



Enabling earth observations in support of global, coastal, ocean, and climate change research and monitoring

Gad Levy, Stefano Vignudelli & Jim Gower

To cite this article: Gad Levy, Stefano Vignudelli & Jim Gower (2018): Enabling earth observations in support of global, coastal, ocean, and climate change research and monitoring, International Journal of Remote Sensing, DOI: [10.1080/01431161.2018.1464101](https://doi.org/10.1080/01431161.2018.1464101)

To link to this article: <https://doi.org/10.1080/01431161.2018.1464101>



Published online: 27 Apr 2018.



Submit your article to this journal [↗](#)



Article views: 19



View related articles [↗](#)



View Crossmark data [↗](#)



Enabling earth observations in support of global, coastal, ocean, and climate change research and monitoring

Gad Levy^{a,b}, Stefano Vignudelli^c and Jim Gower^d

^aNorthWest Research Associates, Seattle, WA, USA; ^bUniversity of Phoenix, Online Campus, USA; ^cConsiglio Nazionale delle Ricerche, Earth Science Department, Pisa, Italy; ^dInstitute of Ocean Sciences, Fisheries and Oceans Canada, Sidney, Canada

1. Editor's preface: introduction

This is a special issue featuring a selection of research papers presented at the 13th Biennial Pan Ocean Remote Sensing Conference (PORSEC) in November 2016. PORSEC was initially established, during the International Space Year 1990, as the Pacific Ocean Remote Sensing Conference – an organization dedicated to helping developing nations around the Pacific Rim stimulate their science programmes focused on the applications of remote-sensing technology to Ocean Sciences. Primarily through volunteer efforts, with some support from the host countries and national and international agencies that share its principles, the PORSEC Association has been holding biennial scientific meetings since 1992, rapidly expanding and gaining global status as a prestigious remote-sensing conference, with a scope covering all the world's oceans. The goal of the meetings and the associated training courses is to further the understanding of the Earth's environmental processes and to assist in training, education, and capacity-building. As the landscape of earth observing systems has been changing in the past two and a half decades, with many nations moving forward with missions, many with regional focus, PORSEC has continued in its efforts to advance science capabilities and to build a bridge to the future, while expanding to new regions and countries, such as India and the Indian Ocean, and Brazil and the Atlantic. Conferences take advantage of the unique perspective provided by satellite remote-sensing technology and those of the host country/region, while striving to protect the ocean and atmosphere and promote sustainable use and development of oceanic and coastal resources. PORSEC 2016 and the preceding capacity-building course were held in Fortaleza, state of Ceará, Brazil, and hosted by the Marine Science Institute (LABOMAR) of the Federal University of Ceará and its Earth Observation Laboratory, with in-kind local support by the Federal University of Bahia and the Oceanographic Institute of the University of São Paulo, as well as in kind and financial support from domestic and international space science and research agencies [the French Centre National des Etudes Spatiales, European Space Agency (ESA), the US National Aeronautics and Space Administration (NASA), the US National Environmental Satellite, Data, and Information Service, the US Office of Naval Research Global].

2. PORSEC2016 location, themes, and scope

Fortaleza, Brazil's fifth largest city, is located on the Atlantic coast in the Northeast Brazilian region, where the local climate is driven by the trade winds. It is a major centre of Brazilian scientific and maritime activities, with teaching and research facilities in ocean and marine sciences. The conference general theme was: 'Enabling Earth Observations in Support of Global, Coastal, Ocean and Climate Change Research and Monitoring', and it was organized in eight thematic sessions:

- (1) Large and mesoscale oceanography – A session focused on satellite observations of the upper ocean and studies concerning the influence of large and mesoscale oceanographic processes, as well as the relationship between the large-scale/mesoscale variability and sea surface temperature, sea surface height, sea surface salinity, and winds.
- (2) Coastal impacts – A session devoted to the capability of satellites to provide longitudinal remote-sensing data for use as an effective tool for environmental impact assessment; combining new satellites with old ones, as well as recent release of satellite constellation designs, and high-resolution images that allow monitoring and assessment of how the coastal areas are changing and the impacts of those changes on the coastal ecosystems. This session also discussed applications of satellite remote sensing to coastal impacts and management, and themes such as mangroves, algal blooms, sediment transport, and sea-level rise impacts.
- (3) New technologies and image processing – Since the launch of TIROS-1 in 1 April 1960, a large number of sensors, with improved temporal, spectral, and spatial resolution, have been employed to gather data and information regarding the Earth's surface. These new technologies associated with new image processing techniques allow users to generate a variety of different types of information from satellite data. This session focused on recent remote-sensing missions, applied image processing tools, Geographic Information System (GIS), machine-learning applied to image processing and classification, as well as drone technologies.
- (4) Extreme events – Extreme events such as flash floods and severe draughts are among the most devastating natural climate and weather hazards around the world causing negative social and economic impacts. Monitoring, predicting, and managing the risks of extreme events are very important. This session focused on extreme weather and climate events, as well as their impacts and the strategies to manage the associated risks. Satellite studies concerning cyclones, waves, storm surges, extreme storm seas, and sea-level rise monitoring were discussed.
- (5) Operational remote sensing – Visible, infrared, and microwave remote sensing have been used for operational applications in multidisciplinary areas. Considering the availability of multi-sensor, multi-temporal, multi-resolution, and multi-frequency data from Earth Observation Satellites, the focus in this session was on the operational aspects of different techniques and applications on ocean and fisheries (e.g., oil spills, and ocean state).
- (6) Ocean–atmosphere interactions – Observations from space can reveal patterns of air–sea coupling over relatively warm and cool ocean areas. Having that in mind,

the focus on this session was threefold: (1) on annual and/or inter-annual cycles of fluxes, winds, temperatures, clouds, and rainfall from the point of view of pre-dominating air–sea interaction processes; (2) the climate sensitivity from the viewpoint of surface energy balance considerations in order to understand the role of ocean–atmosphere interactions in determining, for example, the surface warming due to an increase in CO₂; and (3) the mechanism of ocean–atmosphere interaction governing the phenomena such as the Monsoon Atlantic and ENSO-like events.

- (7) Remote-sensing data for policymaking – The advances in satellite remote-sensing technology, automated feature recognition, and image analysis techniques facilitate the extraction of thematic information for policymaking support and technical decisions. In this session, investigations with focus on initiatives that promote the integration of satellite data with *in situ* measurements for the development of operational systems and integrated services, based on earth observation data and GIS, were discussed.
- (8) Education and outreach.

The 17 research papers in this issue cover the broad range of problems in satellite observations of the ocean, atmosphere, ice, coastal and inland waters covered in themes (1–7) above, some covering overlapping topics (see [Table 1](#)). They also cover many oceanic areas and remote sensors ([Table 1](#)). They are tabulated and classified by theme (s)/session(s) covered in, remote sensors/satellite missions, and geographic area/ocean/sea covered in [Table 1](#). The education and outreach theme was mostly addressed through the tutorial for capacity-building (Katsaros et al. 2017) held prior to the main conference, where students and early career scientists presented individual and team projects. Due to geopolitical circumstance, there was a considerable number of last-minute cancellations and no-shows in the main conference. Tutorial students' projects and presentations at the capacity-building course were of such high quality that they replaced last-minute cancellations in the main conference, and some tutorial students' projects are incorporated in four of the papers in this issue and in [Table 1](#) (Duarte et al. 2018; Karimova 2018; Misra et al. 2018; Sousa et al. 2018).

3. Conclusions

The conference reviewed and discussed the state of ocean remote-sensing observations in support of global, coastal, ocean, and climate change research and monitoring and will help scientists and students involved in ocean–atmosphere studies using remote-sensing techniques to benefit from interactions with the experts participating from all over the globe. The conference was held for the first time on the Atlantic coast in the city of Fortaleza in the Northeast Brazilian region, where the local climate is driven by the trade winds. It is a major centre of Brazilian scientific and maritime activities, with teaching and research facilities in ocean and marine sciences. Conference location and unforeseen geopolitical circumstances resulted in lower-than-usual attendance at the conference, but the high quality of capacity-building students' projects and presentations provided students and early career scientists extra exposure in the main conference,

Table 1. Paper classification by theme, sensor/mission, and region/ocean.

Paper	Theme(s)/session	Remote sensor(s)/mission(s)	Region(s)/ocean(s)/sea(s)
Cheng et al. 2018	Large and mesoscale oceanography	Altimeter, radiometers	Pacific
Karimova 2018	Large and mesoscale oceanography	Thermal infrared imagery, altimeter	North Western Mediterranean Sea
Kuo et al. 2018	Large and mesoscale oceanography	AVHRR	East and South China Seas
Lebedev 2018	Large and mesoscale oceanography	Altimeter	Caspian Sea
Ye et al. 2018	Large and mesoscale oceanography/extreme events/ocean–atmosphere interaction	AQUA MODIS, VIIRS, AMSR-E, AVHRR, Altimeter, ASCAT	South China Sea
Duarte et al. 2018	Coastal impacts/remote-sensing data for policymaking	RapidEye	Atlantic Coast of NE Brazil
Gower and King, 2018	Coastal impacts	MODIS, VIIRS, OLCI	North Pacific
Harun-Al-Rashid and Yang 2018	Coastal impacts	GOCI	Yellow Sea
Sousa et al. 2018	Coastal impacts/new technologies and image processing/remote-sensing data for policymaking	Landsat 5-TM and 8, OLI	Atlantic Coast of NE Brazil
Misra et al. 2018	New technologies and image processing	LANDSAT-8	North Sea/Wadden Sea
Tings and Velotto 2018	New technologies and image processing	Synthetic Aperture Radar (SAR), TerraSAR-X RADARSAT-2	North Sea
Hong and Yang 2018	Operational remote sensing/new technologies and image processing	SAR, Sentinel-1	Arctic Ocean, North, Kara & Chukchi Seas
Ivanov et al. 2018	Operational remote sensing	SAR	Barents Sea
Jaiganesh et al. 2018	Operational remote sensing/new technologies and image processing	MODIS, GOCI	Korea, Japan and China seas
Mitnik et al. 2018	Ocean–atmosphere interaction/extreme events	Meteor-M #2; GCOM-W1	South Atlantic, South Pacific
Sun et al. 2018	Ocean–atmosphere interaction	MODIS-Aqua, ASCAT scatterometer	Indian Ocean, South China Sea
Wang et al. 2018	Remote-sensing data for policymaking	AVHRR	East China Sea

where tutorial students had the opportunity to present their projects, filling in presentation spots vacated due to last-minute cancellations. The conference and this issue demonstrate the wide variety of ways that satellite sensors contribute to study of every part of the earth, especially deep and coastal oceans where much denser monitoring is still required.

Acknowledgements

In preparing this special issue, the support of NASA (Grant NNX16AP70G) and ESA/ESPRIN are acknowledged.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

In preparing this special issue, the support of NASA (Grant NNX16AP70G) and ESA/ESPRIN are acknowledged.

References

- Cheng, Y.-H., J. Hu, Q. Zheng, and F.-C. Su. 2018. "Interannual Variability of Cold Domes Northeast of Taiwan." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2017.1395972.
- Duarte, C. R., F. P. Miranda, A. M. Damasceno, L. I. C. Rodrigues, C. Â. S. Neto, and L. Landau. 2018. "Short Time Analysis of Shoreline Based on RapidEye Satellite Images in the Terminal Area of Pecém Port, Ceará, Brazil." *International Journal of Remote Sensing* 39.
- Gower, J., and S. King. 2018. "Satellite Observations of Seeding of the Spring Bloom in the Strait of Georgia, BC, Canada." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2017.1372864.
- Harun-Al-Rashid, A., and C.-S. Yang. 2018. "Hourly Variation of Green Tide in the Yellow Sea during Summer 2015 and 2016 Using GOCI Data." *International Journal of Remote Sensing* 39.
- Hong, D.-B., and C.-S. Yang. 2018. "Automatic Discrimination Approach of Sea Ice in the Arctic Ocean Using Sentinel-1 Extra Wide Swath Dual-Polarized SAR Data." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2017.1415486.
- Ivanov, A. Y., N. A. Filimonova, A. Yu. Kucheiko, N. V. Evtushenko, and N. V. Terleeva. 2018. "Oil Spills in the Barents Sea Based on Satellite Monitoring Using SAR: Spatial Distribution and Main Sources." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2017.1371869.
- Jaiganesh, N., R. K. Singh, P. Shanmugam, and Y.-H. Ahn. 2018. "Inter-Slot Radiometric Discrepancy Correction (IRDC) for GOCI Ocean Colour Products." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2017.1375619.
- Karimova, S. 2018. "Eddies in the Western Mediterranean Seen in Thermal Infrared Imagery and SLA Fields." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2017.1285078.
- Katsaros, K. B., G. Levy, A. Bentamy, S. King, J. F. R. Gower, and C. Wilson (2017): Tutorial on Remote Sensing for Capacity Building, 26th Symposium on Education, Proceedings of the 97th AMS Annual Meeting, Seattle, WA, January 22 –26, 2017. American Meteorological Society.
- Kuo, Y.-C., J.-W. Chan, Y.-C. Wang, Y.-L. Shen, Y. Chang, and M.-A. Lee. 2018. "Long-Term Observation on Sea Surface Temperature Variability in the Taiwan Strait during the Northeast Monsoon Season." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2017.1387311.
- Lebedev, S. 2018. "Climatic Variability of Water Circulation in the Caspian Sea Based on Satellite Altimetry Data." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2018.1441567.
- Misra, A., Z. Vojinovic, B. Ramakrishnan, A. Luijendijk, and R. Ranasinghe. 2018. "Shallow Water Bathymetry Mapping Using Support Vector Machine (SVM) Technique and Multispectral Imagery." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2017.1421796.
- Mitnik, L. M., V. P. Kuleshov, M. L. Mitnik, and A. V. Baranyuk. 2018. "Passive Microwave Observations of South America and Surrounding Oceans from Russian Meteor-M No. 2 And Japan GCOM-W1 Satellites." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2018.1425569.
- Sousa, W., M. Souto, C. Duarte, and A. Salgueiro. 2018. "Creation of a Coastal Evolution Prognostic Model Using Shoreline Historical Data and Techniques of Digital Image Processing in a GIS Environment for Generating Future Scenarios." *International Journal of Remote Sensing* 39.
- Sun, Q.-Y., D. Tang, G. Levy, and P. Shi. 2018. "Variability of Aerosol Optical Thickness in the Tropical Indian Ocean and South China Sea during Spring Intermonsoon Season." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2017.1387310.
- Tings, B., and D. Velotto. 2018. "Comparison of Ship Wake Detectability on C-Band and X-Band SAR." *International Journal of Remote Sensing* 39. doi:10.1080/01431161.2018.1425568.

- Wang, Y.-C., J.-W. Chan, Y.-C. Lan, W.-C. Yang, and M.-A. Lee. 2018. "Satellite Observation of the Winter Variation of Sea Surface Temperature Fronts in Relation to the Spatial Distribution of Ichthyoplankton in the Continental Shelf of the Southern East China Sea." *International Journal of Remote Sensing* 39. doi:[10.1080/01431161.2017.1407053](https://doi.org/10.1080/01431161.2017.1407053).
- Ye, H.-J., M. A. Kalhor, E. Morozov, D. Tang, S. Wang, and P. R. Thies. 2018. "Increased Chlorophyll-A Concentration in the South China Sea Caused by Occasional Sea Surface Temperature Fronts at Peripheries of Eddies." *International Journal of Remote Sensing* 39. doi:[10.1080/01431161.2017.1399479](https://doi.org/10.1080/01431161.2017.1399479).