Satellite Derived Bathymetry for the Islands of South Eastern Crete

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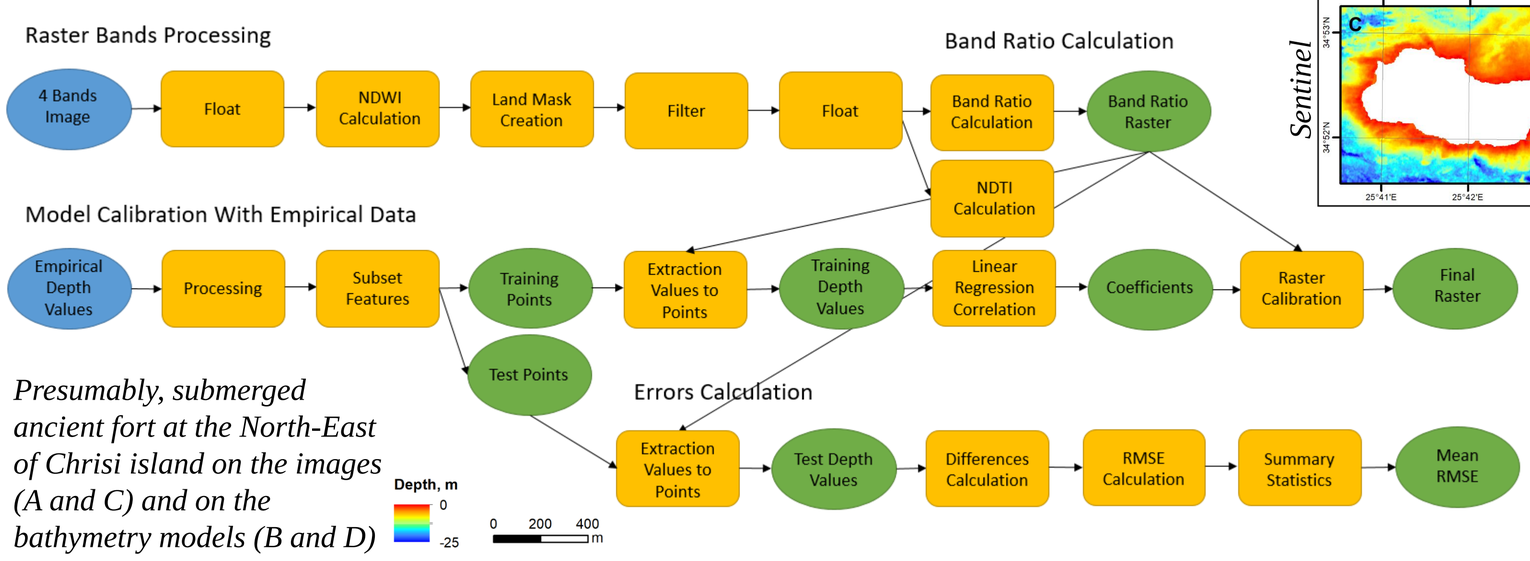
INTRODUCTION

- Recent advances in remote sensing techniques and higher availability of satellite sensors has increased their applicability to several scientifc sectors, including marine research and coastal cultural heritage management.
- Satellite-derived bathymetry is relatively simple, cost-effective, and time-effective method to extract high resolution bathymetry model.
- The method has been applied to Koufonisi and Chrisi islands off the coast of south-eastern Crete in southern Greece. The islands' waters have not yet been investigated for their potential value to cultural heritage in the area, despite their proximity to the relatively archaeologically rich island of Crete.

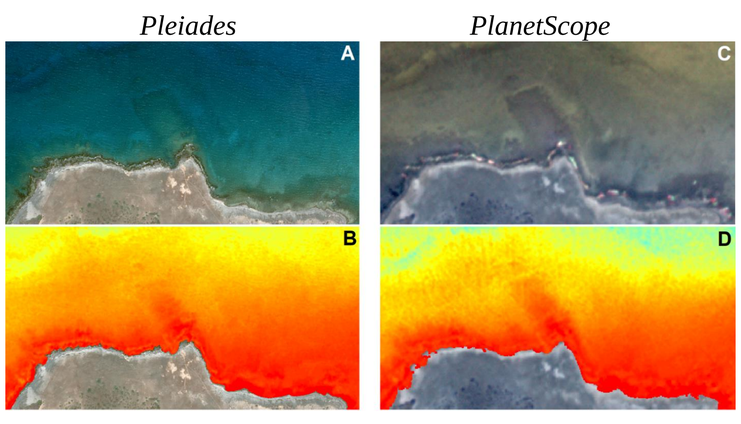
METHODS

A semi-automated model was created via ArcGIS's 'ModelBuilder' tool which carries out several steps required for converting a multiband image into the final bathymetry product via the use of an empirical approach [Stumpf et al., 2003; Ashphaq et al., 2021; Evagorou et al., 2022] for three satellite sources (Pleiades, PlanetScope, and Sentinel 2-A).

Sensor	Resolution	Date	Bands Applied	Training Points	Equations	Test Points	RMSE (m)
			Chrisi				
Pleiades-1A	0.5 m	16.06.2022	B: 430-550 nm G: 490-610 nm R: 600-720 nm NIR: 750-950 nm		y = -31.997x + 31.916		1.2
Planet-Scope	3 m	18.06.2022	B: 465-515 nm G: 547-583 nm R: 650-680 nm NIR: 845-885 nm	753	y = -22.789x + 22.789	178	1.1
Sentinel-2A	10 m	06.06.2022	B: 458-523 nm G: 543-578 nm R: 650-680 nm NIR: 785-899 nm		y = -59.519x + 59.620		1.7
			Koufonisi				
Pleiades-1A	0.5 m	26.04.2022	B: 430-550 nm G: 490-610 nm R: 600-720 nm NIR: 750-950 nm		y = -56.791x + 56.529		1.7
Planet-Scope	3 m	26.04.2022	B: 465-515 nm G: 547-583 nm R: 650-680 nm NIR: 845-885 nm	522	y = -24.686x + 24.621	131	1.4
Sentinel-2A	10 m	07.05.2022	B: 458-523 nm G: 543-578 nm R: 650-680 nm NIR: 785-899 nm		y = -68.762x + 68.901		2.2

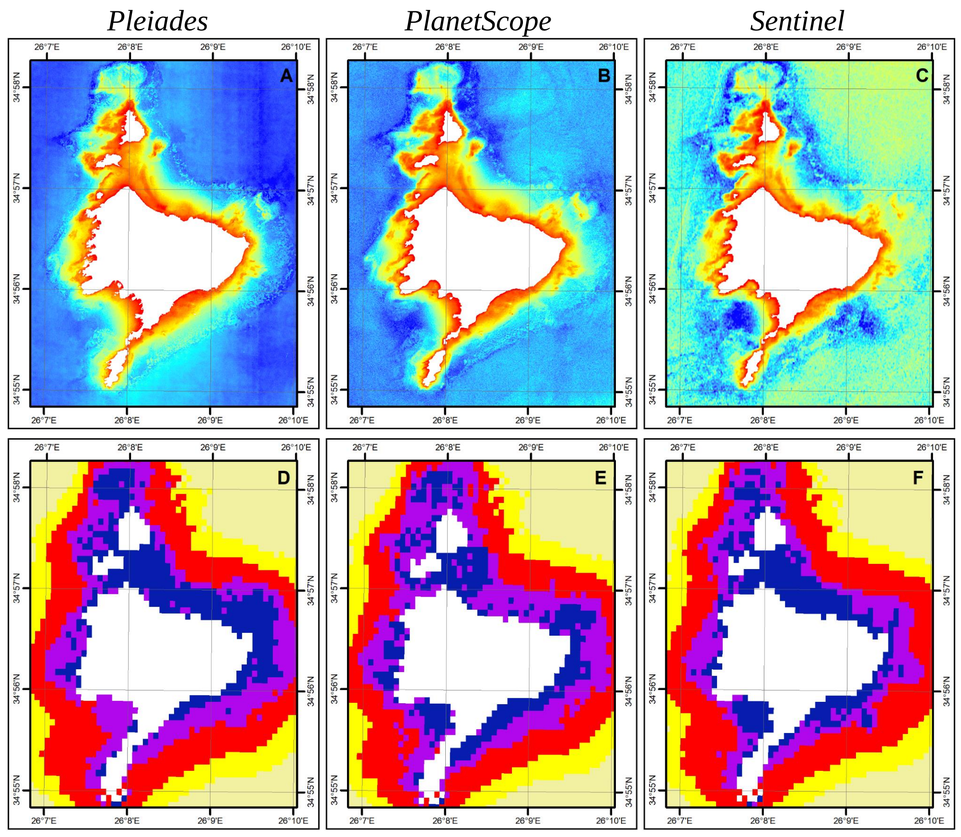


Presumably, submerged ancient fort at the North-East of Chrisi island on the images (A and C) and on the bathymetry models (B and D)



RESULTS/CONCLUSIONS

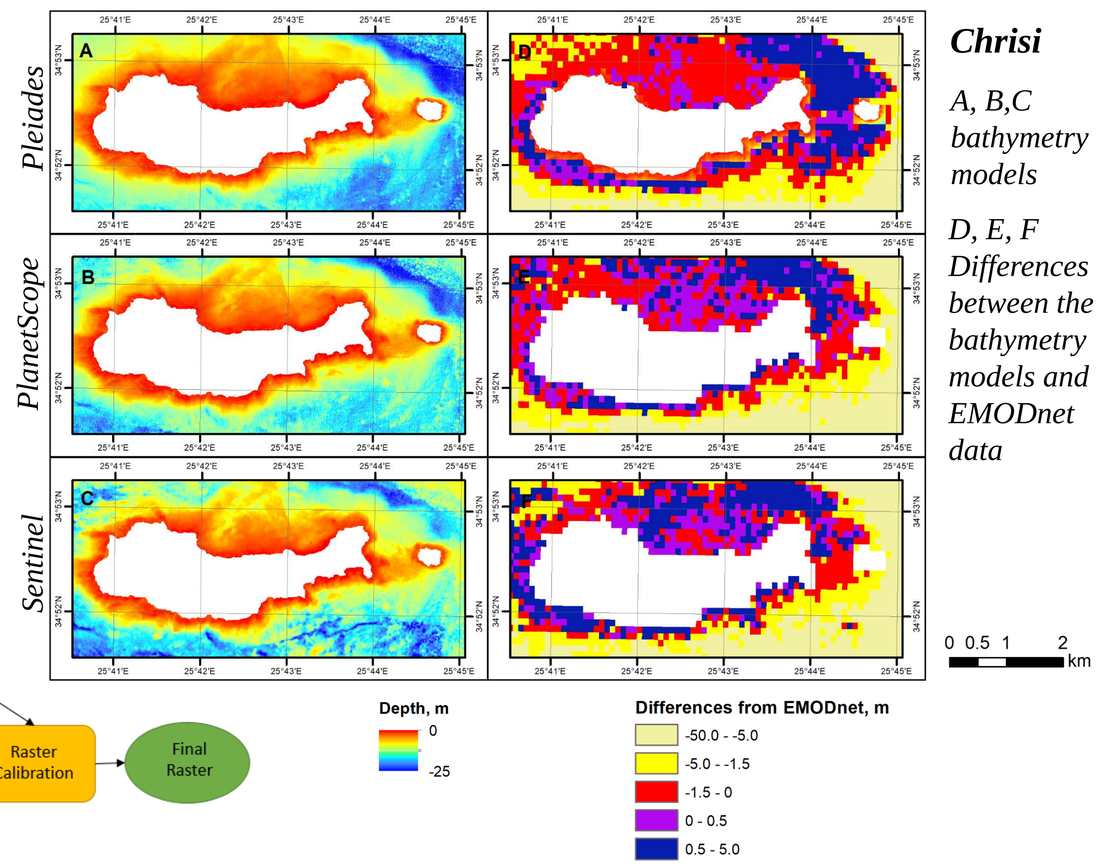
- Accuracy of bathymetry models is amounting to 1-2 m.
- RMSEs of validation are lower for Chrisi island compared to Koufonisi, that could be related to the higher amount of control points used and generally lower NDTI values (i.e. lower turbidity) for this area.
- The most promising result was RMSE 1.1 m for the bathymetry model from the PlanetScope image for Chrisi island. The NDTI values were the lowest for this image. Spatial resolution is lower, than for Pleiades image, though the bandwidths of its sensor's spectral bands are narrower, that may provide the better result.
- The poorest accuracy (2.2 m) was received from the Sentinel image for the Koufonisi area. This image has the lowest resolution and it was probably captured during the period with worse hydrometeorological conditions for bathymetry derivation, as the NDTI values are the highest on this image.



Koufonisi

A, B,C bathymetry models

D, E, F Differences between the bathymetry models and EMODnet data



Chrisi

A, B,C bathymetry models

D, E, F Differences between the bathymetry models and EMODnet data

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