# Pre-Processing Techniques an Features Extraction for Ocean Meso-Scale Structures Detection in SST Images

G.Noel[1], A.Hamam[1], L.Drapeau[2]
[1] French South African Technical Institute of Electronics, TUT, Pretoria, South Africa
[2]Institut de Recherche pour le Developement, Montpellier, France

The proposed paper focuses on images structures in Surface Skin Temperature (SST) images, especially ocean meso-scale structures. The information contains in these images are tremendous and, for some reasons, far-under exploited. Time series SST images can help us to understand the dynamics of the environment and to predict to some extend, their future evolutions.
New remote sensing technologies can improve the understanding of uncertainty regarding the extent of environmental changes. The international context emphasized the need for models and earth observation systems to evaluate these evolutions. Initiatives such as GMES (Global Monitoring of Environment and Security), GEOSS (Global Earth Observation System of Systems), or GOOS (Global Ocean Observing System) objectives are to make systematic observations of atmospheric, terrestrial and oceanic parameters, so as to improve forecasting of the marine, terrestrial and atmospheric environment and to consolidate long-term observations for modelling and in particular prediction.
The present paper focuses only on the first part of a larger project which will include on top of structures detection, tracking, mathematic modeling and forecasting.
A common-sense view of the marine environment as a fluid medium would probably imply progressive changes and smooth gradients in physical properties. Sharp boundaries, however, are actually quite widespread. Ocean meso-scale structures are characterized by significant variations in the physical properties of the water (especially temperature). The location of fronts in SST images provides information on a variety of processes in the ocean. Ocean surface thermal fronts are known to be important from both physical and biological perspectives. These regions are particularly important regarding the distribution and evolution of the marine population (plankton, fishes,…) .Their sizes ranges from few kilometers to hundreds, their lifetime being linked to their size (from days for the smaller to months for the larger ones). According to their spatial properties and behavior, the structures are classified as eddies, upwellings, jets, filaments or narrow frontal regions.
This research is based on images taken by Meteosat Second Generation satellites from 1987 to 2003 (on a monthly basis) of the oceans surrounding southern Africa. These images are relatively easy to use due to their accessibility, their spatial resolution and efficient declouding algorithms.
This research will show that SST images contain a strong seasonal component which needs to be isolated from the meso-scale variability. Principal Component Analysis as well as Independent Component Analysis and Complex Empirical Orthogonal Functions will be used to achieved this goal.
Histogram and Gradient-based techniques, clustering algorithms and wavelet packet detection are tested on the processed database and results are presented and discussed.

The difficulty to obtain reliable results will then guide us to use a probabilistic approach instead of a deterministic one. The results will be then express in the probability to have a structure in a specific region at a specific time.
Future works on detection includes classifications of the structures in fronts, eddies or filaments.
The Tracking of the meso-scale structure will be achieved by extracting additional information from the detection process (speed, shape,…) and to combine them with a mathematical model coming from a physical approach of the problem.