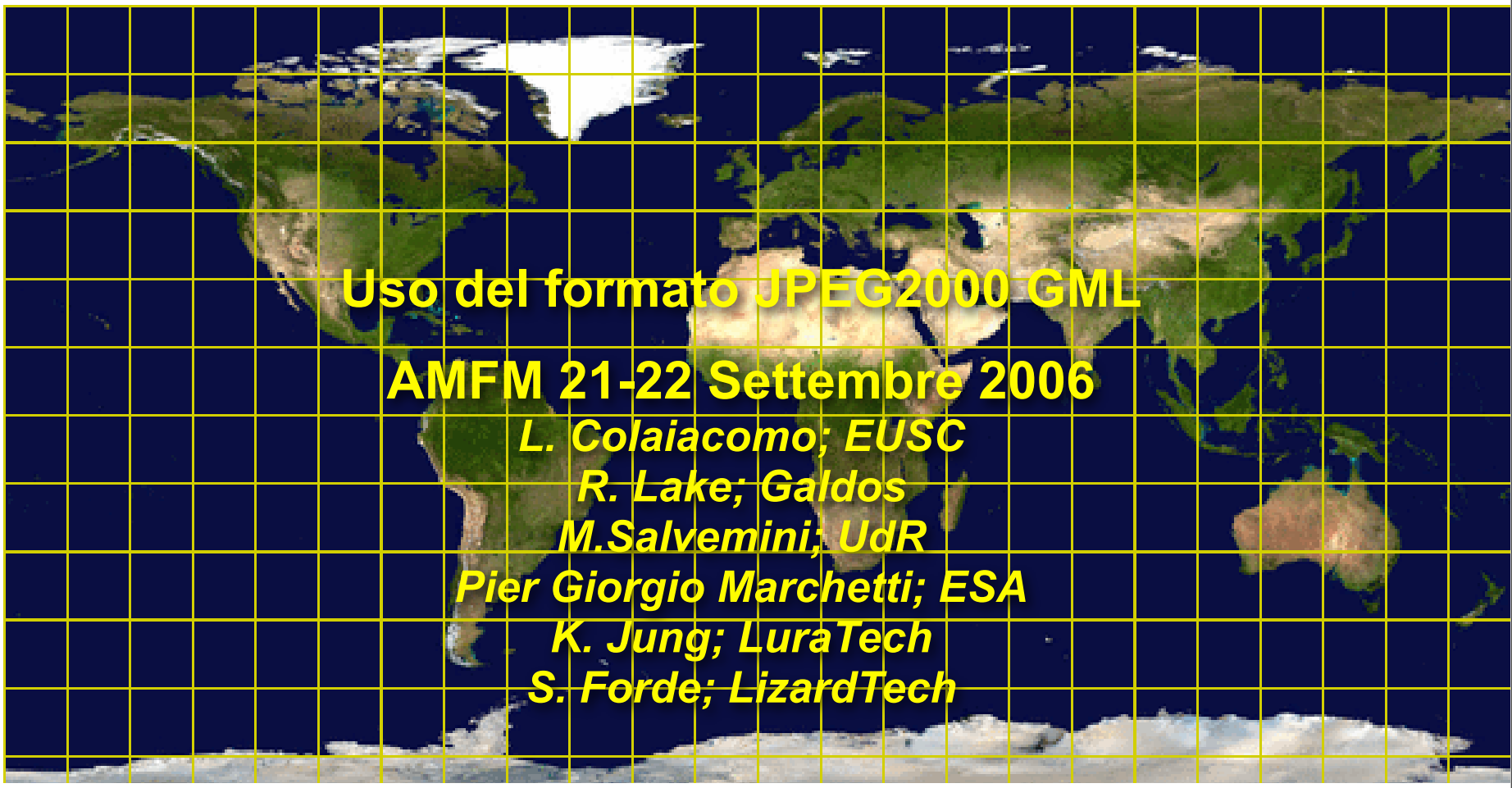

Uso del formato JPEG2000 GML

AMFM 21-22 Settembre 2006

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R. Lake; Galdos
M.Salvemini; UdR
Pier Giorgio Marchetti; ESA
K. Jung; LuraTech
S. Forde; LizardTech

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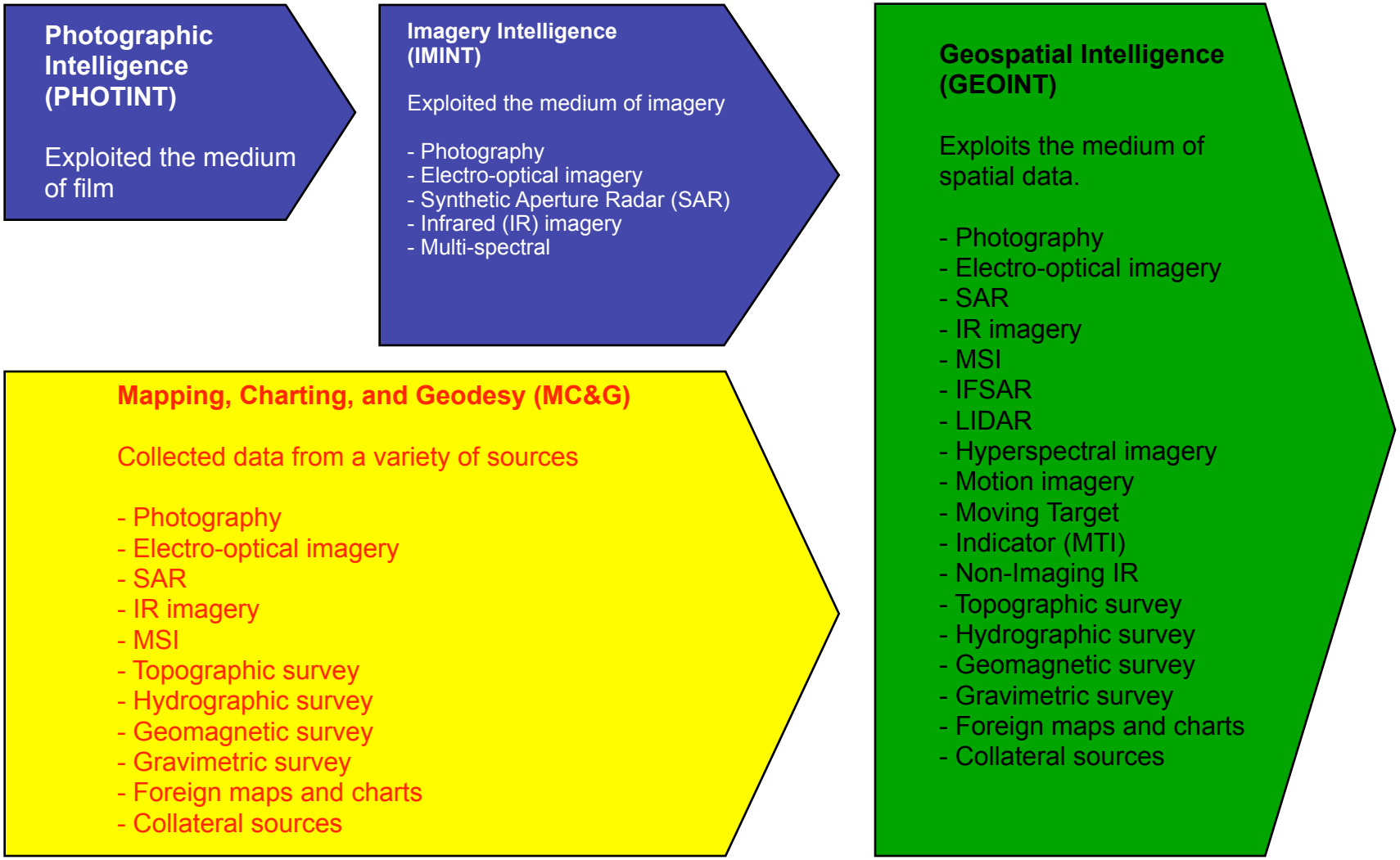
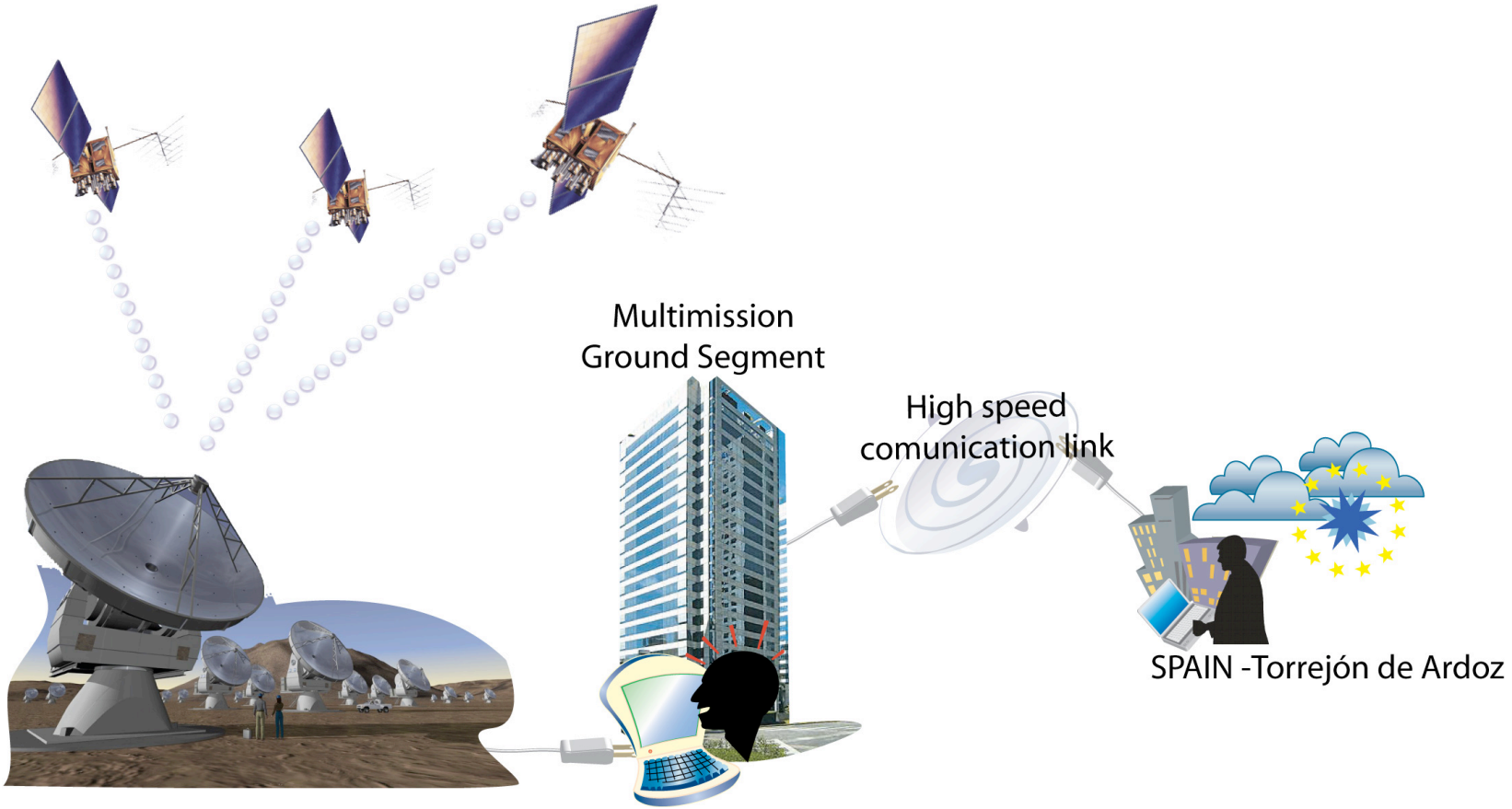
Geospatial Intelligence



Overall scenario

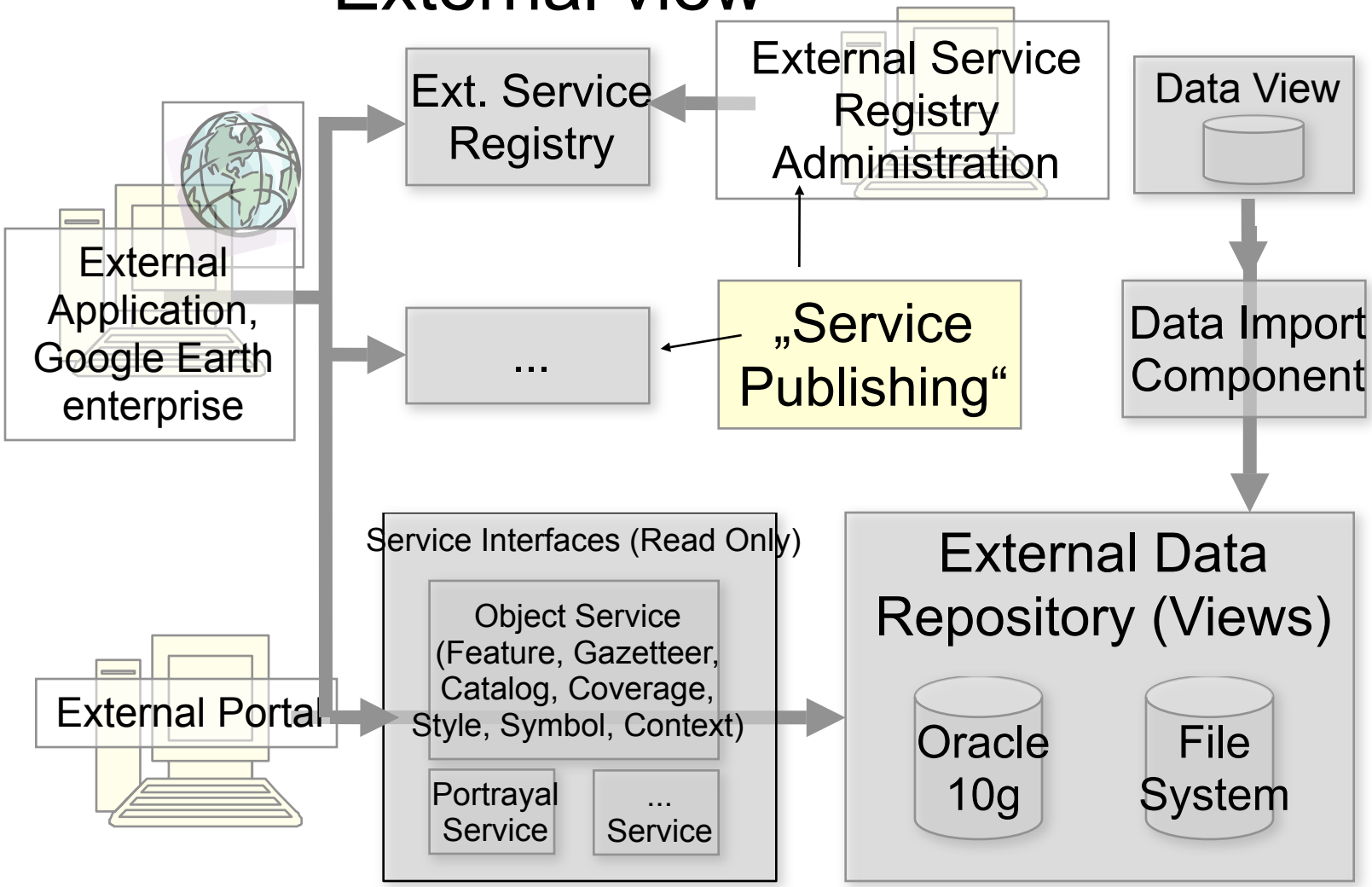


Data Processing Reference Facility

- The RF is a long-term, phased project aiming at the modernisation of the service, thus improving early warning and crisis monitoring capability and efficiency.
- This will be achieved through the adoption of
  - the standards set forth by the OpenGIS Consortium.
  - Service Oriented Architecture

Data Processing-RF

“External view”



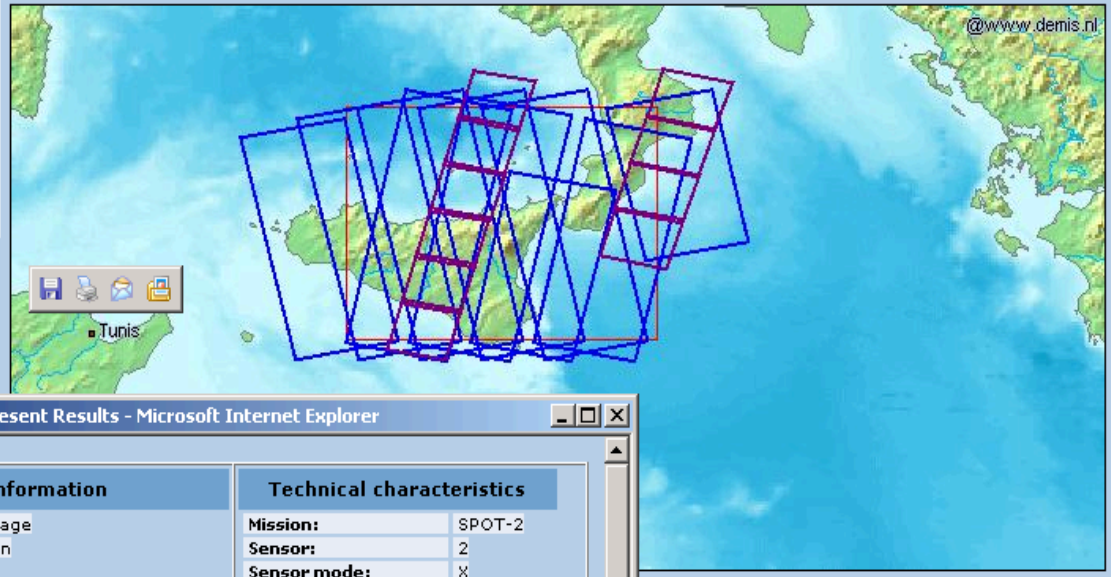
Products Search

Collections:

- ENVISAT
  - ASA_GMI_1S
  - ASA_WVx_xC
  - ASA_IMx_xS
  - ASA_APH_0S
  - ASA_APV_0S
  - ASA_APC_0S
  - ASA_WSx_xS
  - MER_FR__xS

Date:
From: 2005 Feb 28
To: 2005 May 29

Cloud Cover Percentage:



Map | Area of Interest

Services
(Click here to add a WMS ...)
World Map (1.1.1)
ESA MUIS2WMS Server (1.1.1)

Available layers
Ocean features

Selected layers
Envisat ASAR Image mode stripl
Cities (visible)
Streams (visible)

Styles
(Default style)

Map: Update
Settings: Save | Load

Scale : 125 km

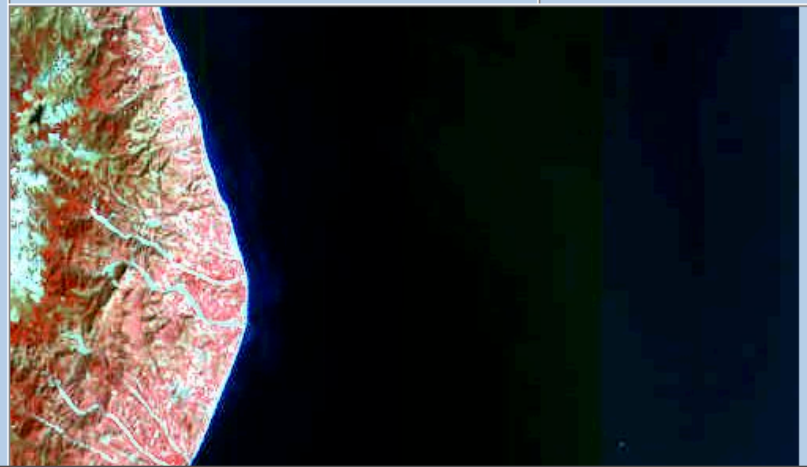
http://services.eoportal.org - Present Results - Microsoft Internet Explorer

Administrative information	
Organisation Name:	Spot Image
Organisation Role:	custodian
Product Identifier:	
20772730503171000552X3150741	
Abstract:	Spot Scene
Product Status:	completed

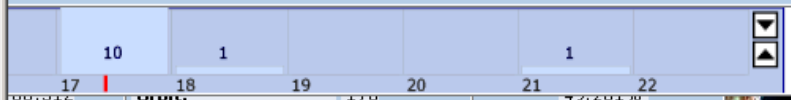
Geographic location	
Polygon Coordinates:	37.9937,17.0028
38.5128,17.2007 38.6564,16.4241 38.1360,16.2313	
Scene Center:	38.3266,16.7084

Temporal information	
Start Date:	2005-03-17T10:00:51Z
End Date:	2005-03-17T10:00:59Z
Metadata Date:	2006-05-29+00:00

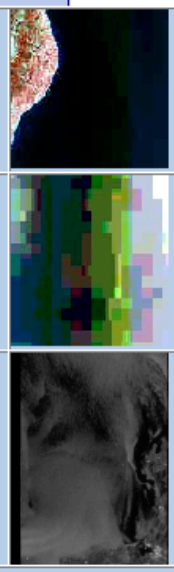
Technical characteristics	
Mission:	SPOT-2
Sensor:	2
Sensor mode:	X
Orbit:	170
Orbit direction:	descending
Frame:	77
Track:	273
Ill. Elevation Angle:	47.5
Ill. Azimuth Angle:	157.1
Cloud Coverage Percentage:	0.0
sat:	09
incidenceangle:	22.7
snowcovercotation:	00000000



Next

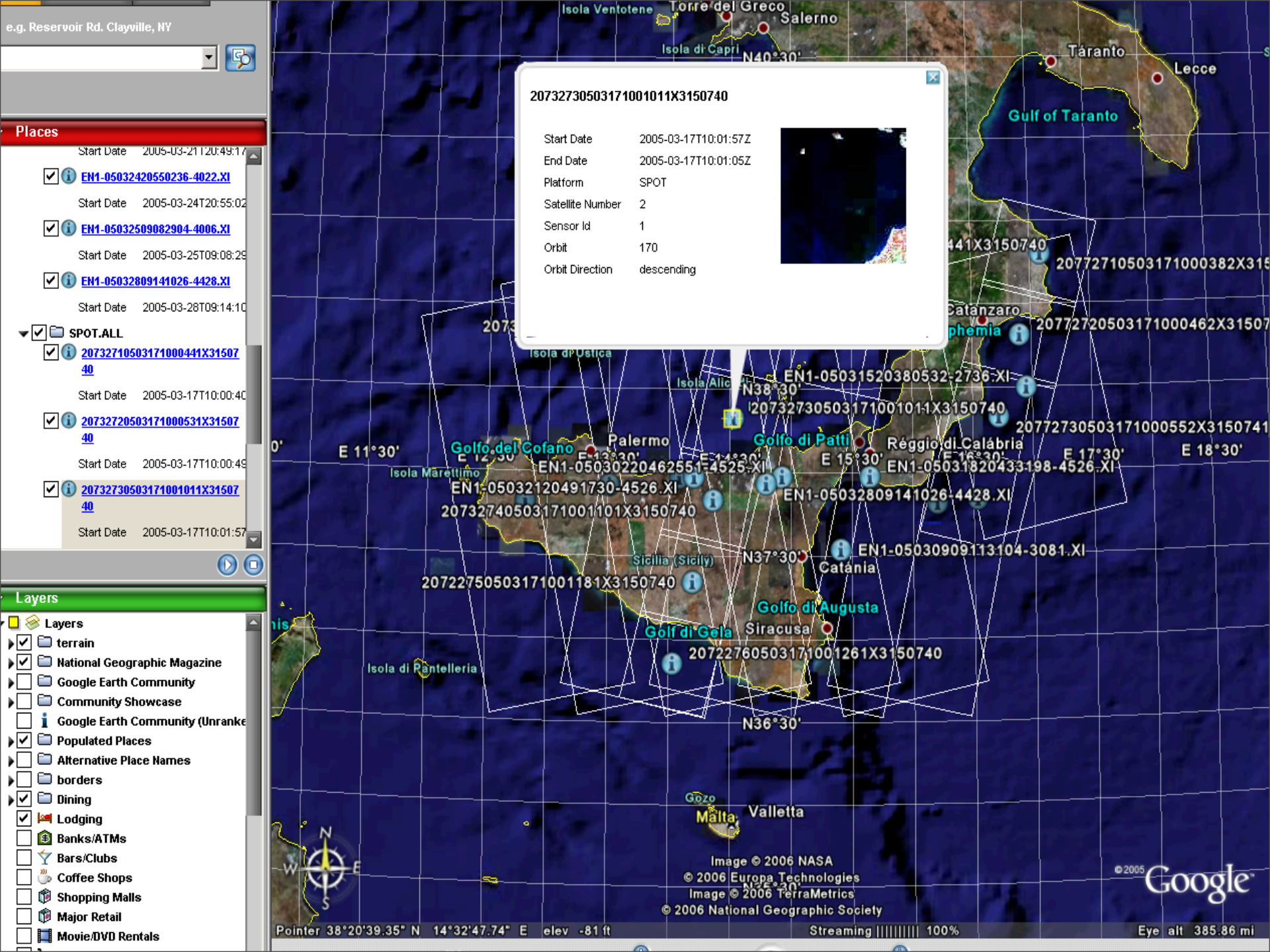


	Orbit Direction:	descending	
	Frame:	77	
	Track:	273	
01:59Z	Orbit:	170	73.024%
	Orbit Direction:	descending	
	Frame:	77	
	Track:	274	
46:25.51Z	Orbit:	15714	92.612%
	Orbit Direction:	ascending	
	Track:	129	



DI: 0.251, Search: 9.29

Disclaimer Privacy Contact Us


e.g. Reservoir Rd. Clayville, NY
Places
Start Date 2005-03-21T20:49:17
EN1-05032420550236-4022.XI
Start Date 2005-03-24T20:55:02
EN1-05032509082904-4006.XI
Start Date 2005-03-25T09:08:29
EN1-05032809141026-4428.XI
Start Date 2005-03-28T09:14:10
SPOT.ALL
2073271050317100044 1X3150740
Start Date 2005-03-17T10:00:40
2073272050317100053 1X3150740
Start Date 2005-03-17T10:00:49
2073273050317100101 1X3150740
Start Date 2005-03-17T10:01:57
Layers
Layers
terrain
National Geographic Magazine
Google Earth Community
Community Showcase
Google Earth Community (Unranke
Populated Places
Alternative Place Names
borders
Dining
Lodging
Banks/ATMs
Bars/Clubs
Coffee Shops
Shopping Malls
Major Retail
Movie/DVD Rentals
2073273050317100101 1X3150740
Start Date 2005-03-17T10:01:57Z
End Date 2005-03-17T10:01:05Z
Platform SPOT
Satellite Number 2
Sensor Id 1
Orbit 170
Orbit Direction descending
Isola Ventotene
Torre del Greco
Salerno
Isola di Capri
N40°30'
Táranto
Lecce
Gulf of Taranto
Catanzaro
Isola di Ustica
Isola Alicudi
N38°30'
EN1-05031520380532-2736.XI
Palermo
Golfo del Cofano
Golfo di Patti
Réggio di Calábria
E 11°30'
E 15°30'
E 17°30'
E 18°30'
Isola Marettimo
EN1-05032120491730-4526.XI
EN1-05032809141026-4428.XI
EN1-05031820433198-4526.XI
Sicilia (Sicily)
N37°30'
Catánia
EN1-05030909113104-3081.XI
Golfo di Augusta
Golf di Gela
Siracusa
Isola di Pantelleria
N36°30'
Gozo
Malta
Valletta
Image © 2006 NASA
© 2006 Europa Technologies
Image © 2006 TerraMetrics
© 2006 National Geographic Society
©2005 Google
Pointer 38°20'39.35" N 14°32'47.74" E elev -81 ft
Streaming 100%
Eye alt 385.86 mi

- So in 1998 EUSC decided to fund a study to identify the best sw codec
- Awarded a wavelet codec
- But then it was evident the problem of handling the geospatial information

- We decided to start implementing a simple adaptation of such codec and the possibility to use as input and output format GeoTIFF

- It was a partial solution to the problem of maintaining a format conversion algorithm between two commercial image processing sw

- JPEG2000 has emerging standards in image processing and for the geo spatial industry why:

- Improved Image Quality
- Compression Types (fully embedded)
  - Lossless
  - Lossy by fixed size
  - Lossy by fixed quality (PSNR)
- Preview Progression & Image Scaling
  - 5 different progression types

- Region of Interest (ROI)
  - Arbitrarily shaped
- Error Resilience
- XML metadata handling

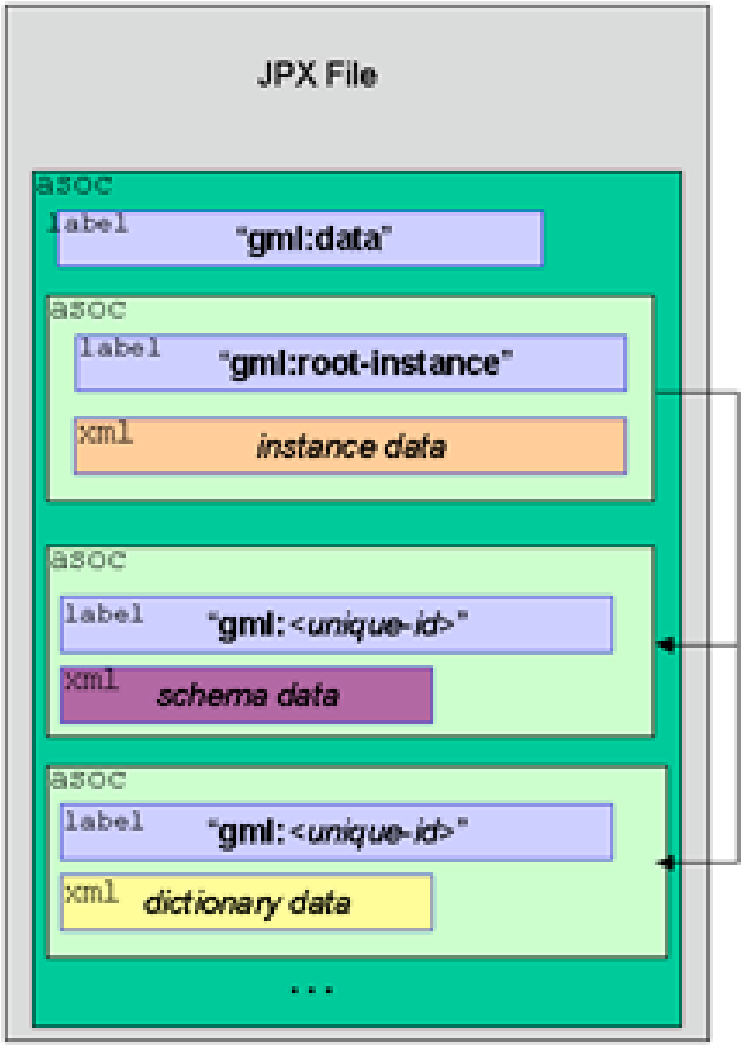
- The idea then was to use a GML profile in order to express the geo information inside JPEG2000 (EUSC 2003)

- First attempt:

- The following example JPEG2000_GeoLocation GML refers to a JP2 file with an EPSG code of 32610 (PCS_WGS84_UTM_zone_10N), origin 631333.108344E, 4279994.858126N, a cell size of X=4 and Y=4, and a rotation of 0.0:

```
<?xml version="1.0" encoding="UTF-8"?>
< JPEG2000_GeoLocation >
    <gml:RectifiedGrid xmlns:gml="http://www.opengis.net/gml" gml:id="
    JPEG2000_GeoLocation _1" dimension="2">
        <gml:origin>
            <gml:Point gml:id="JPEG2000_Origin" srsName="epsg:32610">
                <gml:coordinates>631333.108344,
                 4279994.858126</gml:coordinates>
            </gml:Point>
        </gml:origin>
        <gml:offsetVector gml:id="p1">0.0,4.0,0.0</gml:offsetVector>
        <gml:offsetVector gml:id="p2">4.0,0.0,0.0</gml:offsetVector>
    </gml:RectifiedGrid>
</JPEG2000_GeoLocation>
```

- A more comprehensive specification was then provided by R. Lake (Galdos) considering all the potential benefits of having such powerful profile in the JPEG2000:



JPX View

Single Codestream

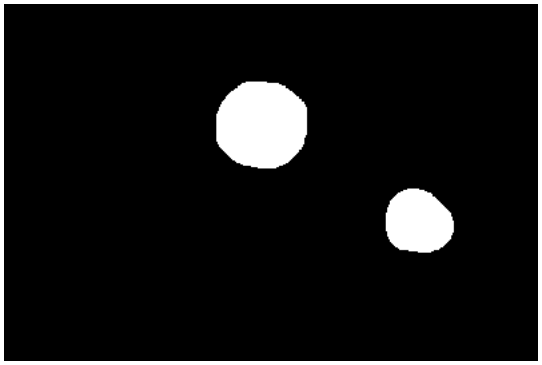
- GML Data Box
  - Asoc box with fixed label "gml:data"
- Root Instance Box
  - First box after "gml:data" label
  - Fixed label "gml:root-instance"
  - Contains instance document
- Schema and dictionary boxes
  - Follow root instance box
  - Unique identifying labels
  - GML data

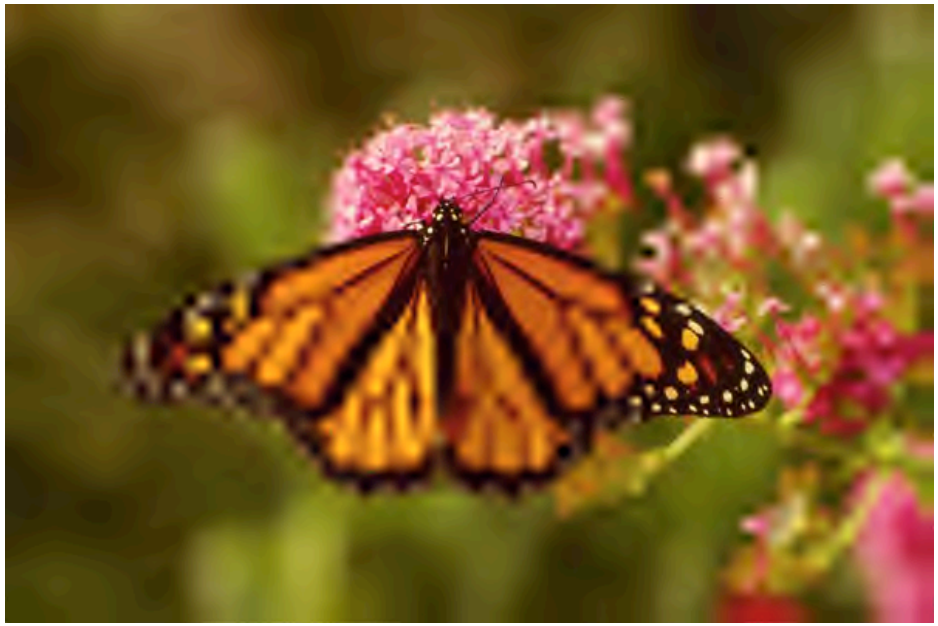
← Original

+

ROI-Mask →

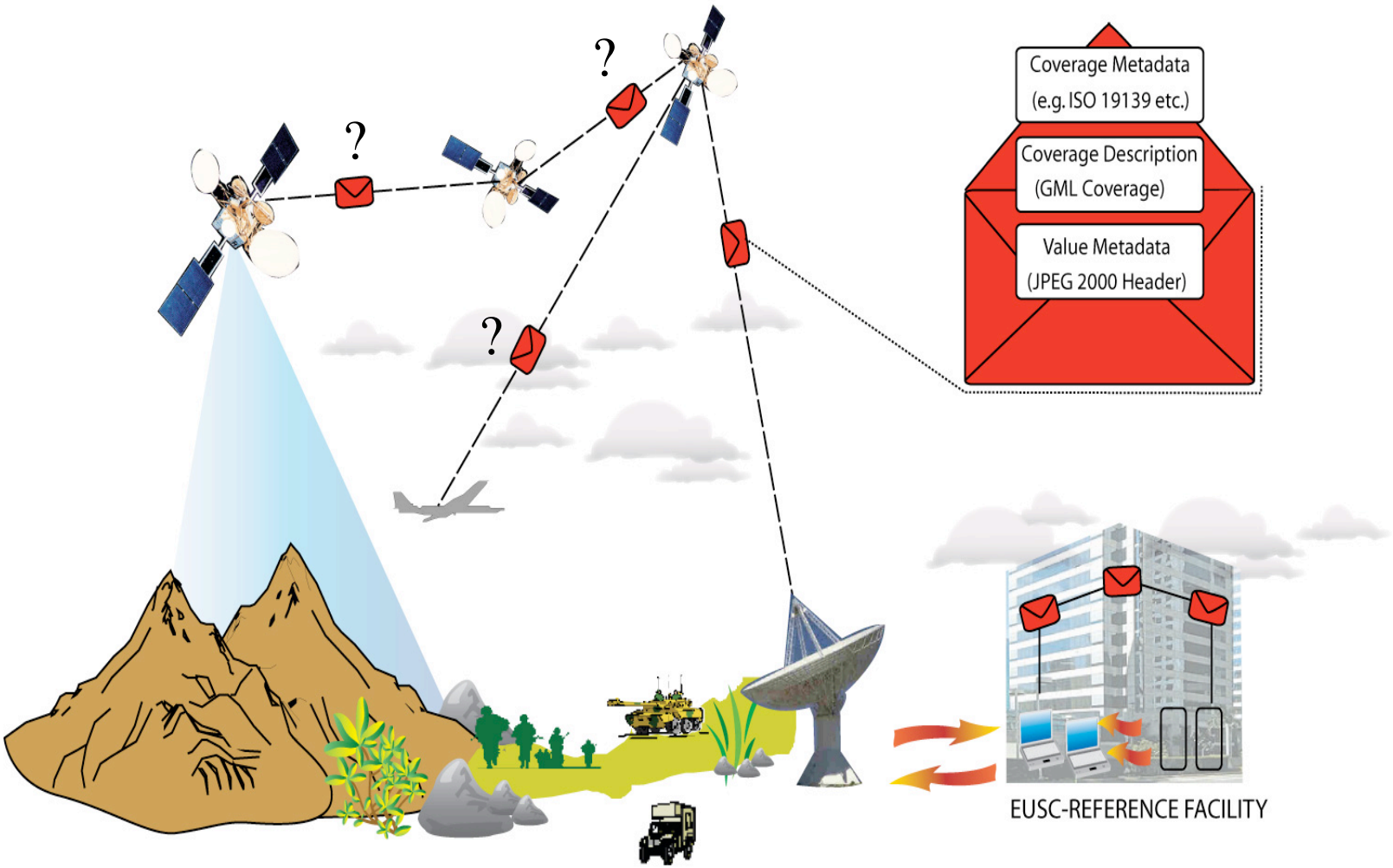
=





LuraWave

- LuraWave JP2 is the one of the leading implementation of the new still image compression standard JPEG2000 + GML.
- Thanks to its state-of-the-art wavelet technology LuraWave JP2 offers significantly improved visual quality at higher compression rates than the widely used JPEG standard.
- Included in IONIC libraries
- Lizardtech GeoExpress, ErMapper, GDAL...


Coverage Metadata
(e.g. ISO 19139 etc.)
Coverage Description
(GML Coverage)
Value Metadata
(JPEG 2000 Header)
EUSC-REFERENCE FACILITY

Usage of JPEG2000+GML

- In the frame of the data processing-Reference Facility project, usage of JPEG 2000 is twofold:
- on one hand it is used as internal, long-term storage format for satellite imagery and digitized maps and charts,
- on the other hand it is one of the possible output format of any coverage offering provided by the RF Web Coverage Service (WCS).

Usage of JPEG2000+GML

- Production of a GMLJP2 file happens in following cases:

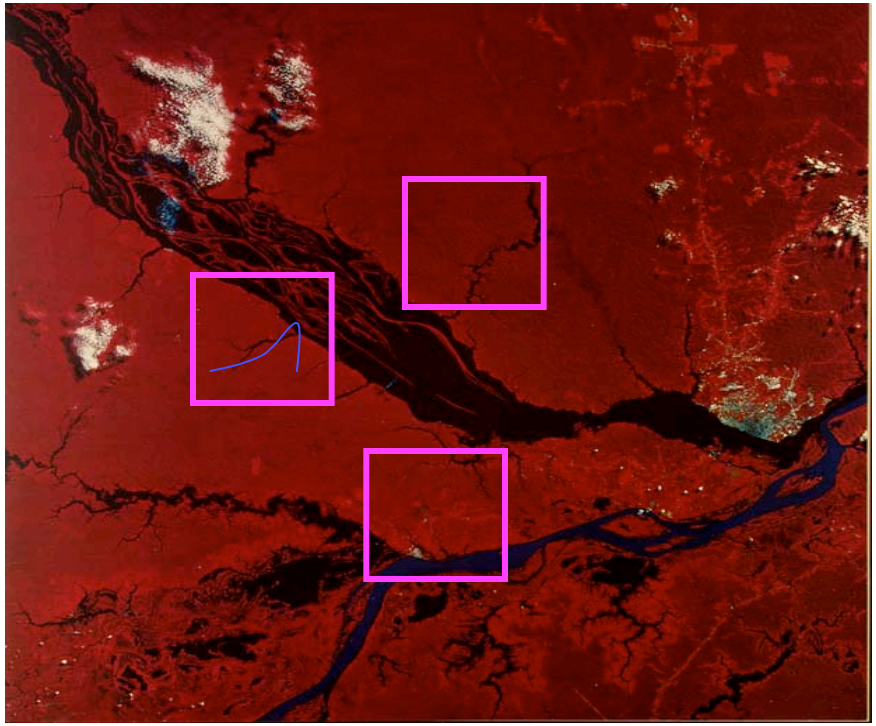
- 1- **Long term storage of original image**. From the original image, data preparation personnel produce a working image (georeferenced and prepared for analysis). The original image (no further used in the operational centre's workflow) and its metadata structure can then be packed in a GMLJP2 file (with customizable compression and loss levels) and maintained for future references.

- 2- **Serving output option of a coverage offering**. RF WCS, upon user request, produces a GMLJP2 file for a given coverage offering. Any image, map and chart in the RF archive can be outputted in this way at any time.

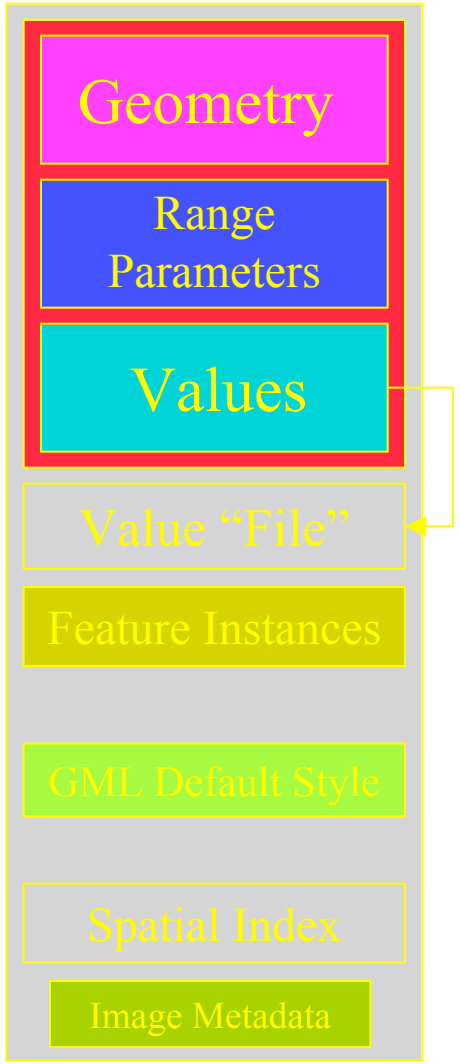
- In both cases, using GML, an application schema is written to hold the image metadata structure.
- The application schema is embedded into JP2 files in the way defined by the OGC's specification OGC 05-047r3 "GML in JPEG 2000 for Geographic Imagery (GMLJP2) Encoding Specification" (available at http://www.opengeospatial.org/specs/?page=specs).

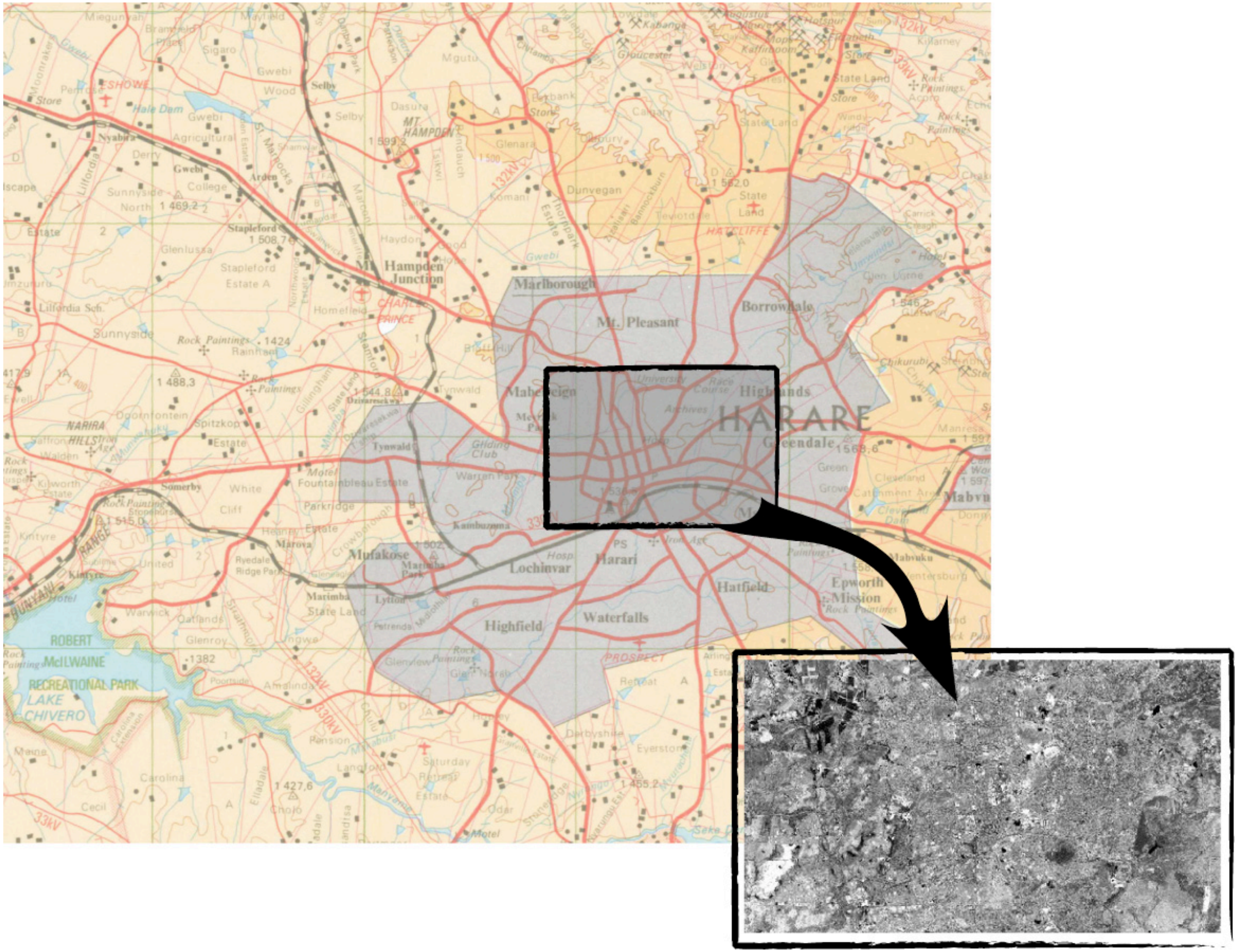
Usage of JPEG2000+GML

- In the context of RF, generation of the GMLJP2 file requires a deep integration of the Web Coverage Service (WCS) and Catalogue (CS-W) OGC compliant implementations with the JPEG2000 codec as described below.
- In the RF, metadata parsing and data encoding/decoding are based on the IONIC framework for the WCS and CS-W implementations (Ionic RedSpiderWeb and Ionic RedSpider Image Archive software).
- The IONIC software gives the possibility to plug in custom java codec. Such a plug-in mechanism is used to integrate the Luratech's LuraWave JP2 codec.
- The metadata to be used will be the ESA EOLI xml metadata description..



Decompress selected parts of the image and associated features




HARARE
Marlborough
Mt. Pleasant
Borrowdale
Highlands
Greendale
Mabelreign
Tynwald
Warren Park
Kambuzuma
Mufakose
Lochinvar
Harari
Hatfield
Epworth Mission
Highfield
Waterfalls
Glenview
Glen Norah
Mabvuku
Hatcliffe
Mt Hampden Junction
Stapleford
Gwebi
Nyabira
Selby
Dunvegan
Sunnyside
Somerby
White Cliff
Marimba Park
Lytton
Prospect
ROBERT McILWAINE
RECREATIONAL PARK
LAKE CHIVERO
NARIRA HILLS
132kV
330kV
33kV

Thank you