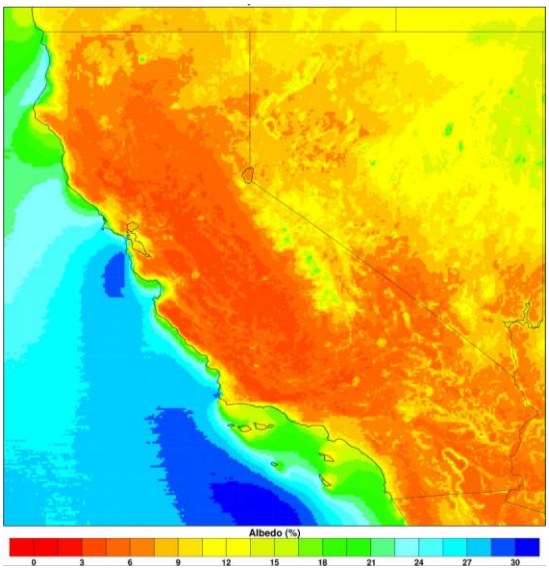
Variability of Coastal California Temperatures Linked to Marine Clouds

A database consisting of surface and satellite measurements reveals the large regional organization of clouds along the California coast and how the variability of this cloud pattern modulates daytime and nighttime temperatures along much of the coast in summer and in winter. This work is funded through the Cooperative Institute for Marine Ecosystems and Climate (CIMEC) and addresses the theme heading of Climate Research and Impacts, and also leverages support from the California Energy Commission.

Background: This work was conducted by researchers at the California-Nevada Applications Program (CNAP) which is part of NOAA's Regional Integrated Systems Assessment (RISA) Program. The results show cloud cover variations are linked to surface air temperature anomalies in California on daily to decadal timescales. For the most part, increased presence of cloud is associated with cooler daytime temperatures and warmer nighttime temperatures. Some regions, especially along the California coast, display a higher sensitivity of temperature to cloud variability than other regions. On seasonal timescales, an increase in cloud frequency of 10% was associated with a daytime temperature decrease of approximately 1.0°C, and vice versa for a cloud frequency decrease.



The average summertime (Jun – Sep) cloud albedo for CA and NV, 1996-2011.

Significance: The frequent stratus clouds are related to a strong low level atmospheric temperature inversion and the relatively cool ocean surface and marine boundary layer below. Cloudiness varies seasonally but also fluctuates from the seasonal average on synoptic, interannual, and decadal time scales. Much of the cloud variation in summer is part of a broader North Pacific cloud pattern. Decadal variations in marine stratus frequency are associated with basin scale climate fluctuations such as the Pacific Decadal Oscillation (PDO). Possible climate change impacts, during the next several decades, on the strength of low-level temperature inversions would be expected to impact the frequency of marine stratus clouds. The results should have broad application, because marine stratus clouds are a very common feature along the California coastal margin, where the majority of California's population lives or works. This research ties directly into NOAA Strategic Goals of working toward a more weather-ready nation and informing society regarding potential climate adaptation and mitigation strategies.

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