

Solar modulation of the northern hemisphere winter trends: implications with increasing CO₂

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The origin of the recent trends in the Northern hemisphere (NH) winter circulation is investigated. Linear trends are calculated separately for low solar (LS) and high solar (HS) winters. Trends during HS exhibit a North Atlantic Oscillation (NAO)/Arctic Oscillation (AO)-like pattern that is related to a stronger stratospheric polar vortex. Whereas during LS, decreasing trends of sea-level pressure appear over the northeastern Pacific in association with warming trends in the tropical troposphere which lead to a strengthening of the subtropical jet and a weakening of the polar night jet. These two trends compare well with those found in previous numerical model simulations where the CO₂ was doubled in either the troposphere or the middle atmosphere. This suggests that the stratospheric cooling effect due to increased CO₂ manifests in the troposphere through nonlinear interaction with solar cycle.