GREAT AUSTRALIAN BIGHT
RESEARCH PROGRAM

RESEARCH REPORT SERIES

Regional Availability of MODIS Imagery in the Great Australian Bight

Ana Redondo Rodriguez[1]

Edward King[2] and Mark Doubell[1]

[1]SARDI Aquatic Sciences
[2]CSIRO Oceans and Atmosphere Flagship

GABRP Research Report Series Number 3

April 2015

DISCLAIMER

COPYRIGHT

THIS PUBLICATION MAY BE CITED AS:

Redondo Rodriguez, A., King, E. and Doubell M. (2015). Regional Availability of MODIS Imagery in the Great Australian Bight. Great Australian Bight Research Program, GABRP Research Report Series Number 3, 6pp.

CORRESPONDING AUTHOR

Ana Redondo Rodriguez
SARDI
e: ana.redondorodriguez@sa.gov.au

FOR FURTHER INFORMATION

www.misa.net.au/GAB

GREAT AUSTRALIAN BIGHT RESEARCH PROGRAM

The Great Australian Bight Research Program is a collaboration between BP, CSIRO, the South Australian Research and Development Institute (SARDI), the University of Adelaide, and Flinders University. The Program aims to provide a whole-of-system understanding of the environmental, economic and social values of the region; providing an information source for all to use.

CONTENTS

FIGURES

INTRODUCTION

The spatial and temporal coverage of remote sensing data acquired by satellite systems has provided important insights into marine ecosystem dynamics (Bousquet et al. 2006; Mohr and Forsberg 2002; Bosc, Bricaud, and Antoine 2004; Krishna and Rao 2008). Ocean colour-based chlorophyll-*a* concentration *(*chl) in combination with sea surface temperature (SST) are currently being used operationally in some areas of the world to indicate potential fishing and conservation zones (Petit et al. 2003; Royer, Fromentin, and Gaspar 2004). However, single sensor daily coverage may be limited by several factors such as clouds, sunglint and other phenomena; thereby restricting the availability of data in space and time (Gregg and Woodward 1998).

Cloud cover is the single greatest factor limiting the availability of ocean color and SST data (Joint and Groom 2000). Globally, the amount of cloud cover varies with location and season. The ability to retrieve oceanic remote sensed data is also affected by sunglint - which can mask the water leaving signal (Barnes, Pagano, and Salomonson 1998)- and failures in atmospheric correction due to high solar zenith or high levels of aerosols in the atmosphere (Joint and Groom 2000).

The purpose of this report is to explore the average coverage of SST and chl products derived from a single sensor (Aqua-MODIS) across Australia's southern shelf and open ocean waters, including the Great Australian Bight (GAB) area. This information will help to understand the limitations of satellite derived SST and chl data for current and future research and management applications in the region.

DATA AND METHODS

Aqua is a polar orbiting satellite which carries the Moderate Resolution Imaging Spectrophotometer (MODIS). Aqua has a sun-synchronous circular orbit -it overpasses any given location on Earth at approximately the same local time twice a day (one night-time and one day-time pass)- and it orbits the earth every 98.8 min, crossing the equator from south to north at around 1:30pm each day.

In order to evaluate the coverage of Aqua MODIS chl and SST products within the area of interest, we used the standard Level-3 products distributed by NASA

(http://oceancolor.gsfc.nasa.gov/) at 4km resolution[1]. The area of interest extends from 123°E to 141° E and 30°S to 40°S and includes the Great Australian Bight (GAB) and the gulfs of St Vincent and Spencer (Figure 1). We used daily images from 2003 to 2013 to estimate the average number of days per month with valid data. Ocean color data is available only during light period of the day and SST data is available during the day and night, hence we inferred the average number of days per month for nighttime and daytime for SST separately.

RESULTS

The availability of daily MODIS data is higher on the shelf and decreases towards the pole (Figure 1). Chl data presented an average coverage of 7.5 days per month in coastal areas, decreasing to around 4 days per month for waters south of 36°S (Figures 1). Daytime (nighttime) SST data presented an average of ~13.5 (13) days per month in coastal areas and 9 (7) days per month in waters south of 36°S. Maximum daily coverage occurred during March, August and September for chl and night-time SST data (Figure 2), while maximum coverage of day-time SST occurred during the summer months (i.e. Dec-Feb).

[1] Aqua MODIS Level-3 products for the GAB are also available from IMOS at 1km resolution

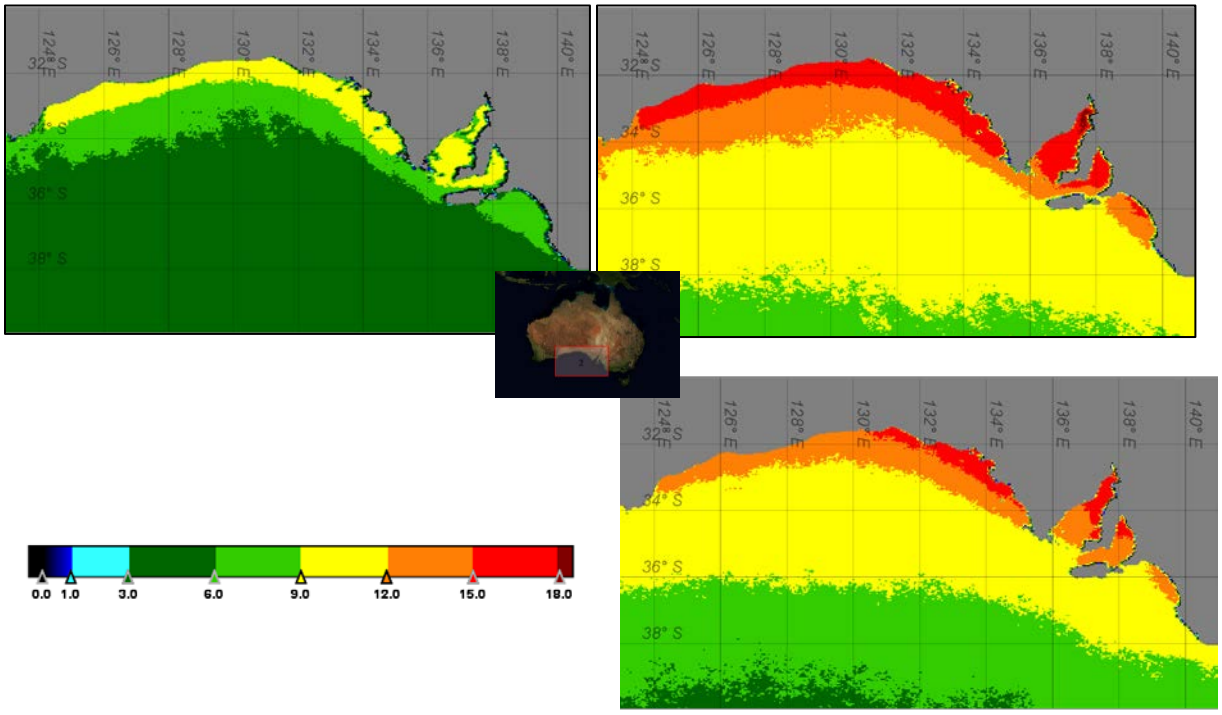

Figure 1: Average number of days per month of available MODIS chlorophyll-*a* (left) day-time SST and (top-right) night-time SST (lower-right) data in the GAB region (2003-2013). Data from Aqua-MODIS standard Level-3 products (4km resolution). Units in days.

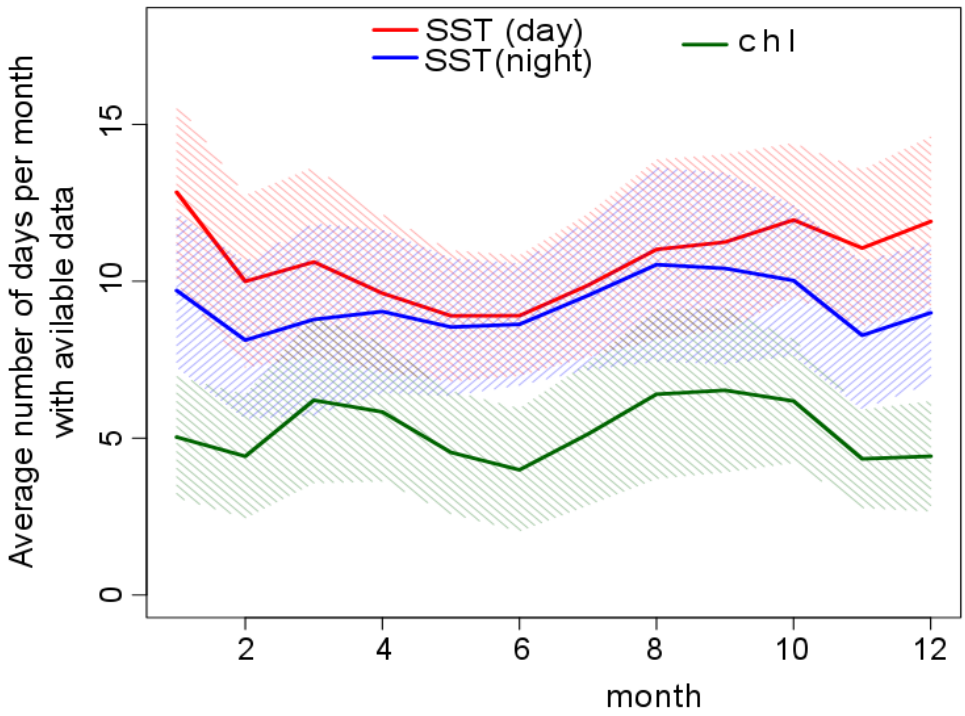

Figure 2: Monthly average of the number of days of available MODIS chlorophyll-*a* (green) day-time SST (red) and night-time SST (blue) data within the GAB area. Data from Aqua-MODIS standard Level-3 products (4km resolution). X-axes represent the months of the year and y-axis represent the average number days with available data.

CONCLUSIONS AND RECOMMENDATIONS

Cloud cover, sunglint and failures in atmospheric correction may limit the availability of satellite data (Gregg and Woodward 1998). Although no major spatial gaps in data were found within the GAB, the average availability of MODIS data varies from ~7.5 days per month in coastal areas to less than 5 days per month at the southernmost areas, and it also changes seasonally: greater coverage occurred in spring and autumn compared to summer and winter for chl and increased coverage was observed in summer for daytime measures of SST. These findings indicate that daily MODIS satellite products should be adequate for looking at annual and inter-annual changes, but often lack sufficient coverage for other studies that require high temporal resolution. Depending on the intended application, it may be more appropriate to use composite images (e.g. 3-day or weekly composites). Selection of the appropriate period for

the composite images will depend on the purpose of the study, since the chance of obtaining good spatial coverage increases with the number of days used, while the accuracy (temporal resolution) of the measurements will decrease.

REFERENCES

Barnes, W., T. S. Pagano, and T. S. Salomonson. 1998. "Prelaunch Characteristics of the Moderate Resolution Imaging Spectroradiometer (MODIS) on EOS-AM1." IEEE Trans. Geosci. Remote Sens. 36 (4):1088-100.

Bosc, E., A. Bricaud, and D. Antoine. 2004. "Seasonal and interannual variability in algal biomass and primary production in the Mediterranean Sea, as derived from 4 years of SeaWiFS observations." Global Biogeochemical Cycles 18 (1). doi: 10.1029/2003gb002034.

Bousquet, P., P. Ciais, J. B. Miller, E. J. Dlugokencky, D. A. Hauglustaine, C. Prigent, G. R. Van der Werf, et al. 2006. "Contribution of anthropogenic and natural sources to atmospheric methane variability." Nature 443 (7110):439-43. doi: 10.1038/nature05132.

Gregg, Watson W., and Robert H. Woodward. 1998. "Improvements in coverage frequency of ocean color: combining data from SeaWiFS and MODIS." IEEE T. Geoscience and Remote Sensing 36 (4):1350-3.

Joint, Ian, and Stephen B. Groom. 2000. "Estimation of phytoplankton production from space: current status and future potential of satellite remote sensing." Journal of Experimental Marine Biology and Ecology 250 (1–2):233-55. doi: http://dx.doi.org/10.1016/S0022-0981(00)00199-4.

Krishna, K. M., and S. R. Rao. 2008. "Seasonal and interannual variability of sea surface chlorophyll a concentration in the Arabian Sea." Journal of Applied Remote Sensing 2. doi: 10.1117/1.2837118.

Mohr, J.J., and R. Forsberg. 2002. "Remote sensing: searching for new islands in sea ice-coastlines concealed in polar seas are now more accessible to cartography." Journal of Geophysical Resesarch C: Oceans 106:7163-80.

Petit, M., P. Gaspar, F. Lahet, L. Demagistri, M. Desruisseaux, C. Boschet, H. Rey-Valette, and J.-Y. Lebras. 2003. SeAGeRH project: toward a service of fisheries management assisted by

satellites. Paper presented at the IGARSS 2003 : Learning form Earth's Shapes and Colors : Symposium, Toulouse (FRA).

Royer, F., J. M. Fromentin, and P. Gaspar. 2004. "Association between bluefin tuna schools and oceanic features in the western Mediterranean." Marine Ecology Progress Series 269:249-63. doi: 10.3354/meps269249.


bp


CSIRO


SOUTH AUSTRALIA
Government
of South Australia
Primary Industries
and Regions SA


SARDI
SOUTH AUSTRALIAN
RESEARCH AND
DEVELOPMENT
INSTITUTE


SUB CRUCE LUMEN
THE UNIVERSITY
of ADELAIDE


Flinders
UNIVERSITY