

HICO Data User's Proposal

HICO data in support of ecological studies in the California Current

Principal Investigator

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Abstract

The California Current Ecosystem (CCE) Long-Term Ecological Research (LTER) area is a productive coastal upwelling biome that is the site of over 60 years of extensive time-series measurements by CalCOFI and other projects. The CCE-LTER program is seeking to understand the mechanisms underlying transitions between different states of this ecosystem. Remote sensing has been an important part of the study since the pioneering CZCS when Scripps Institution of Oceanography was the site of a receiving station that captured most of the CZCS data over the West Coast. Current studies using traditional ocean color sensors (SeaWiFS, MODISA, MODIST, MERIS, VIIRS) have shown inadequacy of the standard algorithms to capture the high chlorophyll-a concentrations associated with occasional blooms (Kahru et al. 2012a and Kahru et al. 2014). It is possible that some of the discrepancies are caused by the different scales of in situ sampling versus the ~ 1 -km satellite pixel size as high-concentration blooms tend to be particularly patchy. The high spatial resolution of HICO and its hyperspectral characteristics offer an opportunity to study the high spatial and spectral structure of the surface distributions which are particularly relevant in this stage of the CCE-LTER project that has special emphasis on meso-scale and small-scale fronts and eddies. HICO has the potential to study the fronts and other small-scale structures at spatial scales not accessible to typical ocean color sensors with approximately 1 km pixel size.

1. Statement of Work/Project Description

We would like to request HICO data to support our ongoing ecological studies of the California Current in general and those of the CCE-LTER and CalCOFI in particular. We would like to estimate the errors due to the mismatch of spatial scales between in situ shipborne sampling with standard ocean color data with approximately 1 km pixel size. We would also like to evaluate the HICO hyperspectral datasets in order to find spectral signatures that could be used to detect phytoplankton functional types to compare with our in situ datasets of phytoplankton pigments and size fractions.

2. Biographical sketch and available facilities

CV of M. Kahru is attached. Dr. Kahru has access to a lab with sufficient computing facilities that include several workstations, satellite data server with about 20 Terabytes of disk space, specialized software for processing satellite data. PI has years of experience in processing various satellite datasets and is active in producing multiple regional archives of processed satellite datasets, e.g.

http://spg.ucsd.edu/Satellite_Data/California_Current/.

3. Output and deliverables

We will evaluate HICO data products by comparing various HICO data products with our extensive in situ datasets. Of special value would be HICO data that has been captured simultaneously with our annual and quarterly cruises. We will also compare HICO data products with other processed satellite datasets that we routinely perform (e.g. http://spg.ucsd.edu/Satellite_Data/California_Current/). PI attended the HICO annual meeting that was held in conjunction with the OCRT meeting in May, 2014 and is committed to attend future HICO meetings.

References

- Kahru, M., E. Di Lorenzo, M. Manzano-Sarabia and B. G. Mitchell (2012a), Spatial and temporal statistics of sea surface temperature and chlorophyll fronts in the California Current, *J. of Plankton Research*, 34, 9, 749-760, doi: 10.1093/plankt/fbs010.
- Kahru, M., R.M. Kudela, M. Manzano-Sarabia and B. G. Mitchell (2012b), Trends in the surface chlorophyll of the California Current: Merging data from multiple ocean color satellites, *Deep-Sea Research. II*, 77-80, 89-98, <http://dx.doi.org/10.1016/j.dsr2.2012.04.007>.
- Kahru, M., R.M. Kudela, C.R. Anderson, and B.G. Mitchell (2014), The poor state of high Chl-a retrievals in the California Current using satellite ocean color. 2014 NASA Ocean Color research team meeting, Silver Spring, MD, May 5-7, 2014.

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(a) Professional Preparation

Tartu University, Tartu, Estonia Dipl. Biol. Cum Laude, 1978
Shirshov Inst. of Oceanology, Moscow, Russia Ph.D., Biological Oceanography, 1982

(b) Appointments

2009-pres. Research Oceanographer, Scripps Institution of Oceanography, UC San Diego
2010-pres. Visiting Researcher, Stockholm University, Stockholm, Sweden
2006-2009 Project Scientist, Scripps Institution of Oceanography, UC San Diego
1997-2006 Specialist, Scripps Institution of Oceanography, UC San Diego
1994-1997 Visiting Assoc. Research Biologist, Scripps Institution of Oceanography, UCSD
1992-1993 Researcher, Stockholm University, Remote Sensing Lab., Stockholm, Sweden
1991-1992 Oceanographer, Swedish Meteorological and Hydrological Institute, Sweden
1986 Visiting Scientist, Scripps Institution of Oceanography, UC San Diego
1985,1987 Visiting Scientist, Institut für Meereskunde, Kiel University, Kiel, Germany
1978-1991 Research Associate, Estonian Marine Institute, Tallinn, Estonia

(c) Products

Five products most closely related to the proposed project:

- Kahru, M., Z. Lee, R. M. Kudela, M. Manzano-Sarabia and B.G. Mitchell (2013), Multi-satellite time series of inherent optical properties in the California Current. *Deep-Sea Research II*, 10.1016/j.dsr2.2013.07.023.
- Kahru, M., R.M. Kudela, M. Manzano-Sarabia and B. G. Mitchell, Trends in the surface chlorophyll of the California Current: Merging data from multiple ocean color satellites, *Deep-Sea Research. II*, 2012, <http://dx.doi.org/10.1016/j.dsr2.2012.04.007>. [PDF](#)
- Kahru, M., E. Di Lorenzo, M. Manzano-Sarabia and B. G. Mitchell, Spatial and temporal statistics of sea surface temperature and chlorophyll fronts in the California Current, *J. Plankton Research*, 2012; doi: 10.1093/plankt/fbs010. [PDF](#)
- Kahru, M., S. T. Gille, R. Murtugudde, P. Strutton, M. Manzano-Sarabia, H. Wang and B. G. Mitchell, Global correlations between winds and ocean chlorophyll, *J. Geophys. Res.*, doi:10.1029/2010JC006500, 2010. [PDF](#)
- Kahru, M., R. Kudela, M. Manzano-Sarabia and B.G. Mitchell, Trends in primary production in the California Current detected with satellite data, *J. Geophys. Res.*, 114, doi:10.1029/2008JC004979, 2009. [PDF](#)

Five other significant products:

- Nevison, C. D., R. F. Keeling, M. Kahru, M. Manizza, B. G. Mitchell, and N. Cassar (2012), Estimating net community production in the Southern Ocean based on atmospheric potential oxygen and satellite ocean color data, *Global Biogeochem. Cycles*, 26, GB1020, doi:10.1029/2011GB004040.
- Kahru, M., V. Brotas, M. Manzano-Sarabia, and B. G. Mitchell, Are phytoplankton blooms occurring earlier in the Arctic? *Global Change Biology*, doi:10.1111/j.1365-2486.2010.02312.x, 2010. [PDF](#)
- Mitchell, B.G. and M. Kahru, Bio-optical algorithms for ADEOS-2 GLI, *J. Remote Sensing Soc. of Japan*, 29, 1, 80-85, 2009. [PDF](#)
- Kahru, M., B.G. Mitchell, S.T. Gille, C.D. Hewes, and O. Holm-Hansen (2007), Eddies enhance biological production in the Weddell-Scotia Confluence of the Southern Ocean. *Geophys. Res. Lett.*, 34, L14603, doi:10.1029/2007GL030430, 2007. [PDF](#)
- Kahru, M. and B.G. Mitchell (2010), Blending of ocean colour algorithms applied to the Southern Ocean, *Remote Sensing Letters*, 1: 2, 119-124, doi:10.1080/01431160903547940. [PDF](#)