



The sensitivity of the Devonian climate to orbital forcing, continental configuration and vegetation cover

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The Devonian period (419 to 359 million years ago) is characterised by profound evolutionary changes. Most importantly, vascular plants and vertebrates started spreading on land whereas life in the ocean suffered from severe extinctions. Disentangling the interactions between these changes and their interplay with Earth's climate remains challenging. The evolutionary changes on land and in the oceans unfold against a backdrop of a shift from a warm greenhouse climate to a cold climate, accompanied by a decrease in the atmospheric CO₂ concentration. In addition to this long-term cooling, the geologic record reveals the influence of orbital forcing on the climate during the Devonian. Therefore, we test the sensitivity of the Devonian climate to Earth's orbital parameters using a coupled climate model. We find the warmest climate states at high obliquity and high eccentricity. However, compared to an earlier study with an uncoupled atmosphere model, global temperature differences due to orbital forcing are much smaller. Furthermore, our results suggest a mode of climate variability which increases with obliquity. The observed change between warm and cold modes is connected to coupled oscillations of sea-ice cover, salinity and convection in the Arctic. In addition to orbital forcing, we also investigate the sensitivity of the Devonian climate to vegetation cover and continental configuration. Combining the results, we suggest best-guess configurations allowing a glimpse at characteristic climate states for the Early, Middle and Late Devonian.