



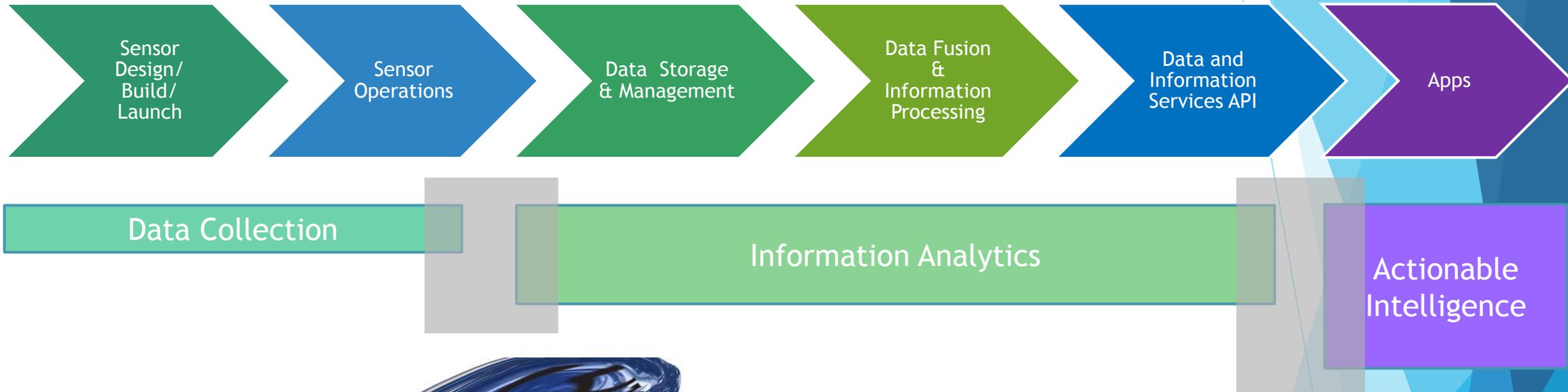
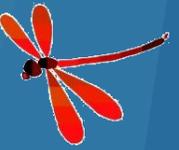
Actionable Intelligence for the Oceans: “Removing the blah”

Graham Stickler

Beyond One Eighty

UNESCO, Paris, 7 December 2016

The Intelligence Supply Chain





Topics

1. Digital Data
 - ▶ When is it 'big'?
2. Digital Geo Data
 - ▶ What makes it special?
3. Data sources
 - ▶ The role of Space
4. Information and Actionable Intelligence
 - ▶ 'Removing the blah'



Big data? - Yes, but it's not just the amount of data, its now about volume too - i.e. throughput!



Courtesy of the MITRE Corporate Archive
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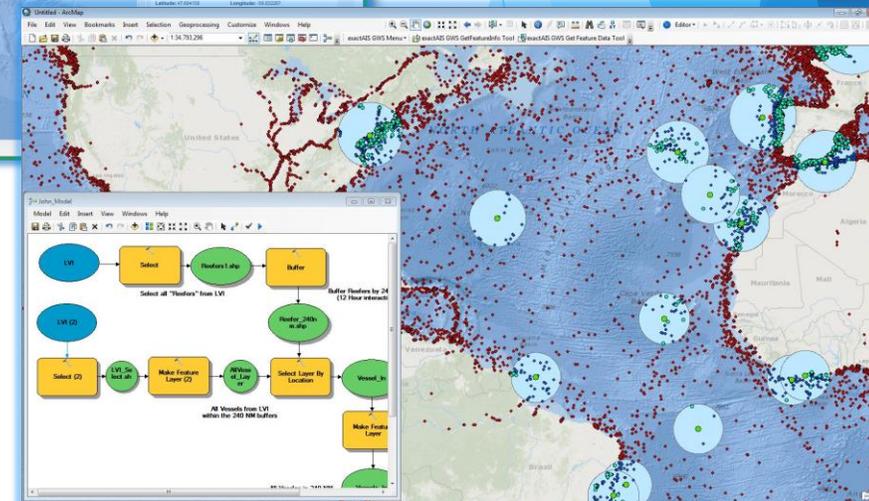
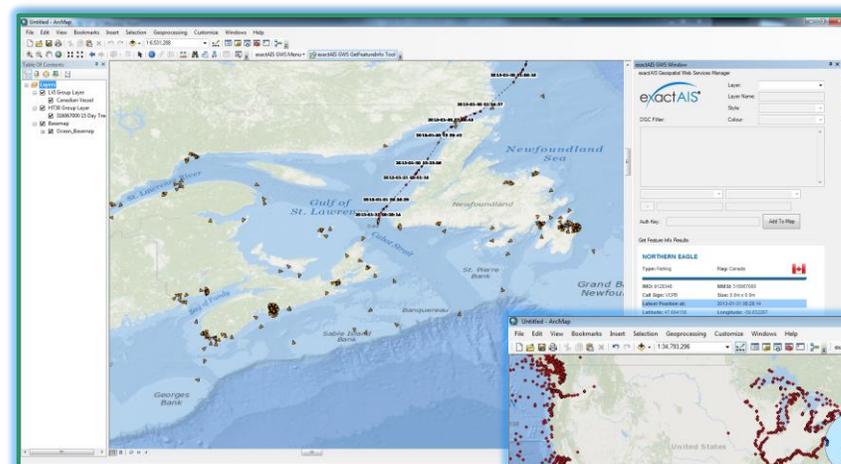
What is Big Data Analytics?
What is (Big) Business Intelligence?

- ETL, OLAP, AI



Geospatial data

- ▶ Not to be confused with GIS or ‘maps’
 - ▶ What’s the difference between a GIS, a Digital Map, a Geospatial database, a web map portal?
- ▶ Location, Location, Location
 - ▶ A common reference
- ▶ Specialist data type
 - ▶ Specialist analytics
 - ▶ Nearness, within, without, projection
- ▶ Map
 - ▶ User interface



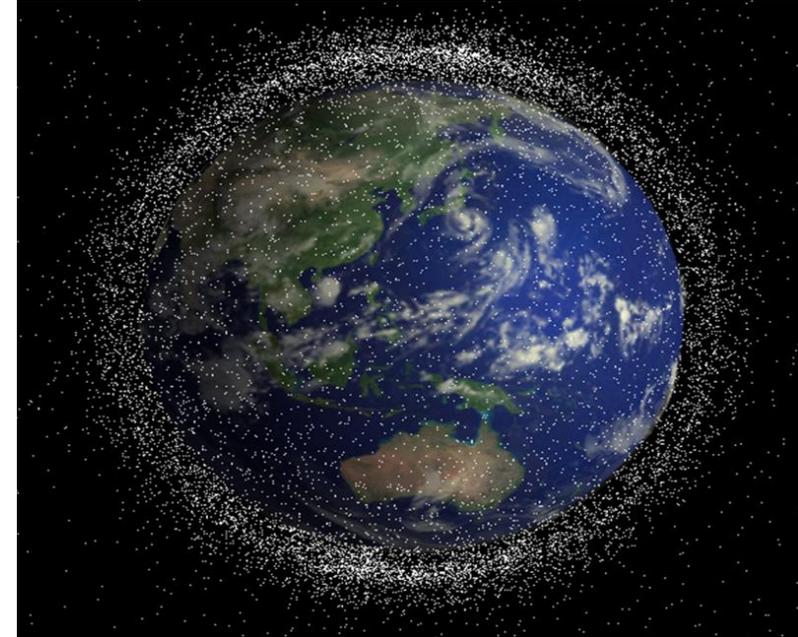
The increasing role of Space



- ▶ Satellites are playing an increasingly important role in the Oceans
 - ▶ Data collection sensors themselves
 - ▶ Sensor communications

 - ▶ Data communications channel
 - ▶ One and two-way
 - ▶ E-Navigation

- ▶ Today, only concentrating on Satellites as Sensor platforms



Imaging from Space

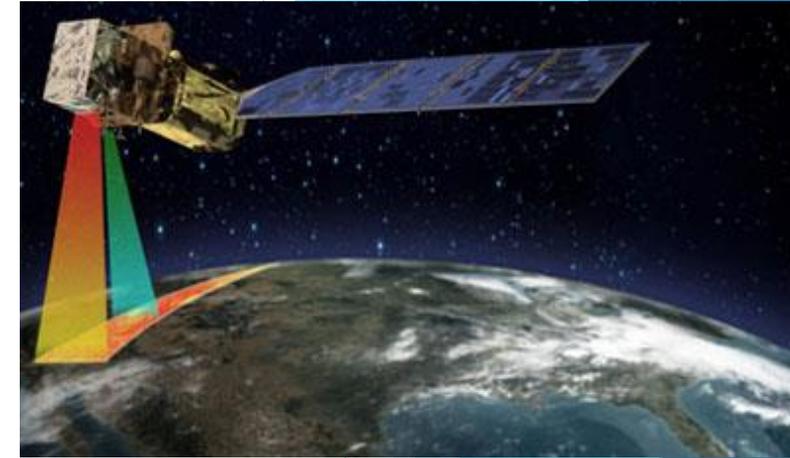


▶ Optical imagery

- ▶ From the early days of Landsat 1 in early 70's the earth has been 'pictured' with increasingly accuracy and regularity
- ▶ DigitalGlobe satellites (WorldView, GeoEye, QuickBird, IKONOS) capture between 50 and 60 terabytes of imagery every day and has a library of more than 80 petabytes.
- ▶ Landsat, Airbus (Pleiades, SPOT,), BlackBridge RapidEye , Deimos, Urthecast
- ▶ Planet Labs Inc began launching its first 'flock' of nanostaellites into space in 2014. The goal is to capture high-res snapshot of the entire globe every 24 hours.
- ▶ And 70% of the planet (the Ocean) has been largely ignored until now.

▶ Then there's radar!

- ▶ Airbus TerraSAR, RadarSat, Sentinel,



Weather and Oceans

- ▶ Weather
 - ▶ TIROS-1 in 1960, Nimbus, ESSA, NOAA, GOES ... GOES-R (Nov 19 2016)
 - ▶ Atmospheric Infrared Sounder, AIRS, NASA
 - ▶ Greenhouse Gases Observing Satellite "IBUKI" (GOSAT), JAXA
 - ▶ Measurement of Pollution in the Troposphere (MOPITT), NASA
 - ▶ Global measurements of atmospheric CO₂, OCO₂, NASA JPL
- ▶ Ocean related
 - ▶ ERS Program, ESA
 - ▶ Wave swell and surface wind, CFOSAT, France/China
 - ▶ MetOp-A, ADEOS-1, QuikSCAT, Jason-1, ERS-1, ENVISAT, TRMM, AQUA





GOES-R

GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE R-SERIES

The next generation of geostationary environmental satellites

The GOES-R series will provide significant improvements in the detection and observations of meteorological phenomena that directly affect public safety, protection of property and our nation's economic health and prosperity.

www.noaa.gov www.nasa.gov

Ship Tracking: Satellite-AIS Growth



6-8 million

Satellite AIS
position reports
daily

> 50,000

Unique vessels
detected daily

< 30

Minute Avg. global
latency

60 million+

Satellite AIS
position reports
daily

> 140,000

unique vessels
detected every day

< 1

minute Avg. global
latency



POWERED BY
esri

Courtesy of exactEarth Limited.

Other Sensors

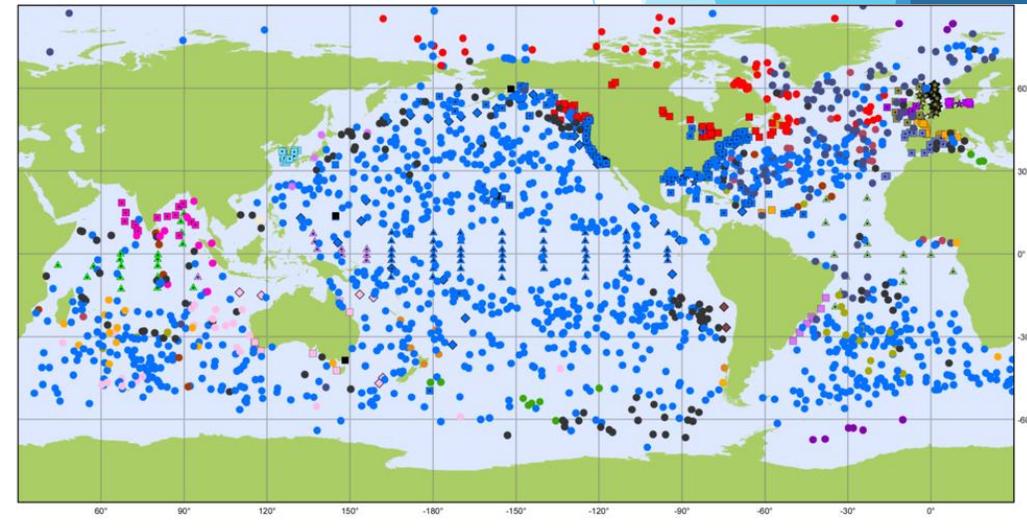
- ▶ Aircraft, Drones, UAVs, Buoys, Ships ('Fleet Sourcing')
- ▶ NOAA GOOS Program
 - ▶ NOAA National Data Buoy Centre
 - ▶ Static plus Global Drifter Array. Satellite-tracked surface drifting buoy observations of currents, sea surface temperature, atmospheric pressure, winds and salinity.
 - ▶ DART (Deep-ocean Assessment and Reporting of Tsunamis)
 - ▶ ARGO - 3739 Buoys reporting 29 Nov 2016
- ▶ Drones, UAVs



Courtesy NOAA



Image courtesy of Liquid Robotics.



Map from the Data Buoy Cooperation Panel (DBCP) website showing deployed Buoys by Platform Type as of September, 2016. 1421 buoys in GDP.

The challenge



- ▶ How do we bring all this data together and empower users with information so that they can make decisions?
 - ▶ Without those same users having to invest huge sums in infrastructure and 'technology expertise training'
 - ▶ The remote sensing industry hasn't changed in 30 years - still selling pixels.

▶ What is needed?

- ▶ Storage: 'The Cloud'; (the easiest bit) eg Amazon,
- ▶ Common access points, eg GEOSS, MapMart, CloudEO, DigitalGlobe BGDX
- ▶ (Big Data) Analytics including AI <coming fast>
- ▶ <missing layer>: integrate, fuse, access to actionable intelligence
- ▶ Question for the audience?
- ▶ Who is defining and delivering your Information and Intelligence requirements?

- ▶ A tidal wave of data is upon us. Yes it could reveal a new whole dimension to our understanding of the Oceans. Do we have the necessary surfboards to ride it or will it just crash all over us?





What is the average surface temperature of the moon



Google Search

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Google.nl offered in: [Nederlands](#)



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About 4.470.000 results (0,57 seconds)

The average temperature on the Moon (at the equator and mid latitudes) varies from -298 degrees Fahrenheit (-183 degrees Celsius), at night, to **224 degrees Fahrenheit** (106 degrees Celsius) during the day.

[What is the temperature on the Moon? | Cool Cosmos](https://coolcosmos.ipac.caltech.edu/ask/168-What-is-the-temperature-on-the-Moon-)
coolcosmos.ipac.caltech.edu/ask/168-What-is-the-temperature-on-the-Moon-

[About this result](#) • [Feedback](#)

[What is the Temperature on the Moon? - Space.com](#)

www.space.com › [Science & Astronomy](#)

Oct 22, 2012 - **Temperatures** on the **moon** are extreme, ranging from boiling hot to freezing cold depending on where the sun is shining. ... When sunlight hits the **moon's surface**, the **temperature** can reach 253 degrees F (123 C). ... LRO Diviner **Lunar Radiometer Experiment surface temperature** map of the ...

[How did lunar astronauts survive the extreme temperatures on the ...](#)

<https://www.spaceanswers.com/.../how-did-lunar-astronauts-survive-the-extreme-temp...>

Nov 19, 2012 - The first thing to know is that all trips on to the **Moon's surface** were carefully planned for **lunar** dawn, to ensure the **surface** hadn't had time to ...

[What is the temperature on the Moon? | Cool Cosmos](#)

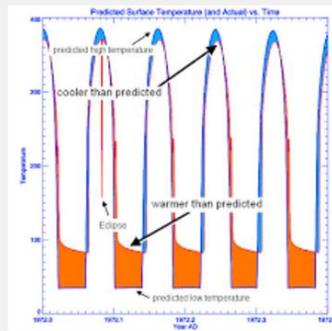
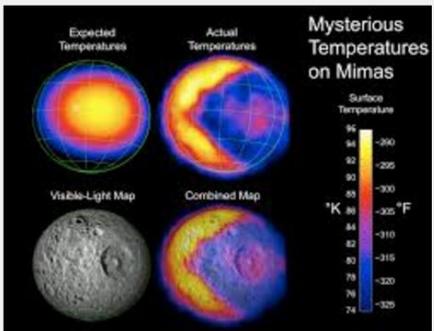
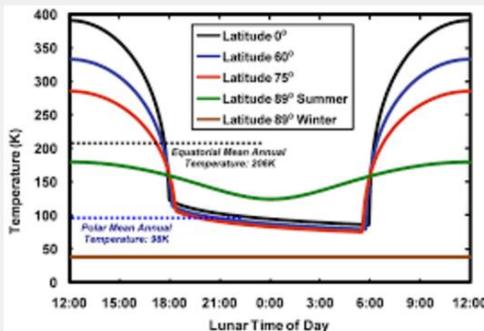
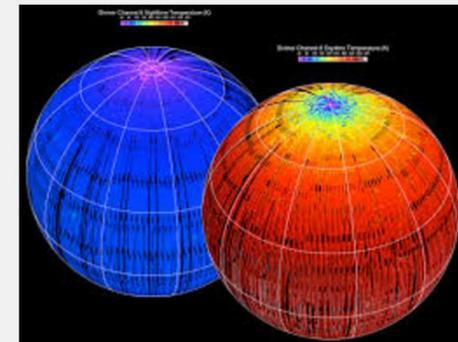
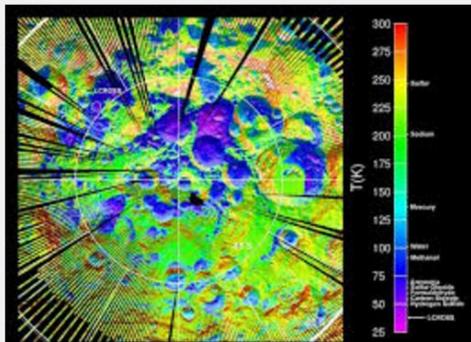
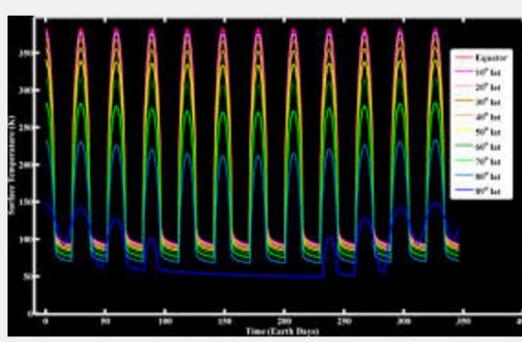
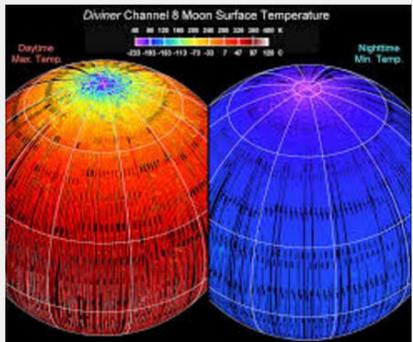
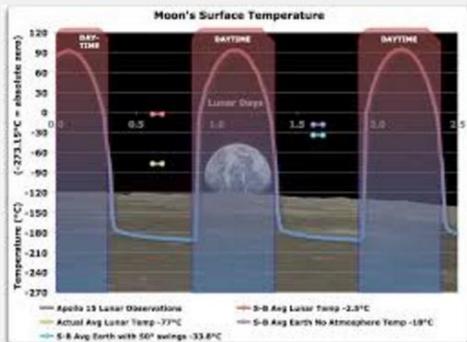
coolcosmos.ipac.caltech.edu/ask/168-What-is-the-temperature-on-the-Moon-

The average temperature on the Moon (at the equator and mid latitudes) varies from -298 degrees Fahrenheit (-183 degrees Celsius), at night, to **224 degrees Fahrenheit** (106 degrees Celsius) during the day.

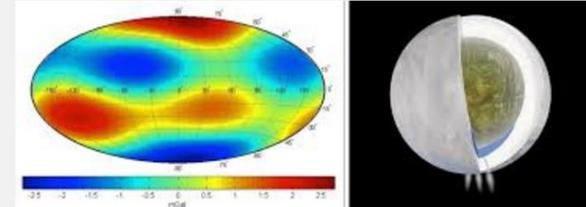
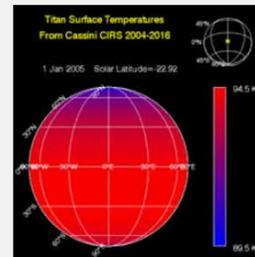
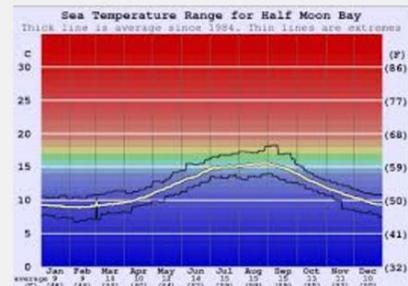
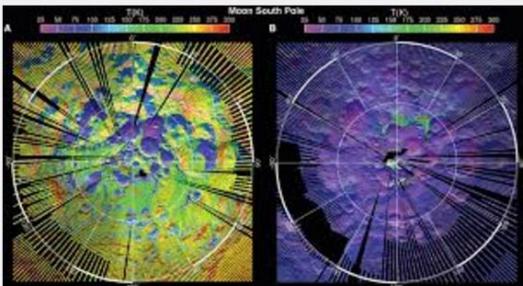
[Why Earth's surface is so much warmer than the Moon's – Part 1 ...](#)

<https://tallbloke.wordpress.com/.../why-earths-surface-is-so-much-warmer-than-the-m...>

Dec 10, 2012 - The Earth and the **Moon** are at the same **average** distance from the Sun, but their **average surface temperatures** are different by around 91C.



	Daytime High			Nighttime Low		
	°C	°K	°F	°C	°K	°F
Mean Surface	107	380	225	-153	120	-243
Equator (0° Latitude)	122	395	252	-158	115	-252
Mid-Latitudes	77	350	171	-143	130	-225
Poles	-43	230	-45	-63	210	-81
Dark Polar Crater	-233	40	-387	-233	40	-387





What is the average sea surface temperature at the Ningaloo Reef 

Google Search

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Ningaloo sea surface temperatures (SST) | Ningaloo Atlas

ningaloo-atlas.org.au › [Browse by Institution](#) › [NOAA](#) ▼

Dec 5, 2011 - **Sea surface temperature (SST)** is the water temperature close to the ocean's surface. ... caused by long periods (usually 4 to 8 weeks) of warmer than **average** summer **SST's**. ... NOAA Coral Reef Watch **SST** (21.5°S, 114°E).

Coral Bay climate: when to go to the Ningaloo Reef - Travel Guide

www.travelguide-en.org › [Oceania](#) › [Australia](#) ▼

At Coral Bay the **average** maximum **temperature** greatly exceed the 30 ° C , reaching ... The **water temperature** of the **sea** along the coast of the **Ningaloo Reef** is ...

Weather for Coral Bay Ningaloo Reef

www.coralbaywa.com.au/2011/03/weather-for-coral-bay-ningaloo-reef/ ▼

Month, Land **Temp.** °C, **Water Temp.** °C. January, Low to high 30's, 25-28. February, Low to high 30's, 25-28. March, Low 30's, 25-28. April, Low 30's, 19-22.

[PDF] tide and seawater temperature data from the ningaloo reef tract, w ...

edit.epa.wa.gov.au/EPADocLib/EPA-bulletin_253.pdf ▼

Seawater temperatures in the **Ningaloo Reef** lagoon were highly variable in space **Ningaloo Reef** lagoon and **mean** weekly **sea surface temperatures** of the ...

Tide and seawater temperature data from the Ningaloo Reef tract ...

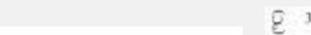
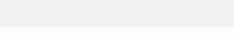
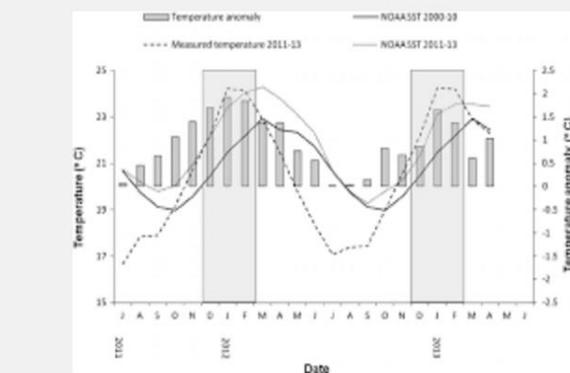
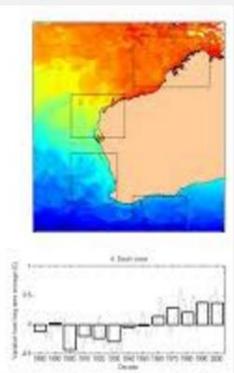
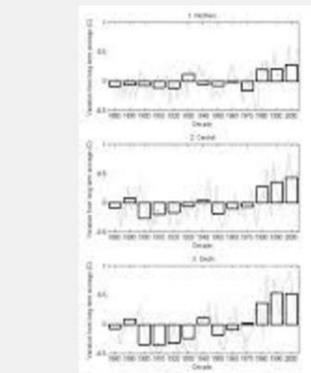
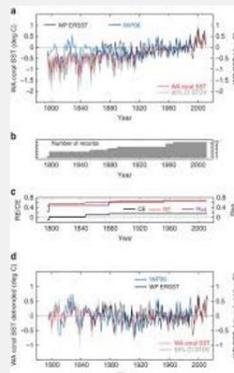
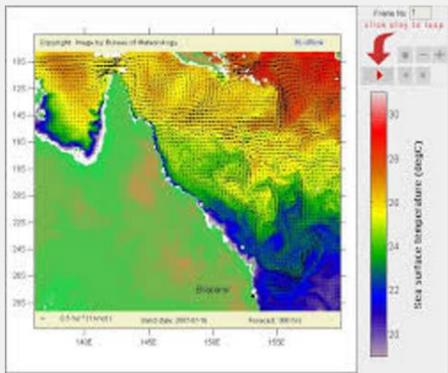
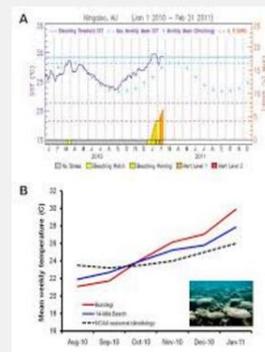
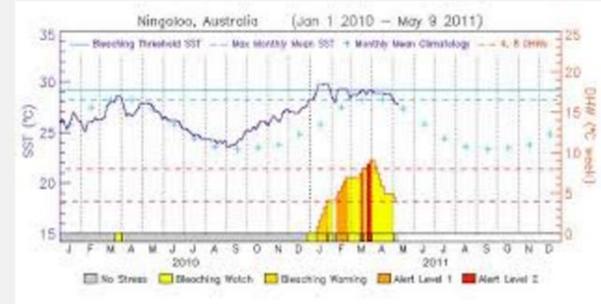
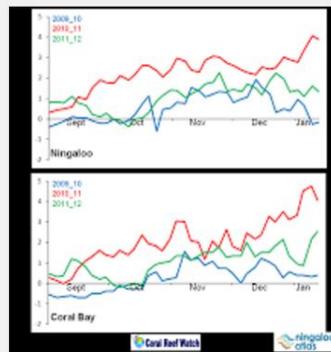
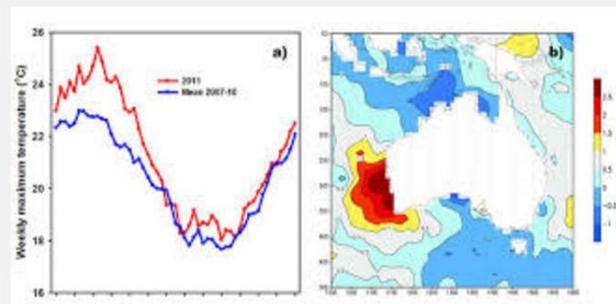
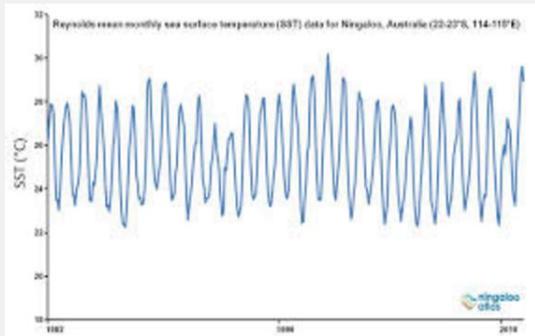
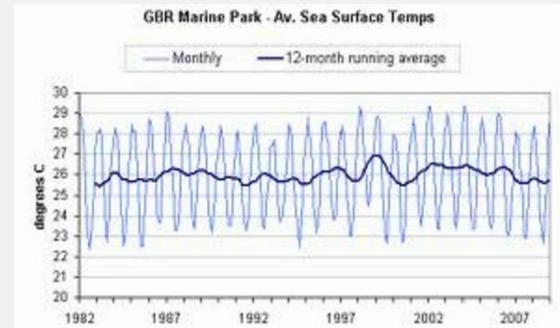
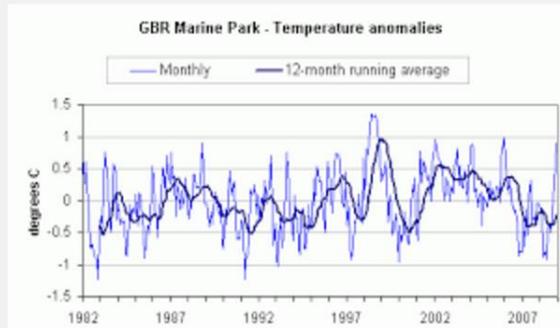
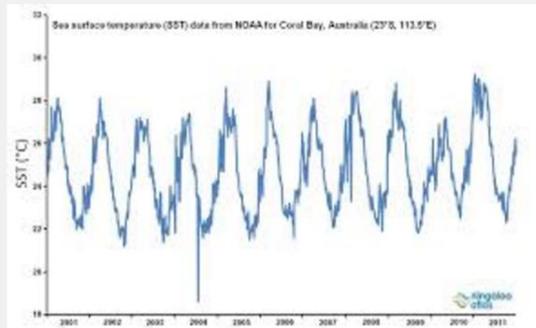
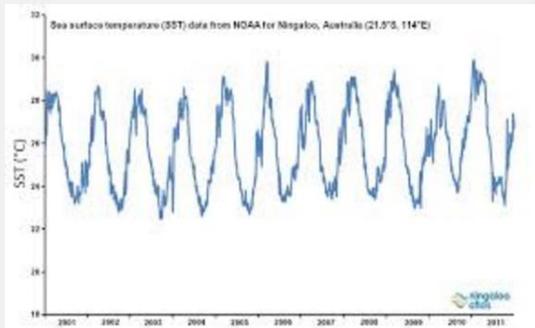
www.epa.wa.gov.au › [Home](#) › [Environmental Impact Assessment](#) › [EPA Reports](#) ▼

Tide and seawater **temperature** data from the **Ningaloo Reef** tract, Western ... **Sea temperatures**, seasonal changes in wind and **water** current patterns, tidal ...

Increased sea surface temperatures off Western Australian coast ...

news.curtin.edu.au › [News and events](#) › [News stories](#) ▼

Nov 2, 2015 - Increased **sea surface temperatures** off Western Australian coast ... within coral cores





what is the average sea surface te

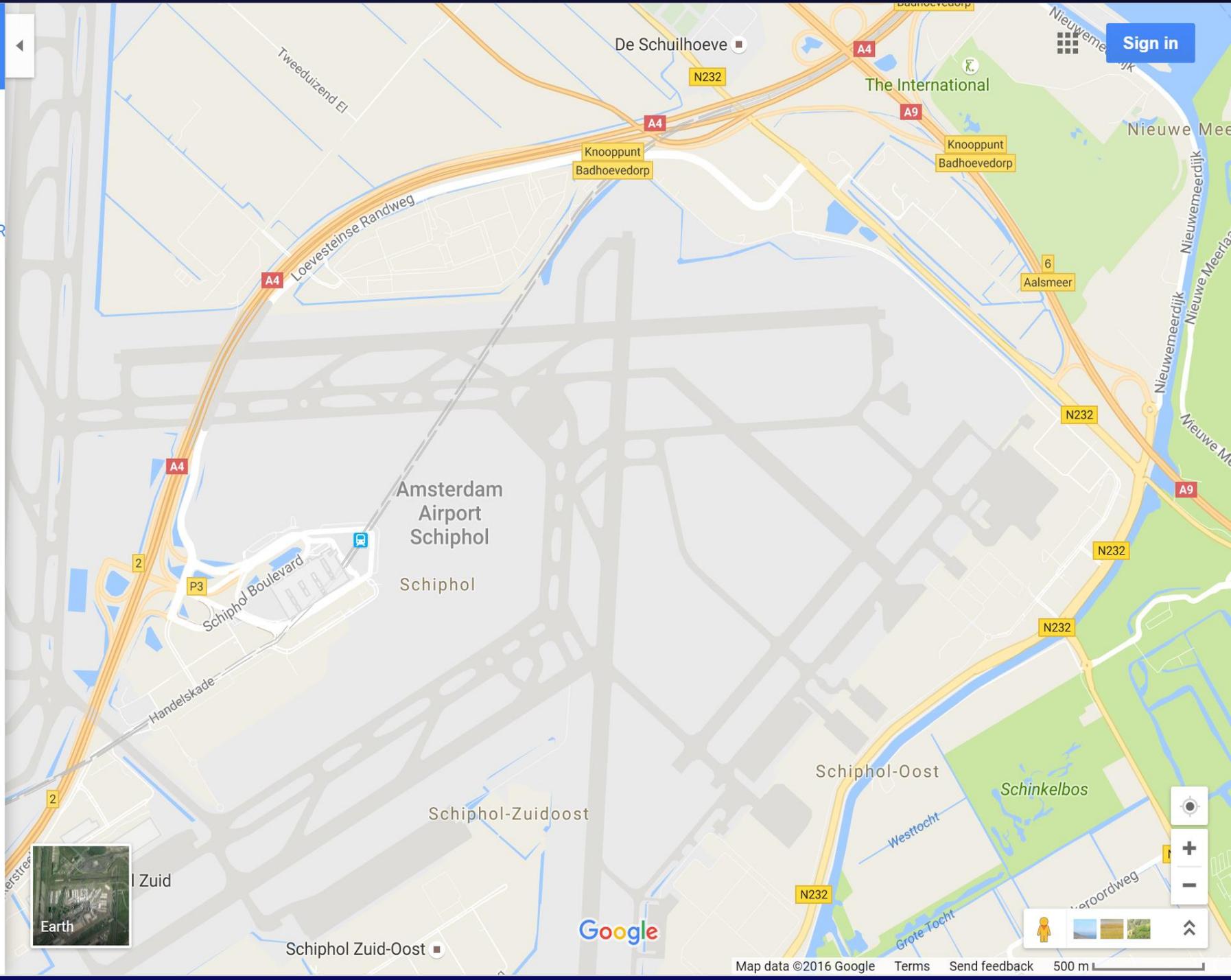


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Dare to dream?





SimpleOceanSearch

B180

|What is the average sea surface temperature at Ningaloo Reef?



SOS Search

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Temperature Portal

Key Performance Indicator

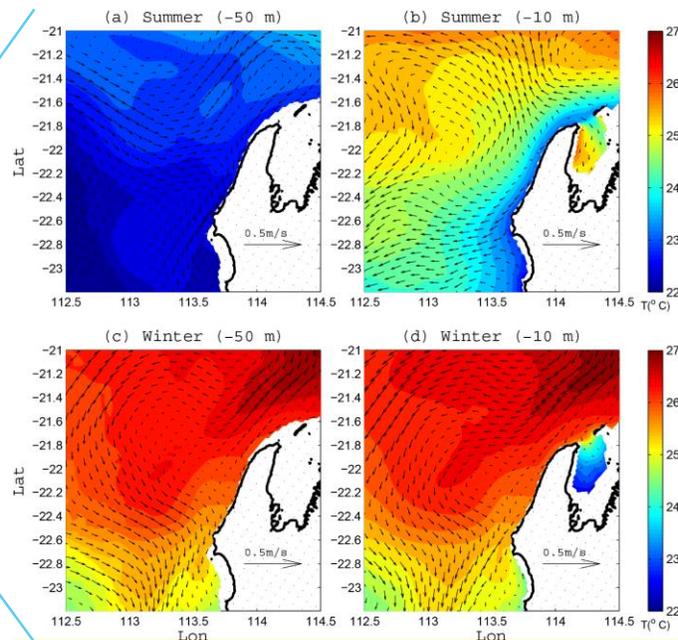
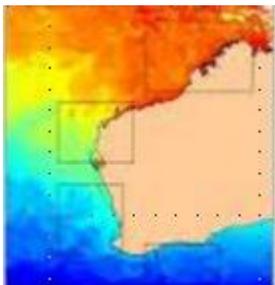
[Summary](#) More ▼

The average sea surface temperature on the Ningaloo Reef, Northwest Australia, varies between **26 degrees Centigrade** (79 degrees Fahrenheit) during to summer months and **22 degrees Centigrade** (72 degrees Fahrenheit) in Winter.

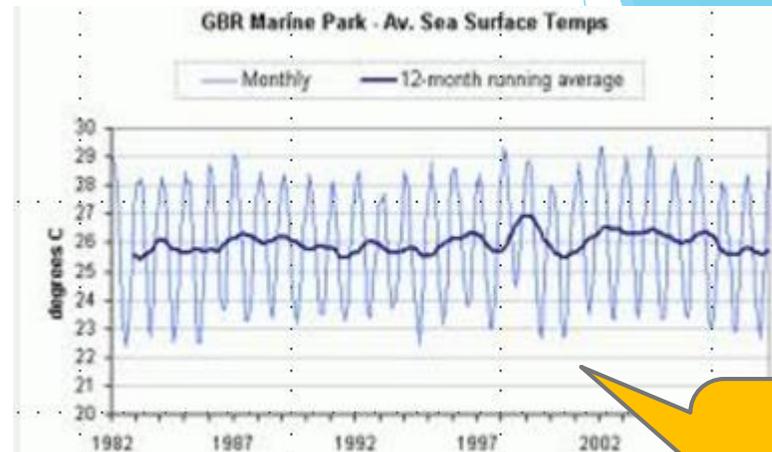
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Interactive Map

Navigation / UI



Data Sources



Information

Images



Information

Hope Spots



- ▶ MAP centric UI
- ▶ Where in the nomination process is this Hope Spot? Fuel Gauge?
- ▶ How much PR has this Hope Spot received in last 12 months? Line graph by month. Rank number?
- ▶ How many visits has this Hope Spot's web page received?
- ▶ Health
 - ▶ Index / Rank / 12 month comparison? Line Bar
- ▶ Nominator Contact Info: Text
- ▶ Video / Pictures: media files
- ▶ Expedition Timetable: Calendar
- ▶ Environmental / Biology Info:
 - ▶ Temperature, Salinity, Species
- ▶ Pollution: Graphs?
 - ▶ Litter
 - ▶ Nitrogen Levels
- ▶ Shipping
 - ▶ Counts and Trends - Histograms?



United Nations
Environment Programme



Global Environment
Facility

Transboundary Diagnostic Analysis of Land-based Sources and Activities in the Western Indian Ocean Region

CHAPTER 4 - ASSESSMENT OF MAJOR TRANSBOUNDARY PROBLEMS AND ISSUES

Draft

July 2008



Transboundary Diagnostics Analysis of Land-based Sources and Activities in the West Indian Ocean Region

Draft: 2008

Chapter 4 Assessment of Major Transboundary Problems and Issues (102 pages)



4 Assessment of major transboundary problems and issues

4.1 Introduction

This chapter of the TDA presents an analysis of the major perceived and documented problems related to land-based sources and activities.

4.1.1 Identification of major perceived problems and issues

The identification of the major perceived problems and issues is a first step in the TDA process. It constitutes the basis for subsequent in-depth scientific and technical analysis of such perceived problems and issues in order to validate and prioritize the same.

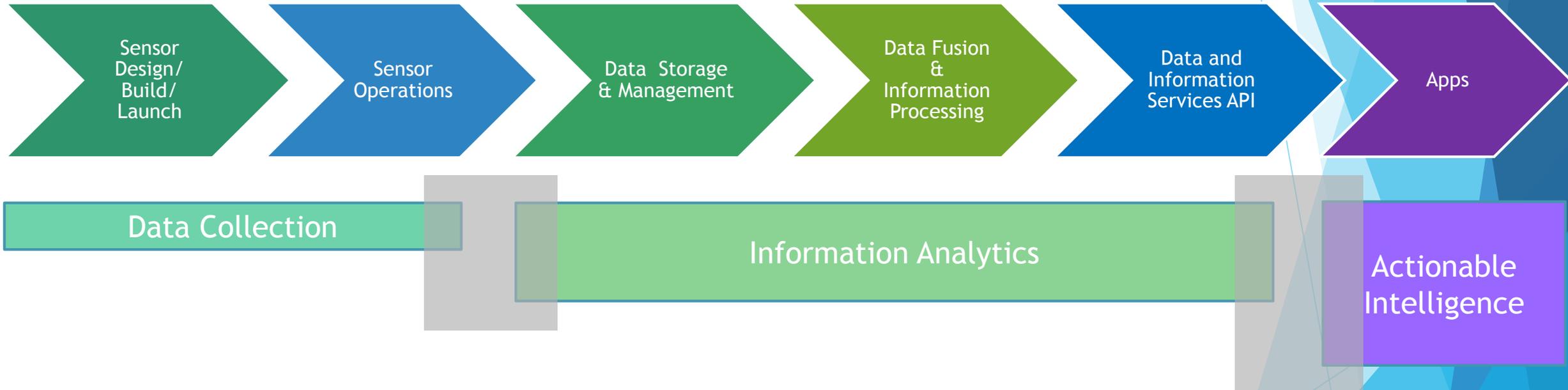
The classification of key transboundary problems related to LBSA is primarily based on the results of the regional TDA/SAP workshop held in April 2007 in Nairobi, Kenya, which identified and grouped problems into three distinguishable clusters:

1. Water and sediment quality degeneration due to pollution from land-based sources;
2. Physical alteration and destruction of habitats; and
3. Alteration in freshwater flows and sediment loads from rivers.

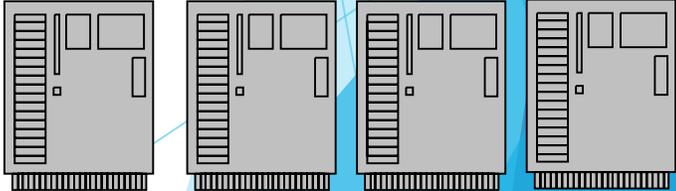
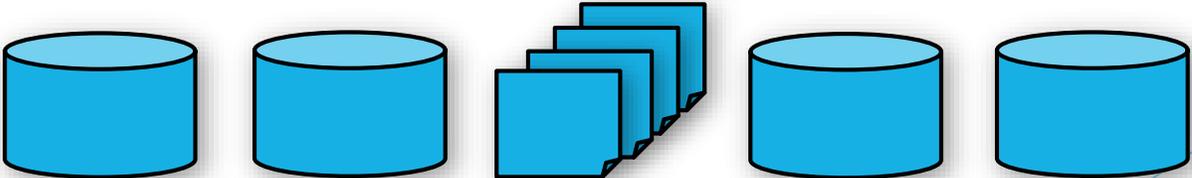
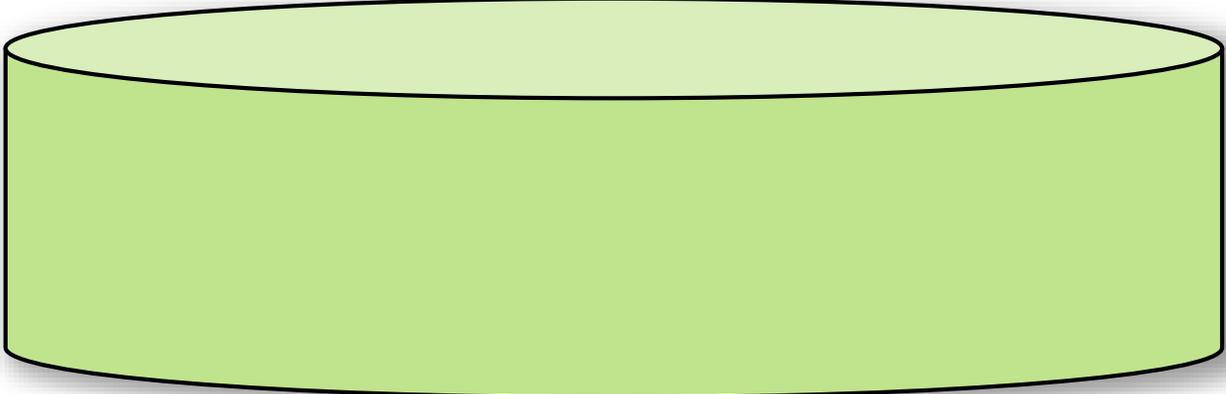
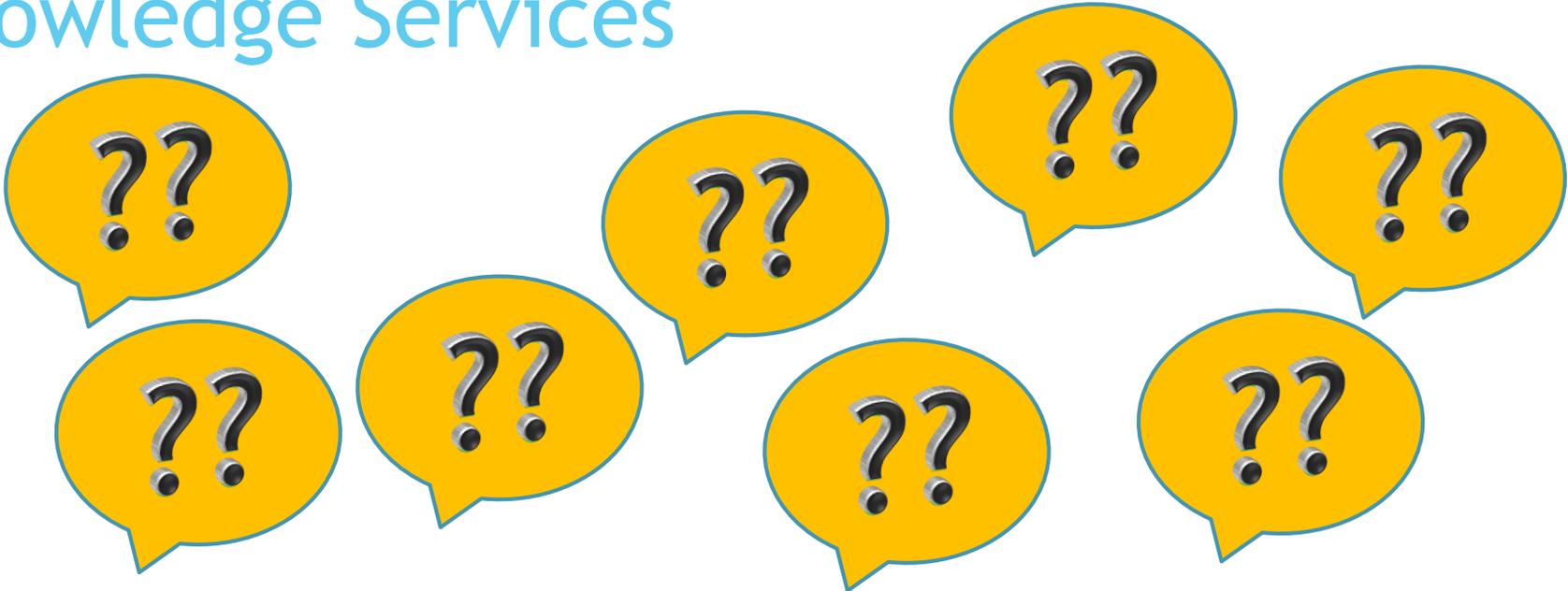
The TDA identified five distinguishable pollution categories:

1. Microbial contamination
2. High suspended solids
3. Chemical pollution
4. Marine litter
5. Eutrophication (harmful/nuisance algal blooms)

The Intelligence Supply Chain



Knowledge Services





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