

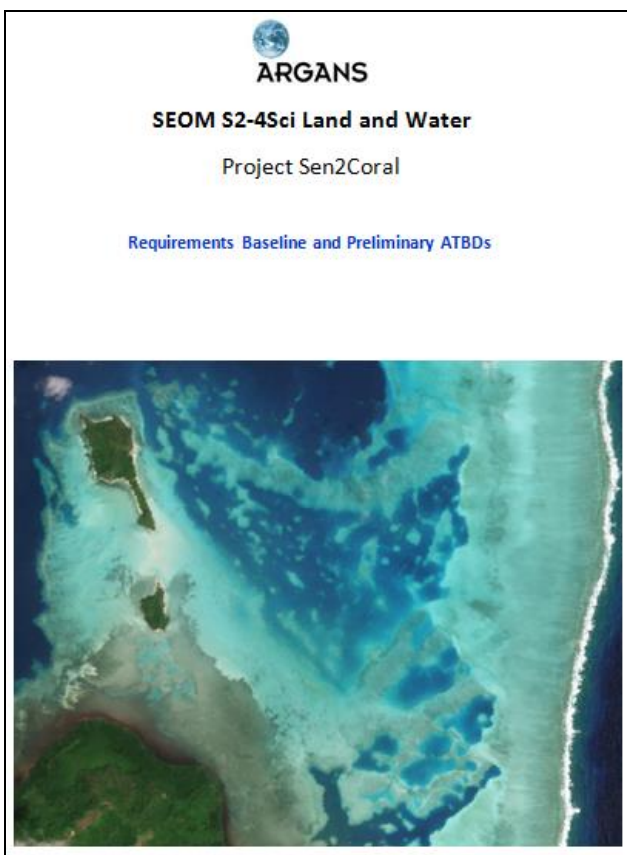


Production and Deliverables Summary

1st Milestone

The Sen2Coral 1st Milestone production and deliverables comprise the following documents:

1. The Science Review.
2. A résumé available on the website.
3. And for the hasty Reader, the ICRS 13 comprehensive PowerPoint presentation.



4. The Fatu Huku Coral Bleaching Survey résumé available on the website.
5. The Fatu Huku Coral Bleaching Survey full report.
6. A flyer produced for the GeoBusiness 2016 exhibition;
7. A PowerPoint presentation on SDB made to the Dublin North Sea Hydrographic Conference (NSHC23).



Sen2Coral

The Fatu Huku Coral Bleaching Survey

An exercise on Coral Bleaching detection by satellite remote sensing (Sentinel-2 Earth Observations)

from February 2016 to April 2016

by F.R. Martin-Lauzer (ARGANS Ltd & ACRI), Antoine Collin (EPHE-CRIOBE), Jean Laporte (ARGANS Ltd), Romain Serra (ACRI-HE)



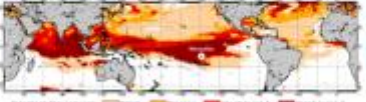
Sen2Coral
an ESA project for coral reefs health assessment and monitoring

El Nino's Coral Bleaching: the Marquesas demonstration

Polyps live symbiotically with an alga, the zooxanthellae, which converts light into carbohydrates. When stressed by photo-inhibition, corals expel their algae (lose their colour) - hence the name of the plague: **Bleaching** - and unless rapidly colonized again, die.

Mass bleaching occurs under thermal stress such as the one induced by the 2002 El Niño. The Marquesas have small deep lagoons, pointed by winds and affected by thermal stress, making their coral reefs highly vulnerable.

NDA thermal stress prediction for May-August 2016

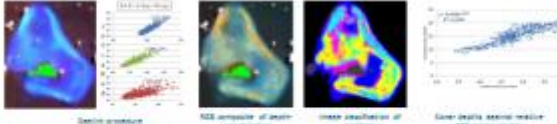


Because they need a higher light absorption rate to synthesize energy, deep corals are more sensitive to thermal stress. The Marquesas mean February temperature anomaly was +2.3°C.

The coral-bleached island of Fatu Huku was selected to conduct a test survey. The object of the exercise was to prove that coral bleaching observed in-situ could also be detected by the Sentinel-2. Multipolar instruments (MSI), or the assumption that if a processing demonstrator can work in such a challenging environment, it will work everywhere!

Habitat mapping such as the detection of coral bleaching requires a toolbox dedicated to enhance Sentinel-2 Earth Observation capabilities.

Amongst the algorithms developed for the Sen2Coral project, special inversion should be made of spatial registration, cloud masks atmospheric corrections, surface glint removal, water column correction, radiometric normalization, depth invariant indices, physics-based inversion, satellite derived bathymetry and, most difficult of all, changes detection.



Changes were detected between two February and April Sentinel-2 images. Very faint variations were observed in relative green/blue ratio in the water column, at the sea surface interface and sea bottom albedo.

CONCLUSION

Positive reflectance anomalies can be ascribed to coral bleaching, while negative anomalies are caused by wind generated turbulence ("spoil storms", radiocastle, seamount).

Although very faint, reflectance anomalies affecting Fatu Huku deep coral could be detected by Sentinel-2, while the towed subsurface camera could only see blurry images.

Fatu Huku's coral bleaching had indeed been confirmed at close distance to the divers.

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8. A draft observational scenario updated as the Sen2Coral project progresses.
- The following additions are envisaged at this stage by the Science Team:
- Listing of the worldwide sites to be observed by Sentinel 2
 - Assessment of the project structuring parameters: climatological threats, cost impact, Sen-2 performances, QC, error budgets, etc.
 - Details of the coordination plan to be negotiated with NASA-USGS.

SEOM S2-4Sci Land and Water

Coral Reefs – Sentinel-2 Observation Scenario

