Global Mangrove Watch

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Aims

An international collaborative project established as part of JAXA's Kyoto & Carbon (K&C) Initiative science programme.

GMW part of Ramsar Wetlands Convention workplan (STRP Task 1.1) and the GEO-Wetlands Initiative plan to develop a Global Wetlands Observation System (GWOS)

Aim to provide geospatial (map) information about mangrove extents and changes at national to global scales for Ramsar Contracting Parties, NGO's and the public

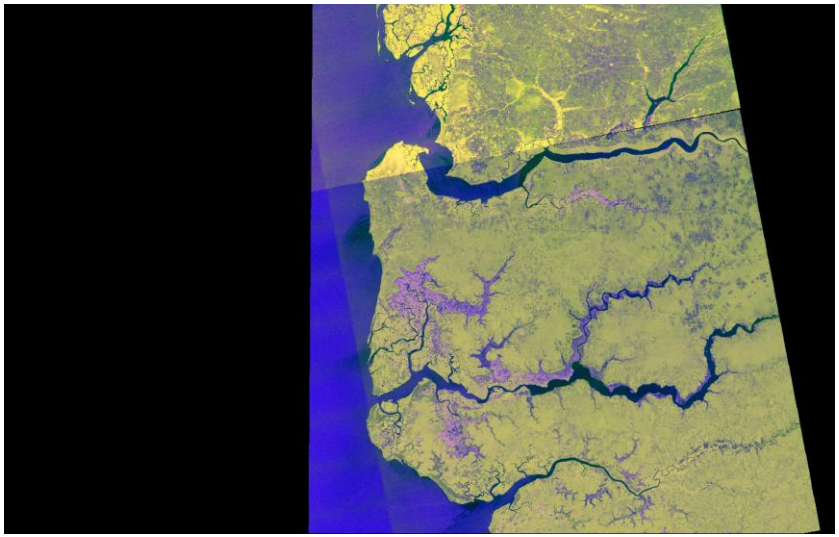
Responds to the UN Sustainable Development Goals (SDG) - SDG6.6.1 reporting on wetlands extents (national-global)

Objectives

- Overall: Mapping of extent and changes in global mangrove areas using satellite data
- Generation of updated baseline extent maps of the global mangrove extent for the year 2010
- Generation of maps of annual changes in the global mangrove areas (at present 7 time epochs between 1996 and 2016).

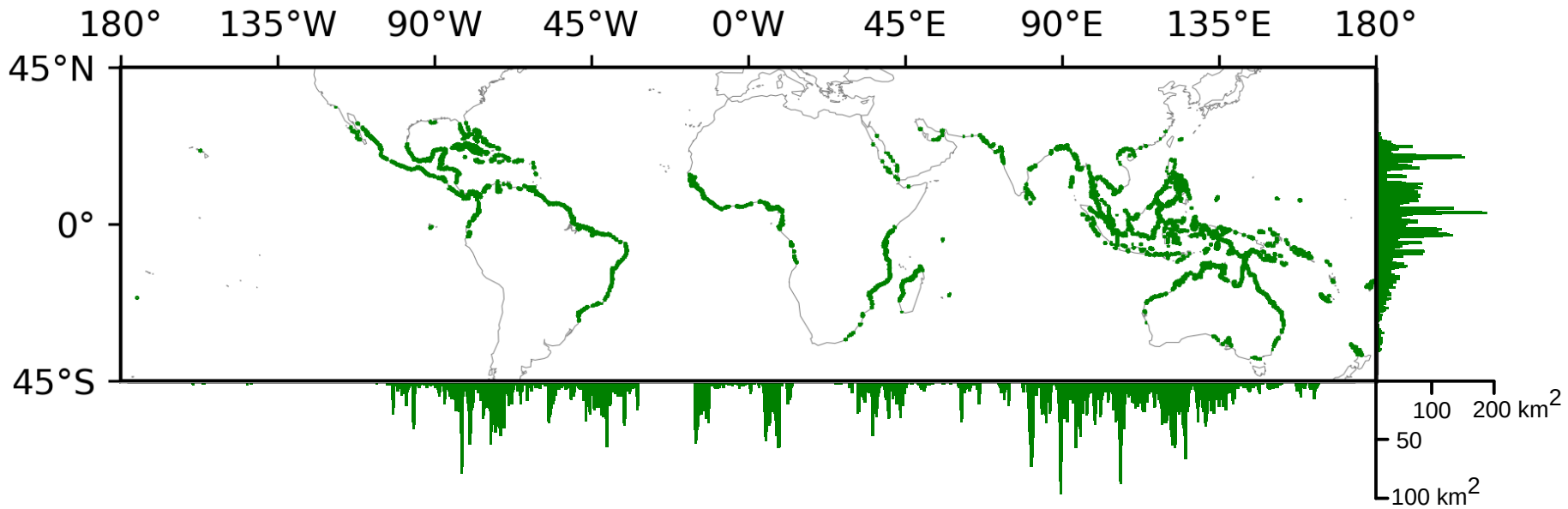
Datasets

- 1996: JERS-1 SAR
- 2007–2009 : ALOS PALSAR
- 2010: ALOS PALSAR & Landsat-5 & 7
- 2015–2016 ALOS-2 PALSAR-2
- 2017 & annually: ALOS-2 PALSAR-2



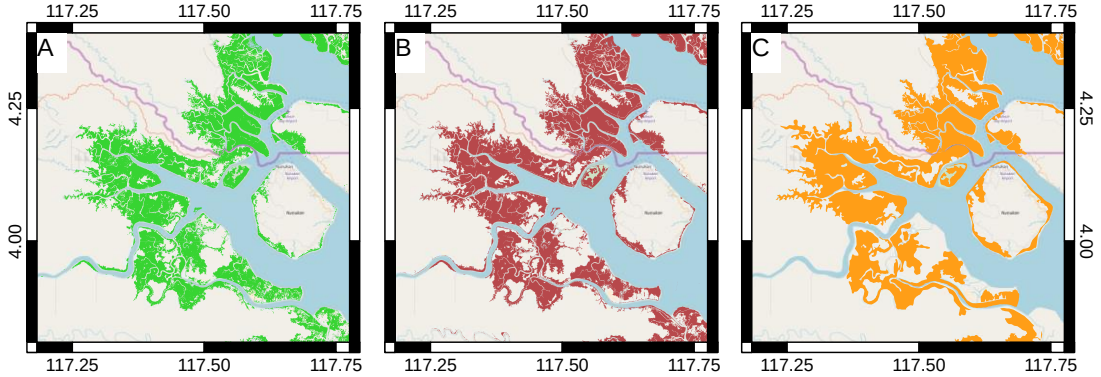
- In total, 15,000 Landsat 5 and 7 scenes were downloaded and processed, using ARCSI, to standardised reflectance.
  - ➧ Maximum NDVI composites created.

2010 Mangrove Baseline



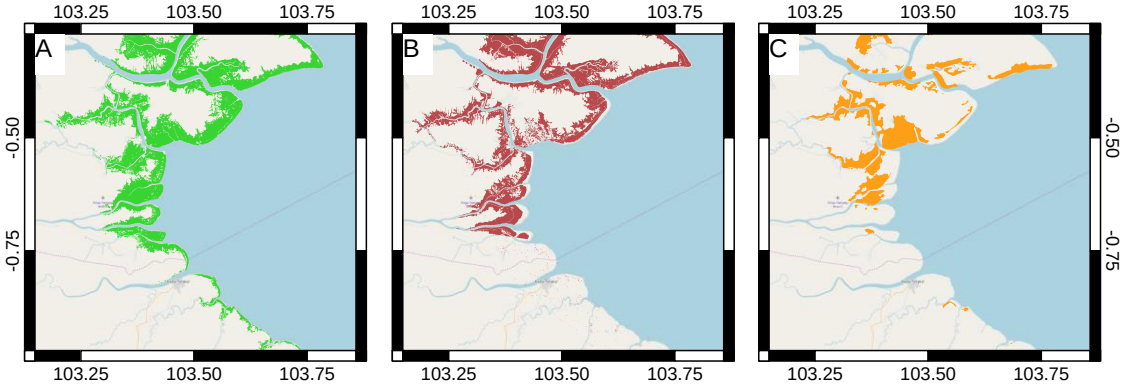
- Globally mapped 157,656 km2 ± 1276.1 mangroves
- Accuracy between 93.6 - 94.5 % with a 99 % likelihood using 53,878 accuracy points across 20 sites distributed globally.

Comparison: GMW, Giri, Wetlands Atlas

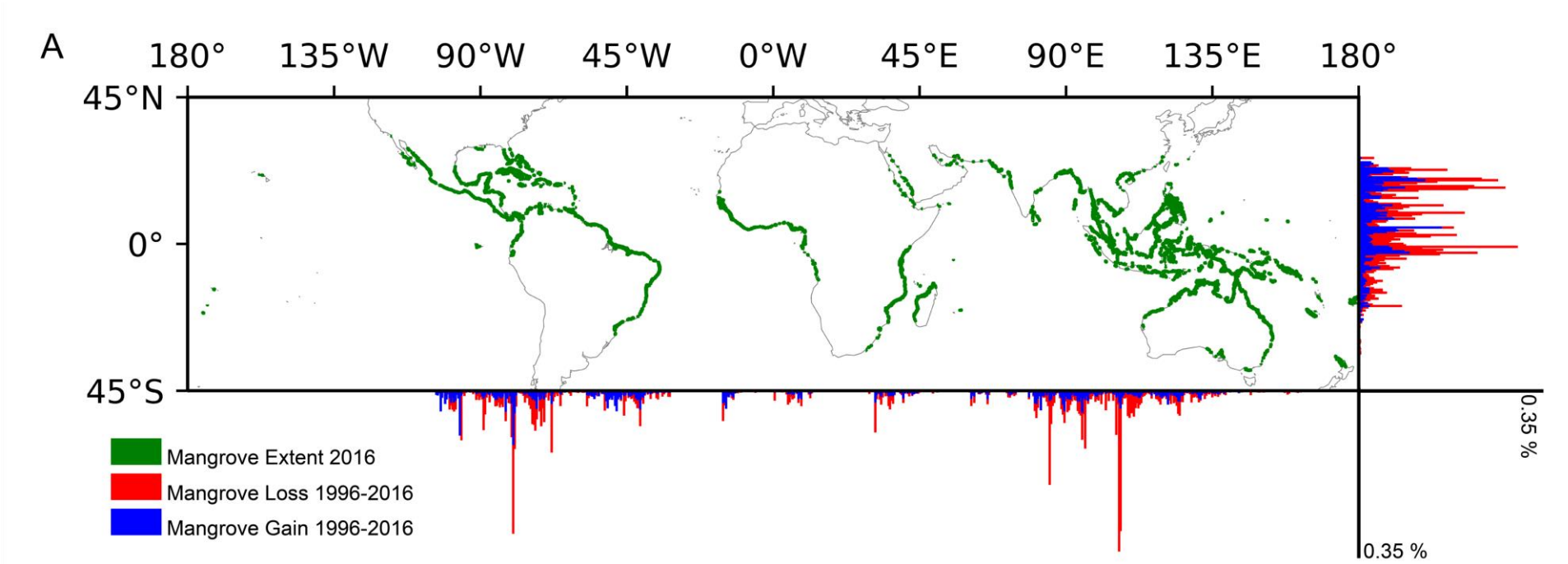


Border of North Kalimantan, Indonesia, and Sabah, Malaysia

Riau/Jambi in Sumatra, Indonesia



Change in Mangrove Extent



RAMSAR	1996	2007	2008	2009	2010	2015	2016
Africa	31,839	31,473	31,517	31,504	31,468	31,318	31,283
Asia	63,640	61,352	61,371	61,295	61,043	60,481	60,674
European Territories	1,126	1,160	1,168	1,172	1,176	1,179	1,174
Neotropics	32,981	32,278	32,300	32,273	32,011	31,803	31,788
North America	14,450	14,005	14,112	13,994	13,250	13,564	13,377
Oceania	18,815	18,667	18,681	18,683	18,709	18,434	18,443
Total	**162,851**	**158,935**	**159,149**	**158,922**	**157,656**	**156,780**	**156,739**
95 % Conf Interval	**± 1,280**	**± 1,277**	**± 1,277**	**± 1,277**	**± 1,276**	**± 1,276**	**± 1,276**
% Change from 1996	**0 %**	**2.4 %**	**2.3 %**	**2.4 %**	**3.2 %**	**3.7 %**	**3.8 %**
% Loss from 1996	**0 %**	**3.6 %**	**3.5 %**	**3.6 %**	**4.5 %**	**5.1 %**	**5.1 %**
% Gain from 1996	**0 %**	**1.3 %**	**1.3 %**	**1.3 %**	**1.4 %**	**1.5 %**	**1.4 %**

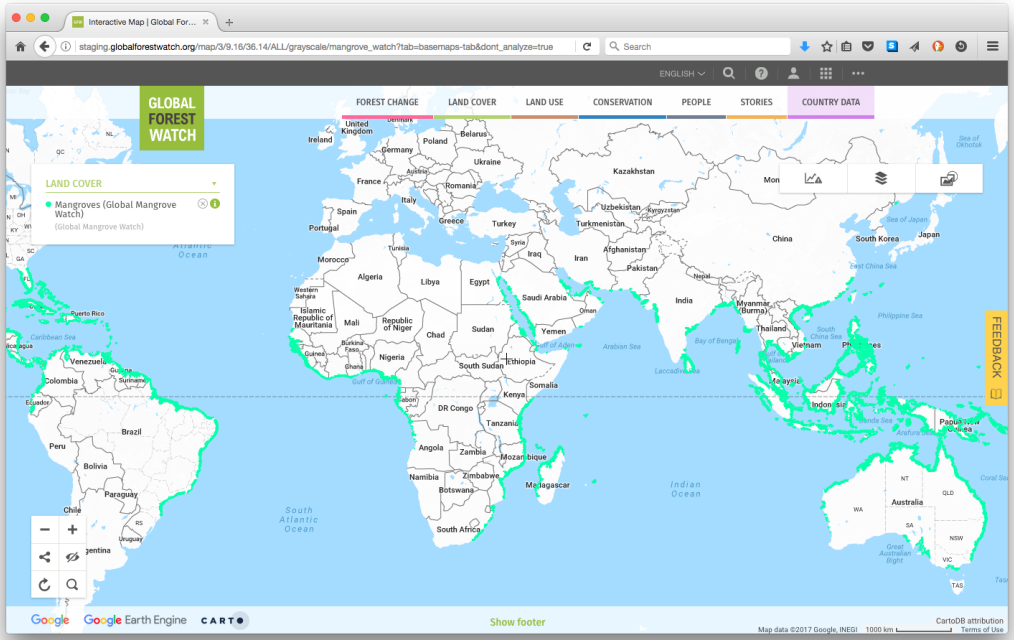
Accuracy of Change

	Loss	Gain	No Change		Users
Loss	11287	675	5023	16985	66.5 %
Gain	248	6637	2194	9079	73.1 %
No Change	1403	1776	16054	19233	83.5 %
	12938	9088	23271	33978	
Prods	87.2 %	73.0 %	69.0 %		75.0 %

- Overall accuracy of change 75 %.
- 45,297 accuracy points
  - 12938 Loss
  - 9088 Gain
  - 23271 Random Sample No Change

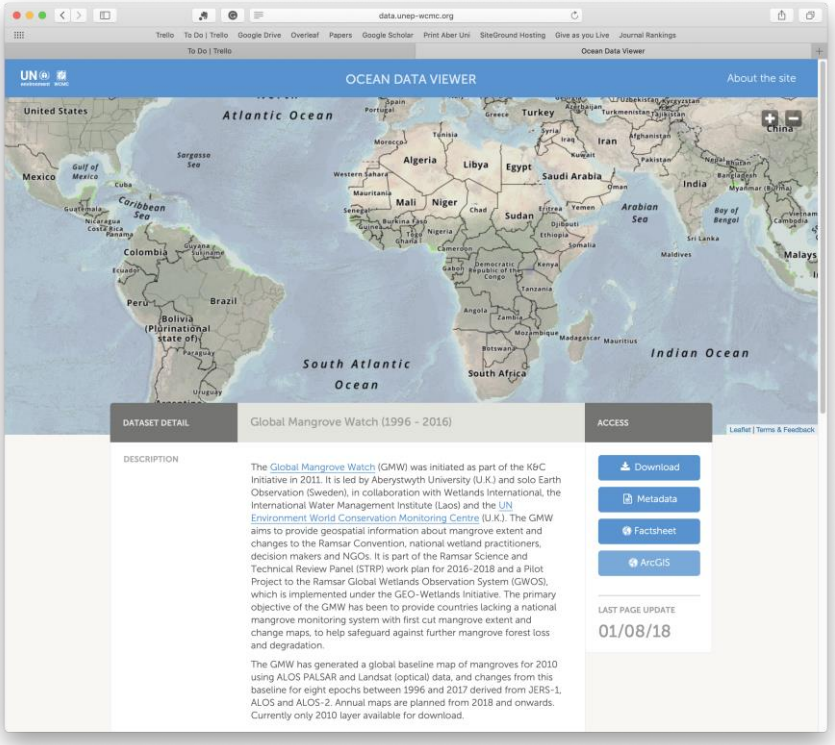
Data Availability

Visualisation on Global Forest Watch



http://www.globalforestwatch.org

Download from the UN Ocean Data Viewer.



https://data.unep-wcmc.org/datasets/45

GMW Summary

New mangrove baseline for 2010

- 157,656 km^2 ± 1276

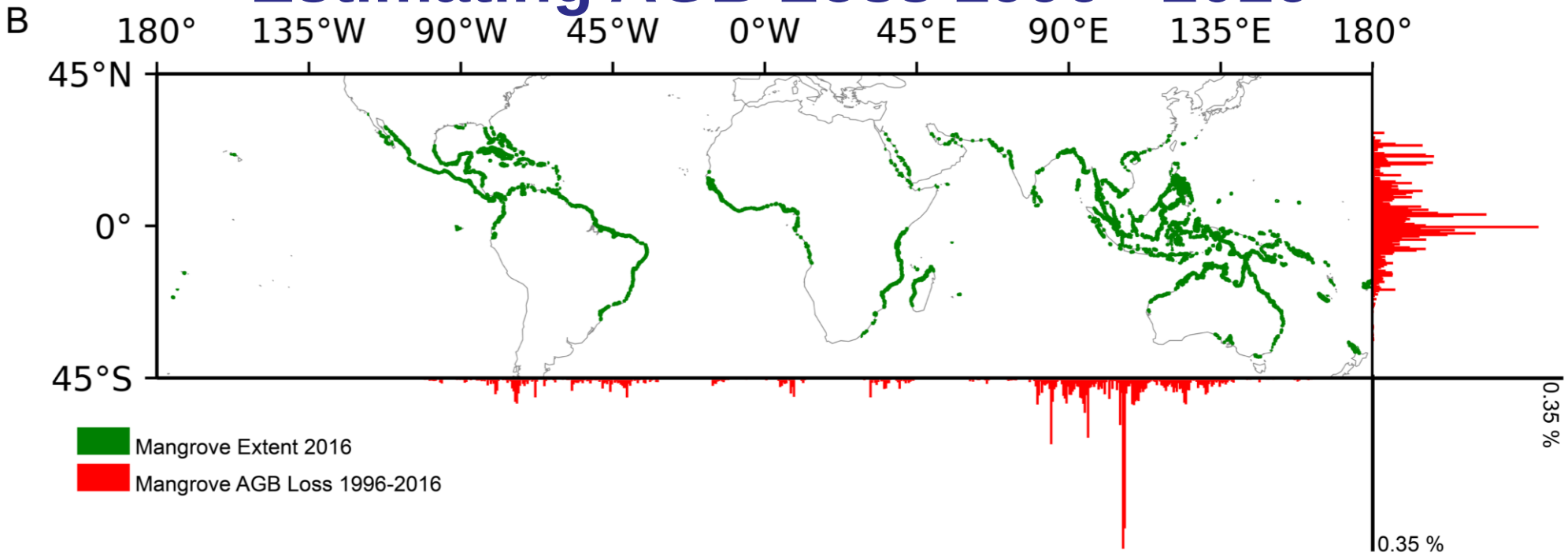
Change maps 1996, 2007, 2008, 2009, 2015 & 2016

- 162,851 km^2 ± 1,280 in 1996
- 156,739 km^2 ± 1,276 in 2016

Net change: -6,112 km^2 average -306 km^2 (-0.19 %) per year

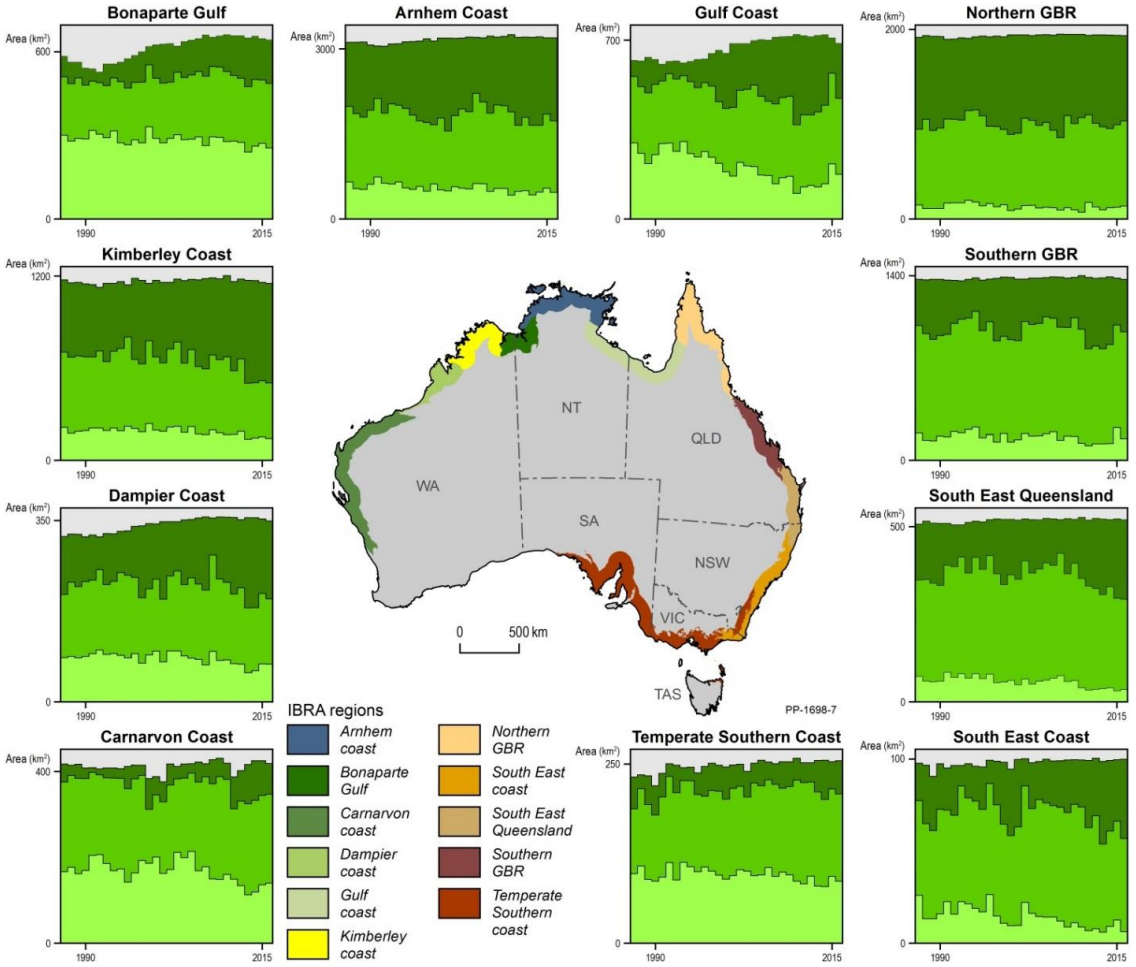
- 1996 – 2010: -5,195 km^2 average -371 km^2 (-0.23 %) per year
- 2010 – 2016: -917 km^2 average -153 km^2 (-0.09 %) per year

Estimating AGB Loss 1996 - 2016



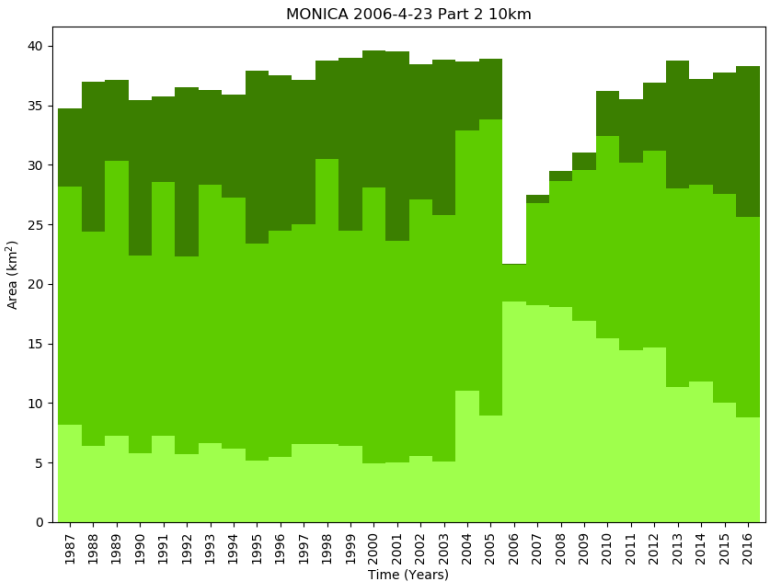
- Implemented Simard et al., (2019) which is cut to each GMW map.
  - Simard et al (2019) used SRTM from 2000 and allometric relationships.
  - National average AGB loss figures generated using areas present in 1996 and 2007 but lost after 2007.
  - Area of loss from the GMW then multiplied by the national average.
- 2 % of AGB loss between 1996-2016 verses 6 % loss in extent

Benefits of the Dense Timeseries



Lymburner et al., 2019 RSE

- Annual mangrove extent maps
  - 3 canopy cover classes
- These were derived from Landsat but the JERS-1 archive could be a useful addition here.
- Allows understand of:
  - Sea level trends
  - Cyclone damage and recovery



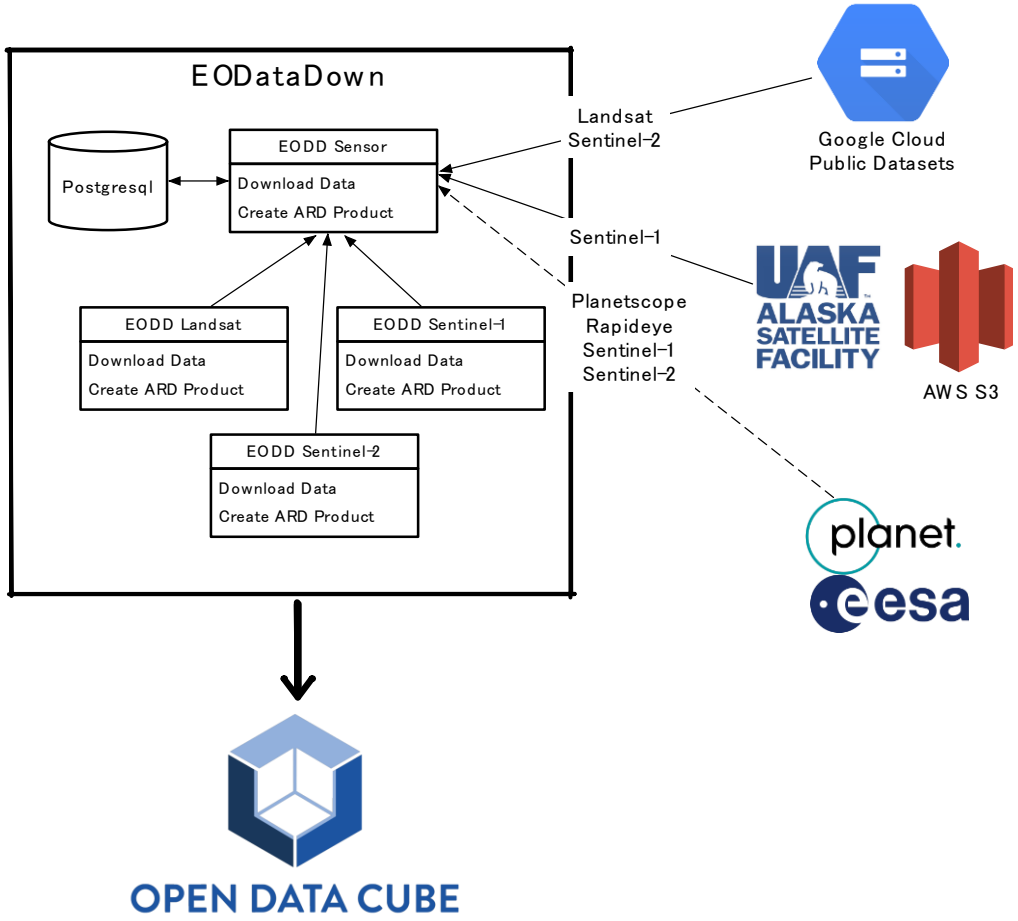
RICHARD SLIDES – flowing on from dense time series

Near Real Time Monitoring: Global Mangrove Watch

- End users have highlighted a need for near real time monitoring of mangroves
  - Currently whenever imagery is available.
- Requires automation:
  - Downloading and keeping track of imagery
  - Generating an analysis ready data (ARD) product from the download
  - Running an analysis (e.g., change detection) on the ARD product and sending the results out.
- Could not find an existing solution so we have developed one.
  - EODataDown – open and source and ‘easy’ to setup and deploy anywhere in the world.
  - A simple web interface has also been created and is be used by the Welsh Government for the provision of EO data.
  - Written in Python, plugins with data processing functionality will be able to be provided by the end user and executed automatically.

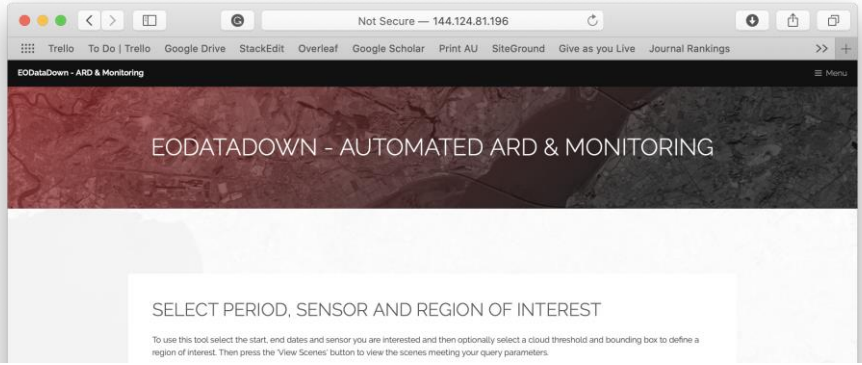
Near Real Time Monitoring: EODataDown Software

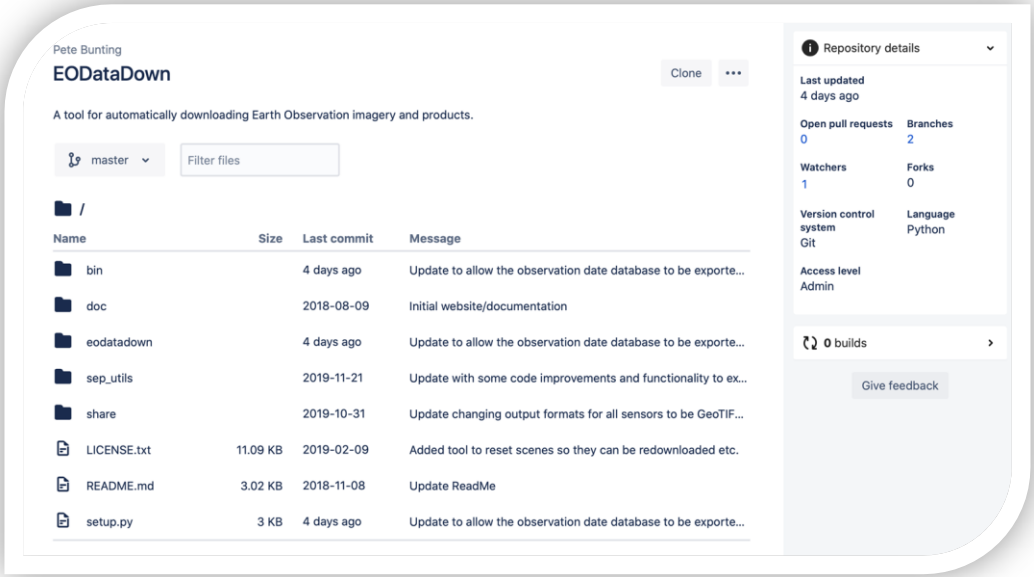
- Full support for:
  - Landsat – Google Cloud
  - Sentinel-1 – Alaska Satellite Facility
  - Sentinel-2 – Google Cloud
- Partial support for Planet data.
  - Planetscope and Rapideye
- Sentinel data could be downloaded from ESA.
  - Download from ESA has been implemented but removed from current build.
- Easy to add new datasets if available via API.



Near Real Time Monitoring: EODataDown Software

- EODataDown is open source and freely available via bitbucket
  - ⬇ Documentation needs to be written.
- Docker image available
- Gamma is closed source. Providing an option to use the Sentinel-1 toolbox is being looked into.
- Plugins to support processing will be added in EODataDown version-2
  - ⬇ In support of Global Mangrove Watch near real time monitoring.





Summary

- Processing 2017 etc. ALOS-2 data to extend the time series.
  - Reimplementing the processing scripts to be run more easily when the new data be comes available.
- Have some results using Sentinel-2, with a longer term aim of creating a new global baseline using Sentinel-2 at a 10 m resolution.
- Working towards a near real time monitoring system, base on Sentinel-1, 2 and Landsat.
  - It would be great to have regular L-band SAR observations which could be added to this system. Data would have to be available via API.
- Demonstrated that longer term mangrove dynamics can be represented with an annual timeseries of extent and canopy cover. We would like to extent the GMW to this annual product.
  - Landsat is likely to the main data source but JERS-1 could really help in terms of extent within the 1990's.