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Estimating Euler pole parameters for NATRF2022

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Canada and the US are collaboratively implementing a new dynamic, geometric reference frame for North America (NA) known as the North American Terrestrial Reference Frame of 2022 (NATRF2022). It will be a plate-fixed reference frame based on ITRF2020/IGS20 that is kept aligned to the NA tectonic plate using an Euler pole rotation. We have estimated Euler pole parameters (EPP) for NA based on the spherical model of Earth using different sets of stations and compared our results to other sources, including those recently obtained by Kreemer (2023) under contract to the U.S. National Geodetic Survey. The velocity field used for our analyses are those from Kreemer (2023) that were obtained for 4274 stations using GipsyX precise point positioning in the IGb14 reference frame and corrected for non-tidal and atmospheric loading as well as hydrological loading obtained from GRACE. A challenge for our analyses is the impact of ongoing glacial isostatic adjustment (GIA) on the horizontal velocities which can bias the EPP estimation. To mitigate such biases, we have used the horizontal component of the ICE-6G model to remove the GIA effect from the velocity field. Following Kreemer (2023), we have determined a small set of homogeneously distributed stations that closely reproduce Kreemer's EPP estimates. We also considered that users of the new reference frame would prefer that the intra-plate motions be minimized across the entire continent for conventional use and have therefore computed the best fitting EPP that minimizes the overall intra-plate motions across the entire continent. In addition, we chose only good stations that met certain statistical criteria for the residuals and had stable monumentation, preferably anchored to bedrock. Finally, we compare the EPP estimates for all these sets of stations with and without GIA removed using statistical tests and descriptive statistics. The differences in resulting intra-plate velocities across the continent are also discussed for each test.