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Exceptionally low susceptibility of aerosol cloud-mediated radiative forcing over the Mediterranean Sea

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The susceptibility (S) of cloud radiative effect (CRE) to aerosols is approximated by satellite retrieval of the fractional change of CRE to a similar fractional change of $\ln(N_d)$, where N_d is the cloud drop number concentration [cm^{-3}]. Larger S means larger aerosol cloud-mediated cooling effect with increasing aerosols that can serve as cloud drop condensation nuclei. The full record (2003-2021) of MODIS satellite observations was used to retrieve N_d, cloud fraction (CF), albedo (A) and CRE of boundary layer water clouds over all the world oceans. The susceptibility of CRE over the Mediterranean Sea is found to be exceptionally small compared to the oceans at the same latitude band. The causes for that are:

- Small albedo susceptibility. It is caused by the large background of N_d, which is more than 200 cm^{-3} on average – 3 times compared to the oceans at the same latitude band.
- Small cloud fraction susceptibility especially at the Eastern Mediterranean. It is also caused by the large background of N_d, which suppresses rainfall from shallow clouds that break them up.
- Small occurrences of events of low clouds – less than half compared to the oceans at the same latitude band.
- The occurrence of low clouds is only 1/3 of the occurrence over the oceans at the same latitude band.

The CRE susceptibility is the sum of the already small albedo and CF susceptibilities.

The total aerosol cloud-mediated cooling is very small because it is proportional to the CRE susceptibility multiplied by the very small occurrence of low clouds over the Mediterranean.

The probable root cause for all of this is the smallness of the Mediterranean Sea, which is dominant by advection of dry and polluted air from the adjacent continents all around it.