ATS/CIRA Colloquium

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Why does SST in the equatorial Pacific cold tongue exhibit a seasonal cycle when the atmosphere heats the ocean year round?

Hosted by Steve Rutledge and Elizabeth Thompson

Friday, October 11, 2013

ATS room 101; Discussion will begin at 11:15am
Refreshments will be served at 10:45am in the weather lab

Sea surface temperature (SST) is a critical control on the atmosphere, and numerical models of atmosphere–ocean circulation emphasize its accurate prediction. Yet many models demonstrate large, systematic biases in simulated SST in the equatorial 'cold tongues' (expansive regions of net heat uptake from the atmosphere) of the Atlantic and Pacific oceans, particularly with regard to a central but little understood feature of tropical oceans: a strong seasonal cycle. The biases may be related to the inability of models to constrain turbulent mixing realistically, given that turbulent mixing, combined with seasonal variations in atmospheric heating, determines SST. In temperate oceans, the seasonal SST cycle is clearly related to varying solar heating; in the tropics, however, SSTs vary seasonally in the absence of similar variations in solar inputs. Turbulent mixing has long been a likely explanation, but firm, long-term observational evidence has been absent. Here we show the existence of a distinctive seasonal cycle of subsurface cooling via mixing in the equatorial Pacific cold tongue, using multi-year measurements of turbulence in the ocean. In boreal spring, SST rises by 2 kelvin when heating of the upper ocean by the atmosphere exceeds cooling by mixing from below. In boreal summer, SST decreases because cooling from below exceeds heating from above. When the effects of lateral advection are considered, the magnitude of summer cooling via mixing (4 kelvin per month) is equivalent to that required to counter the heating terms. These results provide quantitative assessment of how mixing varies on timescales longer than a few weeks, clearly showing its controlling influence on seasonal cooling of SST in a critical oceanic regime.

Link to colloquium videos and announcement page: http://www.atmos.colostate.edu/dept/colloquia.php