

# Possibilities of satellite remote sensing for monitoring coral reefs in the Red Sea

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Coral reefs are considered as one of the most spectacular marine ecosystems on earth. They are characterised by a tremendous biodiversity and, in many places like the Red Sea, by a high level of endemism.

Coral reefs need our attention because of the importance of their biodiversity and their key role in the tropical marine biosphere. But coral reefs are also very valuable as a socio-economic resource. As coral reefs are main fishing grounds and attractors of large numbers of tourists, they generate important contributions to the national income of many developing countries. Despite these natural and socio-economic advantages, many threats are posing stress on coral reefs. A few examples are: extreme pressure from tourism (anchoring damage, coral collection), irresponsible and illegal coastal development, marine and land-based pollution and, on another level, the 'Global Change' -issue.

Remote sensing from satellites can help to collect information about coral reefs in order to get a better knowledge of their current status. Some satellite sensors are especially developed for marine applications, such as the SeaWiFS-, CZCS- or MODIS-sensor. Others are not but can still be useful, for example Landsat (MSS, TM or ETM+), SPOT or ASTER. All these sensors detect visual light. The blue-green range in the visual spectrum is the most important. In optimal conditions, clear calm water, information of objects up to a depth of 25-30m can be gathered. The newest evolution in marine remote sensing applications is tending to use hyperspectral airborne data and very-high-resolution images, such as IKONOS or Quickbird.

The main advantages of using satellite images, in comparison with traditional 'on the spot' survey methods, are the possibilities to work on a multi-temporal basis and over extended areas. Remote sensing offers the opportunity to gather information over vast areas compared to traditional survey methods where only limited spatially distributed information can be collected. It is also possible to follow up the situation more cost effective in a temporal manner. In that way, remote sensing data is very useful for setting up monitoring programs for distant or intensively used coral reef areas. But of course with the constraint of limited depth penetration, gradually increasing with higher turbidity.

Remote sensing techniques can be used to derive information about the location of the coral reefs (X-, Y- and Z-coordinates), their structure, their composition and their condition. Secondly, remote sensing can also contribute in monitoring the physical, chemical and/or ecological conditions of the Red Sea.

These remote sensing based results combined with additional information concerning the coral reefs in the Red Sea, information on the conditions in the Red Sea, natural hazards and threats, possible bleaching events, different human threats posed on the coral reefs, as well as predictions, give us a wide range of thematic maps and databases which can be combined into a 'Coral Reef GIS'. As one of the outcomes, a 'near real time' risk map can be created which marks the localisation of the reefs in the Red Sea that are under potential stress due to the changing conditions. These maps and others can be used for immediate actions or as a back up for coastal planning, by government, coastal developers, environmentalists or other decision makers.