



Global warming is shifting the major ocean gyres toward the poles

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Global warming has several fundamental impacts on the climate, for example, increasing the temperature, melting the ice sheets, retreating the Arctic sea ice and raising the sea level. While, recent studies have pointed out that the wind-driven ocean circulations are also strongly affected by global warming. However, detecting such changes is challenging due to insufficient data both on temporal and spatial scale. Here, based on several lines of independent evidence, we highlight that global warming can shift the major ocean gyres towards the poles. Detailed examining the observational records indicates that such shift is ongoing and already detectable since the satellite era even though strong natural climatic variability superimpose on it. The shift has significant impacts on the ocean heat transport, regional sea level rise and marine biosphere in regions close to the edge of the gyres, such as Japan, Gulf of Maine, the Benguela ecosystem. However, these changes have not raised much attention yet.