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Reconstructing paleogeography using site-level apparent polar wander paths

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Paleomagnetism provides the main quantitative tool for reconstructing Earth's paleogeography. Apparent polar wander paths (APWPs), derived from paleomagnetic data, trace the motion of tectonic plates relative to the Earth's rotation axis through geological time, providing a paleogeographic framework for studying the evolution of Earth's interior, surface, and atmosphere. Traditionally, APWPs are calculated from study-mean paleomagnetic poles that are assigned equal weight, regardless of the number of paleomagnetic sites used to compute it and the uncertainties in the position or age of the pole. Here, we introduce the next generation of APWPs that are calculated from site-level paleomagnetic data instead of from study-mean poles. This alternative approach assigns larger weight to larger data sets and allows the incorporation of spatial and temporal uncertainties. We demonstrate the advantages of this new method with recently published APWPs based on compiled (Gallo et al., 2023) and simulated site-level data (Vaes et al., 2023). We show how the latter, a global APWP for the last 320 Ma, provides more reliable estimates of the apparent polar wander rate of all major tectonic plates, and discuss its implications for the rate and magnitude of true polar wander since 320 Ma. In addition, we introduce *APWP-online.org*: an online, open-source environment that provides user-friendly tools to compute site-level APWPs and to use them to quantify relative paleomagnetic displacements. We showcase how these tools are currently used to compute site-level APWPs, e.g., for the North China block and Tibetan terranes. Finally, we provide future directions for the construction of APWPs and highlight opportunities for improving their quality and resolution.