remote sensing

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# Towards Sustainable Management of Mussel Farming through High-Resolution Images and Open Source Software—The Taranto Case Study

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**Supplementary Materials**

In general, data acquired from high-altitude systems offer a broader spatial coverage but a low-resolution image. Nevertheless, some satellites sensors can provide high-resolution images at the expense of a higher price, whereas an airborne sensor may furnish high-resolution spatial images. Moreover, aeroplanes benefit from more flexible use since they may be used to examine small geographical areas. The only issue is that they must fly in favourable weather conditions because turbulence may cause the instability of the aircraft. Airborne sensors acquire images with a temporal resolution in the order of minutes, differently from satellites that orbit around the Earth at regular intervals of days or hours, such as the Sentinel 2A and 2B that provides images every five days [1–3], making their use inappropriate for investigations in near-real-time [1,4].

**Table S1.** Advantages and disadvantages between aircraft and satellite platforms.

| Platform | Advantages | Disadvantages | References |
|---|---|---|---|
| **Aircraft** | Relatively high spatial resolution<br>High spectral resolution<br>Changeable sensors<br>They are highly flexible in terms of their configuration (spatial resolution, spectral range, number of bands, bandwidth, etc.) and the time of the survey.<br>Coverage of smaller geographic areas due to lower image acquisition altitude<br>Temporal resolution: minutes | High operating costs<br>Planning for aerial surveys, taking into account factors such as air traffic, solar conditions, weather<br>Image processing is complex<br>Low stability due to turbulence | |
| **Satellite** | High stability.<br>Good historical data<br>Image processing is relatively easy | High cost for high spatial resolution images.<br>Low spectral resolution<br>Atmospheric attenuation | |

| | | |
|---|---|---|
| | Low-cost for low-resolution images | Temporal resolution: hours and days<br>Adverse climatic conditions (e.g., clouds) or temporal changes can influence the interpretation of findings.<br>May need to sort through many images to obtain helpful information.<br>There is significant limitation when eliminating cloud cover is problematic. |

All of these applications produce georeferenced raster images containing various spectral bands defined by their wavelength and bandwidth. In general, the sensors record electromagnetic waves in the visible (VIS) (430–720 nm), medium (MIR) (1580–1750 nm) and near-infrared (NIR) (750–950 nm) light ranges. For example, various satellite and airborne sensors are used in evaluating the quality parameters of surface water, such as the analysis of chlorophyll, dissolved oxygen (DO), sea surface salinity, sea surface temperature, turbidity [5–11] and for monitoring the forms of pollution of water (plastic pollution, oil spill) [12–14] and soil [15], by measuring the amount of radiation at various wavelengths reflected from the surface of the water. However, the coverage of the electromagnetic spectrum of spaceborne sensors is limited in blue and middle infrared, as well as the thermal bands are not covered at the point that this may affect the accuracy of the estimation of water quality parameters [3]. Tables 2 and 3 show some satellite and airborne sensors and their configurations [3,5,10,16].

**Table S2.** Some sensor satellites and their configurations.

| Satellite sensor | Number of bands | Spectral range (nm) | Spatial resolution (m) | Swath width (km) | Temporal Resolution (days) | References |
|---|---|---|---|---|---|---|
| **Sentinel-2 Multi-Spectral Imager (MSI)** | 13 spectral bands, including 3 bands for atmospheric corrections | 443 – 2190 | 10<br>20<br>60 | 290 | 5 | [17] |
| **NOAA WorldView-3** | 8 MS in VNIR<br>1 Pan<br>8 MS in SWIR | 400–1040,<br>450–800,<br>1195–2365 | 1.24<br>3.7<br>0.31 | 13.1 | 1– 4.5 | [18] |
| **Landsat 8 OLI/TIRS** | 9 OLI including<br>1 Pan<br>2 TIRS | 433–2190,<br>500–680,<br>10.600–12.510 | 30<br>15<br>100 | 185 | 16 | [19] |
| **Sentinel-3 OLCI** | 21 | 400–1020 | 300 | 1200 | 4 | [20] |
| **Terra MODIS** | 2<br>5<br>29 | 620–876,<br>459–2155, 405–877 | 250<br>500<br>1000 | 2330 | 2 | [21] |

**Table S3.** Some typical airborne hyperspectral imaging systems.

| Airborne sensor | Number of bands | Spatial resolution (m) | Spectral range (nm) | FOV (deg) | IFOV (mrad) | Imaging swath | References |
|---|---|---|---|---|---|---|---|
| **Compact Airborne Spectrographic Imager (CASI)** | Up to 288 | 0.5–3 | 400–2500 | 40 | 0.49/ 0.698 | 512 pixels per scanline | [16,22] |
| **Airborne Visible Infrared Imaging Spectrometer (AVIRIS)** | 224 | 17 | 400–2500 | 30 | 1 | 12 km and 614 pixels per scanline | [23] |
| **Airborne Prism Experiment (APEX)** | Up to 334 VNIR -199 SWIR | 2–5 | 380–970, 940–2500 | 28o | 0.48 | 2.5–5 km | [24] |
| **HyMap** | 128 | 3–10 | 400–2500 | 60 | 2x2.5 | 512 pixels | [25] |
| **AISA - Airborne Imaging Spectrometer** | 286 | 1 | 450 - 900 | 21 | 1 | 384 pixels per scanline | [26] |

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