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Observing submesoscale activity in the Bay of Biscay with satellite-derived SST and Chlorophyll concentration

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Submesoscale activity in the upper ocean is linked to vertical velocities that enable transport of nutrients to the euphotic zone and trigger primary production, and yet its contribution to the global production budget is still to be fully investigated. Sampling the submesoscales is a challenge, due to their spatial scales of O(1-10) km and their life spans of a few days. Thus, we utilized high resolution ($\sim$ 1km) satellite images of sea surface temperature (SST) and chlorophyll concentration (Chl) for the purpose of identification and classification of submesoscale activity over the Bay of Biscay continental shelf. For our analysis, we applied an event-based approach. We constructed a large data set of the last ten years' (2003 - 2013) MODIS images of both Aqua and Terra satellites. Due to cloud coverage, number of quality images covering the entire region is limited making the data set discontinuous in time and space. To maximize the portion of usable images covering the temporal and spatial scales we wanted to investigate, we discretized our data set. Given the fact that submesoscale features are highly localized, instead of the entirety of the Bay, we divided the domain into sub-regions that are defined by their hydrological features, such as river plumes. Then, we selected "events" of cloud-free, consecutive daily images of SST and corresponding Chl. For an understanding of the driving mechanisms of submesoscale activity and its outcome as enhanced production, together with satellite images, background environmental conditions such as turbidity, and forcing fields such as wind stress distribution and river runoff before and during these events were analyzed. As a quantitative measure, correlation (or lack thereof) between occurrence and strength of submesoscale features and these factors is presented. As a result of this effort, a classification of the submesoscale features based on their driving mechanisms is proposed.