United Nations/Morocco/European Space Agency International Workshop
on the Use of Space Technology for Sustainable Development.
Rabat, Morocco, 25 – 27 April 2007.

"Mapping of marine macrophytes (algae) in the atlantic coast of Tierra del Fuego (South extreme of Argentina) by mean of different satellite sensors".

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Study Area: Atlantic Coast of Tierra del Fuego, Argentina.

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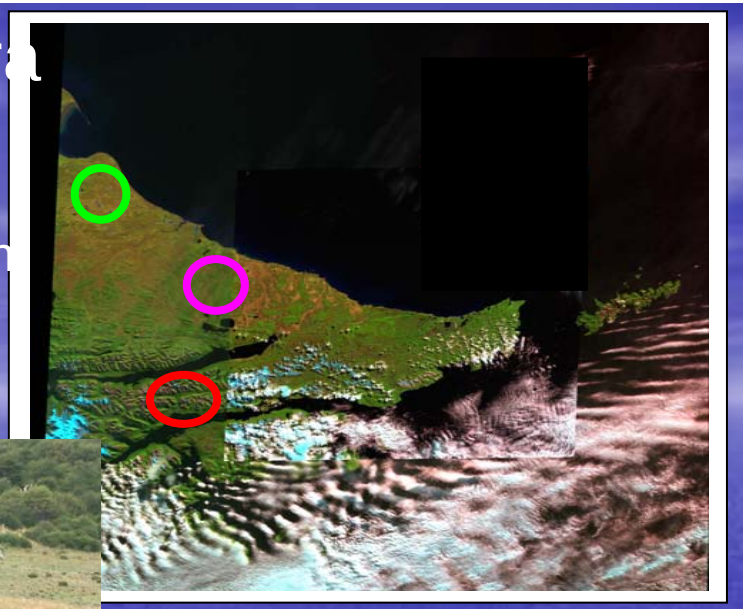
Environmental Characteristics of Tierra del Fuego Province:



The steppe is the dominant physiography /landscape in the north of the island.

Central Zone
Transitional Areas.

In the south, the last portion of Andinean Patagonic Forest is present (with different species of *Nothofagus*) and the peatbogs (moss) are abundant.

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The coast…….

It presents a discontinuous series of rocky formations of variable dimensions in the intertidal zone.

In these environments many marine algae (macrophytes) grow in abundance, as *Macrocystis pyrifera* (Class Phaeophyta,“Kelp” or “Cachiyuyo”) forming “subaquatic forests or praires”, true fauna reservoirs and potential stock for the industry of derived algae products.

These communities of marine macrophytes remain exposed according with tidal changes.

Fixer disk

The objectives of this study were:

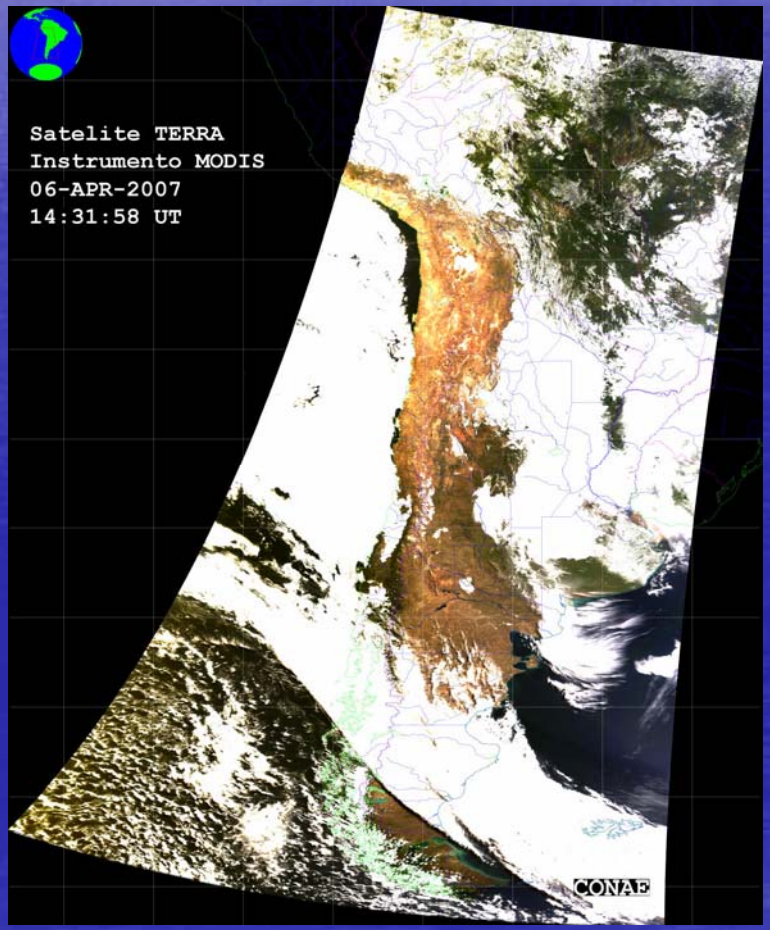
The mapping of this natural resource (Marine Macrophytes-Algae) by mean of remote sensing data.

The evaluation of the application and/or combination of different satellite sensors.

Before some special considerations….

1.The main “problem” in this area is the high clouds cover along the year (only 15 sunny days per year as average) and short days (low sunlight) during winter (latitude: -55°S).

Sac-C image portion



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2. It’s a zone with intense oil off-shore activities (from Argentina and Chile).

Off-shore Platforms

(Radar image)

3. It’s necessary to know the distribution of the algae to estimulate the exploitation and the sustainable management of the resource (for industry of derived algae products) with few development today in the zone.

Uses of Alginates:

Textile: 42%

Alimentary: 34 %

Paper: 9,4 %

Pharmaceutic and dental industry: 5,3 %

Others:8,8 %

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Materials:

1. Satellite data from:

Landsat MSS (Film format, date 1981).
Landsat 5 TM (9 images, years: 1999, 2003, 2004).
Landsat 7 ETM+ (15 images, years: 2001,2003).
SAC-C (10 images, years: 2002, 2003, 2004)
Aster (1 image, year: 2006)
Radar (1 image, year: 2006)

2. Aerial photographs (analogical format, year 1970).

3. Maps (topographic and bathymetric (1939)) (analogical format).

4. Softwares: Erdas, ENVI and Arcview.

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Methods:

1. All satellite data were co-registered over a SAC-C image in Geographic Coordenates in order to unify the reference system.

The process wasn't easy because the study area was on the coast (most of each image was over the sea, so we need to subset the interest area to increase the accuracy) and in this latitude the deformation of the images was important.

2.The bands green, red and near infrared were analized to recognize the "subaquatic forest" along the different sensors and to separate them of other coastal covers (sand, bare rocks).

3. Maps were generated from the visual and digital interpretation of the images and maps.

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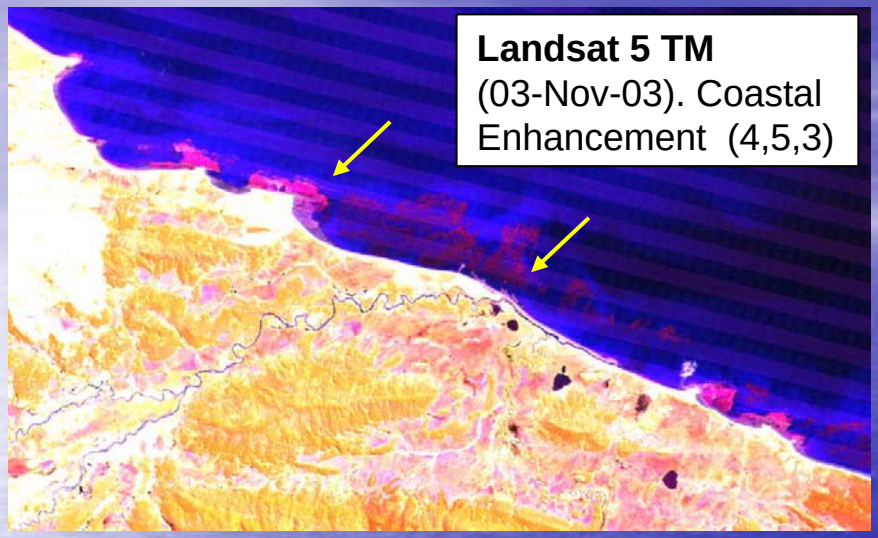
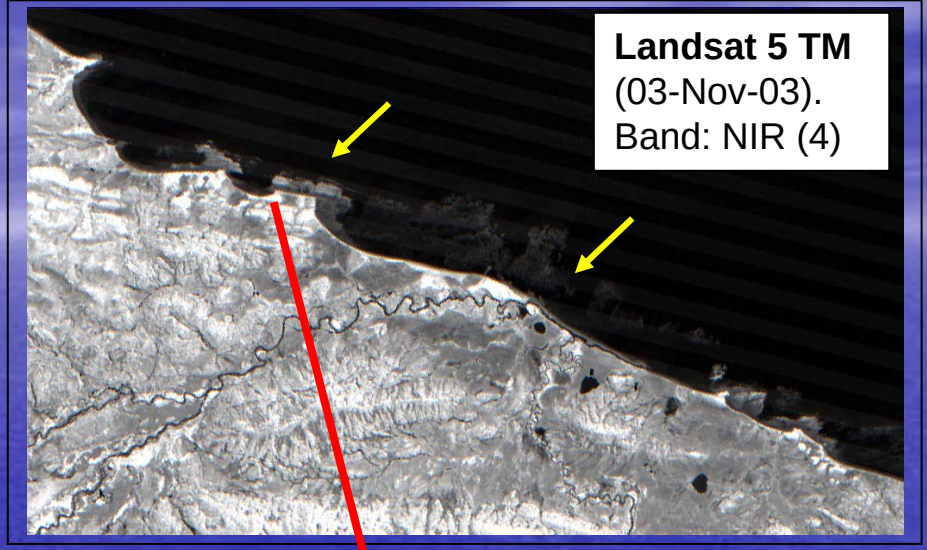
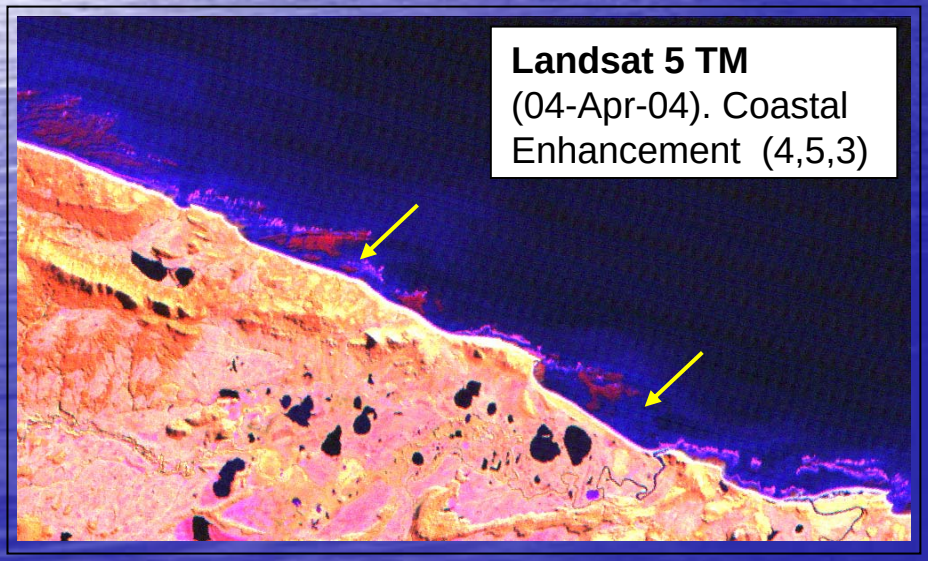
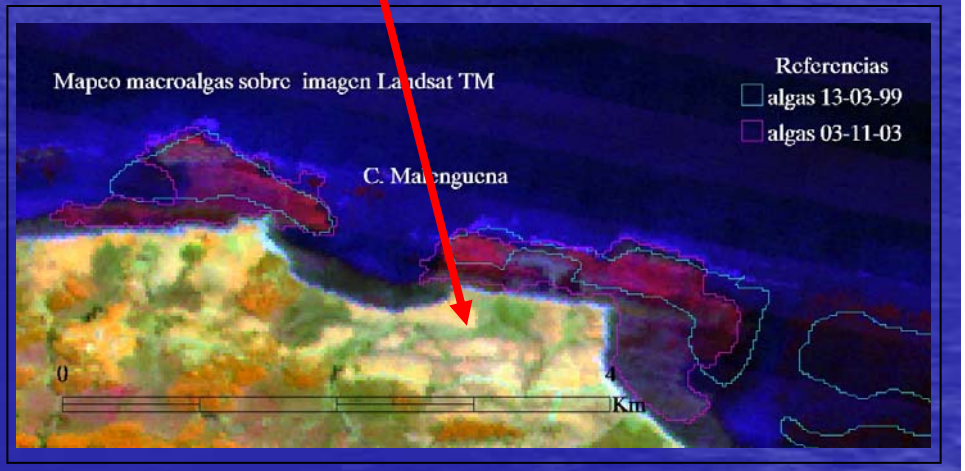
Results:

Details over different images along the eastern coast.









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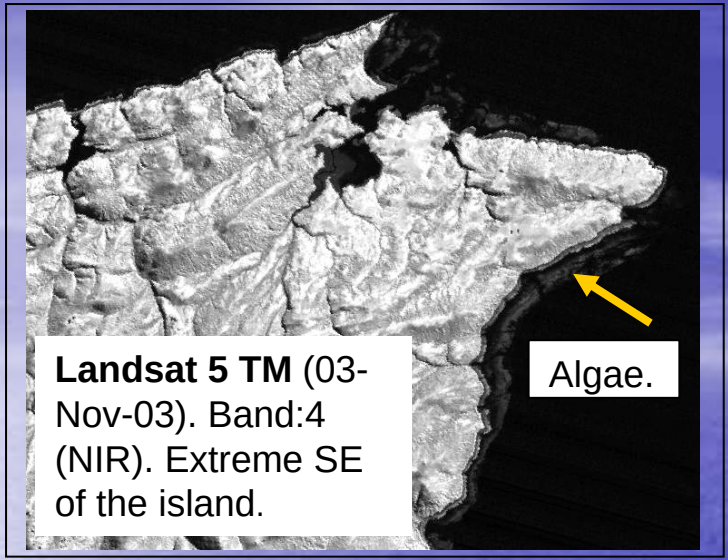
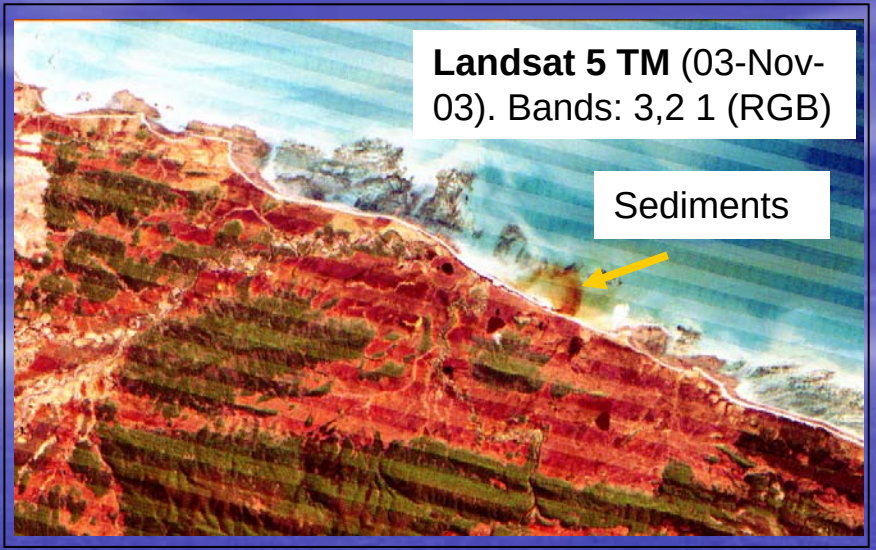
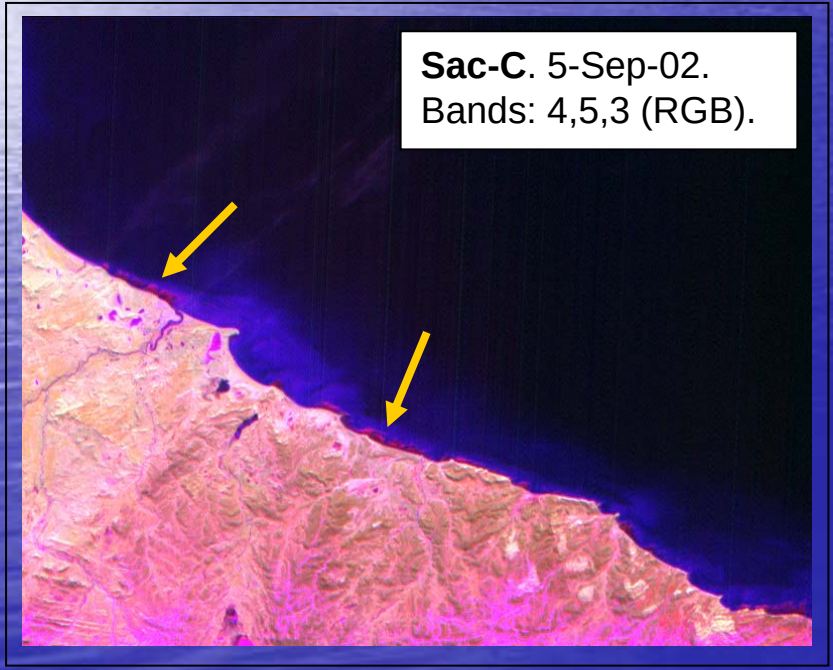
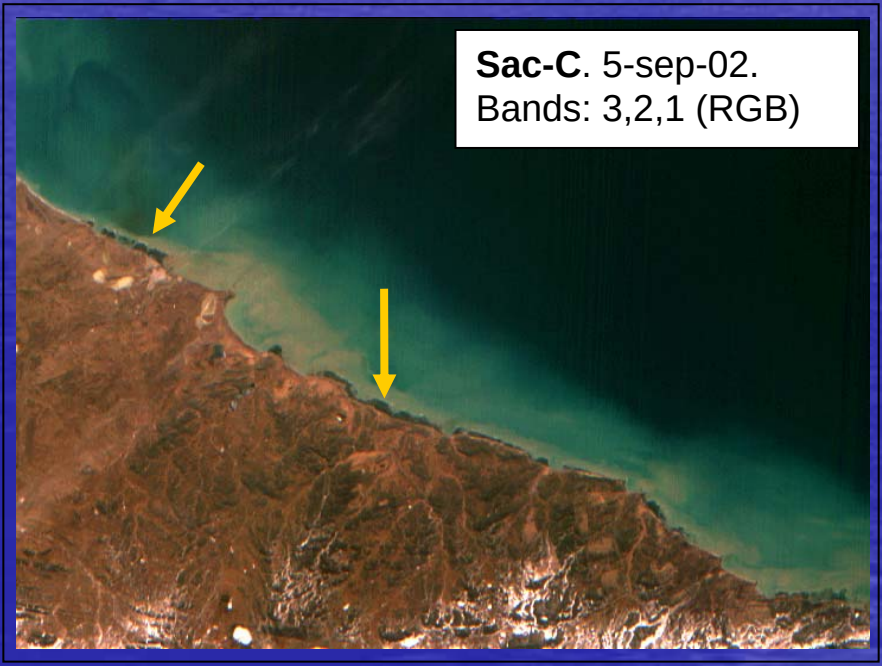


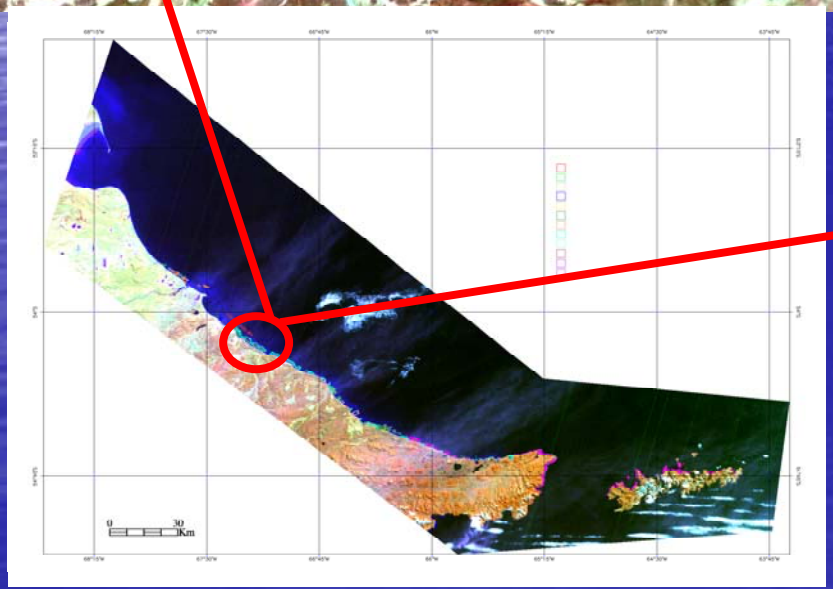






Results: Details over different images along the eastern coast.

ASTER Image (2006)
Bands: 321 (RGB)



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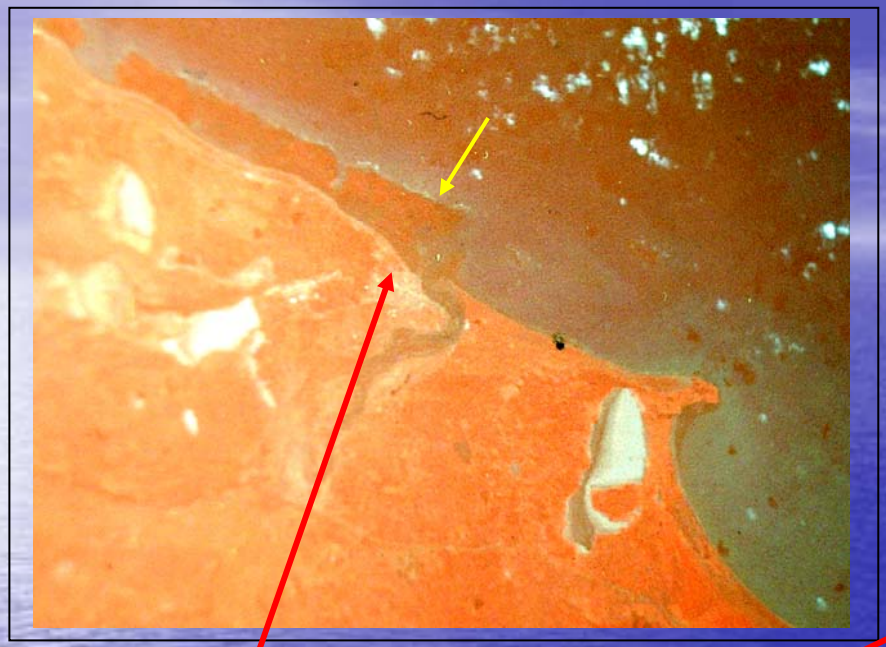
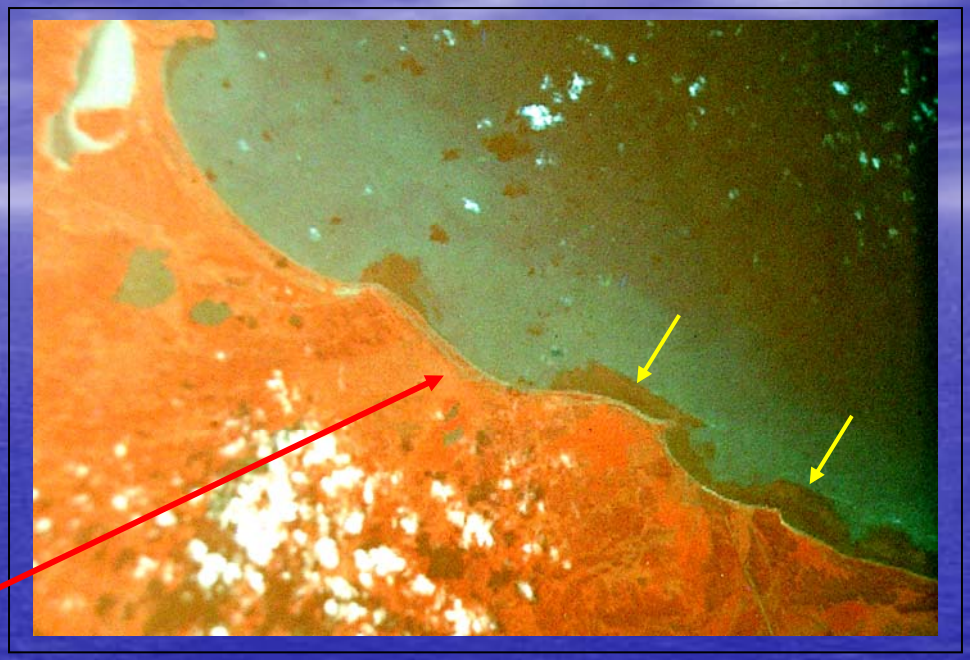
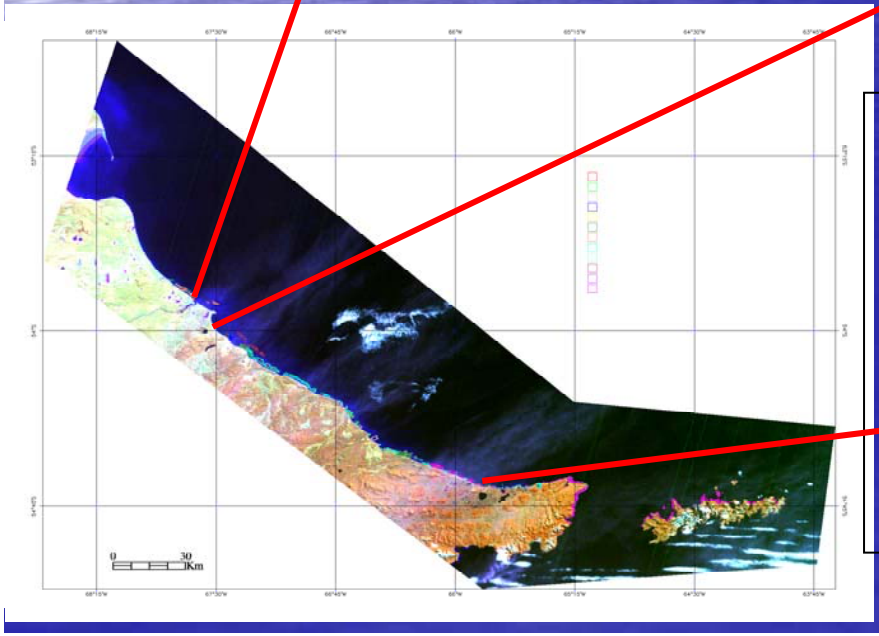
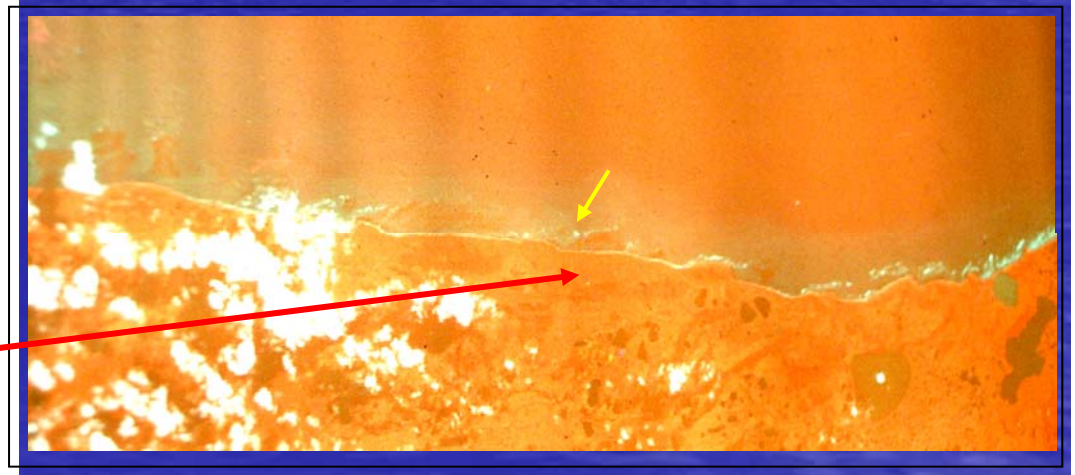
Identification over Landsat MSS (1981).

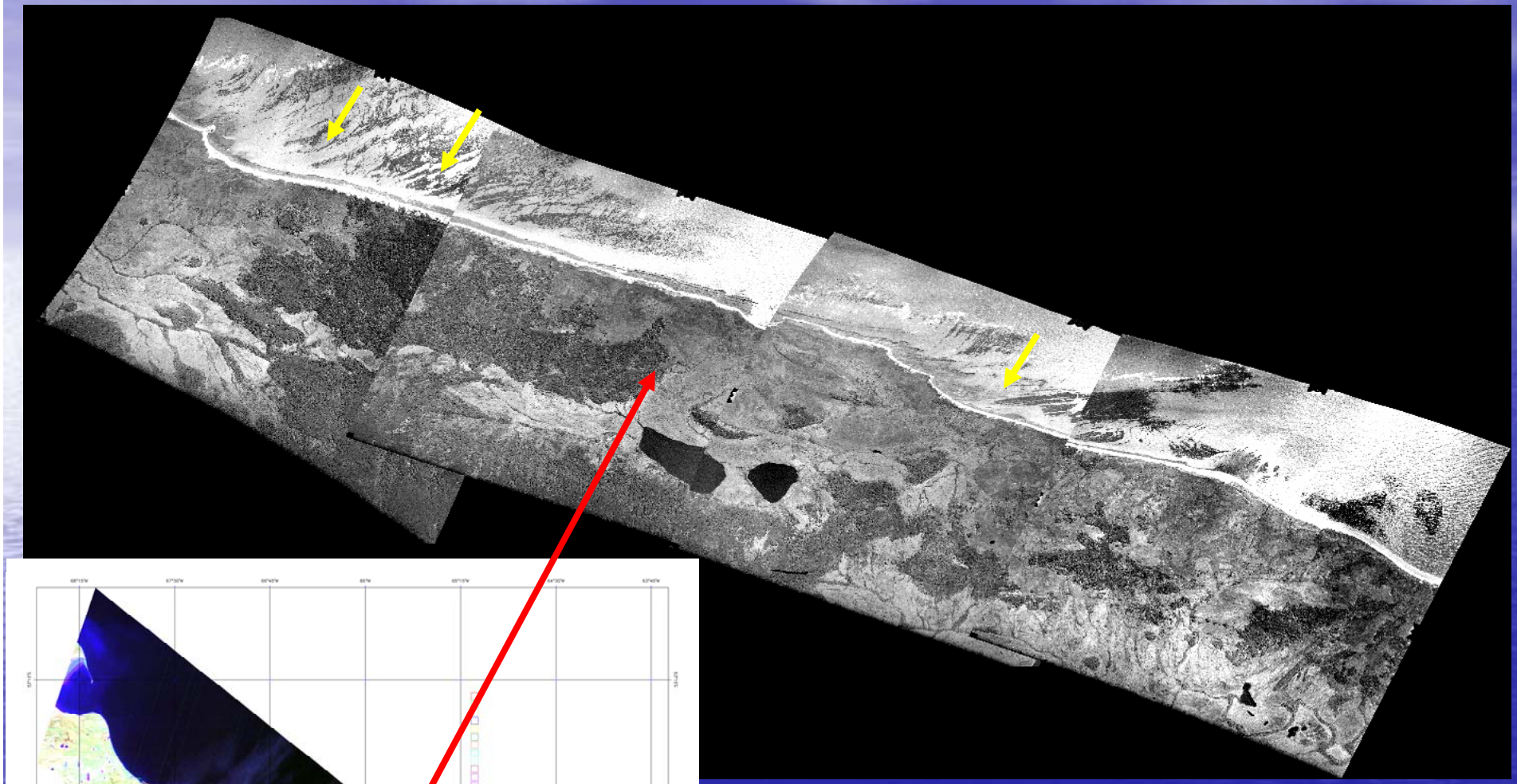


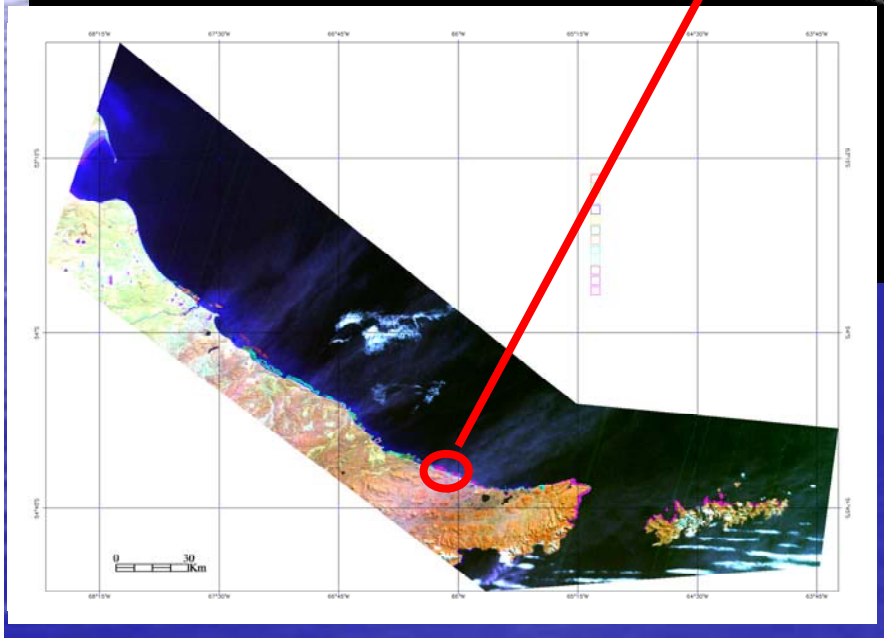






Identification over Aerophoto Mosaic (1970).





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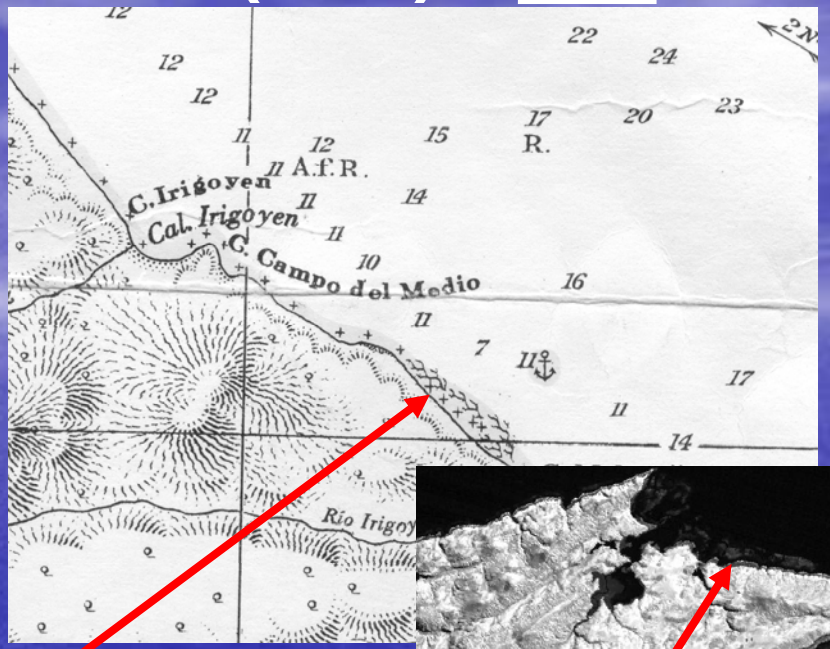
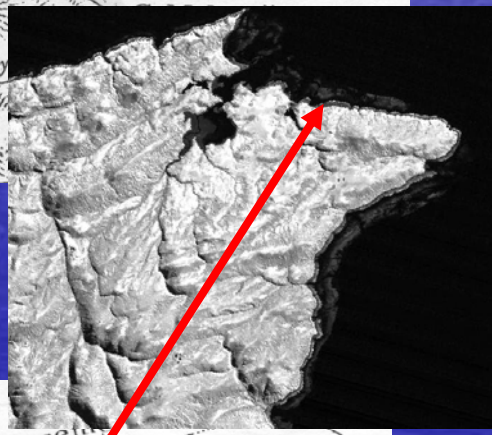
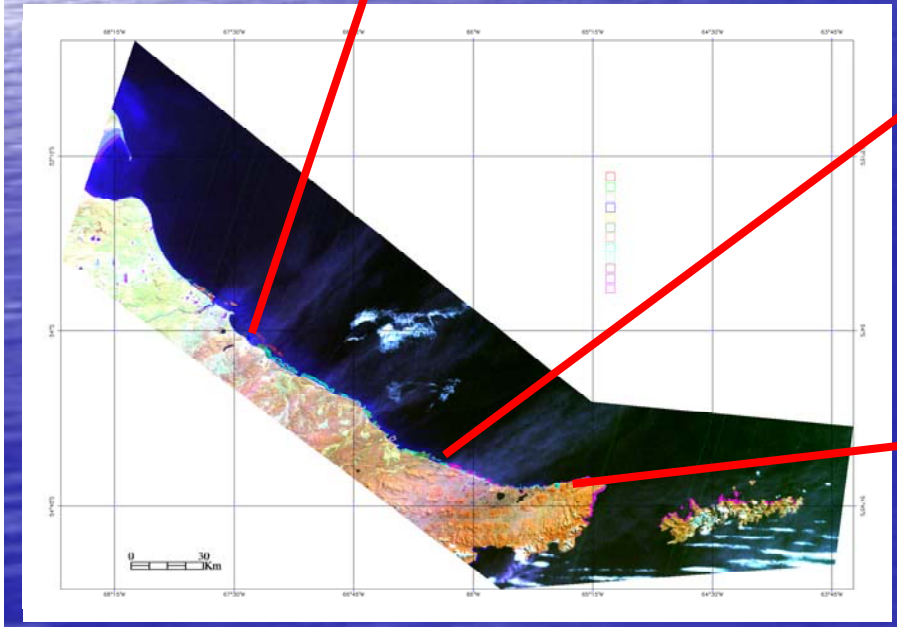
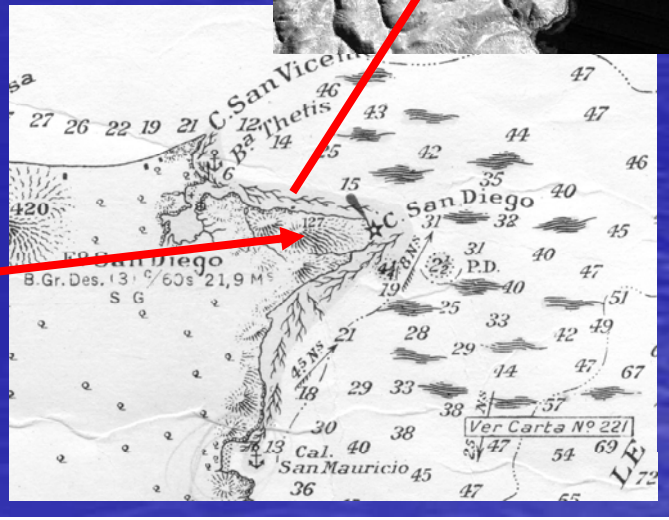
Identification over bathimetric charts (1939).

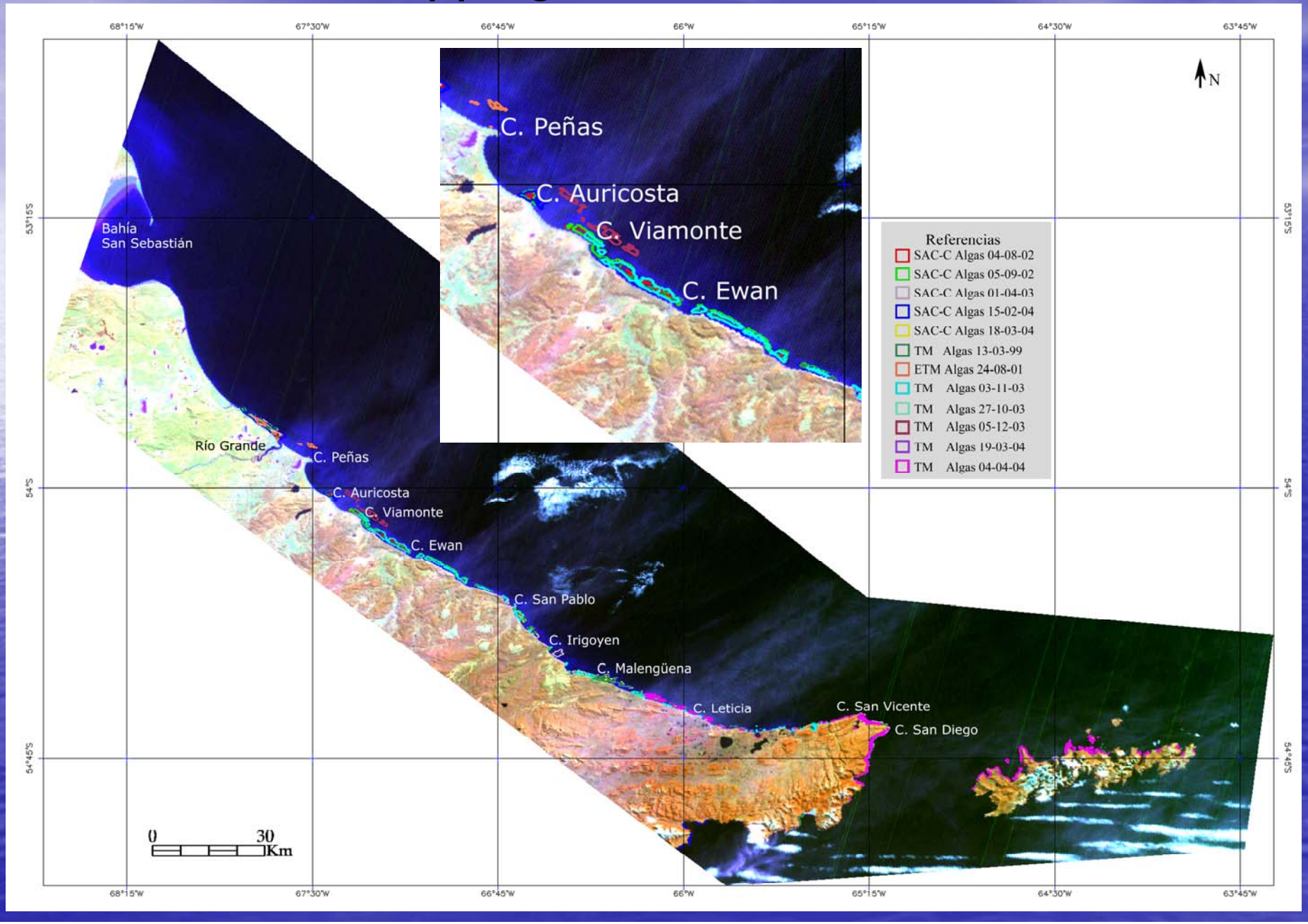








Total Mapping: SAC-C and Landsat



Mapping: Spring-Summer

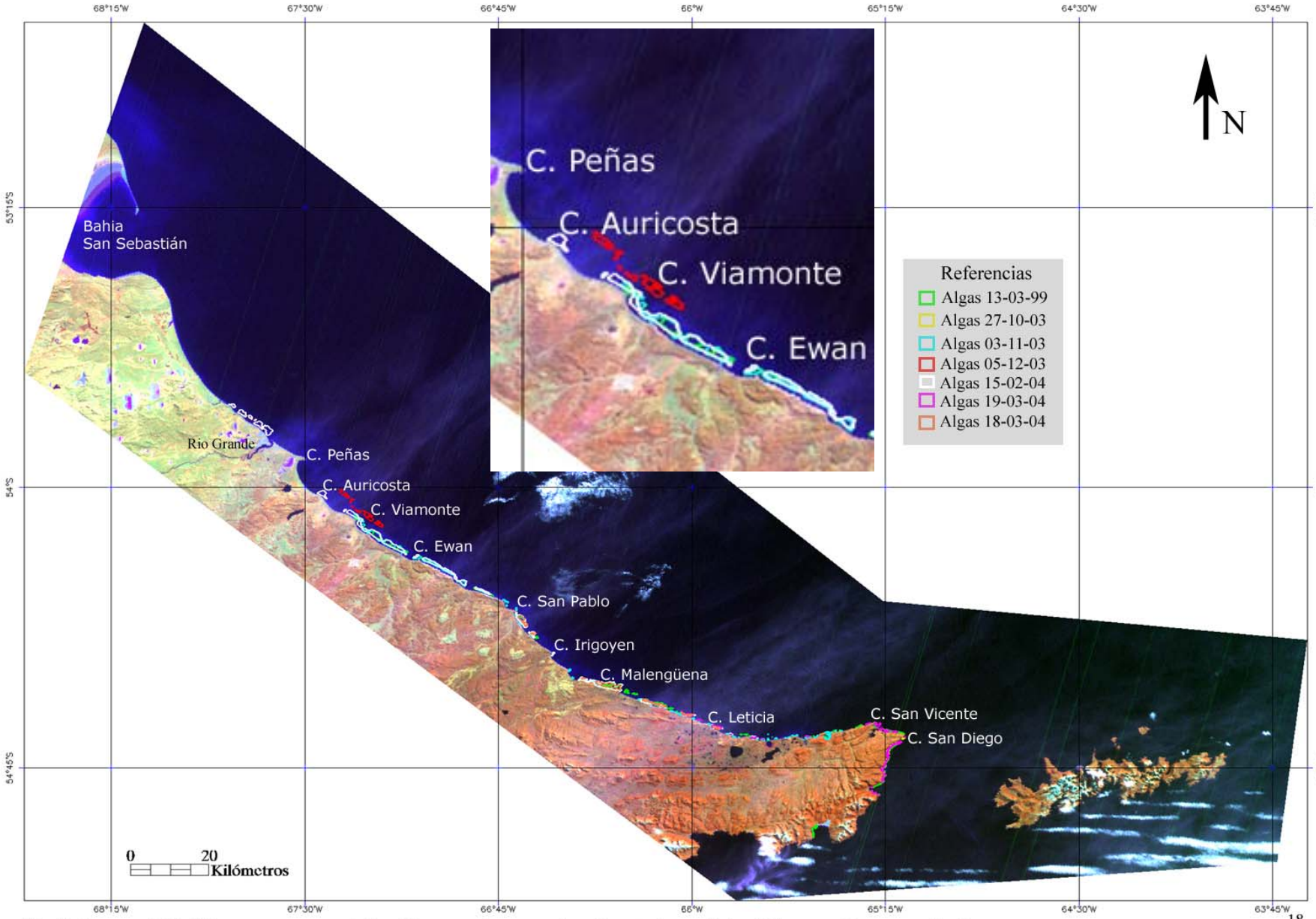


Fig.5b. Imagen SAC-C base con superposición del mapeo de macroalgas durante los períodos Primavera-Verano analizados.

Mapping: Fall-Winter

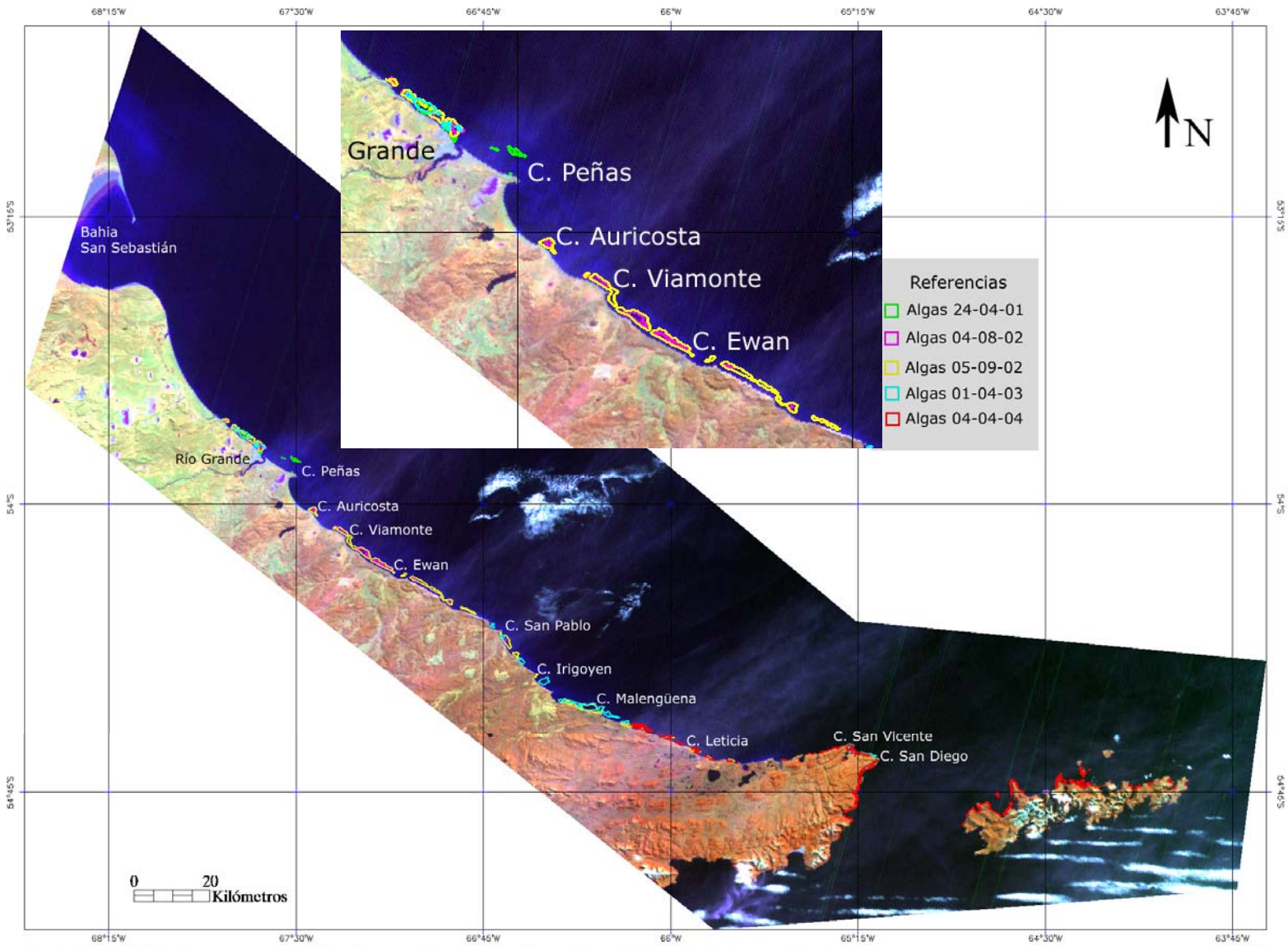


Fig. 5a. Imagen SAC-C base con superposición del mapeo de macroalgas durante los períodos Otoño-Invierno analizados.

Conclusions:

1. Landsat and Aster data were very useful to identify the marine macrophytes (good spatial and spectral resolution).

2. Sac-C data were useful too. It has good temporal resolution, very important for areas with high clouds cover.

3. Few changes of algae distribution were detected along seasons and years (1970-2006), on the coastal rocky formations, taking into account the tidal dynamic too. Here the distribution has remained stable.

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4. To know the marine macrophytes spatial distribution is important for several reasons:

*Preserve and conserve these environments, true fauna and flora reservoirs.

*Potential stock of this resource for the industry of derived algae products.

*The development of environmental monitoring of oil off-shore activities requires radar data (for clouds cover and facilities to detect oil spill on the sea). With this sensor is not easy to separate oil spill and macrophytes on the shorline, and false alarm can occur.

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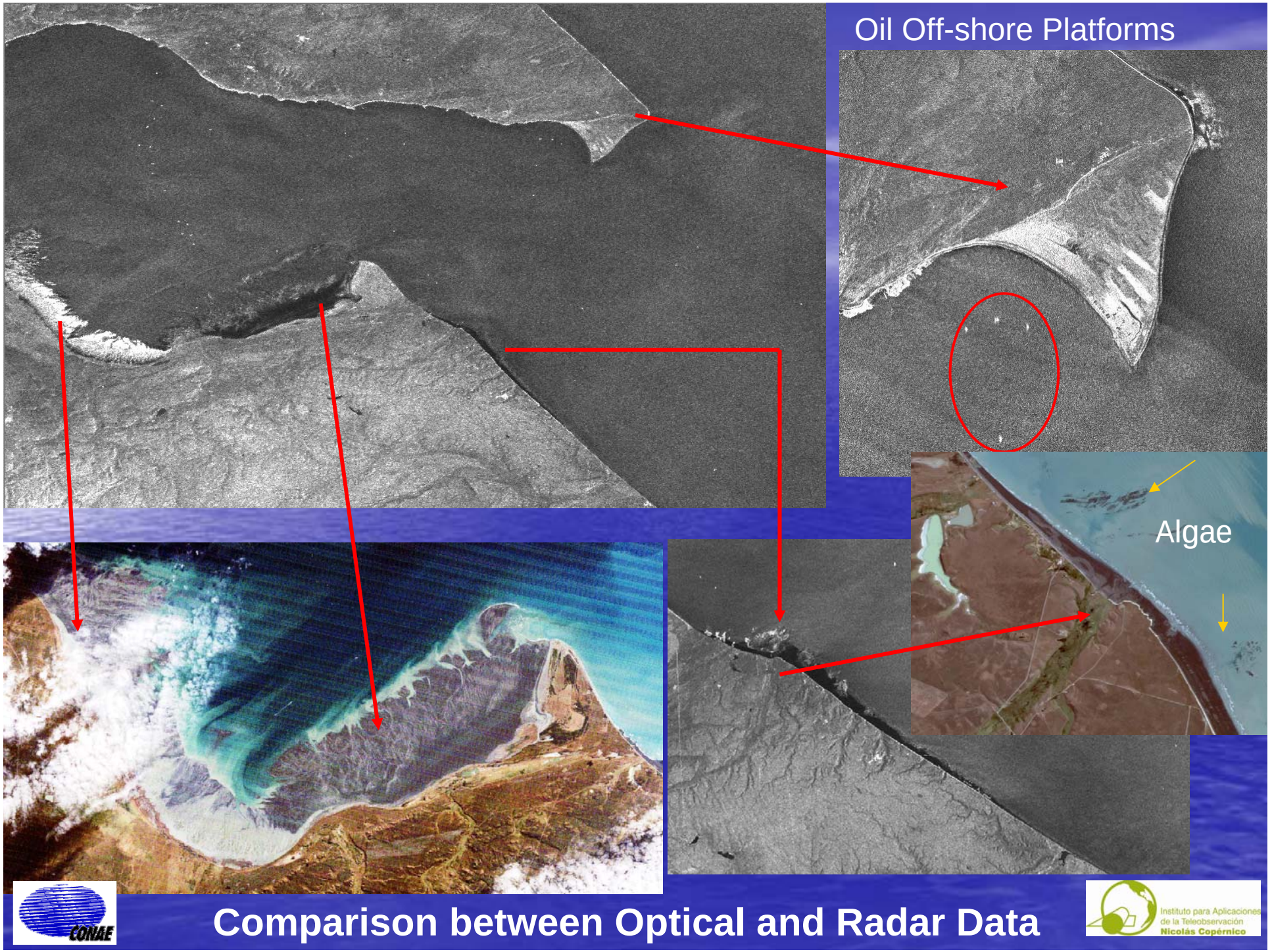

Comparison between Optical and Radar Data

In the Future...High Spatial Resolution.....

Magallanes Strait

From Quick Bird

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Thank you very much for your attention!!!

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