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WAVELET ANALYSIS OF SATELLITE IMAGES IN OCEAN APPLICATIONS

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A two-dimensional wavelet transform is a very efficient bandpass filter, which can be used to separate various scales of processes and show their relative phase/location. A feature tracking procedure based on wavelet transform has been developed and used for image processing at NASA Goddard Space Flight Center for the past several years. The two-dimensional Gaussian wavelet has been applied to satellite images for coastal monitoring (e.g. oil spills) and for ice edge and ice floe tracking from synthetic aperture radar (SAR), ocean color, and infrared (IR) data. However, SAR is valuable for feature tracking due to the fine spatial resolution of the data, but its less than daily coverage may be a serious problem for some ocean applications. A similar technique of wavelet analysis for scatterometer and radiometer data has been developed to obtain daily sea ice drift information in the Arctic region. This technique provides improved spatial coverage and better temporal resolution over techniques utilizing data from SAR. From low earth orbits, ocean surface feature tracking analyses have always been based on data from a single orbital sensor collected over the revisit interval of a single satellite. For the first time, ocean surface layer currents have been derived by wavelet feature tracking of ocean color data from different sensors on different satellites. Ocean color data can be used as a tracer for measuring ocean surface layer currents, because the ocean color signal comprises information from a deeper water depth than surface signatures. The results of feature tracking from these multiple sensors demonstrate that wavelet analysis of satellite data is a very useful tool for image processing.

Keywords: Wavelet, feature tracking, sea-ice drift, surface layer currents