Abstract View

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Toward a Physical Explanation of the Seasonal Dynamics and Thermodynamicsof the Gulf of California

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ABSTRACT

The annual component of the horizontal heat flux $\mathcal{F}^x$ is calculated from the temperature advection by the geostrophic velocity. This estimate of $\mathcal{F}^x$ is in good agreement, in amplitude and phase and as a function of the distance x to the head, with that calculated from the difference between the surface heat flux $\mathcal{Q}$ and the local heating, that is, from $\partial\mathcal{F}^x/\partial x = \mathcal{Q} - \partial\mathcal{H}/\partial t$, where $\mathcal{H}$ denotes the heat content.

Sea level η variations are well correlated with those of $\mathcal{H}$, while the surface velocity $u_{\rm surf}$ (which can be calculated from the difference of η between both coasts) is well correlated with $\mathcal{F}^x$. The proportionality coefficients between (η, $\mathcal{H}$) and between ($u_{\rm surf}$, $\mathcal{F}^x$) correspond to what is expected for a dominance of the first baroclinic mode, in spite of the inhomogeneity of the gulf's topography.

A linear one-dimensional two-layer model is enough to reproduce the observations of the transversely averaged (η, $\mathcal{H}$, $u_{\rm surf}$, $\mathcal{F}^x$) fields at the annual frequency. Most of the dynamics and thermodynamics are controlled by the Pacific Ocean, which excites a baroclinic Kelvin wave at the mouth of the gulf. Wind drag produces a slight slope in η, whereas $\mathcal{Q}$ causes a local heating of the upper layer; both surface forcings have a small effect on $u_{\rm surf}$ and $\mathcal{F}^x$.

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