Terrestrial Applications of Remote Sensing of Environment in the Azores

Artur Gil (arturgil@uac.pt)
Azorean Biodiversity Group (CITA-A)
Department of Biology - University of the Azores
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Azores’ Land-based Environmental Issues

- In 2006, almost 4.3 million people lived in the EU outermost regions, representing 0.9% of the EU population.
- The majority of EU regions – except the French Guiana – are small islands or archipelagos.
- These regions face several obstacles to full development – remoteness, insularity, terrain and climate constraints, economic dependence and narrow range of the goods they produce.
Azores’ Land-based Environmental Issues

Main threats to small islands’ sustainable development, nature conservation and biodiversity maintainability:

- Climate Variability and Changes
- Proliferation of invasive exotic species
- Increasing growth of tourist activity
- Overexploitation of natural resources
- Pollution and residue management
- Natural catastrophes
Environmental Planning and Land Management in the Azores

16 land-based spatial and environmental legal instruments being currently applied and developed in the Azores Autonomous Region, which can be divided and classified into five core areas:

(1) Land planning and management;
(2) Natural resources management
(3) Sustainable economic development;
(4) Environmental conservation and biodiversity protection;
(5) Emergency and civil protection.
LULC Mapping: the core instrument for Land Planning & Management

- All of them require high spatial resolution data in order to deliver accurate and reliable outputs at special zones (basin and lake, coastal zone, protected areas), at municipal and island scales.
- A Land Use / Land Cover (LULC) mapping program with high spatial and temporal resolutions and with an adequate legend constitute the core mapping requisite for the Azorean land-based spatial and environmental legal instruments.
Impact of GMES in the Azorean Policy for Land Planning and Management

- The ESA’s GMES Sentinel 2 Mission (high-resolution multispectral imaging with 13 spectral bands and resolutions of 10, 20 and 60 m; with a swath width of 290 km) constitutes the most adequate and cost-effective Sentinel Mission in order to support the land-based legal instruments which are currently being applied in this region.

- Free-of-charge and permanent access through GMES to high-resolution data from commercial sensors as Worldview-2 or Rapideye could be an effective solution for EU Outermost regions Land Planning Policy support.
Impact of GMES in the Azorean Policy for Land Planning and Management

- IDEiA is the Azorean Spatial Data Infrastructure.
- Due to the scarcity of human, technical and financial resources, the implementation of a cost-effective “GMES Azorean Regional Framework” (GARF) is mandatory in order to maximize the societal benefits derived from the access to the GMES Space Component Sentinel Mission.
- A GARF integrated within the original IDEiA main framework will constitute a more operational and cost-effective solution.
Impact of GMES in the Azorean Policy for Land Planning and Management

- The Technology/Cartography Department of the Regional Government shall constitute the nuclear entity in order to ensure the setup, development, maintenance and cost-effectiveness of this GMES infrastructure.

- The University of the Azores and its research centers shall be responsible for setting up, feeding, managing and updating periodically the Regional In-situ GMES infrastructure, with the direct support and contributions of local, regional, national and international R&D centers, NGOs and the Public Administration.
Impact of GMES in the Azorean Policy for Land Planning and Management
Land-based Applications of Remote Sensing Imagery in the Azores

- **Aerial Photography:**
  - Photogrammetric restitution + GIS-based vectorization and photo-interpretation of orthophotomaps (Regional and Municipal Official Cartography)
  - GIS-based photo-interpretation of orthophotomaps + Field Work (Regional Forest Inventory)
Land-based Applications of Remote Sensing Imagery in the Azores

- **Satellite Remote Sensing:**
  - *Public Projects:*
    - Corine Land Cover 2006 and 2010 (ongoing)
    - Azorean LULC Map 2007 (using Landsat imagery - 2008)
Land-based Applications of Remote Sensing Imagery in the Azores

❖ Satellite Remote Sensing:

❖ Academic Projects:

☒ Coastal Change Detection using Landsat imagery (2009 – MSc Thesis)

☒ Mapping light pollution stress on Biodiversity – The case study of Cory’s Shearwater (*Calonectris diomedea borealis*) in S. Miguel Island (2011)

☒ LULC Mapping using Landsat, SPOT and ASTER imagery (ongoing PhD & Post-Doc)
Land-based Applications of Remote Sensing Imagery in the Azores

- **Satellite Remote Sensing:**
  - *Academic Projects:*
    - Vegetation and Ecosystem Services Mapping using IKONOS, ASTER, Rapideye, Hyperion and Chris-Proba imagery (ongoing PhD & Post-Doc)
    - Crop, Pasture and Vineyard Management in Terceira Island using field spectroscopy, multispectral and hyperspectral satellite imagery (ongoing PhD)
Land-based Applications of Remote Sensing Imagery in the Azores

Using DMSP Remote sensing imagery to map light pollution stress on Cory’s Shearwater, *Calonectris diomedea borealis*, in S. Miguel Island
Land-based Applications of Remote Sensing Imagery in the Azores

Mapping Woody Invasive Species (*Pittosporum* woodland) in Pico da Vara Natural Reserve (815 ha) using IKONOS

IKONOS (MLC): 126 ha *versus* REGIONAL FOREST INVENTORY: 35 ha
Some Cost-effective Remote Sensing Technologies to be tested in the Azores

- Applications using **UAV - Unmanned Aerial Vehicles** (LULC and Vegetation Mapping, Digital Elevation Models, Coastal Surveillance, etc.)

- Applications using **High-Resolution Satellite SAR (Synthetic Aperture Radar) Data** (Forest Biomass Estimation, Land Motion Risk Mapping, etc.)

- A Multi-Source approach is mandatory in order to reach the full potential for Land Monitoring in the Azores, by minimizing climate and surface morphology constraints.
Some proposals for a Regional Strategy on Remote Sensing of Environment

- Promoting and funding a Regional Research Line in “Integrated Remote Sensing of Environment” (Atmosphere, Coastal, Land and Ocean)
- Implementation of the “GMES Azorean Regional Framework” within IDEiA
- (Co-)Funding PhD and Post-Doc Projects to be developed under partnerships lead by Private Companies based in the Azores (Cybermap, Azorean UAV, Globaleda, EDA, SATA, YDreams Azores, etc.)
- Supporting partnerships between R&D Centers and Private Companies based in the Azores to lead or to participate in Research Projects under international calls (EU, ESA, NATO, UN, etc.)
THANKS FOR YOUR ATTENTION

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