Geophysical Research Abstracts
Vol. 14, EGU2012-11072, 2012
EGU General Assembly 2012

Northern Hemisphere Atmospheric Transient Eddy Fluxes from the MERRA and Their Co-variability with Ocean Frontal Variability near the Western Boundary Current Regions

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Time series of winter (January-March) meridional transient eddy heat and moisture fluxes (<v'T'> and <v'q'>) for 1979-2009 in two separate frequency bands, i.e. the synoptic (2-8 days) and intra-seasonal (8-90 days), are calculated for the whole Northern Hemisphere based on daily atmospheric variables from the NASA Modern Era Retrospective-analysis for Research and Applications (MERRA) at 1/2 degrees latitude by 2/3 degrees longitude resolution. The climatological mean transient eddy fluxes in two frequency bands exhibit markedly distinct spatial patterns. The synoptic transient eddy fluxes show storm-track variability, of which maxima are co-located with the Gulf Stream and the Kuroshio-Oyashio Extensions, respectively in each basin. On the other hand, the intra-seasonal transient eddy fluxes exhibit maxima co-located with the major orography, e.g. the Rockies. In a vertically and zonally integrated poleward heat transport sense, the maximum heat transports in the two frequency bands are similar, while the sensible heat fluxes are twice greater than the latent heat fluxes.
In addition, co-variability between the meridional transient eddy heat and moisture fluxes and their divergence in the Northern Hemisphere atmosphere and the variability in the position of ocean fronts associated with the Kuroshio Extension, Oyashio Extension and Gulf Stream is examined with a focus on the interannual to decadal time scale. Statistically significant correlations are found between the <v'T'> as well as <v'q'> and the ocean fronts from the surface up to 250 hPa for all three ocean fronts. The co-variability explains approximately half of the interannual and longer variance in the synoptic band, while only $\sim$20 % for the intra-seasonal band.