



Australian Government  
Geoscience Australia



Digital Earth  
AUSTRALIA

# Analysis Ready Data: Correct Once, Use Many

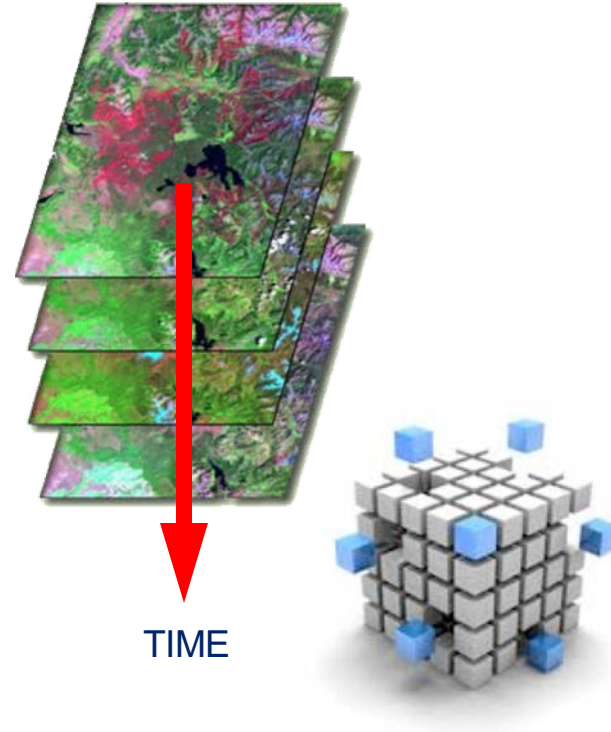
Dr David Hudson

# Wake up pretty picture



# What are Data Cubes?

- Data Cube = Time-series multi-dimensional (space, time, data type) stack of spatially aligned pixels ready for analysis
- Proven concept by Australia with plans for global implementation
- Open:
  - Open data via the GEO data sharing principles
  - Open code via the Open Data Cube Github
  - Analysis Ready Data via the CEOS CARD4L standard
  - Open and transparent community





# Background of Analysis Ready Data

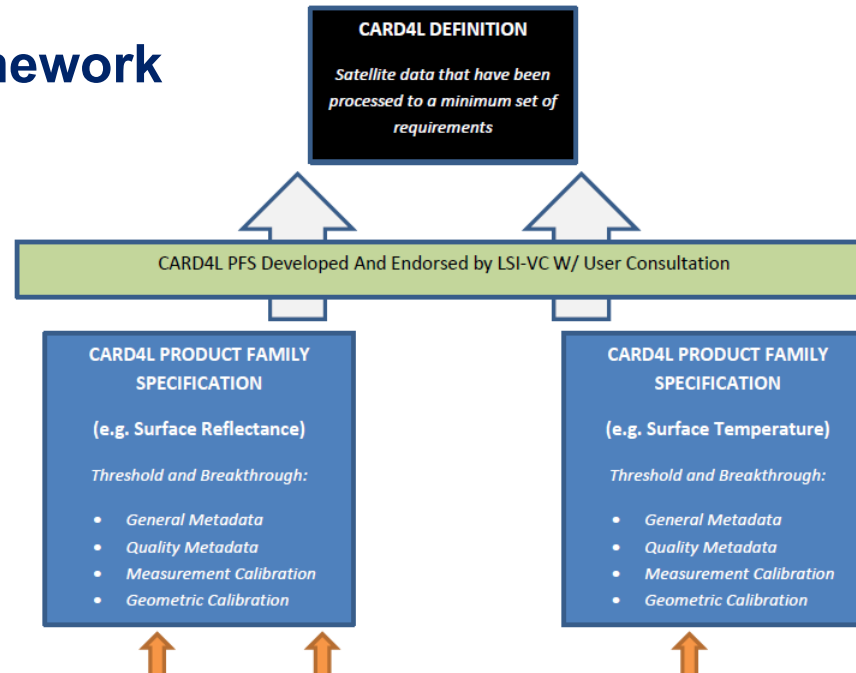
- ❑ **Committee on Earth Observation Satellites Analysis Ready Data for Land (CARD4L) definition:**

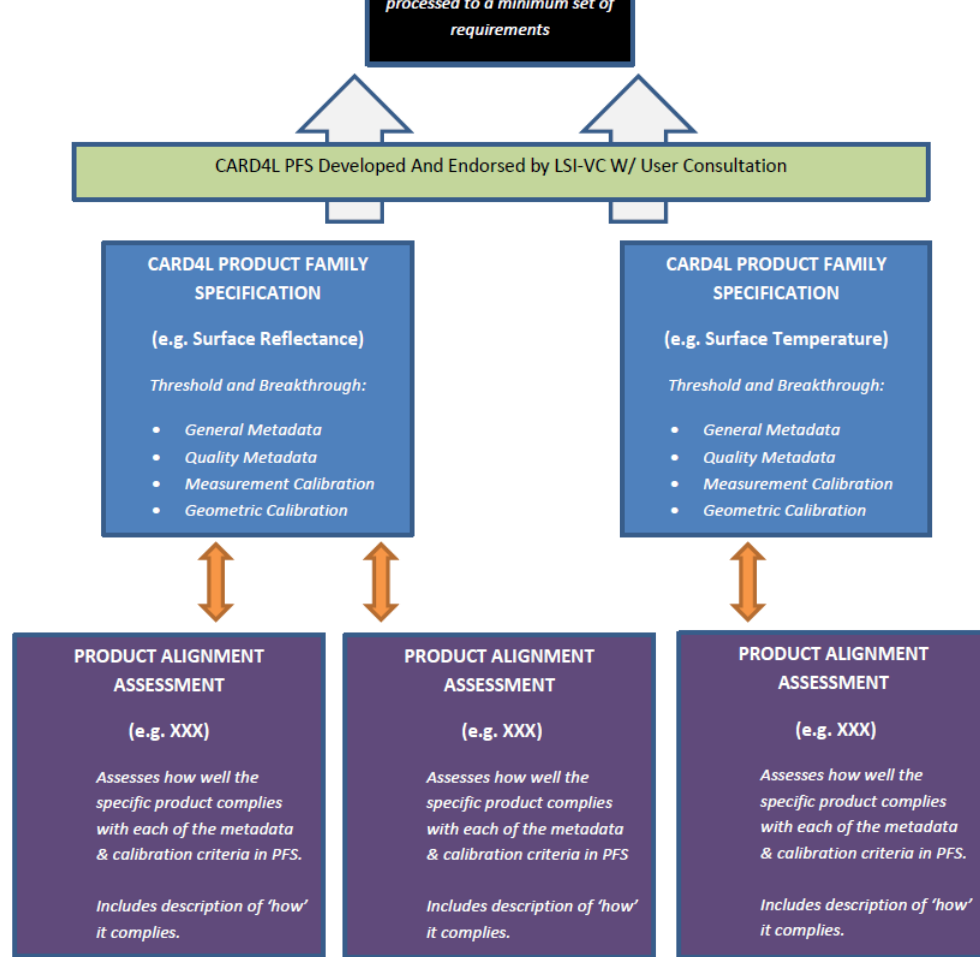
*CARD4L are satellite data that have been processed to a minimum set of requirements and organized into a form that allows immediate analysis with a minimum of additional user effort, and, interoperability both through time and with other datasets*

- ❑ **CARD4L is a framework for establishing ‘minimum requirements’ for products that:**
  - **Are ready for ‘immediate analysis’**
  - **Require minimal additional user effort to prepare**
  - **Interoperable with other CARD4L datasets**



# ARD framework







- General Metadata
- Quality Metadata
- Measurement Calibration
- Geometric Calibration

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- Quality Metadata
- Measurement Calibration
- Geometric Calibration



**PRODUCT ALIGNMENT ASSESSMENT**  
(e.g. XXX)

*Assesses how well the specific product complies with each of the metadata & calibration criteria in PFS.*

*Includes description of 'how' it complies.*

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PAA Developed by Agency Seeking CARD4L Brand  
Peer Review in collaboration with LSI-VC with WGCV

CARD4L  
TARGET

CARD4L  
THRESHOLD



# ARD framework

Definition of CARD4L

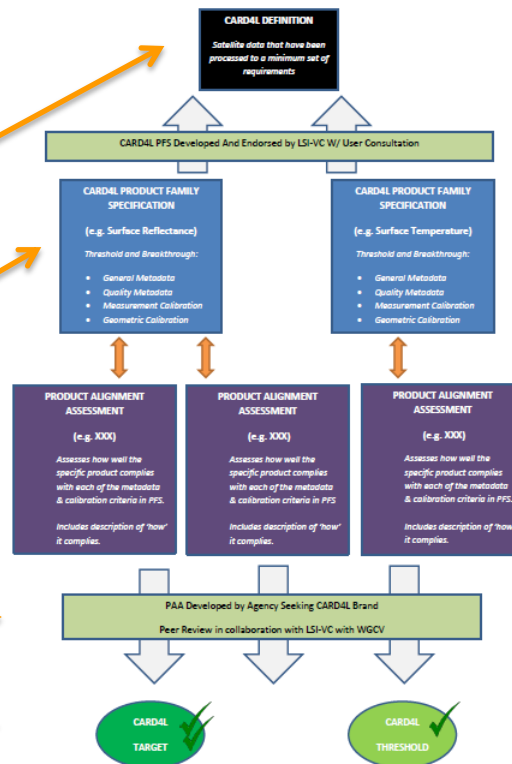
Product families with specifications

Providers self-assess

how well their products meet the specifications

Peer review

CARD4L stamp !





# 2018 ARD Standards: <http://ceos.org/ard/>

## Sensors

- Landsat OLI
- Landsat ETM+
- Landsat TM
- Landsat TIRS
- Sentinel-2a MSI
- Sentinel-2b MSI
- ALOS - PALSAR
- Sentinel-1a
- Sentinel-1b

## Product Families

- CARD4L PRODUCT FAMILY Surface Reflectance**
  - General Metadata
  - Quality Metadata
  - Measurement Calibration
  - Geometric Calibration
- CARD4L PRODUCT FAMILY Surface Temperature**
  - General Metadata
  - Quality Metadata
  - Measurement Calibration
  - Geometric Calibration
- CARD4L PRODUCT FAMILY Radar Backscatter**
  - General Metadata
  - Quality Metadata
  - Measurement Calibration
  - Geometric Calibration

## ARD products

- Surface Reflectance - OLI
- Surface Reflectance - ETM+
- Surface Reflectance - TM
- Surface Reflectance - MSI
- Surface Reflectance - Planet.
- Surface Temperature - TIRS
- Backscatter - L band PALSAR
- Backscatter - C band SAR

# AO GEOSS Task 4 Oceans, Coasts and Islands

## Analysis Ready Data for Water (ARD4W)

### Sensors

MODIS  
VIIRS  
GCOM-C  
Landsat  
Sentinel-2  
Kompsat?  
ALOS3?  
GF1?  
THEOS?

### Product Families

#### ARD4H20 Product Family

##### Ocean monitoring

- General Metadata
- Per-pixel Metadata
- Data Measurements
- Geolocation

#### ARD4H20 Product Family

##### Shallow Water Bathymetry

- General Metadata
- Per-pixel Metadata
- Data Measurements
- Geolocation

### ARD products

Ocean colour – MODIS  
Ocean colour – VIIRS  
Ocean colour – GCOM-C  
Ocean temperature – MODIS  
Ocean temperature – VIIRS  
Ocean temperature – GCOM-C  
Ocean solids – MODIS  
Ocean solids – VIIRS  
Ocean solids – GCOM-C

Shallow water bathymetry – Landsat  
Shallow water bathymetry – Sentinel-2  
Shallow water bathymetry – Kompsat?  
Shallow water bathymetry – ALOS1/3?  
Shallow water bathymetry – GF1?  
Shallow water bathymetry – THEOS?

## Task 4 OCI

- CARD4W/M/H2O
- What products?
  - Ocean products very mature – how do we connect existing work to CEOS framework?
  - Coastal products emerging – how do we develop the new standard?
    - *Coastal model?*
    - *Shallow water bathymetry?*
    - *Benthic mapping?*
- Who would like to contribute?
- Who can connect us with other existing technical forums