

## UNUSUAL LARGE-SCALE PHYTOPLANKTON BLOOMS IN THE EQUATORIAL PACIFIC

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### Abstract\*

Unusual large-scale accumulations of phytoplankton occurred across 10,000 km of the equatorial Pacific during the 1998 transition from El Niño to La Niña. The forcing and *dynamics* of these *phytoplankton blooms* were studied using satellite-based observations of *sea surface height*, temperature and *chlorophyll*, and *mooring*-based observations of winds, *hydrography* and ocean currents. During the bloom period, the *nutricline* was abnormally shallow across the equatorial Pacific. The relative importance of processes that enhanced nutrient flux into the sunlit zone differed between the western and eastern regions of the blooms. In the western bloom region, the important vertical processes were *turbulent* mixing and wind-driven upwelling. In contrast, the important processes in the eastern bloom region were wave-forced shallowing of nutrient source waters directly into the sunlit zone and wind-driven upwelling, among others. *Advection* by the *Equatorial Undercurrent* spread the large bloom 4500 km east of where it began, and advection by north-south currents transported the blooms hundreds of kilometers north and south of the equator. Many processes influenced the intricate development of these massive biological events. Diverse observations and new analysis methods have advanced the framework for understanding complex dynamics and ecology of the equatorial Pacific.

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### Abstract Glossary

**advection:** horizontal transport of water or air

**chlorophyll:** green pigments in plants that facilitate photosynthesis

**dynamics:** the forces and motions that characterize a system

**ecology:** study of how organisms interact with each other and their physical environment

**Equatorial Undercurrent:** a subsurface current flowing eastward along the equator

**hydrography:** measurement of physical characteristics of waters

**mooring:** an anchor or weight, permanently attached to the sea floor, with a buoy going to the surface, used to hold science instruments in place

**nutricline:** depth at which the concentration of nutrients – chemicals whose uptake is essential for phytoplankton – changes dramatically (i.e., nutrients are scarce above; nutrients are plentiful below)

**phytoplankton blooms:** excessive growth of drifting one-celled microscopic plants

**sea surface height:** the distance of the sea surface above a reference surface, often an "ellipsoid" with equatorial radius of 6378.1363 kilometers and a flattening coefficient of 1/298.257

**turbulent:** motion of a fluid having local velocities and pressures that fluctuate randomly