High Spatial Resolution Remote Sensing of the Plymouth Coastal Waters.

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• Overview of 2003 fieldwork
• CASI & CHRIS-PROBA imagery
• Future research
Location.

Plymouth provides an ideal location to study coastal waters, as there are Case I waters offshore and progressively more turbid Case II waters inshore.

CHRIS-PROBA 12th and 14th April combined coverage
Choice of appropriate remote sensing imagery

Temporal Resolution
- Yearly
- Monthly
- Daily
- Hourly

Spatial Resolution
- 1m
- 10m
- 50m
- 100m
- 500m
- 1km

Choice of appropriate remote sensing imagery
- CASI
- CHRIS
- MERIS
- SeaWiFS

Applications:
- Estuarine Mapping
- Coastal Mapping
- Ocean Mapping
How does the SPM vary spatially and temporally?
Quantification of the suspended particulate matter.

- Linking of hyper-spectral optics to geo-chemistry
- X-Ray Diffraction (XRD) & Scanning Electron Microscopy (SEM)

Minerals in order of relative abundance

<table>
<thead>
<tr>
<th>Location</th>
<th>Minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calstock</td>
<td>Quartz, Muscovite, Kaolinite</td>
</tr>
<tr>
<td>Tamar</td>
<td>Quartz, Muscovite, Kaolinite</td>
</tr>
<tr>
<td>Tamar</td>
<td>Quartz, Kaolinite, Muscovite</td>
</tr>
<tr>
<td>Barn Pool</td>
<td>Quartz, Muscovite, Kaolinite</td>
</tr>
<tr>
<td>(Mar to Aug)</td>
<td>Quartz, Muscovite, Kaolinite</td>
</tr>
<tr>
<td>P Sound (W)</td>
<td>Quartz, Kaolinite, Muscovite</td>
</tr>
<tr>
<td>Plym Estuary</td>
<td>Kaolinite, Muscovite</td>
</tr>
<tr>
<td>Plym Estuary</td>
<td>Kaolinite, Quartz, Muscovite</td>
</tr>
</tbody>
</table>
Fieldwork in 2003.

Table 1: Available imagery collected with contemporaneous in-situ data.

<table>
<thead>
<tr>
<th>Months</th>
<th>CHRIS-PROBA Coverage</th>
<th>CASI imagery</th>
<th>In-situ Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 03</td>
<td>18\textsuperscript{th} Feb. Lower Estuary &amp; Plymouth Sound. Broken cloud.</td>
<td>None.</td>
<td>17\textsuperscript{th} Feb, Plymouth Sound.</td>
</tr>
<tr>
<td>Mar 03</td>
<td>6\textsuperscript{th} Mar. Plymouth Sound &amp; Offshore. Some cloud.</td>
<td>None.</td>
<td>None</td>
</tr>
<tr>
<td>Apr 03</td>
<td>12\textsuperscript{th} &amp; 14\textsuperscript{th} Apr. Tamar estuary and Plymouth Sound. Cloud over upper reaches.</td>
<td>16\textsuperscript{th} Apr in upper reaches of Tamar.</td>
<td>13\textsuperscript{th}, 14\textsuperscript{th} and 16\textsuperscript{th} Apr in the upper reaches of Tamar. 14\textsuperscript{th} Apr, Plymouth Sound.</td>
</tr>
<tr>
<td>Jun 03</td>
<td></td>
<td>13\textsuperscript{th} Jun. P Sound / Offshore. 24\textsuperscript{th} Jun. Upper and main Tamar (clouds and shadow).</td>
<td>16\textsuperscript{th} Jun, Breakwater. 23\textsuperscript{rd} &amp; 24\textsuperscript{th} Jun, Tamar transects including Barpool. 25\textsuperscript{th} - 27\textsuperscript{th} Jun, Calstock</td>
</tr>
<tr>
<td>Aug 03</td>
<td>24\textsuperscript{th} Aug. Offshore, imagery dominated by glint</td>
<td>None.</td>
<td>22\textsuperscript{nd} Aug, Plymouth Sound.</td>
</tr>
<tr>
<td>Sep 03</td>
<td>16\textsuperscript{th} Sep. Offshore, some cirrus.</td>
<td>None.</td>
<td>None</td>
</tr>
<tr>
<td>Nov 03</td>
<td>2\textsuperscript{nd} Nov. Plymouth Sound &amp; Offshore, some cloud.</td>
<td>None.</td>
<td>None</td>
</tr>
</tbody>
</table>


Tamar CASI Imagery, April 2003.

4 flightlines in total.
CHRIS-PROBA Imagery, April 2003.
CHRIS-PROBA, April 2003

Colour Composite of 667, 560 and 490 wavebands as red, green and blue.

Uncorrected Image

Non-water mask
CHRIS-PROBA Atmospheric Correction

Colour Composites of 667, 560 and 490 wavebands as red, green and blue.

Rayleigh corrected Image

Fully (Case I) corrected Image
CHRIS-PROBA, March 2003

Colour Composite of 667, 560 and 490 wavebands as red, green and blue.

Uncorrected Image

Non-water mask
CHRIS-PROBA Atmospheric Correction

Colour Composites of 667, 560 and 490 wavebands as red, green and blue.

Rayleigh corrected Image

Fully (Case I) corrected Image
CHRIS-PROBA Spectral Plot for pixel off Rame Head, March 2003.

- Sensor
- Rayleigh corrected
- Case I corrected
- Case 2 corrected
Future research

- Further work on processing the satellite (CHRIS/PROBA) and aircraft (CASI) imagery
  - presentations at the NERC EO Conference and RSPSoc 2004.

- 2004 Fieldwork:
  - Repeat of attempt to get contemporaneous in-situ, CASI and CHRIS-PROBA data.
  - Enhanced biological sampling as previous research has indicated a summer bloom in the upper reaches of the Tamar.

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