

衛星多元遙測資料服務平台



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多元衛星影像整合



多元多時序衛星資料整合: Data Cube

■ 影像前處理程序

- 影像前處理程序為後續影像分析之基礎
- 對遙測影像之終端使用者為相對困難
- 影像輻射前處理產生即可分析資料(Analysis Ready Data, ARD)

■ 多元多時性衛星影像提供方式

- 檔案方式之資料提供模式有其限制
- 以資料服務方式進行資料提供做為改進 (Data Cube Service Model)

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Taiwan Data Cube (TWDC)



TWDC與TWCC



台灣杉二號
TAIWAN↑A 2

The NCHC is accelerating
AI innovation in Taiwan



20TH 10TH
計算能量 能源效率

2018年11月排名 TOP 500 Green 500

TWDC
衛星多元遙測資料服務平台

TWCC TAIWAN
COMPUTING
CLOUD

TWDC功能與應用

- 資料時空範圍查詢與管理
- 影像匯整與輸出
- 基本分析應用
 - 光譜指標運算
- 客製化分析應用

資料時空範圍查詢與管理

已匯入資料空間範圍

Ingested Data Cubes

The regions visualized on the map represent the various Data Cubes that are present and ingested on the system.

Use the filtering options below to hide or show specific subsets of Ingested data. Clicking a region on the map will populate the area below with additional information about the clicked regions.

Selecting one of these cards will create a pop up with specific details about the area and a link where a sample cube can be created based on the area.

Start Date
01/01/2010

End Date
01/02/2010

Source Dataset Type
All

Select a platform to filter Data Cubes

- ✖ fs8_lasrc_general
- ✖ fs2_ms_nspo_general
- ✖ s1_sigma0_general
- ✖ s1_gamma0_general
- ✖ fs5_ms_nspo_general

Additional Information ✕

Satellite	FS5 MS_NSP0
Product	fs5_ms_nspo_general
Min Latitude	22.119539995
Max Latitude	25.30280466
Min Longitude	120.1700239075
Max Longitude	121.2149428175
Start Date	2018-11-03
End Date	2019-03-01
Scene Count	47
Pixel Count	2166561656

View Dataset Type

View Datasets

Create a Sample Cube

Close

福衛五號資料空間範圍

影像匯整與輸出

Filters
History
Results
Output

Satellite

FS5 MS NSPO

Data Selection:

Result Type (Map view/png):

NIR, RED, GREEN

Compositing Method:

Least Recent Pixel

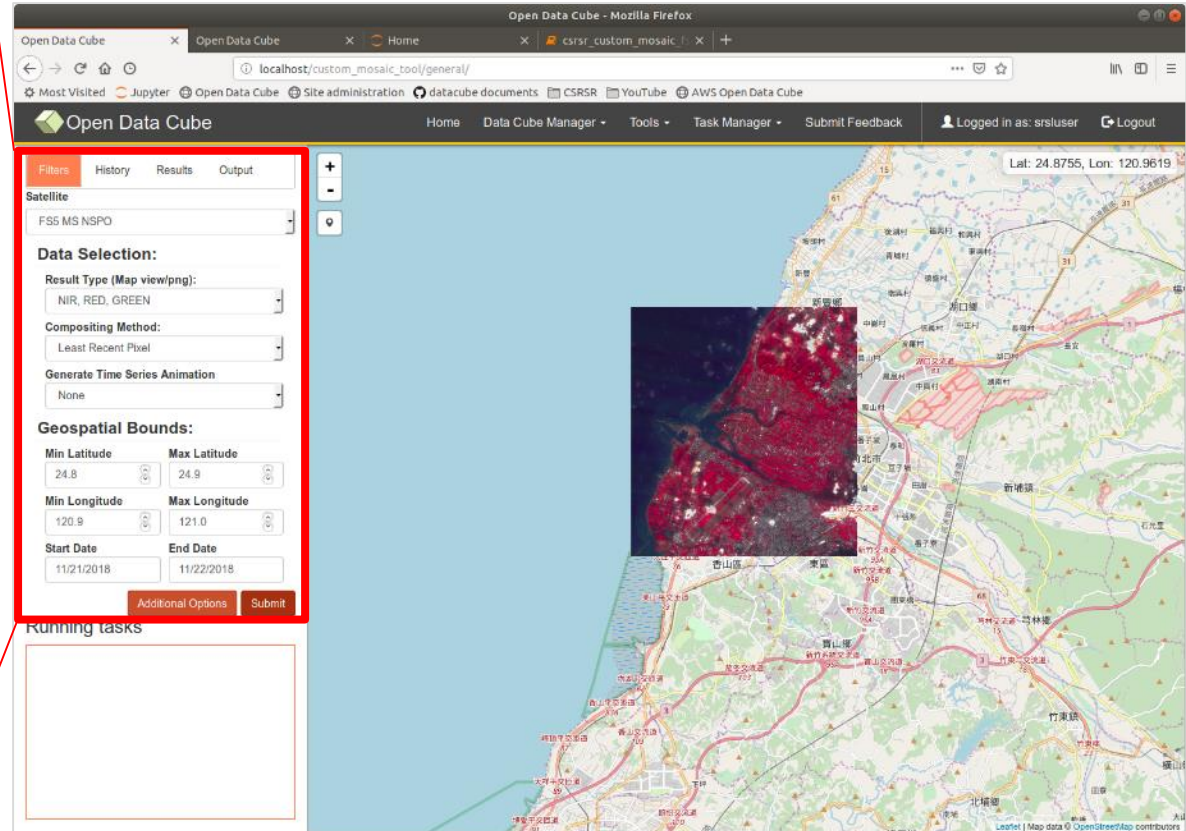
Generate Time Series Animation

None

Geospatial Bounds:

Min Latitude	Max Latitude
<input type="text" value="24.8"/>	<input type="text" value="24.9"/>
Min Longitude	Max Longitude
<input type="text" value="120.9"/>	<input type="text" value="121.0"/>
Start Date	End Date
<input type="text" value="11/21/2018"/>	<input type="text" value="11/22/2018"/>

Additional Options
Submit



單一日期影像: 2018/11/21

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The screenshot displays the Open Data Cube web interface in a Mozilla Firefox browser. The page is titled "Open Data Cube" and shows details for a specific task. The interface is divided into several sections:

- Task Details:**
 - Title: Custom Mosaic Query
 - Description: None
 - Status: Complete
 - Start Time: 07/25/2019 03:04
 - End Time: 07/25/2019 03:04
- Task Metadata:**
 - Platform: FS5_MS_NSPO
 - Scene Count: 2
 - Pixel Count: 6517809
- Task Parameters:**
 - (Lat, Lon) Min: (24.800000, 120.900000)
 - (Lat, Lon) Max: (24.900000, 121.000000)
 - Compositing Method: Least Recent Pixel
- Task Outputs:**
 - Mosaic Path: [View image](#)
 - Filled Mosaic Path: [View image](#)
 - NetCDF Path: [Download nc](#)
 - GeoTIFF Path: [Download tif](#)
- Scene Metadata:**

Date	Clean pixels	Total Pixels	Clean Pixel Perc...	Satellite
11/21/2018	6360644	6517809	97.59%	FS5_MS_NSPO
11/21/2018	2834145	6517809	43.48%	FS5_MS_NSPO

The main image on the right is a satellite mosaic of a coastal area, with a blue overlay indicating the cloud mask. A callout box labeled "Cloud Mask" points to the blue areas. Below the main image are two smaller thumbnail images.

localhost/custom_mosaic_tool/task_details/5319e401-42f0-42d9-8e1f-b63ba8bbf588#carousel

單一日期影像: 2018/12/17

The screenshot displays the Open Data Cube web interface in a Mozilla Firefox browser. The browser tabs include 'Open Data Cube', 'Home', and 'csrsr_custom_mosaic'. The address bar shows the URL: localhost/custom_mosaic_tool/task_details/0226a5cd-3909-4fa0-8b4c-d36281f5e777. The interface is divided into several sections:

- Task Details:** A table with the following information:

Title	Custom Mosaic Query
Description	None
Status	Complete
Start Time	07/25/2019 03:09
End Time	07/25/2019 03:09
- Task Metadata:** A table with the following information:

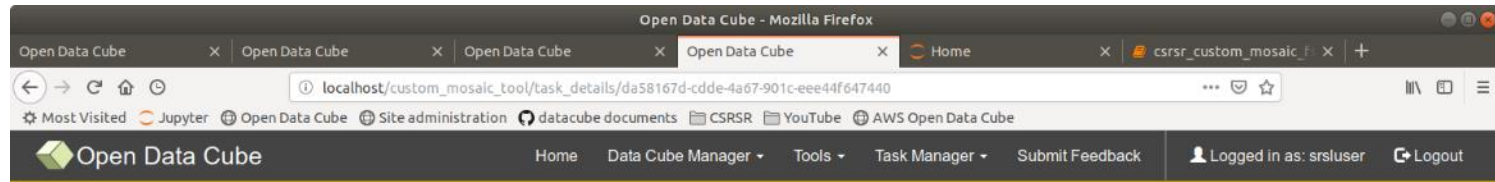
Platform	FS5_MS_NSPO
Scene Count	1
Pixel Count	6517809
- Task Parameters:** A table with the following information:

(Lat, Lon) Min	(24.800000, 120.900000)
(Lat, Lon) Max	(24.900000, 121.000000)
Compositing Method	Least Recent Pixel
- Task Outputs:** A list of links: Mosaic Path (View image), Filled Mosaic Path (View image), NetCDF Path (Download nc), and GeoTIFF Path (Download tif).
- Scene Metadata:** A table for the date 12/17/2018:

Clean pixels	6328584
Total Pixels	6517809
Clean Pixel Perc...	97.10%
Satellite	FS5_MS_NSPO
- Mosaic Image:** A large satellite mosaic image with a dark blue area on the left. A callout bubble points to a dark area in the top right, labeled 'No Data Area'. Below the image, text reads: 'Custom Mosaic Image (No-data filled)' and 'Output mosaic image with no-data areas filled with a contrasting color for the task with the id: 0226a5cd-3909-4fa0-8b4c-d36281f5e777'.

localhost/custom_mosaic_tool/task_details/0226a5cd-3909-4fa0-8b4c-d36281f5e777#carousel

複合日期影像: 2018/11/21+2018/12/17



Task Details

Title	Custom Mosaic Query
Description	None
Status	Complete
Start Time	07/17/2019 00:09
End Time	07/17/2019 00:09

Task Metadata

Platform	FS5_MS_NSPO
Scene Count	3
Pixel Count	6517809

Task Parameters

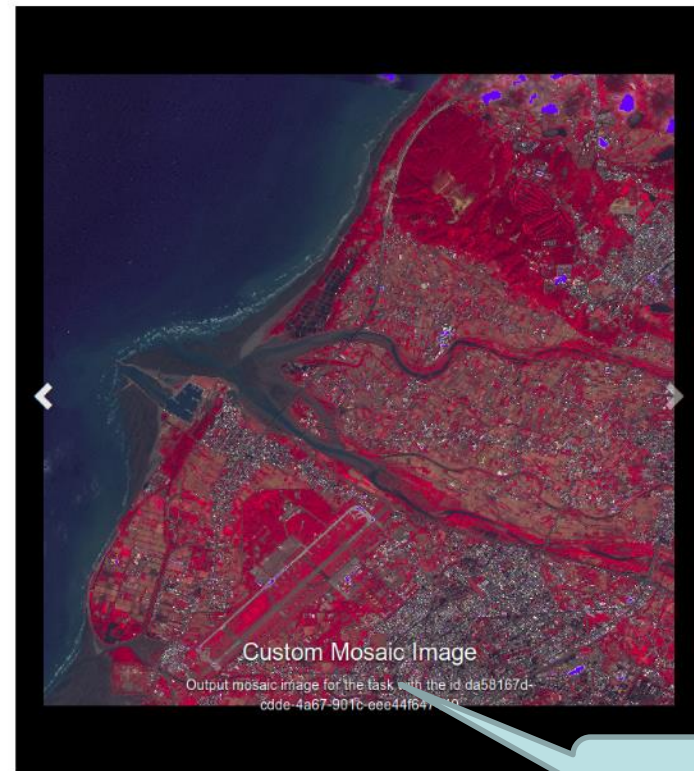
(Lat, Lon) Min	(24.800000 , 120.900000)
(Lat, Lon) Max	(24.900000 , 121.000000)
Compositing Method	Most Recent Pixel

Task Outputs

Mosaic Path	View image
Filled Mosaic Path	View image
NetCDF Path	Download nc
GeoTIFF Path	Download tif

Scene Metadata

12/17/2018	
Clean pixels	6328584
Total Pixels	6517809
Clean Pixel Perc...	97.10%
Satellite	FS5_MS_NSPO
11/21/2018	
Clean pixels	6360644
Total Pixels	6517809
Clean Pixel Perc...	97.59%
Satellite	FS5_MS_NSPO
11/21/2018	
Clean pixels	2834145
Total Pixels	6517809
Clean Pixel Perc...	43.48%
Satellite	FS5_MS_NSPO



Better Result

localhost/custom_mosaic_tool/task_details/da58167d-cdde-4a67-901c-eee44f647440#carousel

基本分析應用：光譜指標運算

Open Data Cube

Home Data Cube Manager Tools Task Manager Submit Feedback Logged in as: srsluser Logout

Filters History Results Output

Satellite: FSS_MS_NSPO

Data Selection:

Spectral Index: NDVI

Compositing Method: Most Recent Pixel

Geospatial Bounds:

Min Latitude	Max Latitude
24.7971	24.9292
Min Longitude	Max Longitude
120.9134	121.0595
Start Date	End Date
11/01/2018	12/31/2018

Additional Options Submit

Running tasks

NDVI Differencing Color Scale: -0.4 to 0.4

NDVI Anomaly

NDVI Percent Change Color Scale: -100% to +100%

ryg

NDVI Color Scale: -1 to +1

ndvi

Open Data Cube

Home Data Cube Manager Tools Task Manager Submit Feedback Logged in as: srsluser Logout

Task Details

Title	Spectral Index Query	Platform	FSS_MS_NSPO
Description	None	Scene Count	3
Status	Complete	Pixel Count	12577917
Start Time	12/29/2018 19:21		
End Time	12/29/2018 19:21		

task Metadata

task Parameters

(Lat, Lon) Min	(24.797100, 120.913400)	Mosaic Path	View image
(Lat, Lon) Max	(24.929200, 121.059500)	Filled Mosaic Path	View image
Compositing Method	Most Recent Pixel	NetCDF Path	Download file
		GeoTIFF Path	Download file
		Animation Path	Download gif

task Outputs

Scene Metadata

12/17/2018	Clean pixels	9084712
	Total Pixels	12577917
	Clean Pixel Perc...	72.23%
11/21/2018	Clean pixels	9510661
	Total Pixels	12577917
	Clean Pixel Perc...	75.61%
11/21/2018	Clean pixels	6770039
	Total Pixels	12577917
	Clean Pixel Perc...	53.82%

Band Math Image

Data Cube客製化分析應用

應用TWDC FORMOSAT-5影像偵測水田區域

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■ 應用影像變遷偵測技術

- 台灣中部地區之水田耕作區域在冬季進行整地並且於春季進行放水與播種工作
- 部分農地為增進農地肥沃程度，以施作綠肥方式進行農地改良

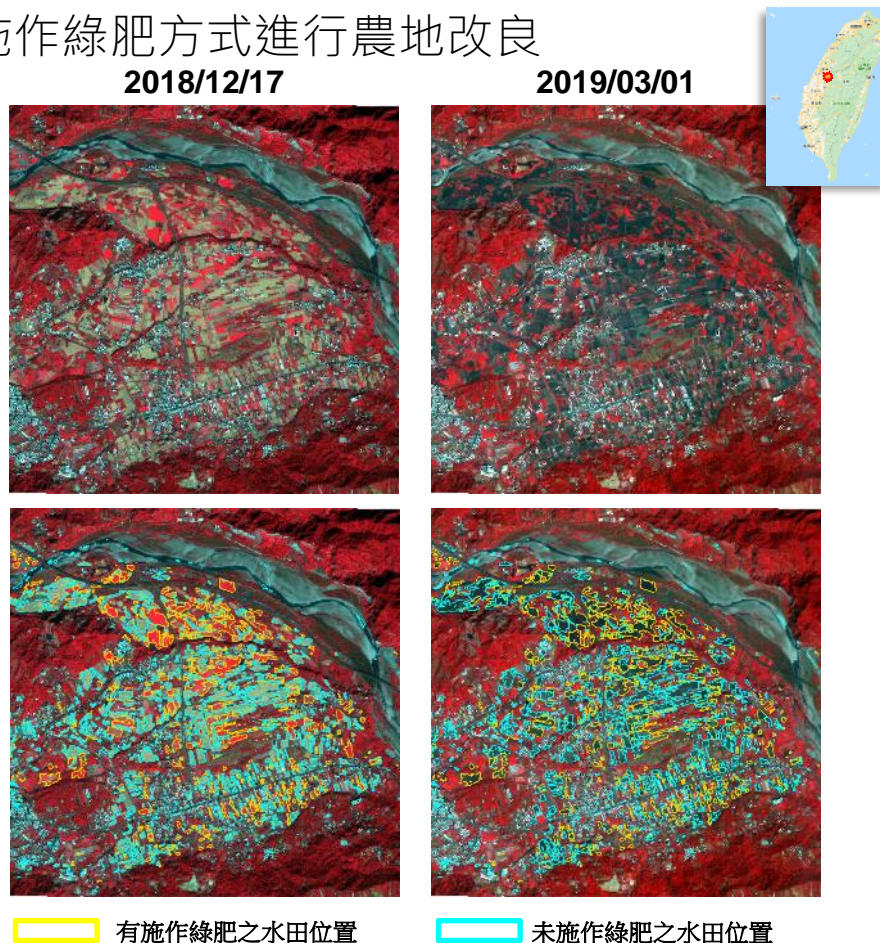
■ 測試資料

- FORMOSAT-5衛星影像:

- 冬季 2018/12/17
- 春季: 2019/03/01

■ 使用影像處理方法

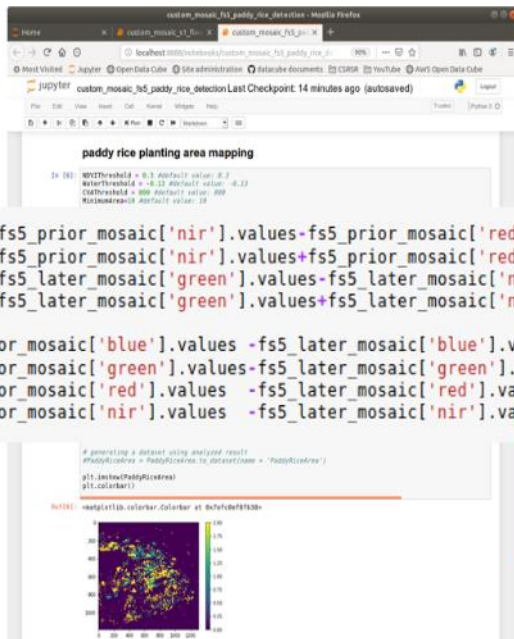
- 影像光譜向量變遷偵測法
 - 偵測變遷區域
- 植生指數
 - 偵測前期影像是否具有植生或裸露地
- 水域指數
 - 偵測後期影像是否為水域



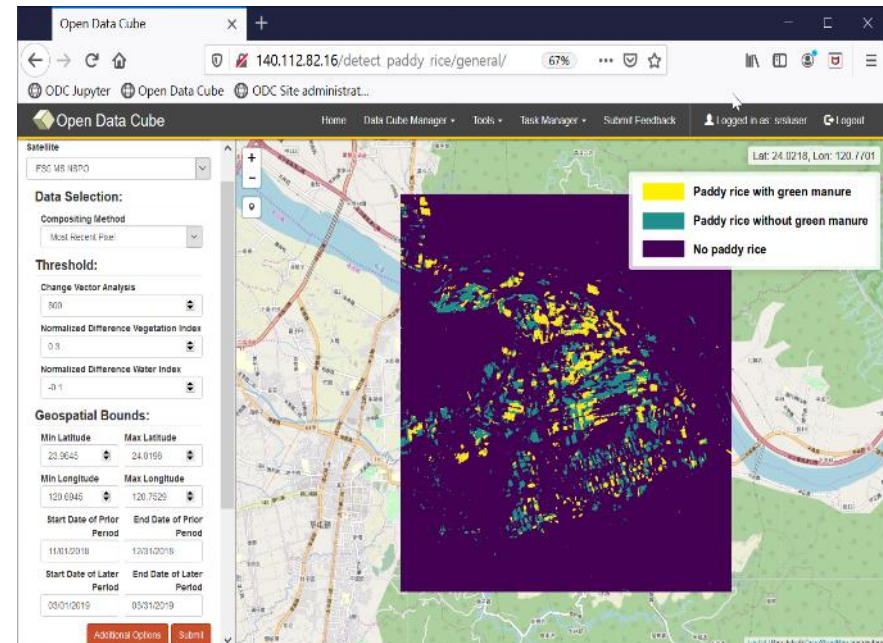
應用TWDC進行遠端線上分析

■ Data Cube可建置分析模組

- 不須下載原始資料直接在遠端完成分析
- 僅下載分析結果提高整體效率



遠端客製化分析模組



遠端使用者分析介面

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TWDC之擴充



ARD to DRD

■ DRD

- Decision Ready Data
- 使用ARD配合需求進一步推導或是反演出可直接進行決策分析之資料，以進一步提升決策之效率

■ Data Cube之DRD整合

- DRD 結果亦可在 Data Cube中以特定資料型別進行儲存與提供服務

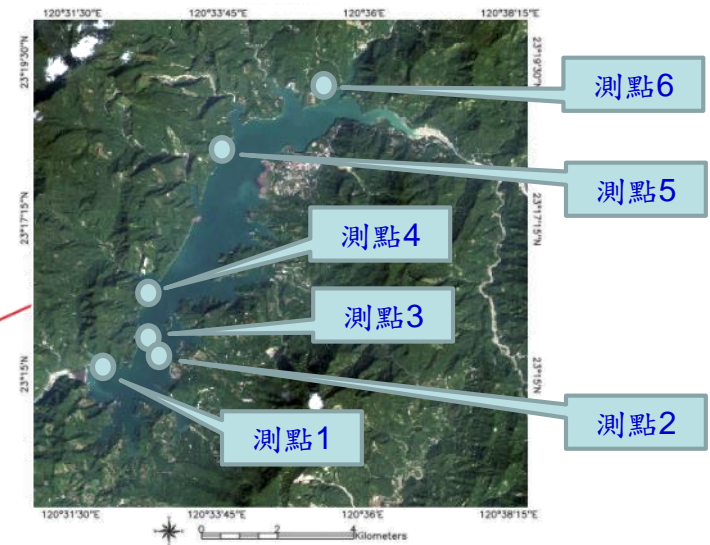


Data Cube之DRD應用

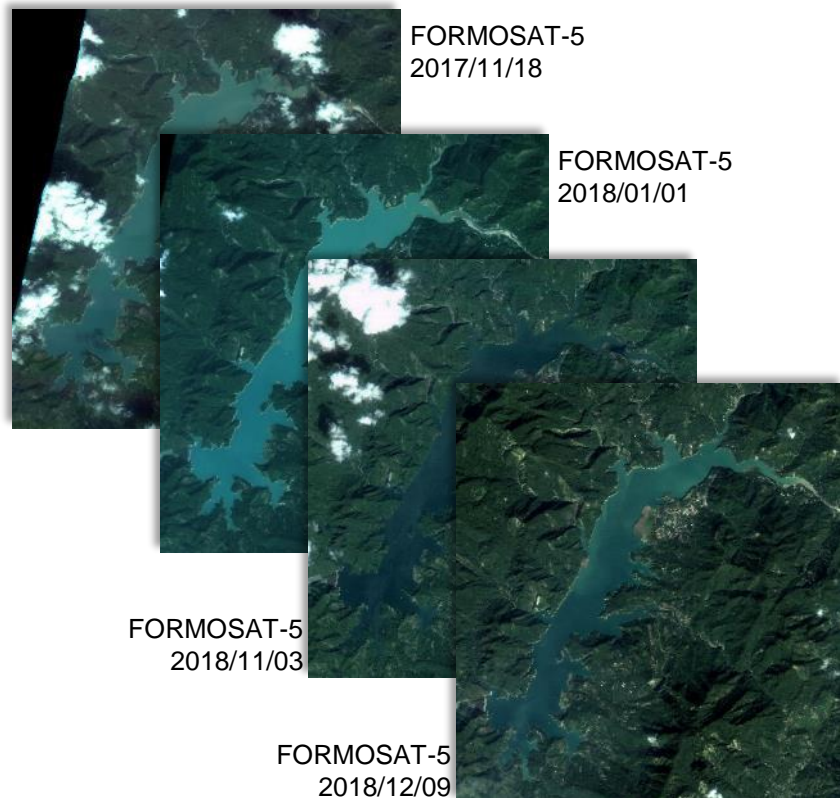
■ 水庫水質應用資料服務

- 水質監測多使用人工至現地採樣檢測，且採樣為點狀分佈，僅能反應局部的水質資訊
- 衛星影像之光譜資訊可反應大範圍之水質特性
- 若需確實之水質物理量以支援決策，則需進行水質反演之分析

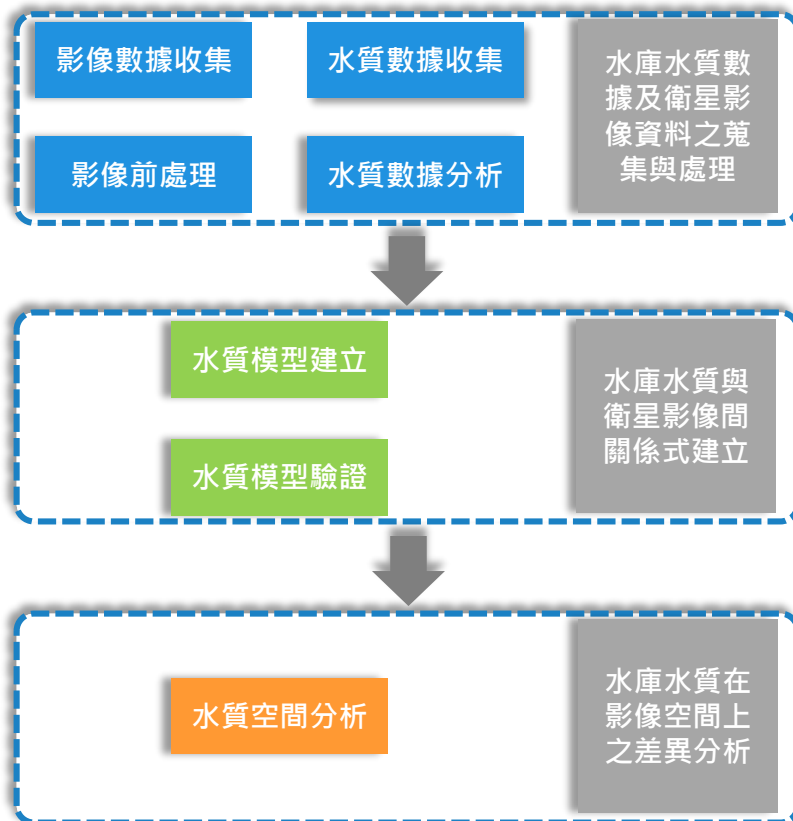
曾文水庫



ARD資料與分析模式

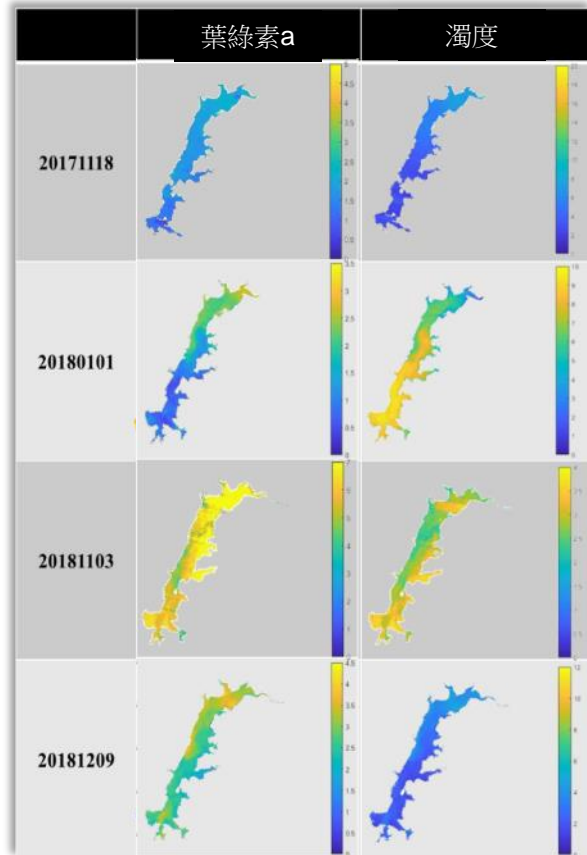


水質
反演



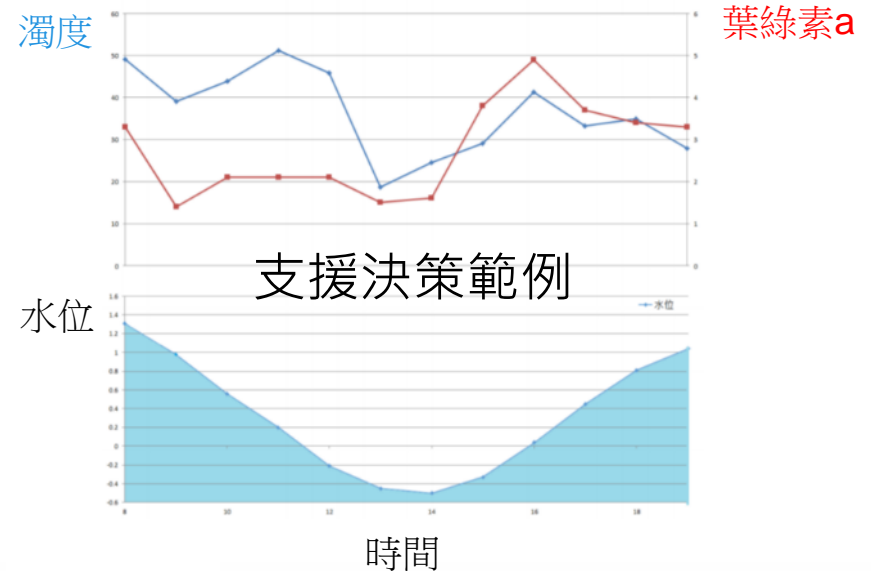
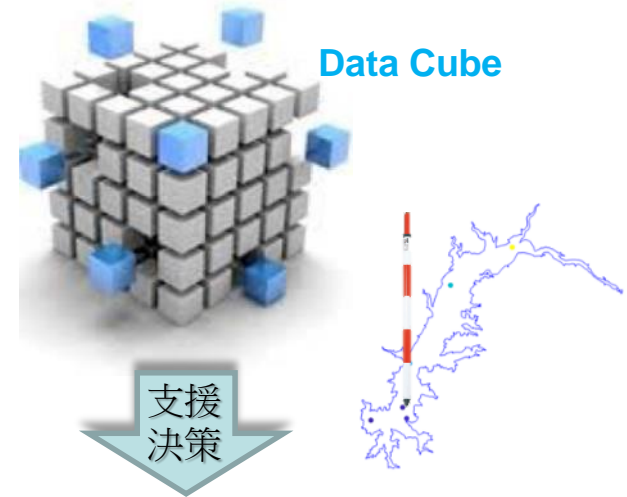
DRD資料產生與匯入Data Cube

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⋮

空間時序DRD



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TWDC效益評估



TWDC分項效益

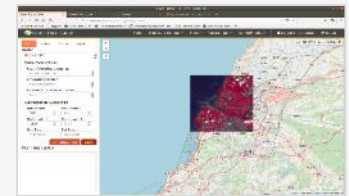
資料時空範圍查詢與管理

- 影像查詢
- 資料型別管理
- 影像記錄編修



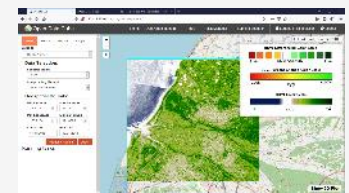
影像匯整與輸出

- 影像查詢結果匯出
- 複合影像產生與匯出 (複合方式可選擇)
- 多時期影像物候特徵查詢



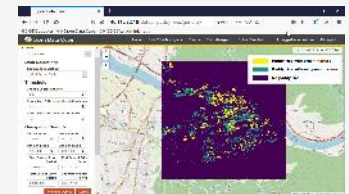
基本分析應用

- 光譜指標計算及整合分析
 - NDVI, NDWI, NDBI,



客製化分析應用

- 可按需求功能進行開發客製化功能
 - WEB UI Development
 - Python Scripting



TWDC 整體效益

資料管理便利

- 多元衛星資料控管容易，查詢方便。
- 客製化衛星資料格式導入流程建置，由Data Cube 整合控管專屬資料。
- Data Cube 平台多元衛星整合、查詢、分析和下載功能。

提升資料分析效率

- 透過開發環境建立專屬分析模式，建立屬於自己的Data Cube。
- 開發分析模式和Data Cube UI鍵結，有效達到快速分析結果。

加速決策流程

- 透過即可分析資料，快速分析資料轉化成決策資料後，並可有效率提升決策效率

衛星多元遙測資料服務平台技術諮詢窗口

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