Centre Royal de
Télédétection Spatiale

TRAINING WORKSHOP ON SPACE OCEANOGRAPHY
Organized by CRTS and COSPAR

In collaboration with
NWRA, NOAA, INCOIS, NRC Italy, LOV

CRTS, 12 - 16 September 2022
AGENDA

DAY	ENTITLED	SPEAKERS
Monday , September 12, 2022	08h30 – 09h00: Registration 09h00 – 09h30: Opening Session - Driss EL HADANI, CRTS Director - Jean Claude WORMS, COSPAR Executive Director - Gad LEVY, NRWA - Amal LAYACHI, CRTS	
	09h30 – 09h50: Coffee break	
	09h50 – 12h30 Introduction to spatial oceanography and the main marine parameters and products: - Electromagnetic spectrum and oceanography - Space missions to observe the oceans - Main products / oceanographic satellite parameters - Main applications	Dr. Abderrahmane Atillah, CRTS Royal Center for Remote Sensing
	12h30 – 13h30: Lunch	
	13h30 – 17h00 Operational oceanography: Modeling - Assimilation – Forecasting (1) Introduction to Data Assimilation and Forecasting (GL): An overview of data assimilation methods used in research and operations; parameters used & forecasted. Types of data assimilated with emphasis on the expansion in observing systems from conventional to space/satellite borne Optimum Interpolation (GL): The basic model and method of Optimum Interpolation as applied in 2 and 3 dimensions Variational Analysis (GL): The expansion of OI as used in operational forecasting. Bayesian methods (GL): The Bayes theorem and its application and adaptation to modern existing DA and forecasting models and scheme	Dr. Gad Levy, NorthWest Research Associates (NWRA), Washington

Tuesday, September 13, 2022	**09h00 – 12h30** **Operational oceanography: Modeling - Assimilation – Forecasting (2):** **Introduction to ML (AG):** ML paradigms, and typical remote sensing applications **Supervised & Unsupervised methods* (AG)**: regression, linear discriminant, SVMs, e K-means, SVD, etc. **State of the art ML methods (AG):** deep learning, random forests, etc. **Integration, Common problems Applications (GL):** Putting it all together: Integration of above methods in existing global and regional ocean physical analysis and forecasting systems; common problems with assimilation and integration, with emphasis on challenges in evaluating, validating, and scoring forecasts; Specific problems that result from the expansion in observing systems from conventional to satellite borne and the corresponding transition from small, medium, and large datasets to massive datasets.	**Dr. Gad Levy,** NorthWest Research Associates (NWRA), Washington **Andrew Geiss, Ph.D.** Pacific Northwest National Laboratory, Washington
	12h30 – 13h30: Lunch	
	13h30 – 17h00 **Hands on practical (GL, AG):** Generate Probability Forecast, applying Bayesian &/or ML rules: (i) Pick the area/parameter/event of your choosing and a time in the future, preferably before workshop ends. (ii) Use climatology as your initial prior (choose your own data source for climatology, you can use multiple sources, assigning them weights). (iii) Choose one or more additional sources of information (e.g., model) to refine your forecast, refining your initial forecast, generating a revised (posterior) forecast. You may revise your forecast more than once. (iv) Score your forecast against climatology (your prior) and against "persistence" at the end of your forecast period."	

Wednesday, September 14, 2022	**09h00 – 12h30** **Marines resources applications (1):** **Satellite Applications in Fisheries** This lecture will cover how remote sensing observations and telemetry can help (capture as well as culture) fisheries applications. **Accessing Satellite Data with other tools:** This lecture will cover acquiring satellite data through ocean data portals e.g. NASA's Ocean Colour portal, INCOIS's LAS (Live Access Server) etc. Further, data handling software such as BRAT toolbox (for altimetry data) and BEAM (for OC data) will be introduced. The idea behind this session is to show participants that there is a wide variety of open access satellite data and software to access and visualize satellite data	**Dr. Nimit Kumar,** Indian National Centre for Ocean Information Services, INCOIS, India
	12h30 – 13h30: Lunch	

	13h30–17h00 (remote session, with NK in class to support) **Marines ressources applications (2) :** **Fundamentals of Ocean Color** This lecture will provide a brief introduction to the fundamentals of ocean color remote sensing. **Accessing Satellite Data with ERDDAP:** This lecture will explain how to use ERDDAP to create customizable surface maps, wind vector field plots, time series and Hovmöller diagrams, subset datasets spatially and temporally, download the selected data in the file format of your choice and understand the 'grammar' of an ERDDAP URL **Accessing Satellite Data with ERDDAP and R:** This lecture will present packages and scripts that make it easier to pull data from ERDDAP into R and work with it.	**Dr. Carla Wilson,** NOAA National Marine Fisheries

Thursday, September 15, 2022	**09h00 – 12h30** **Radar Altimetry: Applications to marine and coastal risks** - Radar Altimetry foundation, satellite missions, processing in different targeted domains (coastal zone, inland water), available data set, examples of applications with special focus how the technique can to coastal hazards contribute (e.g., storm surges and climate change)	**Dr. Stefano Vignudelli,** National Research Council, ITALY
	12h30 – 13h30: Lunch	
	13h30 – 17h00 **Hands- on practical**: - Data services (e.g. SARVATORE GPOD), data extraction and analysis, characterizing differences in satellite-based and tide gauge observations, examples using scripts written in Matlab.	

Friday, September 16, 2022	**09h00 – 12h30** **Coastal ecosystems Applications :** - **Ocean color remote sensing of turbid coastal waters**: fundamentals This lecture will introduce the basic principles of ocean color remote sensing in the case of turbid coastal waters: atmospheric corrections, adjacency effects, bottom contamination, inversion algorithms applied to estimate biogeochemical products (water turbidity, concentrations of algal and non-algal suspended particles, colored dissolved organic matter). - **Selected examples of applications** This lecture will present specific coastal ecosystems applications, namely: - Mapping the bathymetry of navigation channels - Monitoring the dynamics of the maximum turbidity zone in estuaries - Shellfish aquaculture from space - Monitoring key water quality parameters in polluted coastal lagoons - Quantification of solid fluxes discharged by rivers into the coastal ocean	**Dr. David DOXARAN** Laboratoire d'Océanographie de Villefranche Villefranche-sur-Mer
	12h30 – 13h30: Lunch	

	13h30– 17h00 **Hands- on practical**: - Processing of ocean color satellite data from the top-of-the atmosphere to the mapping of biogeochemical products in coastal ecosystems. Tutorials will present how/where to: - access multi-sensor Level-1&2 satellite data; - apply atmospheric, glint and adjacency effects corrections to retrieve the water-leaving reflectance signal; - apply appropriate inversion algorithms to map the water turbidity, concentrations of algal and non-algal particles; - extract satellite products for matchups with field data (validation). Tutorials will use the following ocean color satellite softwares: ACOLITE, SeaDAs, SNAP	
	17h00 : Evaluation – Closing Session	

NB: lunch and coffee break will be on site:

. 10h30-10h45: Coffee break (except Monday morning)

. 15h30-15h45: Coffee break