

Effects of solar dimming and brightening on the terrestrial carbon sink

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Aim To estimate the impact of changes in diffuse radiation on land productivity and carbon storage

Introduction

Changes in cloud cover, scattering and absorption of light by tropospheric and stratospheric aerosols

- Caused: Solar Dimming^{1,2,3}, an observed decrease in total incident radiation over 1950-1980 and regional brightening since the 1980³.
- Impacts: Plant photosynthesis, which is more efficient under diffuse light^{4,5}

Methods

□ Met Office Land Surface Model: accounts for variations of direct and diffuse radiation on sunlit and shaded canopy photosynthesis⁶.

□ Model Forcing: CRU 1901-2000 (T, P, Cloud cover)⁷

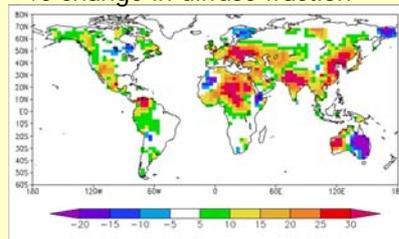
□ GCM direct & diffuse radiation reconstruction (incl. Tropospheric & Stratospheric Aerosols)⁸

Simulated Global Diffuse Fraction



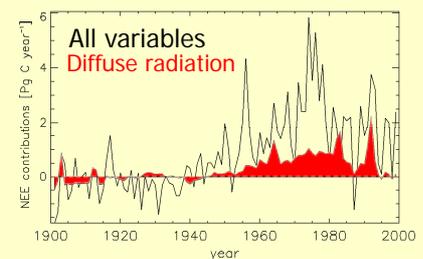
Global dimming period

% change in diffuse fraction

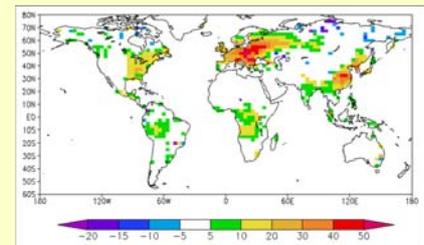


Results: Historical

Simulated Net Ecosystem Exchange



Contribution of diffuse fraction change to land carbon accumulation [g C m⁻² yr⁻¹]



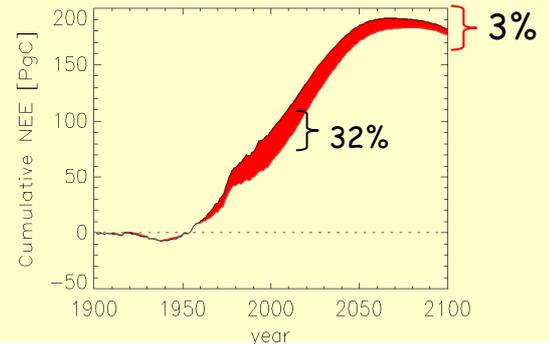
Summary

□ Global dimming & brightening contributes to a decreasing and an increasing land C sink, respectively.

□ Diffuse radiation contribution to land C sink is likely to decrease under decreased aerosol emissions.

Future

Impact of radiation changes on future land C sink



References

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