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Is destabilisation risk increasing in land carbon sinks?

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Global net biome production (NBP), or net land carbon uptake, has been repeatedly shown to increase during recent decades. However, whether the temporal variability and autocorrelation of NBP has changed during this period remains elusive. Answering this question is particularly relevant given that an increase in both could indicate destabilising C sinks and potentially lead to abrupt changes. We investigated the trends and controls of net land C uptake and its temporal variability and autocorrelation, from 1981 to 2018, using two atmospheric inversion models, the amplitude of the seasonal cycle of atmospheric CO_2 derived from nine monitoring stations distributed across the Pacific Ocean, and 12 dynamic global vegetation models. Spatially, we found that plant biodiversity presented a convex parabolic relationship with NBP and its temporal variability at the global scale while nitrogen deposition generally increased annual NBP. We also found that annual NBP and its interdecadal temporal variability globally increased, but temporal autocorrelation decreased. Regions characterized by increasingly variable NBP were usually with warmer and with increasingly variable temperatures, and lower and weaker trends in NBP compared to those where NBP variability did not increase, where NBP became stronger. Annual temperature increase and its increasing temporal variability were the most important drivers of declining NBP and increasingly its variability. Our results show that increasing regional NBP

variability can be mostly attributed to climate change.