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Autonomous Ocean Current Geolocation from Orbit

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Abstract

A small satellite mission concept for the identification and tracking of ocean surface thermal features associated with warm-water currents is currently being developed within the Center for Space Systems at the Georgia Institute of Technology. The Ocean Thermal Imaging (OTI) mission will acquire thermal images using an uncooled focal plane array (UFPA), and apply on-board image processing algorithms to detect and geolocate warm-water ocean currents. A "blobber" algorithm is used to identify a set of contiguous pixels with characteristics that fall within specified temperature and area parameters. Satellite position and attitude knowledge are used to geolocate the thermal features. The resulting mission data products will provide a useful resource for the oceanographic science and maritime operations communities. This article gives an overview of the mission concept, introduces the microbolometer thermal imaging system, describes the design and testing of the thermal image processing algorithm, and discusses the process for the geolocation of thermal features.

1. Introduction

Ocean surface temperature measurements can be used to detect and track the location of warm-water currents. Knowledge of the time-varying locations of ocean surface currents has applications spanning chemical plume tracking, weather forecasting, and maritime operations. Presently, coastal currents are monitored through buoys, moorings, shore-based radar observations, and satellite altimetry, in addition to sea surface temperature mapping. The primary advantage of sea surface temperature observations is the near real-time determination of warm-water current locations.

The April 2010 Deepwater Horizon oil drilling rig disaster in the Gulf of Mexico dramatically highlighted the need for accurate monitoring of coastal currents in order to predict oil plume propagation for environmental response planning. Forecasting the trajectory of the Deepwater Horizon oil plume was complicated by

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