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NEWS RELEASE

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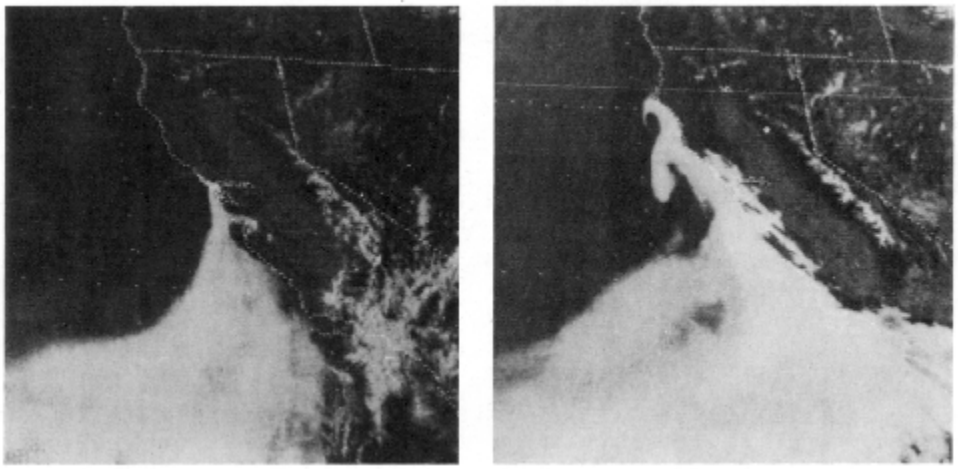
Piercing the Fog: NCAR Scientists Shed Light on a Silent California Threat

December 6, 1996

BOULDER--Using computer models of California weather, three scientists at the National Center for Atmospheric Research (NCAR) in Boulder have successfully replicated the process that causes a narrow tongue of low clouds and fog to surge northward along the state's coast after clearing has occurred. Their findings will help improve the models used in actual forecasting and could lead to better warnings for transportation, defense, and recreation in the coastal zone.



These satellite images reveal the northward progress of a coastal surge of low stratus clouds on 4-5 May 1982. In 24 hours, the surge moved from near Monterey to near Eureka. (Reprinted from Monthly Weather Review, courtesy American Meteorological Society.)

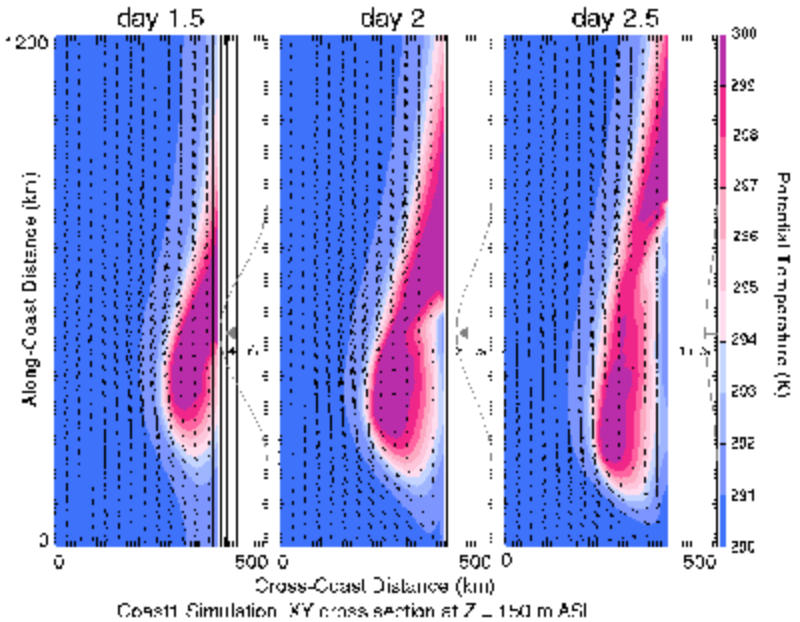
NCAR scientists Joseph Klemp, William Skamarock, and Richard Rotunno will present first results of the modeling on December 19 at the American Geophysical Union's fall meeting in San Francisco. Their paper, "Evolution of Trapped Atmospheric Disturbances along a Coastal Barrier," is part of a session on measurement and modeling of the coastal marine atmosphere. The NCAR modeling was conducted with

support from the Office of Naval Research (ONR) under the Navy's Accelerated Research Initiative.

While fog can occur under a variety of circumstances, the northward-surge phenomenon--especially common in the summertime--has vexed California forecasters for years. The process begins when high pressure noses eastward from the Pacific into Washington, Oregon, and Idaho. This typically produces light east or southeast winds on the California coast. As they descend from the Coast Range, the breezes bring dry, sunny conditions to the shoreline while they push the marine layer (the cool, moist air that extends a few hundred meters above the Pacific) just offshore.

Forecasters can predict the large-scale pressure changes that cause the winds to blow offshore, but they cannot yet reliably tell when the marine layer might return and surge northward to bring overcast or fog. The surges can be less than 100 kilometers (km) wide. The computer models used by present-day forecasters trace the atmosphere at points separated by around 30 to 90 km, a resolution too coarse to fully outline the surges.

Klemp and colleagues used a finer-scale research model in their attempt to depict the surges. Their simulations reveal that when the clearing-fog boundary is displaced a few tens of kilometers offshore, a weak area of low pressure--too small to be detected by coastal weather stations--may form just offshore. As the low circulates air counterclockwise, it wraps moist marine air around its south side and toward the coast. When the marine air reaches the higher terrain along the shoreline, it is forced upward. Clouds and fog may form, along with a small high-pressure center that pushes the air northward. The result is a narrow tongue of cloud pinched between the coastline and the offshore clear zone. The surge can traverse hundreds of kilometers of coastline over a day or two.



A three-dimensional computer model at NCAR produced this simulation of a California coastal surge. The marine layer is depicted by the darker shading, with air temperatures below 294 degrees Kelvin (about 21 degrees Celsius or 70 degrees Fahrenheit). The arrows depict air flow wrapping around a weak low pressure center offshore and surging northward near the coast. (Illustration courtesy William Skamarock, Richard Rotunno, and Joseph Klemp.)

According to the NCAR scientists, the surge's movement up the coast can be characterized as a Kelvin wave, a particular kind of atmospheric feature in which winds blow in the direction of movement of a pressure disturbance. Research computer models tend to handle Kelvin waves skillfully, so this bodes

well for surge prediction efforts.

The NCAR researchers simulated the surge in two and three dimensions with a numerical cloud model run on a Digital Equipment Corporation workstation. The model featured a simplified version of the coast's topography. The scientists' next step is to add sharper resolution to incorporate the bays, inlets, and peninsulas that dot the California coast. The added detail will help the modelers analyze more precisely how the surges develop and move.

"This phenomenon is a tough test for a model," says investigator Rotunno. "Delicate imbalances (in pressure) seem to set it off, and it's too fine-scale to show up in most models. Still, it can produce enough fog to envelop boats and airports."

Researchers at the Naval Oceanographic Institute, the Scripps Institution of Oceanography, and several other universities and laboratories will cover other aspects of coastally trapped disturbances at the AGU meeting. NCAR is operated by the University Corporation for Atmospheric Research under sponsorship of the National Science Foundation.

-The End-

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