Santa Barbara Channel, CA. Two HABs occurred over the time period of this particular mooring deployment, a toxic *Pseudo-nitzschia australis* bloom and a bioluminescent bloom of *Lingulodinium polyedra* (Figure X.15). In April and May 2003, the *P. australis* bloom resulted in a coast-wide domoic acid event and the demise of several sea lions, dolphins, and birds (G. Langlois, pers. comm.). The *L. polyedra* bloom occurred from late August through early October 2003; termination of the bloom led to a massive fish kill in nearby Ventura Harbor (Scheibe, 2003). Physical, hydrographic, and chemical data help to characterize environmental conditions associated with each HAB. Qualitatively, data suggest that the *P. australis* bloom were associated with higher nutrient conditions whereas the *L. polyedra* blooms were not dependent on nutrients at the surface (see Heaney and Eppley, 1981). Also, while *L. polyedra* blooms indeed occurred during times of stratification, waters were stratified during periods when no blooms were present. Therefore, other factors are necessary for the formation of these nuisance blooms.

The value of bioluminescence as an indicator of developing HAB conditions could be determined using coherence analysis between bioluminescence potential and a marker for *L. polyedra* (e.g., cell concentrations determined from water samples). Threshold values of bioluminescence potential coupled with other optical proxies (e.g., phytoplankton absorption at specified wavelengths) should be determined in order to develop rapid response HAB mitigation strategies, i.e., when threshold values of these parameters are exceeded, HAB investigators are automatically alerted by the web-based data management system. Then, adaptive sampling (whole water sample collection, increased sampling rates, etc.) can commence and responsible authorities notified.

Complementary shipboard sampling and advanced data analyses (e.g., statistical analyses outlined above) methods can also aid in the quantification of these HAB dynamics. Cross-shelf wind and current velocity and temperature measurements (transected using an AUV, glider, or ship) could have helped determine whether coastal upwelling was related to these blooms. Maps of current velocity (using HF radar) and additional hydrography data could have enabled the observation and quantification of advection and/or freshwater inputs.

Figure X.14
Time series of (a) temperature collected at about every meter from near surface to 22 m and (b) derived nitrate concentration at 22 m (following McPhee-Shaw et al., 2004) from 20 May to 2 October 2003. Remote sensing reflectance spectra computed from hyperspectral radiometer data during (c) a *Pseudo-nitzschia australis* bloom (until 30 May), (d) conditions not affected by HABs (14-24 July), and (e) a bloom of *Lingulodinium polyedra* (from 30 August to 7 September and again from 17 September to 2 October). Data were collected on a mooring in the Santa Barbara Channel (25 m water depth). The remote sensing signals during the times of the *L. polyedra* bloom are different from conditions not affected by HABs; this shows promise in using optics for detection and identification of HABs.

Figure X.15