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A new deep-time historical perspective of the terrestrial water cycle that is needed to solve UPH #1:

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This work could contribute to solve UPH #1: is the hydrological cycle regionally accelerating/decelerating under climate and environmental change, and are there tipping points (irreversible changes)?

This fundamental question hinges upon the Nature of the hydrologic cycle itself, and for which a geological perspective is needed. To begin to solve this problem, we thus must have a clear picture of how the water cycle has changed throughout Earth's History. However, current narratives of the history of Earth's water cycle lack a coherent description of how life altered water cycling on land. Here I review a body of evidence of plant evolution events in Earth's history and propose how rainfall runoff mechanisms evolved through five key evolutionary phases. This review reveals that for most of Earth's history, water cycling on land was likely very different from today, with fewer mechanisms available to store water between rainfall events in the critical surface zone, with implications for water availability and surface climate. A key tipping point occurred during the Silurian-Devonian periods with the greening of the planet. This deep-time perspective illustrates the step-by-step process through which plants optimized the water cycle in which it increased the distribution in space and time, culminating in the development of forests in the late Devonian. Lastly, I review how the past may serve as a key to the future, discussing how the historical perspective illustrates key areas needed to improve our current conceptualization of water availability so that we may better understand and predict changes of water availability during the Anthropocene.