

ABSTRACT

The "time-series composite clean-coastal-water (CCW)" image pre-processing algorithm is one of the alternatives for obtaining minimal atmospheric disturbance satellite images for data inputs in satellite-derived Bathymetry (SDB). However, the performance of time-series composite images for shallow water bathymetric mapping needs to be assessed, considering the presence of pixel and band dispersion during the composite image construction process. This research aims to study the result of a time-series composite clean-coastal-water Sentinel-2 by using cloud computing pre-processing as input data for SDB in shallow waters, compare the results of SDB from a Sentinel-2 single date image and from the time-series composite clean-coastal-water image using a band ratio model (BRM) and a random forest regressor (RFR) algorithm in terms of accuracy and spatial distribution of the bathymetry, and evaluate the performance and quality of bathymetric maps obtained from a single date image and time-series composite clean-coastal-water Sentinel-2 images based on International Hydrographic Organization standards (IHO). The results show that not all time-series composite processes can produce clean images of interference from clouds, sunglints, bad waters, and pixel wave breaks. The acquisition time range affects the quality of the time-series composite image. The SDB RFR model can handle the complex relationship between the in situ water depth variable and the surface reflectance value of a time-series composite clean-coastal-water image that has pixel and band dispersion compared to the SDB BRM. Overall, the quality of the SDB data generated by the BRM method has not qualified for the scale of data on shallow water bathymetry according to CATZOC IHO standards. The SDB RFR model was successfully used to predict bathymetry in shallow waters with accuracy that meets the IHO standard CATZOC requirements, with RMSE and MAE values of less than 0.5 meters as well as TVU confidence level values of more than 95% at a depth of 0-5 meters resulting from each - respectively CCW composite time-series images in Tanjung Kelayang, Seribu Islands, waters around Morotai Island and waters around Ontoloe Island.

Keywords: *SDB, shallow water, Sentinel-2, clean-coastal-water*

INTISARI

Algoritma pra-pemrosesan citra “*time-series composite clean-coastal-water (CCW)*” merupakan salah satu alternatif untuk memperoleh citra satelit yang minim gangguan atmosfer untuk input data pemetaan batimetri perairan dangkal dari citra satelit. Akan tetapi, performa dari citra *time-series composite* untuk pemetaan batimetri perairan dangkal perlu diuji, mengingat adanya dispersi piksel dan *band* pada saat proses pembangunan citra komposit. Tujuan dari penelitian ini adalah mengkaji hasil citra *time-series composite clean-coastal-water* Sentinel-2 berbasis *cloud computing* sebagai data input untuk pemetaan batimetri di perairan dangkal, membandingkan hasil ekstraksi batimetri perairan dangkal dari citra Sentinel-2 perekaman tunggal dan citra *time-series composite clean-coastal-water* menggunakan algoritma *band ratio model* dan *random forest regressor* dari segi akurasi dan distribusi spasial kedalaman perairan dangkal. Dan mengevaluasi performa dan kualitas peta batimetri perairan dangkal yang dihasilkan dari citra perekaman tunggal dan citra *time-series composite clean-coastal-water* Sentinel-2 berdasarkan standar *International Hydrographic Organization* (IHO). Hasil penelitian menunjukkan bahwa tidak semua proses *time-series composite* dapat menghasilkan citra yang bersih dan bebas dari gangguan awan, *sun glint*, perairan keruh, dan piksel pecah gelombang. Rentang waktu perekaman berpengaruh terhadap kualitas citra *time-series composite* yang dihasilkan. Model SDB RFR (*Satellite Derived Bathymetry Random Forest Regressor*) dapat menangani hubungan kompleks antara variabel kedalaman perairan *in situ* dengan nilai *surface reflectance* dari citra *time-series composite clean-coastal-water* yang memiliki ketidakpastian dispersi piksel dan *band* daripada model SDB BRM (*Satellite Derived Bathymetry Band Ratio Model*). Secara keseluruhan, kualitas data SDB yang dihasilkan dari metode BRM belum memenuhi syarat ketelitian data kedalaman perairan dangkal menurut CATZOC IHO. Model SDB RFR berhasil digunakan dalam memprediksi batimetri di perairan dangkal dengan akurasi yang memenuhi syarat CATZOC standar IHO, yaitu nilai RMSE dan MAE kurang dari 0,5 meter juga nilai tingkat kepercayaan TVU lebih dari 95% pada kedalaman 0-5 meter yang dihasilkan dari masing-masing citra *time-series composite CCW* di Tanjung Kelayang, Kepulauan Seribu, perairan sekitar Pulau Morotai dan perairan sekitar Pulau Ontoloe.

Kata kunci: SDB, perairan dangkal, Sentinel-2, *clean-coastal-water*