



Catalina Conservancy Divers Thermograph Project

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Catalina lies in Complex Region

Southern California Bight



- Catalina is in the center of the Southern California Bight, surrounded by deep water.
 - Allows us to measure the Bight thermal dynamics.
- The thermographs are on the steep slopes of Catalina Island. Other temperature experiments have been on shallow continental shelves.

What can we learn from temperature?



- Water temperature changes slowly
 - tracer for currents
 - water dynamics
- Driver for currents
 - A temperature gradient can create a current.
- Atmosphere-ocean interactions

Significance of the Dynamics



- Currents and internal waves are transport mechanisms.
 - Nutrients
 - More nutrients may be available than an analysis of yearly variation would suggest.
 - Larvae
 - The distribution and dispersal of benthic organisms about the island is affected.
 - Fish and animal populations
 - Temperature sensitive species may move with the change in temperature. Fish counts may not be representative of the actual fish population.

Experiment Description



- An array of underwater thermographs was deployed and has been maintained around Catalina Island at various depths and sites since 1992.

<u>Site</u>	<u>Location</u>	<u>Depths of Instruments (m)</u>
1	WIES	5, 9, 18, 30
2	Pumpnickel	12
3	Italian Gardens	12
4	Casino Point	12
5	East End	5, 9, 18
6	Little Harbor	5, 9, 18
7	Cactus Bay	5, 9, 18



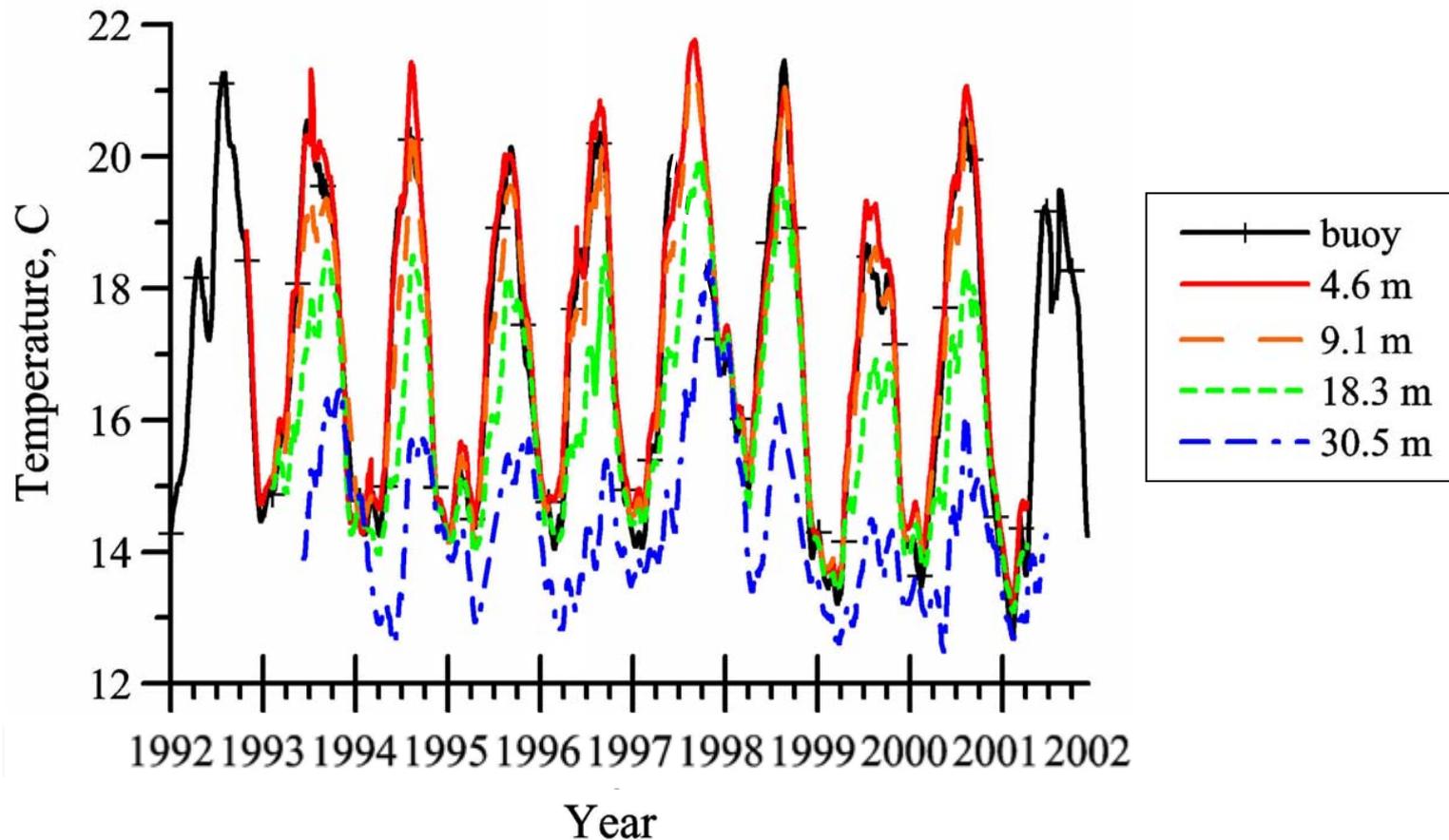
Project Strengths



- The thermograph project is a very long time series (an extremely unique experiment).
 - A long-term variation analysis tells us about:
 - Seasonal changes
 - Depth dependence
 - El Nino events
 - A short-term variation analysis provides information on internal wave dynamics.
- The thermographs are densely spaced horizontally (about the island). This provides additional information about the internal waves and currents.

Long-term Variations

Yearly Variations

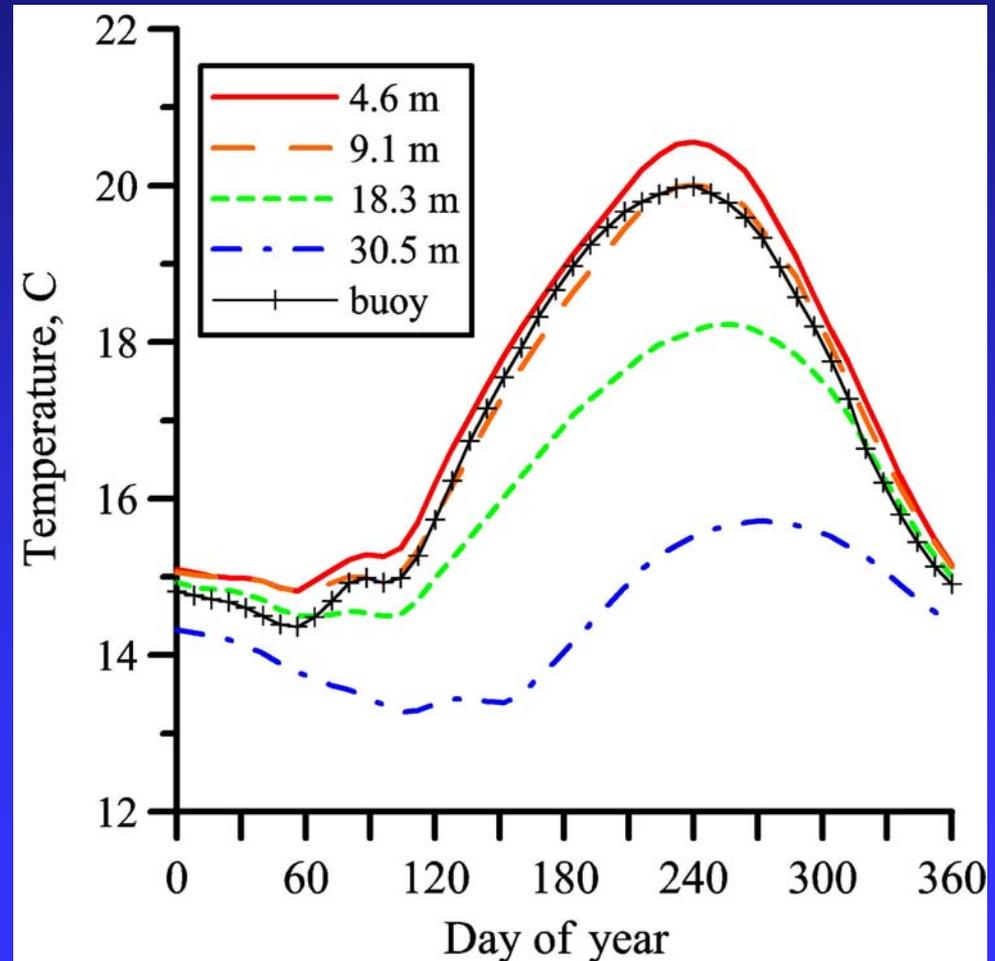


Long-term Variations

Yearly Average



- Daily values from 4 sites averaged over all the years.
- 6° C difference between the surface max and min.
- Maxima and minima have time lags between the depths.
 - **Diffusive process.**
- Subtle increase in temperature in March at all depths.

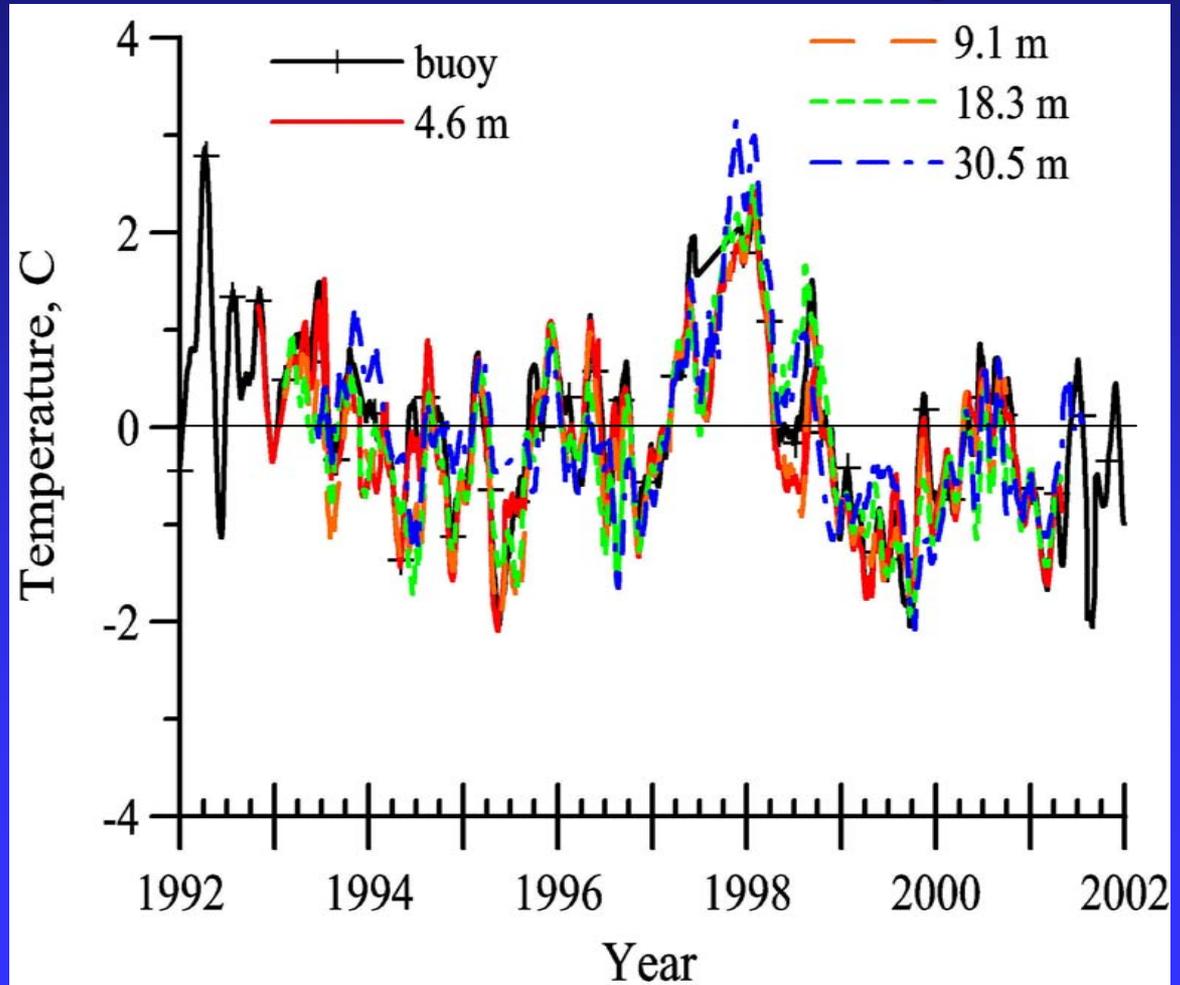


Long-term Variations

Yearly Anomalies



- Yearly Average subtracted from daily temperatures
- 1997-98 El Nino is evident
 - 3° C deviation

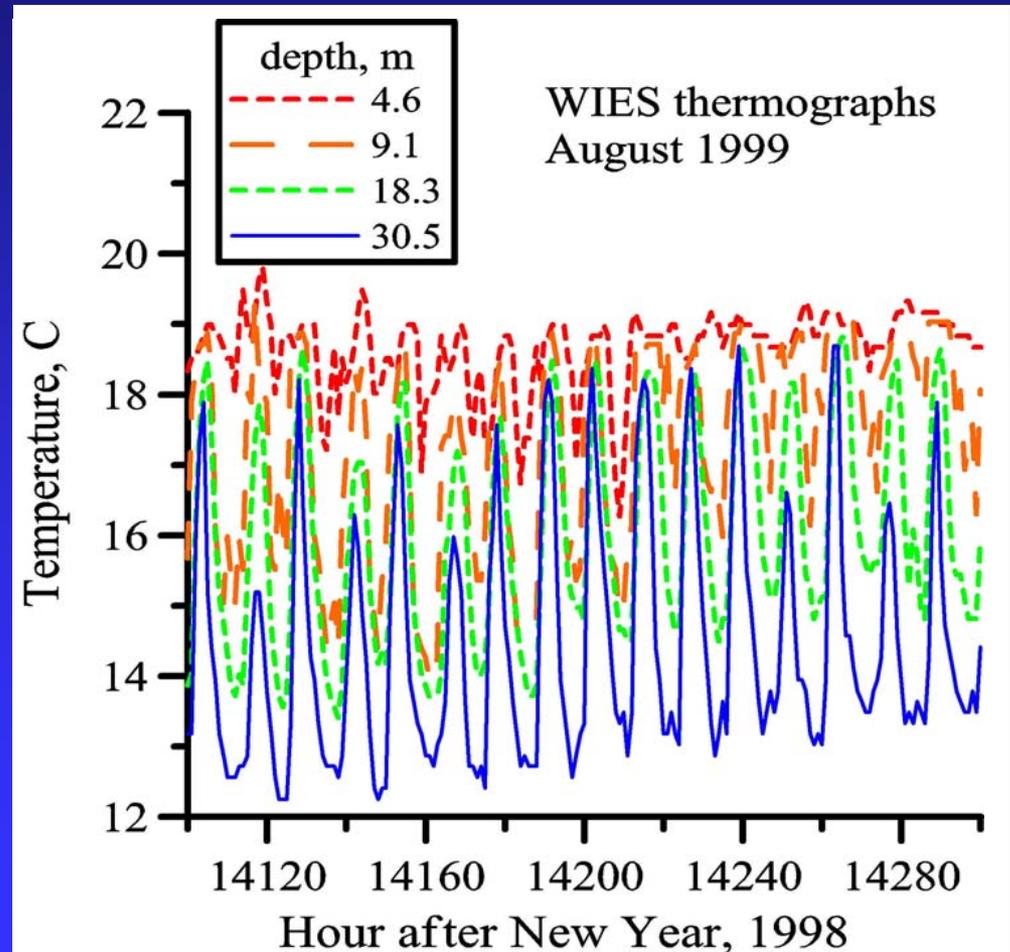


Short-term Variations

Sample 100-Hour Time Series



- A trend of decreasing temperature with depth.
- Cyclic fluctuations that increase in amplitude with depth.
 - 6 C at 30.5 m
 - smaller modulations at 4.6 m
- Major fluctuations have a period of about 12 hours.



Implications



- Internal waves are present.
 - Surface water is being transported to depth.
 - In the summer, water at a deep depth experiences a daily range in temperature equal to its yearly variation.
- Vertical eddies are present. (Topic of the paper currently in review for publishing.)
 - Heat is being transported vertically, from the surface to depth.

Summary



- CCD has maintained a unique thermograph project about Catalina Island.
- Analysis of the data revealed dynamics that are significant to the Southern California Bight.
 - Internal waves
 - Vertical eddy diffusion of heat
- Results may impact the understanding of the marine environment in the Bight.
 - Nutrient availability
 - Larval distribution and dispersion
 - Fish populations