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Global ocean uptake and storage of anthropogenic carbon estimated using transit-time distributions

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The release of fossil fuel CO_2 to the atmosphere by human activity has been implicated as the predominant cause of global climate change. The ocean plays a crucial role in mitigating the effects of this perturbation to the climate system, sequestering 20% to 35% of anthropogenic CO_2 emissions from the atmosphere. While much progress has been made in recent years in understanding and quantifying this sink, considerable uncertainty remains as to the distribution of anthropogenic CO_2 in the ocean, and its precise rate of uptake over the industrial era. Here, I present a novel approach to addressing this important problem in climate science. The method is based on the recognition that the transport of tracers in the ocean is described by a Green's function or "transit-time distribution" (TTD) which may be inverted from tracer data. I will present the first observationally-based estimates of the global distribution and evolution of anthropogenic carbon uptake over the industrial period. In contrast to previous efforts, the TTD method takes full account of the ocean's complex transport, and the time-varying air-sea disequilbrium of CO_2 over the industrial period.