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Neural Network Technique for Continous Transition from Ocean to Coastal Retrackers

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This paper presents the development of neural network for continuous transition of altimeter sea surface heights when switching from ocean to coastal waveform retrackers. In attempting to produce precise coastal sea level anomaly (SLA) via retracking waveforms, issue arose when employing multiple retracking algorithms (i.e. MLE-4, sub-waveform and threshold). The existence of relative offset between those retrackers creates 'jump' in the retracked SLA profiles. In this study, the offset between retrackers is minimized using multi-layer feed forward neural network technique. The technique reduces the offset values by modelling the complicated functions of those retracked SLAs. The technique is tested over the region of the Great Barrier Reef (GBR), Australia. The validation with Townsville and Bundaberg tide gauges shows that the threshold retracker achieves temporal correlations (r) of 0.84 and 0.75, respectively, and root mean square (RMS) error is 16 cm for both stations, indicating that the retracker produces more accurate SLAs than those of two retrackers. Meanwhile, values of r (RMS error) for MLE-4 is only 0.79 (18 cm) and 0.71 (16 cm), respectively, and for sub-waveform is 0.82 (16 cm) and 0.67 (16 cm), respectively. Therefore, with the neural network, retracked SLAs from MLE-4 and sub-waveform are aligned to those of the threshold retracker.

The performance of neural network is compared with the normal procedure of offset removal, which is based on the mean of SLA differences (mean method). The performance is assessed by computing the standard deviation of difference (STD) between the SLAs above a referenced ellipsoid and the geoidal height, and the improvement of percentage (IMP). The results indicate that the neural network provides improvement in SLA precision in all 12 cases, while the mean method provides improvement in 10 out of 12 cases and deterioration is seen in two cases. In terms of STD and IMP, neural network reduces the offset better than those of the mean method. The IMPs with neural network reaches up to 67% for Jason-1 and 73% for Jason-2, meanwhile with mean method the IMPs only reaches up to 28% and 46%, respectively. In conclusion, the neural network technique is efficient to reduce the offset among retrackers by handling the linear and nonlinear relationship between retrackers, thus providing seamless transition from the open ocean to the coast, and vice versa. Studies in currently on-going are to consider other geophysical parameters, such as significant wave height that might be related to the variation of the offset, in the neural network.