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The strongest El Nino-Southern Oscillation (ENSO) event of the last century was accompanied by anomalous conditions in the Indian Ocean which had historic regional climatic impacts. The debate continues about whether these zonal modes in the Indian Ocean (IOZM) need an external trigger or can be initiated internally within the Indian Ocean. An ocean GCM coupled to an advective atmospheric mixed layer model and forced with NCEP reanalyses winds for the period of 1949-2001 is employed to analyze each IOZM event to understand their preconditioning, onset, and growth phases with respect to ENSO events. The composite analyses of the weak, strong, and aborted IOZM events clearly demonstrate that the atmospheric circulation changes associated with the onset of ENSO events in the Pacific are crucial for triggering the initial anomalous cooling off Java after which the coupled IOZM events can grow. The MJO activity and the Indonesian throughflow also play crucial roles not only in preconditioning the Indian Ocean but also in the growth phase. The ENSO-IOZM interactions underwent interdecadal changes centered around 1976, the well known climate shift. The details of the intercomparisons of the IOZM events and the mechanism of the ENSO trigger for each event is presented including the role of the 1976 shift on IOZM.

OS11M-08 1035h

Roles of the Indian Ocean in decadal ENSO variations

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The fundamental physical processes that give rise to El Nino-Southern Oscillation (ENSO) are believed to be within the tropical Pacific. However, climate features external to the tropical Pacific may be capable of affecting ENSO behaviors. In this study, we perform experiments with a coupled atmosphere-ocean GCM (CGCM) to examine the roles of the Indian Ocean-Monsoon system in the decadal modulation of ENSO. In the control simulation, the oceanic component of the CGCM includes only the tropical Pacific Ocean (i.e., the Pacific Run). In the second CGCM simulation, both the Indian and Pacific Oceans are included in the ocean model component (i.e., the Indo-Pacific Run).

Our CGCM experiments show that the Indian Ocean-Monsoon system can modulate the amplitude and frequency of ENSO and produce interdecadal ENSO variations. The strong and weak ENSO decades are very different in their thermocline depths and Walker circulation strengths. In this talk, we will examine the major differences between the strong and weak ENSO decades in their atmospheric and oceanic mean states. Focus will be placed on the relative importance of the Indonesian throughflow and Asian Monsoon variation in allowing the Indian Ocean to affect decadal ENSO variations.

OS11M-09 1050h

How Does the Indo-Pacific Region Affect the Interannual Variability of the Tropical Oceans?

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The influence of anomalous conditions in the tropical Indo-Pacific region on the interannual variability in the tropical Indian Ocean is investigated both in observations and a series of numerical simulations. The simulations have been carried out with a coupled atmosphere-ocean model at different resolutions and an ocean only general circulation model which appear to reproduce realistic modes of variability of the tropical oceans. Evidence of significant correlations between wind anomalies in the Indonesian throughflow region and sea surface temperature anomalies in the tropical Indian and Pacific Oceans have been found both in observations and simulations. Our studies suggest a possible role of the Indo-Pacific region in the onset of interannual variability in both the tropical Indian and Pacific Oceans. The role of air-sea coupled processes and upper ocean dynamics on the evolution of the Indian Ocean interannual varibility is also investigated.

OS11M-10 1105h

Remote Response Of The Indian Ocean To Interannual SST Variations In The Tropical Pacific

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Coupled model experiments are used to investigate Indian Ocean SST variability associated with ENSO via an "atmospheric bridge". An ensemble of 16 atmospheric general circulation model (AGCM) simulations are performed in which observed SSTs are specified in the central and eastern tropical Pacific Ocean over the period 1950-1999. The remainder of the global oceans are simulated using a grid of 1-dimensional mixed layer models

Composites of SST and surface fluxes for warm and cold ENSO events for the period 1950-1999 are formed. The coupled model simulates some aspects of the observed Indian Ocean SST anomalies associated with ENSO including the basin-wide warming and development of a zonal dipole structure in Northern autumn. Surface flux anomalies associated with ENSO in the eastern tropical Indian Ocean agree with NCEP reanalysis fluxes reasonably well. AGCM and coupled model experiments suggest that a large portion of surface flux amomalies in the eastern tropical Indian Ocean associated with ENSO is remotely forced by the SST variation in the eastern tropical Pacific. The remotely forced SST in the eastern tropical Indian Ocean significantly contributes to the dipole variation.

OS11M-11 1120h

The Roles of Rainfall and High Frequency Wind on the Interannual Variability of the Indian Ocean-Atmosphere Climate

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The roles of rainfall and high frequency wind on the interannual variability of the Indian Ocean-Atmosphere Climate are examined with data (XBT temperature profiles, TOPEX sea level, AVHRR SST, FSU or Quickscat wind stress, and GEWEX rainfall) and a nonlinear reduced-gravity thermodynamic model forced by observed atmospheric conditions. In the control run (CR), the ocean is forced with FSU interannual monthly winds over 1980-2000 and climatological monthly rainfalls. In experiment R, wind remains unchanged, but rainfall is prescribed to their interannual monthly values observed over 1980-2000. Results show that the interannual anomaly in salinity-rainfall has a major impact on the surface and subsurface temperature distribution. The simulated SST in experiment R is in much better agreement with the observed SST. However, the amplitude of SST anomalies is smaller than the observed. One possible explanation is that the monthly averaging of wind and rainfall is inappropriate. This possibility is examined over 1999-2000 by experiments Q and RQ, where the daily wind variability observed by Quickscat is superimposed on FSU monthly average of experiments CR and R. Because of the nonlinear nature of the mixing induced by wind and rainfall, this study highlights the role of high-frequency processes in the Indian Ocean climate.

OS11M-12 1135h

Anomalous Surface Currents in the tropical Indian Ocean

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An anomalous climate event occurred in 1997 in the Indian Ocean with severe consequences for the surrounding continental areas. In response to an intensification of the trade winds, a westward gradient of SST and an anomalous reversal of the eastward surface currents with peak velocity anomalies exceeding 1 m/s were evident in the boreal autumn. A similar but weaker event took place in 1994. In this study we examine the observational record during the 1990s including surface drifter velocities, SST and altimeter sea level to confirm these dramatic changes. We examine the key momentum balance between wind-induced momentum flux and the pressure gradient force as well as the important role of horizontal temperature advection in the mixed layer heat response.

URL: http://www.meto.umd.edu/~senya/HTML/io_vel/io_vel.html

MON

OS11N HC: 323 A Monday 0830h

Low-Latitude Boundary Currents

Presiding: **T Qu,** University of Hawaii**; R Lukas,** University of Hawaii

OS11N-01 0830h INVITED

Pacific Low-Latitude Western Boundary Currents

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Recent observational and modeling studies on the Pacific low-latitude western boundary currents and their connection to the Indian Ocean are reviewed. The topics include the water mass characteristics, the current structure and their effects on the global thermohaline circulation, determination of the currents using inverse method and numerical modeling.

OS11N-02 0850h

Variabilities of the New Guinea Coastal Current and Undercurrent

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The seasonal and interannual variabilities of the New Guinea Coastal Current (NGCC) and the New Guinea Coastal Undercurrent (NGCUC) were examined based on the 3-5 year-long time series of current data from subsurface ADCP moorings and hydrographic data from the ship. The change of the Antarctic Intermediate Water (AAIW) was also discussed. As seasonal reversal of the surface NGCC was clearly observed. In boreal summer characterized by the southeasterly monsoon, northwestward current was dominant in the surface layer. At that time, the warm low-salinity layer thickened and sloped down toward the New Guinea coast from the equator. That surface water accumulation may be caused by onshore Ekman drift at the New Guinea coast, combined with weak Ekman upwelling at the equator. In the boreal winter, southeastward surface current developed extending down to 100 m depth in response to the northwesterly monsoon. Coastal upwelling was indicated in that season and the surface water accumulated at the equator due to Ekman convergence. Year-around northwestward NGCUC whose core speed was about 60 cm/s was observed around 200 m depth, and apparently intensified in boreal summer. The characteristics of the AAIW around sigma-theta = 27.2 in that region also varied seasonally, as the temperature and salinity of the AAIW in boreal summer were lower than those in boreal winter. The water mass change was consistent with the variability of the NGCUC, as the intensified NGCUC in boreal summer could advect much volume of the AAIW from the source region. The seasonal change of the NGCUC was mainly induced by basin scale wind change. It was because the time series of volume transport at the western boundary, which were estimated from Sverdrup flow based on the basin scale wind field, correlated highly with the time series of depth averaged NGCUC. The most significant feature in the ENSO time scale was that the reversal of surface current disappeared in the boreal winter from late 1997 to early 1998 in the height of the strongest El Nino on record, and the southwestward current from surface to the NGCUC core depth dominated. The NGCUC core depth coincided with the salinity maximum layer of the south Pacific tropical

water, thus the variabilities of the NGCUC may have a large effect on the salinity distribution in the warm pool in the northern hemisphere.

OS11N-03 0910h INVITED

The Role of the North Brazil Current and its Rings in the Atlantic Thermohaline Circulation

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The North Brazil Current (NBC) is a major western boundary current in the Atlantic Ocean that transports waters northward across the equator. Within the context of the general circulation it plays a dual role, first in closing the wind-driven equatorial gyre in the Atlantic, and second in providing a conduit for interhemispheric warm water transport as part of the large scale meridional overturning circulation. The presentation will focus on the role of the NBC primarily in the latter context and how this flow interacts with the wind-driven circulation in the low-latitude Atlantic. The presence of the northward thermohaline flow in the basin dramatically alters the western boundary current system that would be expected from wind-stress distributions, and modifies both the magnitude of the transports and the location of gyre boundaries. Two areas will be specifically highlighted: (1) the region just north of the equator where the NBC attains its maximum transport from the combined wind and thermohaline contributions and has its largest seasonal cycle, and (2) the termination region of the NBC where it sheds large anticyclonic rings that propagate northwestward toward the Caribbean Sea. Recent observations and model results in these regions are reviewed to illustrate what is known about the mean transports, pathways, and low-frequency variability of the NBC. New results on ring formation rates, structures, and ring transports from the recently-completed North Brazil Current Rings Experiment will also be presented. These new results suggest that NBC Rings may account for an annualized transport of as much as 8 Sv of South Atlantic waters into the North Atlantic, which is about twice as much as previously thought, and nearly half the total strength of the Atlantic overturning circulation.

OS11N-04 0930h

Energetic Deep Currents Observed East of Mindanao

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Two cruises of the JAMSTEC ship Kaiyo, during October 1999 and September 2000, included lowered acoustic Doppler current profiler (LADCP) measurements to 2000 m depth on zonal sections extending east from the Mindanao coast. On the second cruise, the LADCP profiles were augmented by shipboard ADCP profiles to 1000 m from a new 38-kHz phased array instrument (model OS-38 made by RD Instruments). All zonal sections (7°N, 8°N, 10°N) showed southward flow along the coast extending to at least 2000 m depth. Although the Mindanao current in the upper 500 m forms a continuous narrow stream along the coast, the deeper southward flow appears to be part of a set of deep eddies within 300 km of the coast; northward flow was found 100–200 km offshore during both cruises. Currents mapped by the shipboard ADCP on the second cruise indicate that cyclonic eddies were centered near 7.5°N, 128°E and 10.2°N, 127°E. Maximum speeds of 0.5 m s^{-1} were observed at 800 m depth on the 10°N section, and speeds of 0.2–0.3 m s^{-1} were found at 2000 m.

OS11N-05 0945h

Mooring observation of the Mindanao Current

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Mooring observation using an upward ADCP with a frequency of 150kHz (depth: 260m) and two recording current meters (depths: 400m and 700m) was conducted from October 1999 to September 2000 near the Mindanao Coast (6-50N, 126-43E) in order to observe current variability at the axis of the Mindanao Current. This current is very strong. Its maximum instantaneous speed exceeded 2.0m/s above 100m depth. Averaged velocity above 250m depth also exceeds 1.0m/sec and there is a subsurface velocity maximum of >1.4m/sec around 100m depth. However, current speed is week at 400m depth (about 20cm/sec), and averaged velocity at 700m depth is nearly zero, that is, the Mindanao Current does not reach at 700m depth and steady northward current (Mindanao Undercurrent) was not found at this location and depth. Comparing large averaged velocity, variability is small (standard deviation is smaller than 20cm/s above 250m depth) and this current seems very stable above subsurface layer. Intraseasonal variability around 40 to 50 days is also seen with an amplitude of 10–15 cm/sec. Seasonal variability seems the same order as the intraseasonal variability and current velocity was large during boreal summer.

OS11N-06 1000h

Variation of the Mindanao Current Transport During 1997-2000 Estimated From TOPEX/Poseidon Data and an OGCM

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The Mindanao Current (MC) plays an important role in the tropical-subtropical exchange in the North Pacific. This study investigates its transport variation during 1997-2000 using a product generated by assimilating TOPEX/Poseidon-derived sea level data into a near-global OGCM (available at http://eyre.jpl.nasa.gov/las/). Sea level data imply a stronger surface flow along the MC in 1997 than in 1998-2000. The estimated annual-mean MC transport at 10°N decreases from 22 to 12 Sv (1 Sv = 10^6 m^3/s) from 1997 to 1998, and remain to be smaller than that in 1997 through the years of 1999 and 2000. This is found to be caused by a similar interannual variation in the transport of the North Equatorial Current (NEC) in the western part of the basin. This change in NEC transport is consistent with the variation of wind stress curl as a result of the meridional shift of the Intertropical Convergence Zone associated with the 1997-2000 ENSO event. Effects of the interannual variation of the MC transport on the equatorial Pacific and tropical Indian Ocean are also highlighted.

URL: http://ecco.jpl.nasa.gov/odap/html/index.html

OS11N-07 1035h

Seasonal Bifurcation of the North Equatorial Current in the Pacific

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A new climatology using historical temperature and salinity data in the western Pacific is constructed to examine the bifurcation of the North Equatorial Current (NEC). Integrating dynamically calculated circulation from the sea surface to 1000 m and combining it with surface Ekman transport, we show that the bifurcation of the NEC occurs at the southernmost position (14.8°N) in July and the northernmost position (about 17.2°N) in December. This annual signal lags behind the seasonal meridional migration of the zero zonally integrated wind-stress-curl line by 4-5 months, but corresponds surprisingly well with the local Ekman pumping associated with the Asian monsoon winds. The bifurcation latitude of the NEC is depth dependent. On the annual average, it shifts from about 13.3°N near the surface to north of 20°N at depths around 1000 m. There is a time lag of 1-2 months from the sea surface to the subsurface (300-700 m) for the annual cycle. Below 700 m, the bifurcation of the NEC approaches as far north as 22°N during the northeast monsoon (November-January), and as a result, an anomalous transport of subtropical water is shown to flow equatorward along the western boundary. The bifurcation of the NEC below 700 m becomes unrecognizable when the prevailing wind is from the southwest (June-August).

OS11N-08 1050h

Bifurcation of the Pacific North Equatorial Current From Model Simulations and Re-analysed Hydrography

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In the western Pacific the North Equatorial Current bifurcates into the northward flowing Kuroshio and the southward flowing Mindanao Current. The bifurcation latitude is about 14°N on average, but varies with depth and with the seasons. Recent analysis of observations shows that the bifurcation latitude increases with depth to about 500 m. During the northern summer and winter the bifurcation latitude is shifted equatorward and poleward respectively. Wind-driven layer models as well as general circulation models show similar changes in bifurcation latitude, and the model flows are discussed in detail and compared to the observations.

OS11N-09 1105h

Simulated Seasonal and Interannual Variations of the Mindanao Dome and the Western Tropical Pacific

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The Mindanao Dome (MD) is a cold cyclonic circulation composed of the NEC in the northern flank, the MC in the western flank, and the NECC in the southern flank. Using a high-resolution OGCM of the Pacific Ocean forced by the daily NCEP/NCAR reanalysis data from 1979 to 1997, we analyze the seasonal and interannual variations of the MD in the Western Tropical Pacific. The model result is consistent with various observational data in terms of the heat content along 137?E, synoptic current patterns, and transport variations of western Pacific low-latitude currents.

From the present study, we have proposed a new scenario for the seasonal variation of the MD. It is the interaction between the local seasonal cycle and the basin-scale seasonal cycle that determines the evolution of the MD. The MD is generated by local Ekman upwelling as the positive curl of the Asian winter monsoon increases over the western tropical Pacific, as discussed in the literature (Masumoto and Yamagata, 1991). It is shown, however, that the MD decays owing to the Pacific basin-wide annual cycle; the warm anomaly that propagates from the eastern tropical Pacific plays an important role in the attenuation of the MD. Thus, in order to understand the mechanism even for the seasonal variation of the western tropical Pacific including the MD, we need to take into account the whole Pacific basin. Since the interannual variation of the MD is also governed by changes in the local Ekman pumping and the remotely forced downwelling, we emphasize that the understanding of the seasonal cycle is very important in understanding the interannual variation.

OS11N-10 1120h

Dynamics of Pacific Low-Latitude Western Boundary Currents and Climate Change

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Pacific low-latitude western boundary currents (LLWBCs) potentially play a significant role in a wide

spectrum of climate phenomena. However, spatially and temporally sparse observations prevent us from completing a zero-order description of the Pacific LLWBCs. Thus models play a crucial role in the elucidation of the interplay between changes in LLWBCs structure and large scale climate.

Changes in the dynamics of the Pacific LLWBCs are explored using an intermediate resolution version of the Geophysical Fluid Dynamics Laboratory Modular Ocean Model 3 with an optimal interpolation scheme for assimilation of surface and subsurface temperature data. The model is forced with bias corrected weekly reanalysis winds from the National Center for Environmental Prediction (NCEP). This correction varies spatially, with largest differences in tropics, but does not vary in time. SST is damped to NCEP weekly values and the sea surface salinity is damped to monthly mean climatology from the Comprehensive Ocean Atmosphere Data Set with a damping time scale of 21 days. The model was spun up for 20 years using climatological winds and then run from 1948 to 2000.

In this study we address the question of how the fluctuation of volume, heat transport, and bifurcation latitude of the North Equatorial Current and the South Equatorial Current, the major upper ocean zonal flow suppliers of the Pacific LLWBCs, influence climate on both interannual and decadal time scales. A number of previous studies stress the influence of Northern Hemisphere water anomalies that reach the western boundary due to the presence of the atmospheric Inter-Tropical Convergence Zone which creates a potential vorticity barrier. However, we find that Southern Hemisphere anomalies that reach the western boundary have more impact because those in the Northern Hemisphere weaken relative to the Southern Hemisphere before reaching the western boundary. Additionally, most of the thermocline flow from the south, which contains significant anomalies, retroflects eastward into the Equatorial Undercurrent and the northern Subsurface Countercurrent with an impact on Tropical Pacific climate.

OS11N-11 1135h

Surface water mixing in the Solomon Sea as documented by a high-resolution coral-14C record.

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A bi-monthly coral-based record of the post-bomb radiocarbon content of Solomon Sea surface waters is interpreted to reflect mixing of subtropical surface water and that advected in from the east by the equatorial branch of the South Equatorial Current (SEC). Annual mean D14C has a dynamic range of nearly 175per mil, with a total range of nearly 200per mil. Pre-bomb values average -56per mil and the annual mean post-bomb maxima occurs in 1985 with a value of +117per mil. Interannual variability in the record reflects surface current variations in conjunction with surface wind changes associated with ENSO. During El Nino years the waters of the Solomon Sea reflect a stronger influence of waters advected in from the east by the SEC and less "pure" subtropical water. This is most likely accomplished by a southward shift of the SEC during El Nino. There is an overall decrease in the relative proportion of eastern tropical water which could be interpretted to reflect a decrease in the strength and intensity of upwelling in the eastern Pacific. Our observation of decreasing upwelling tends to support the contention that there is a bias in the observed wind field products.

OS11N-12 1150h

The Indian Ocean STC from the SODA model and observations

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From observations of western boundary cross-equatorial flow by the Somali Current, from upwelling off Somalia and Arabia and from southward Ekman return flow the intensity of the cross-equatorial shallow thermohaline cell of the Indian Ocean is estimated at about 7Sv. These observations are compared with the output of the Simple Ocean Data Assimilation (SODA) model of Carton et al. (2000), which is based on assimilations of SST and T/P altimetry. Estimates of subduction in the southern hemisphere and upwelling in the northern hemisphere, as well as transport sections are studied to discuss sources, pathways and sinks of the Indian Ocean STC and its interannual variations.

OS11O HC: 316 C Monday 0830h

Coupled Biophysical Processes, Fisheries Resources, and Climate Variability in Coastal Ecosystems of the Northeast Pacific Ocean I

Presiding: **F B Schwing,** Pacific Fisheries Environmental Laboratory**; S E Allen,** Dept. of Earth and Ocean Sciences, University of British Columbia

OS11O-01 0830h

Mixed Layer Depth Variability on Decadal and Interdecadal Scales in the Northern Gulf of Alaska

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The mixed layer depth (MLD) in the North Pacific controls the vertical flux of nutrients into the euphotic zone and hence affects the biological productivity there. A time series of hydrographic measurements, temperature and salinity versus depth, at a coastal site in the northern Gulf of Alaska is used to determine the seasonal and interannual variations of the MLD from 1974 through 1998. This station, GAK 1 (59^{o}50.7'N, 149^{o}28.0'W), is in 263 m of water. Seasonal and interannual variations of the GAK 1 temperatures and salinities reveal 1) a possible coupling between salinity, density and freshwater discharge and 2) a strong coupling between temperature and Pacific Decadal Oscillation (PDO) and the Southern Oscillation Index (SOI). The environmental parameters or physical forcing can be separated according to their dominant periods of variation; 1) seasonal, 2) El-Niño – Southern (ENSO) periods of less than 10 years or 3) decadal periods. The hydrographic parameters primarily have seasonal variations. However, they also have ENSO periods, though the deep waters, in addition, have significant interdecadal variations. The upwelling index has seasonal variability and approximately equal contributions from ENSO and interdecadal variability, while freshwater discharge variations have seasonal, ENSO and decadal periods.

The MLD changes seasonally from about 50 m in summer to more than 130 m in winter. These changes are in response to the seasonal variations in the wind stress, solar heating, precipitation, and freshwater discharge. The 25 years of hydrographic data also allow the determination of interannual variations in this MLD. The MLD trend over this period is for a slight increase in the MLD that is not statistically significant. This is in contrast to previous studies which found a significant shoaling of the MLD in the central region of the Gulf of Alaska (Ocean Station P, 50^{o}N, 145^{o}W). This difference in the response of the marine system is consistent with an increase in the circulation of the Alaskan Gyre with enhanced upwelling in the central gulf (Ocean Station P) and enhanced downwelling along the coast (GAK 1).

OS11O-02 0845h

Trends and Change Points in the Subsurface Temperatures of the California Current System

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State-space models are used to examine long-term trends, nonorthogonal common trends, and significant climate-driven change points in a set of subsurface temperature time series representing the meridional and offshore extent of the California Current System (CCS). We use global one-degree summaries from the World Ocean Database at 11 locations and 10 standard depths in the upper 200 m for the period 1948-94. Four common trends account for most of the total variance and the important time-dependent features of the temperature series. The first common trend, essentially a weighted mean of the series, reveals a series-long warming tendency at all locations, with the greatest changes occurring at 50 m (75 m) depth for the coastal (offshore) stations. Superimposed on the long-term warming trend are a number of interannual fluctuations, most associated with El Niño and La Niña events. Weights for the second and third common trends clearly separate the study area in the offshore and meridional directions, respectively, while the fourth common trend separates the series by depth. Many of the features and change points described by the first common trend are also seen in the second common trend, but accentuated at coastal locations and mitigated offshore. In particular, the rapid warming seen around the 1976 regime shift in the first common trend appears to be an acceleration of a warming trend that began several years earlier. The third common trend, with weights greatest in the thermocline, features maxima during strong El Niño years, thus accentuating these events at southern latitudes (and in the thermocline) but neutralizing their signal north of 40^{o}N. The depth-dependent effect of the fourth common trend reveals a gradual warming of the thermocline prior to 1983 followed by a cooling trend, leading to increased thermal stratification in the CCS. We use these results to speculate on the nature and causes of regime shifts and variable ENSO responses in the Northeast Pacific, and on their biological consequences.

OS11O-03 0900h INVITED

Decadal Regime Shifts in the North Pacific: Physical Mechanisms and Ecological Consequences

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In recent years, researchers trying to document and understand the impacts of climate variability on north Pacific marine ecosystems have witnessed exceptional environmental extremes. One of the strongest El Niño events on record, in 1996-97, was followed by a strong La Niña in 1998. The transition between these events was by many measures the most dramatic and rapid episode of climate change in modern times. For example, ocean temperatures off central California fell by nearly 10^{o}C in less than two years. Within the context of these El Niño and La Niña events, a longer-term climate shift in late 1998 or early 1999 produced striking anomalies in environmental conditions. Many of the atmospheric and oceanic anomalies that developed at this time have remained to the present. These also bear strong resemblance to anomaly patterns associated with previous decadal-scale climate regimes (e.g., before 1976). This new physical state seems to have translated into substantial alterations in marine populations at all trophic levels. As with many oceanic changes, reports of shifts in living marine resources first drew attention to this period as a regime shift. Atmospheric and oceanic anomalies prior to and during this regime shift will be described, with an eye toward how this particular period might be similar to, or differ from, previous documented regime shifts, as well as major El Niño and La Niña events. Possible mechanisms responsible for this shift, and their geographic sources, will be discussed. Another focus will be on biological changes observed in the north Pacific in 1998 that may be related to this regime shift. At a minimum, we have learned that marine ecosystems can respond to environmental change in a surprisingly swift and dramatic way.

OS11O-04 0925h

Climate Variations in the Northeast Pacific: Dynamic Similarities and Links to the Northwest Atlantic

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