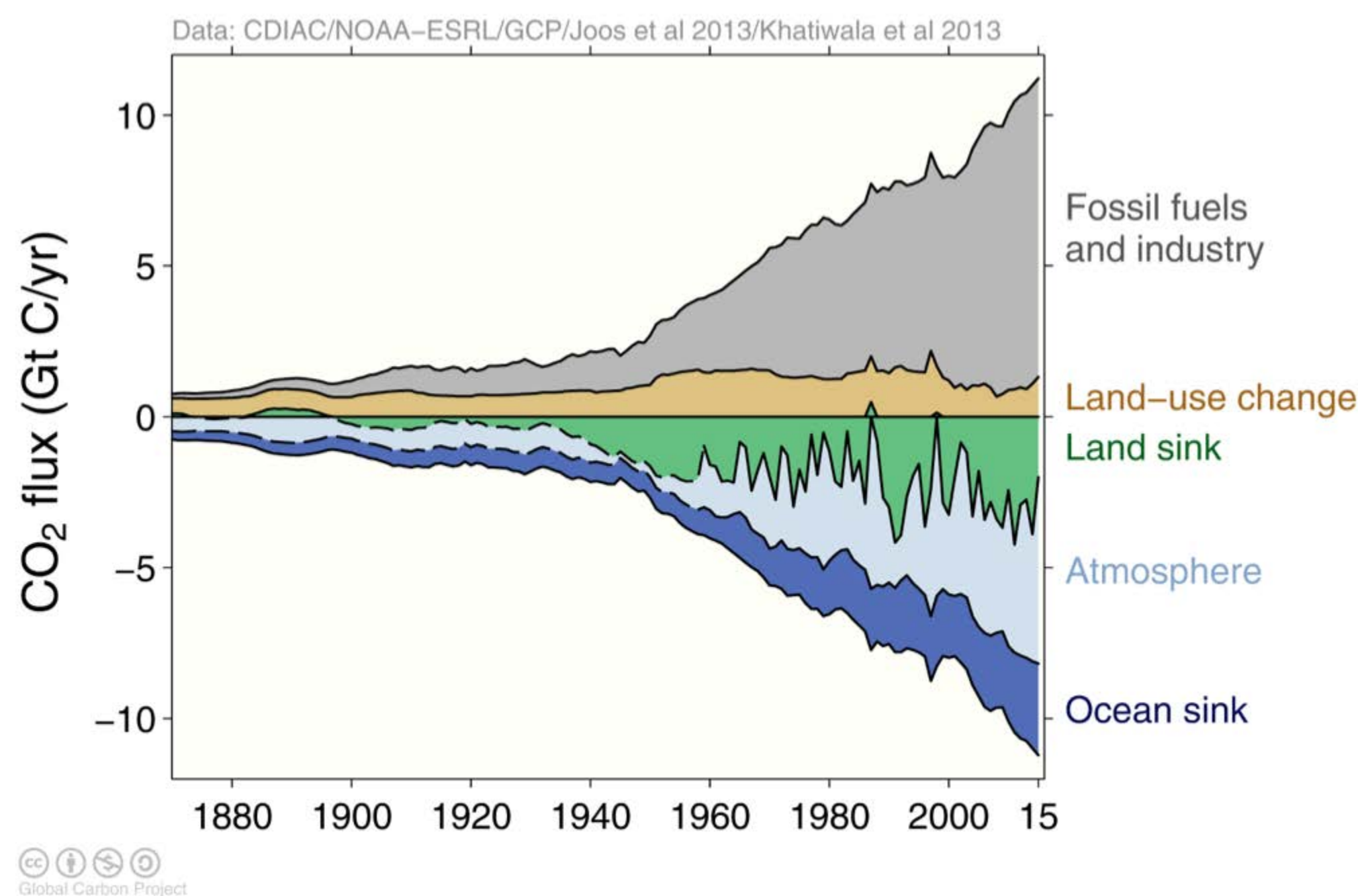




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Terrestrial rock weathering and the carbon cycle in the UVic Earth System Climate Model



We first discuss the long-term global carbon cycle and weathering as a moderator for the Earth's climate. We next describe the two basic types of terrestrial rock weathering – carbonate and silicate. Then we review the development of a new spatially explicit (2-D) weathering model for use in the University of Victoria Earth System Climate Model (UVic ESCM). This weathering model incorporates the worldwide distribution of carbonate and silicate rock types. The weathering rates for each rock type in the model are modulated by changes in temperature, terrestrial primary productivity and runoff. We determined the efficiency of this model in drawing down atmospheric CO₂ in simulations of the UVic ESCM forced by various future carbon emission scenarios. In addition, the 2-D results are compared with those for a zero-dimensional weathering model. Overall, the 2-D weathering model is more efficient than the zero-dimensional model at restoring the carbon cycle to its pre-industrial state after the anthropogenic carbon emissions have ceased. The simulations also show that the largest contributions to future changes in weathering rates come from the expansion of tropical and mid-latitude vegetation in grid cells dominated by weathering-vulnerable rock types. Finally, the results confirm that only silicate rock weathering can lead to a full recovery of the carbon cycle on multimillennial time scales.