

Paper	Method/Time/Location	Key Finding	Relevance to CLAW?
Shaw 1983	Model of cooling from sulfate aerosol	Suggests that there is a biological control of the climate (biothermostasis) through the sulfur cycle, building on the Gaia theory, with sulfate particles acting to cool the surface but mentions that there is no information on the temperature dependence of biogenic gas generation.	The precursor idea that there is biological control of the climate through the sulfur cycle.
Charlson et al. 1987	Review	Found that phytoplankton emit DMS which is oxidized in the atmosphere to form sulfate which can act as CCN. Proposed a negative feedback in which the oceans warms, more DMS is produced, CCN increases, and the surface temperature decreases. Assumptions: 1. Sulfuric acid and sulfate aerosols are the only significant contributors to CCN over the oceans (ignoring any manmade fluxes of SO₂); 2. The flux of DMS is only proportional to the seawater temperature	CLAW
Bates et al. 1992	Review paper	Compiled evidence to show that the oceanic DMS fluxes are dependent on the ocean, season, and region and showed that there are multiple sources of terrestrial sulfur species (vegetation, volcanoes, biomass burning, etc.) in addition to anthropogenic sulfur emissions.	Disproves CLAW assumption because DMS fluxes are non-uniform and sulfate in the MBL can be from long range transport.
Russell et al. 1994	Dynamic model	Linear relationship between DMS flux and CCN concentration at typical MBL conditions which is not true for low DMS fluxes in which sea salt particles heterogeneously convert available SO₂ to sulfate preventing the creation of new particles.	Supports the relationship between DMS and CCN at specific DMS fluxes.

Andreae and Crutzen 1997	Review	Show that there are still gaps in the understanding of biosphere-climatic interaction and that it is unknown whether a warming climate would increase or decrease DMS emissions. The concentration of the DMS metabolic precursor, DMSP, varies between different phytoplankton species over a range of five orders of magnitude.	Starts to disprove a CLAW step by pointing out that there is no evidence yet for a DMS flux tied to ocean warming and shows the difference in fluxes based on species.
Bates et al. 1998	Shipboard measurements of DMS, SO ₂ , mass size distribution, number size distribution; Fall 1995; North and South Pacific	The presence of ultrafine mode particles in the MBL could be explained by convective mixing between the free troposphere and MBL – there was no evidence of major new particle production in the MBL. DMS contributes to the growth of Aitken and accumulation mode particles.	Disproves the new particle formation from DMS, shows that the small particles could be from mixing, but states that DMS could add to the particle growth.
Clarke et al. 1998	Aircraft measurements of DMS, SO ₂ , sulfuric acid, OH, O ₃ , atmospheric conditions, and aerosol size distributions and a model; September 1996; equatorial Pacific	Demonstrated aerosol nucleation and growth linked to DMS emissions in the MBL by showing good agreement between measured and modeled SO ₂ produced from DMS.	Supports the CLAW idea of particle nucleation from DMS.
Blanchard and Woodcock 1980	Review	Showed that ocean bubble bursting created sea salt aerosol particles and that those particles could be less than 0.2 μm in diameter.	Disproves the CLAW assumption that all relevant CCN sized aerosol are from sulfate.
Murphy et al. 1998	Measurements; Fall 1995; southern ocean	Aerosol particles larger than 0.13 μm in the MBL contain sea salt, have important radiative effects, were responsible for the majority of aerosol-scattered solar radiation, and comprise a significant fraction of CCN.	Disproves CLAW assumption that the only relevant CCN in the clean MBL are from sulfate.

Quinn and Bates 2011	Measurements of CCN and aerosol and modeled steps in CLAW hypothesis; 1987-2011; clean MBL	Used evidence from the past 20 years showing that (i) there are non-DMS sources of CCN in the MBL, (ii) there is no observational evidence for a DMS-controlled marine biota-climate feedback, and (iii) there is a low sensitivity between change and response in each step of the to show that it is “time to retire the CLAW hypothesis”.	De-CLAW
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