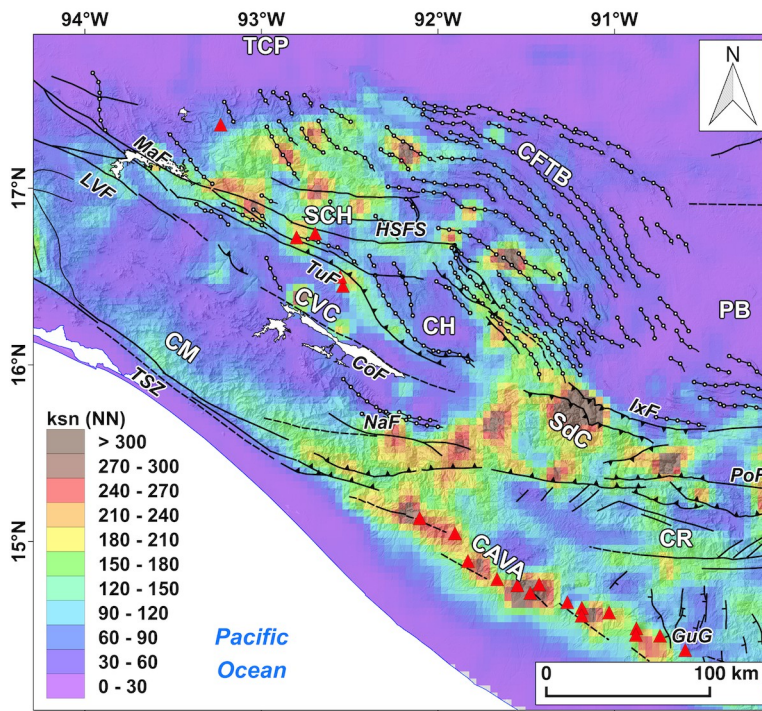


**Figure 13.** Longitudinal profiles for the Grijalva river and the tributaries from the Sierra de los Cuchumatanes and Chiapas Massif. Profiles were extracted from the modeled drainage network. See Fig. 2 for faults abbreviations and Fig. 10 for plot description.

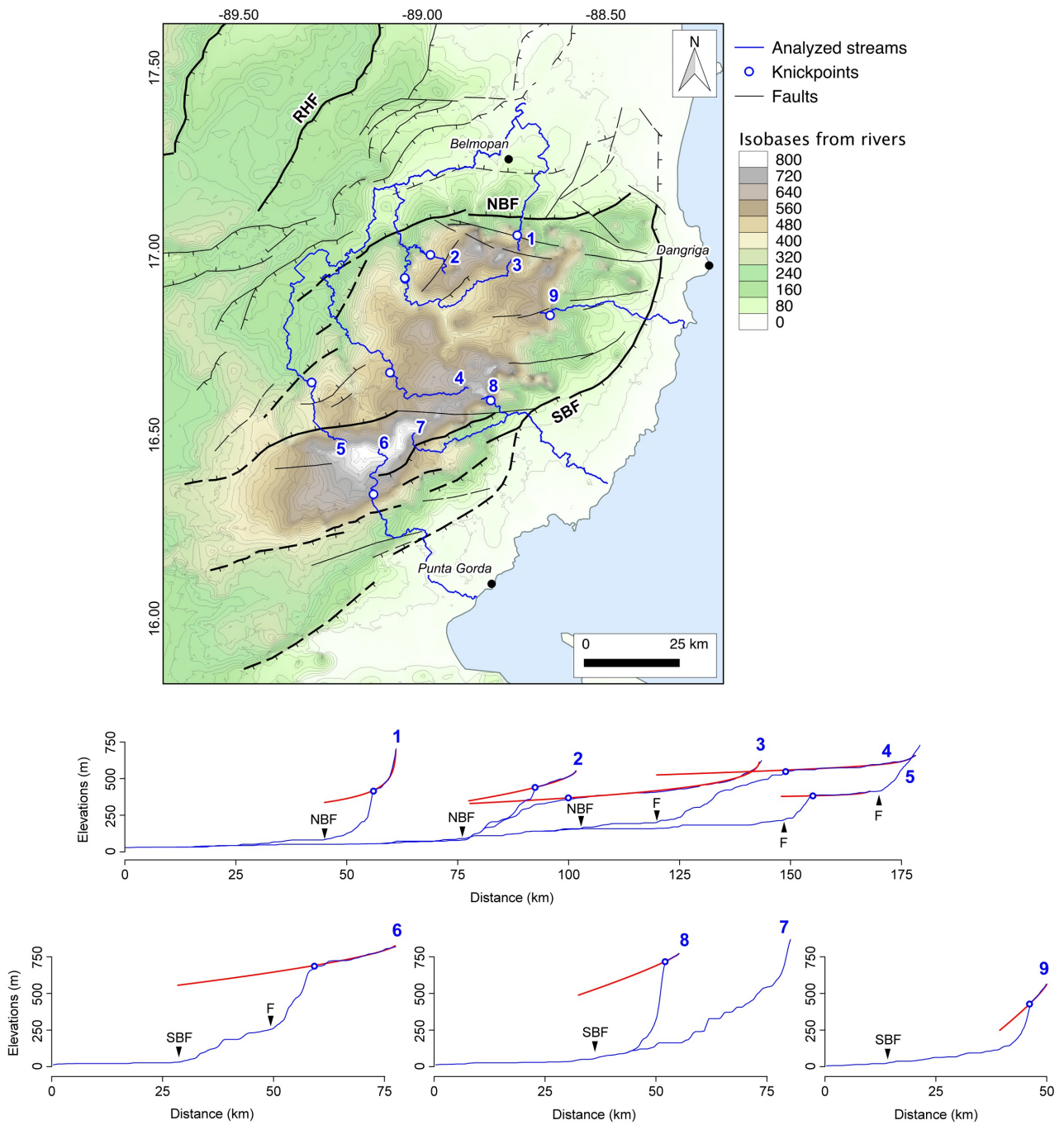


**Figure 14.** Longitudinal profiles for the Sierra de Chiapas. Channels and profiles were extracted from the modeled drainage network. [See Fig. 10 for plot description.](#) Abbreviations: LVF – La Venta fault, MaF – Malpasos Fault, SCF – San Cristobal fault, TecF – Tectapan fault, TenF – Tenejapa fault, TuF – Tuxtla fault.

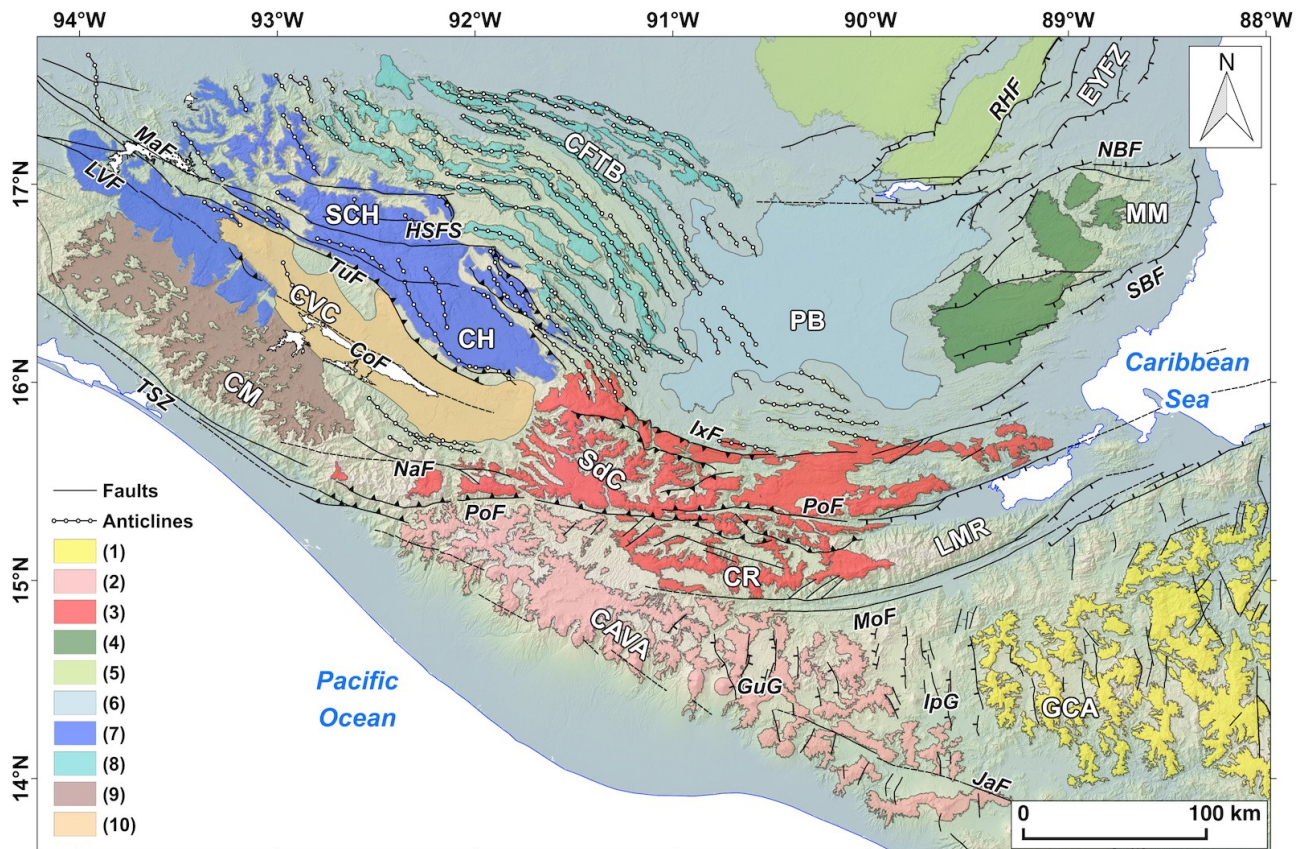




**Figure 15.** Interpolated map of steepness index (ksn) for the Sierra Madre de Chiapas and the northern segment of the Central America volcanic arc. Values were extracted from river longitudinal profiles using 5 km long segments and interpolated using a natural neighbor (NN) method. See Fig. 2 for abbreviations.

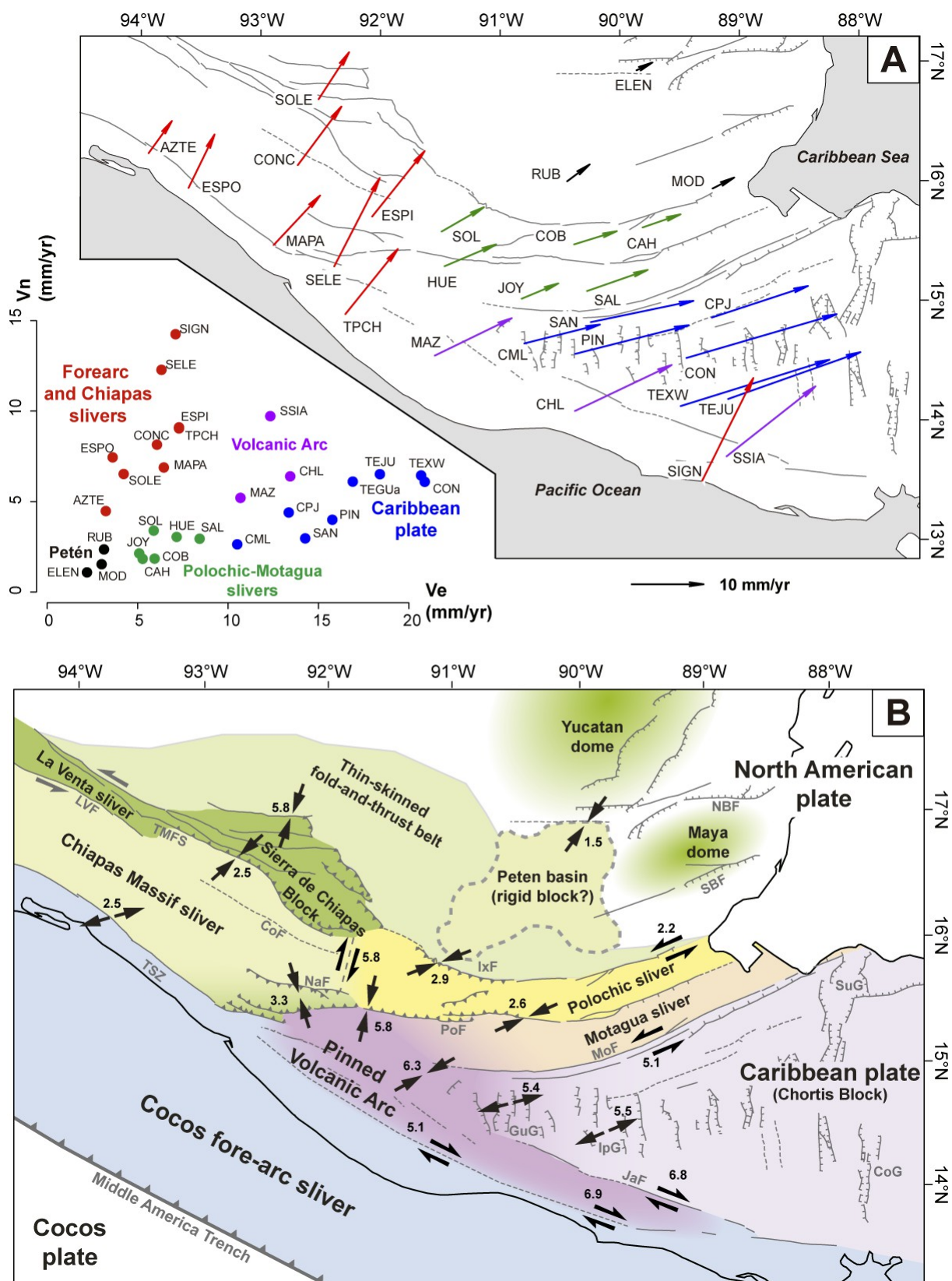


**Figure 16.** Analysis of drainage network for the Maya Mountains. Top: map of isobases (i.e., interpolated elevations) from rivers with a Strahler order  $\geq 2$ . Main faults (black lines), analyzed streams (blue lines) and main knickpoints (blue dots) are also reported. Bottom: longitudinal stream profiles. Blue dots are main knickpoints (location on the map). Red lines show profiles reconstructed using segments located above the knickpoints (see Eq. 7). Black arrows show the intersection with main faults. Abbreviations: NBF – Northern Boundary fault, SBF – Southern Boundary fault, RHF – Rio Hondo fault, F – other faults.

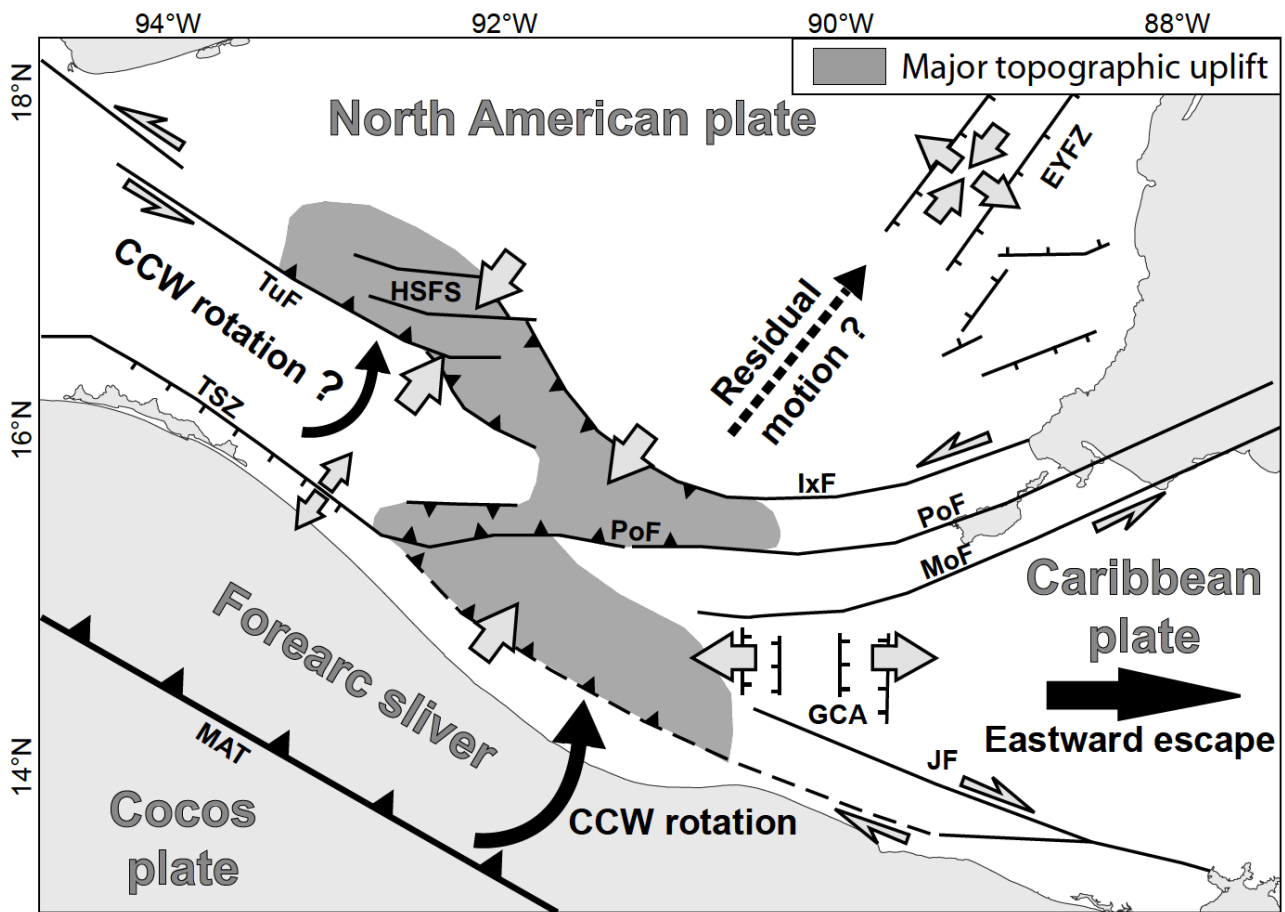


**Figure 17.** Proposed extension of elevated surfaces and relict landscapes in northern Central America (interpretative map based on morphometric maps, Figs. 7 and 8). Legend: 1 – Remnants of the Miocene ignimbritic plateau (Rogers et al., 2002), 2 – Plio-Quaternary volcanic arc plateau, 3 – Middle Miocene Mayan paleosurface (Authemayou et al., 2011; Brocard et al., 2011), 4 – relict landscape of the Maya Mountains, 5 – tilted surfaces of the Yucatán platform, 6 – Petén basin, 7 – elevated plateaus of La Venta and northern Sierra Madre de Chiapas, 8 – inferred extension of the plateau within the fold-and-thrust belt, 9 – monadnock landscape developed over the Chiapas batholith, 10 – Central valley of Chiapas. See Fig. 2 for faults and morpho-tectonic domains abbreviations.





**Figure 18.** Proposed limits of tectonic slivers forming the plate boundary. (a) GPS velocities with respect to the fixed North American plate (Franco et al., 2012). Colors emphasize vectors with similar azimuths and velocities. The diagram of northern and eastern components (bottom left corner) allows to deduce motions between paired GPS stations. (b) Main tectonic blocks defined using known major faults (Fig. 2), our geomorphic maps (Figs. 7 and 8) and published GPS data (Fig. 16a) and seismicity (Fig. 3a). Black arrows show the motion along blocks boundaries deduced from paired GPS stations (values are in mm.yr<sup>-1</sup>). See Fig. 2 for faults abbreviations.



**Figure 19.** Proposed model for the North American–Caribbean–Cocos plate boundary in northern Central America. **See Fig. 2 for faults abbreviations.** Abbreviations: EYFZ – East Yucatán fault zone, GCA – Grabens of Central America, HSFS – High Sierra fault system, IxF – Ixcán fault, JaF – Jalpatagua fault, MAT – Middle America Trench, MoF – Motagua fault, PoF – Polochic fault, TSZ – Tonalá shear zone, TuF – Tuxtla fault.