Gaining new insight by placing the Landsat archive into the context of rainfall, stream flow and tide

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Digital Earth Australia (DEA)

A continental archive of 30 years of analysis ready Earth Observation data

Processed to nadir view angle, BRDF, atmospherically corrected surface reflectance (NBAR)

Pixel Quality flags for cloud, cloud shadow, saturation

API makes it possible to link the time of observation to other contextual time-stamped data
Linking the Landsat archive to stream gauges
Erin Telfer
Diamantina River

Interactive hydrograph: Diamantina River at Birdsville (A0020101)

- All discharge values
- Discharge values with satellite imagery
interactive hydrograph: A0020101

- Discharge
- Discharge values with suitable satellite imagery

**Dates:**
- 1990-01
- 1990-07
- 1991-01
- 1991-07
- 1992-01
- 1992-07
- 1993-01
- 1993-07

**Discharge (m³/day):**
- 0
- 100000
- 200000

**Legend:**
- a) c)
- b) e)
- d) f)
- g)
OK, so it works really well for large desert catchments...
Extracting the intertidal extent and topography of the Australian coastline from a 28 year time series of Landsat observations

Dr. Stephen Sagar
National Earth and Marine Observations Branch
The Observed Tidal Range (OTR)

A sun-synchronous sensor – observes at the around the same time of the day for each observation.

This means that even with tidal variations, we most likely will only observe a portion of the full tidal range.

We can characterise this as highest (HOT) and lowest (LOT) observed tide.

Oregon State Tidal Prediction Software (OTPS)

*(Egbert and Erofeeva, 2002)*
The Intertidal Extents Model (ITEM) Process

- Each tile stack of observations is attributed with a tidal height utilising the OTPS model
- Observations are the reordered based on tidal height rather than time
- The Observed Tidal Range is divided into 10 equal interval buckets to create ensemble stacks of observations for each 10% of the range
Moving from Time to Tidal – how we deal with incomplete and noisy data

Reordering the ensemble of images into the tidal domain highlights the spatial trend

Extracting a median across different tidal intervals deal effectively with data noise, gaps, masking artefacts and a level of uncertainty in the tidal modelling.
The Relative Extents Model

Models the Extent and Topography of the Intertidal Flats

Layers values reflect the spatial extent of the exposed intertidal land surfaces at intervals of the OTR

Modelled up to the highest 80% of the OTR

Roebuck Bay, Western Australia
Where to next?

- Focus on exploring the coastal stability potential of the model
- More extensive validation through field work
- Contributing to government programs such as QLD Sub and Intertidal Habitat Mapping project

What ITEM is not designed for....

- Modelling the profile or elevation of areas that aren’t inundated in the tidal cycle (ie. beach profiling)
- Of limited use in micro tidal regions with a steep sloping shoreline or breaking waves
- Cannot model obstructed intertidal regions, ie vegetation cover, mangroves
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Leo Lymburner
Claire Phillips

Data Access:
or
http://eos.ga.gov.au

Extracting the intertidal extent and topography of the Australian coastline from a 28 year time series of Landsat observations

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Using composite imagery to explore change dynamics

Imagery can be constrained to specific tidal ranges over time to reduce tidal influence.

Specific temporal ranges can be examined to isolated changes based on events such as flooding and cyclones.
High and low tide composites – Cambridge Gulf, WA

High tide composite: top 10% of observations

Low tide composite: bottom 20% of observations

Provides valid surface reflectance spectra suitable for uses such as habitat mapping
MANGROVES IN CHANGING ENVIRONMENTS

Mapping of mangrove extent and zonation using high and low tide composites of Landsat data

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Mapping mangroves in Darwin Harbour
Mangrove mapping workflow
Improved classification accuracy through use of tidal composites

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Landsat in the context of rainfall anomalies

'Interpolated Rain Gauge Precipitation 1-Day Australia 5km Gridded'
EPSG:4326 (WGS84) resolution 0.05 degrees – Bureau of Meteorology

Dry season of driest year (red) and dry season of wettest year (blue)
The influence of a more complete archive in DEA