NEW CALIBRATION METHOD APPLICABLE TO SIGNIFICANT WAVE HEIGHTS OBTAINED BY X-BAND RADAR

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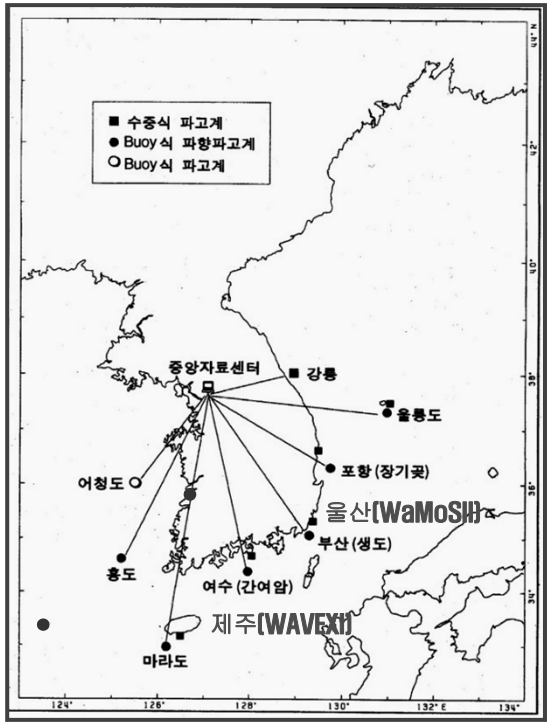
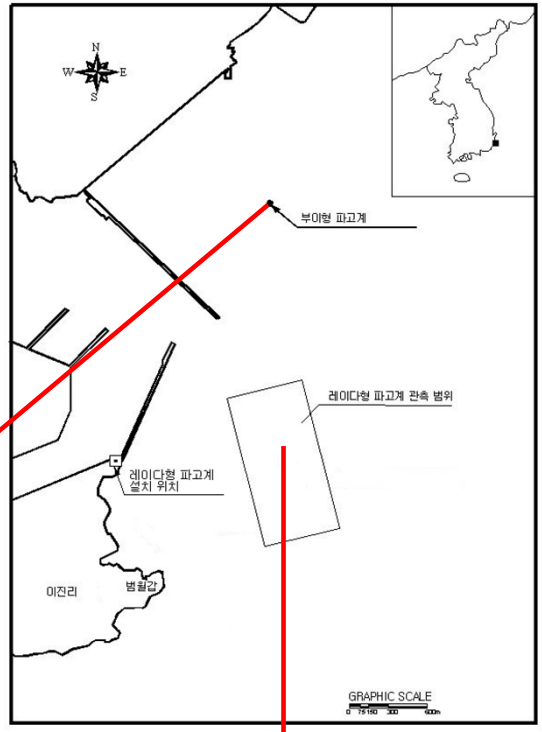
Outline

1. Motivation of the Research
2. Wave measurement systems (X-band Marine Radar)
3. Calibration of Wave Heights for X-band Marine Radar
4. Conclusions

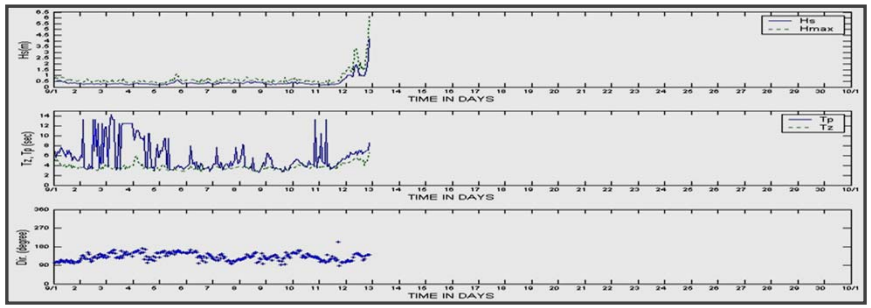
Motivation of the Research

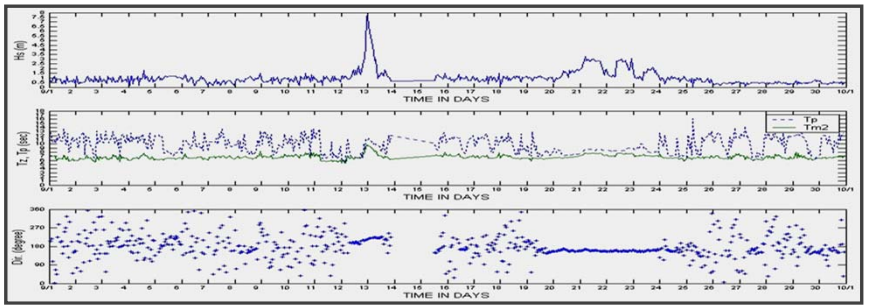




Waverider Buoy (Tri-Axys) lost

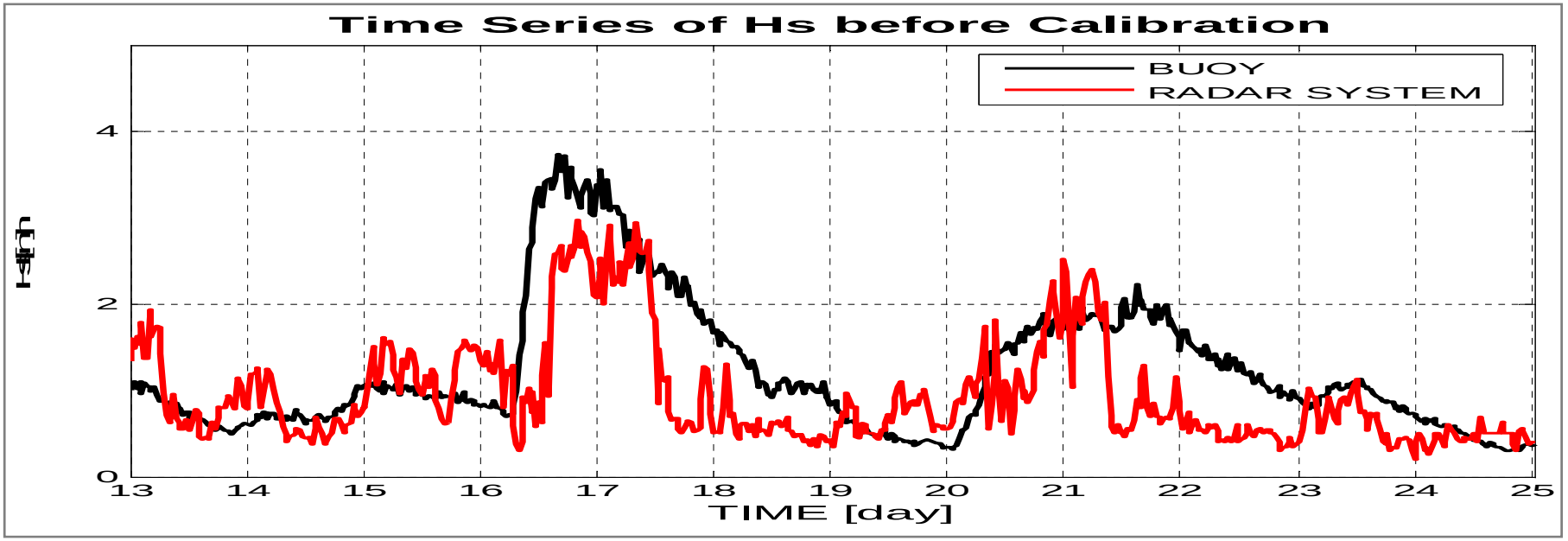
X-band marine radar system (WaMos II)





Comparison of Different Directional Wave Gages

	Buoys	P-u-v gage	ADCP	Radar
Accuracy	high	medium high	high	very low
Durability	low	medium high	medium high	very high
Initial Cost	high ($80,000)	low ($25,000)	low ($30,000)	very high ($120,000)
Maintenance Cost	high	medium	medium	very low
Water Depth	20~100 m	< 20 m	< 50 m	distance from the system
Spectrum	frequency	frequency	frequency	frequency & wave number
Currents	No	bottom currents	current profile	surface currents
Data transmission	direct	data link to shore	data link to shore	direct



Wave measurement system using X-band Marine Radar is a promising next generation wave gage

If accuracy ↑ initial cost ↓

3S-system has been developed

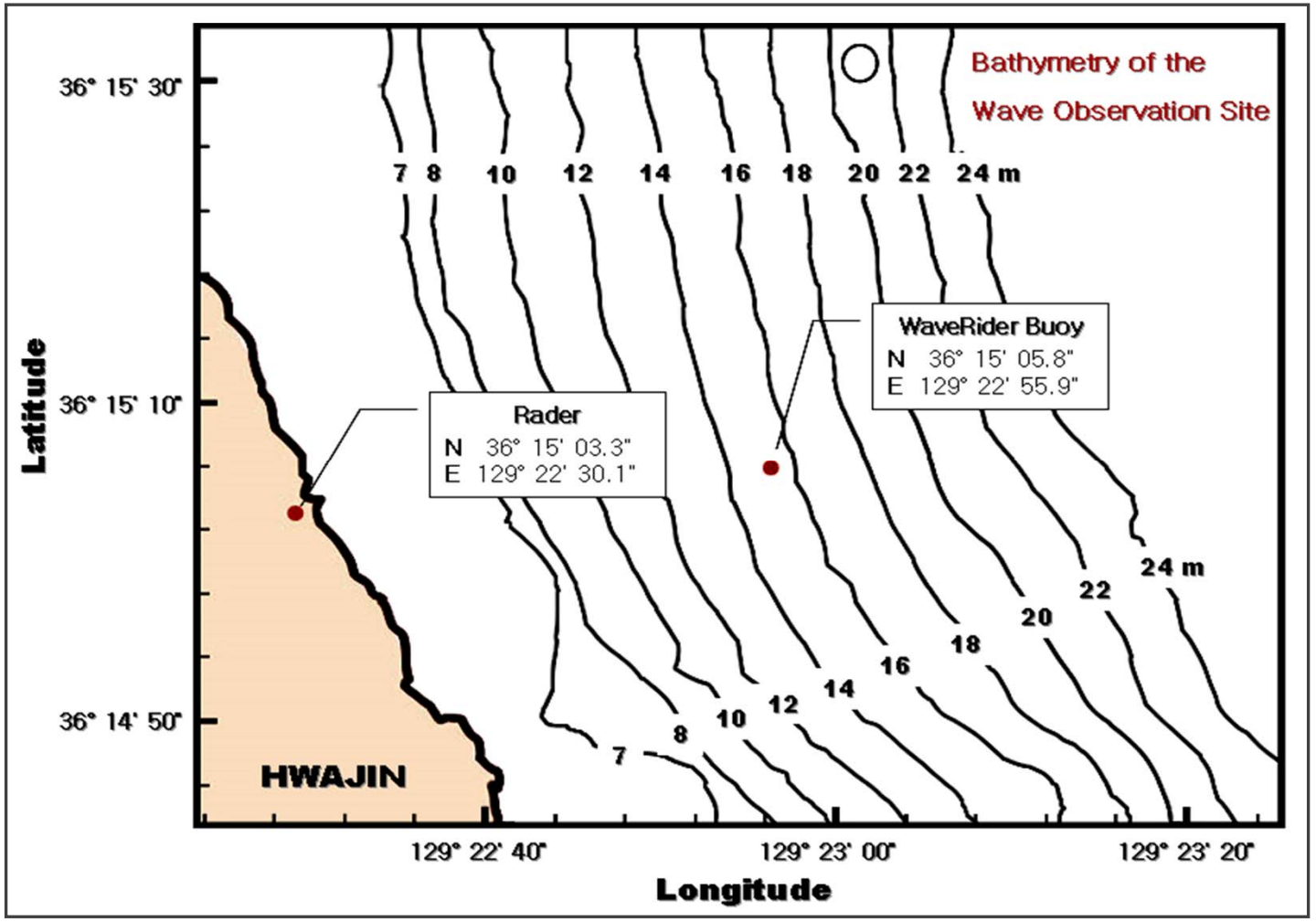
3S-system Sea Surface Scanning


Radar


Wind Station


Datawell Buoy

Hwagin Beach



Location of waverider buoy and radar system in the Hwajin Beach

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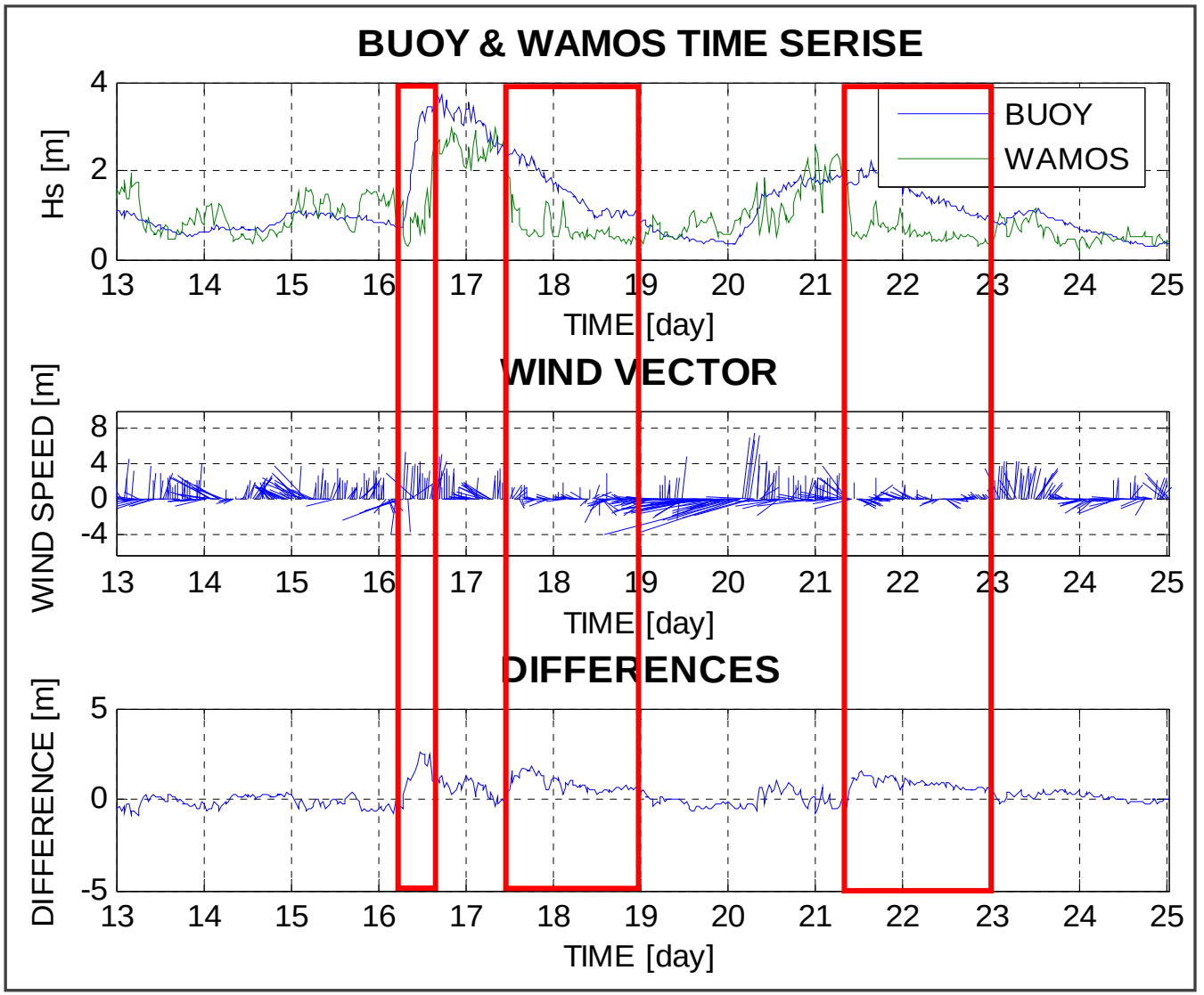
Time series of measured Hs and wind velocity



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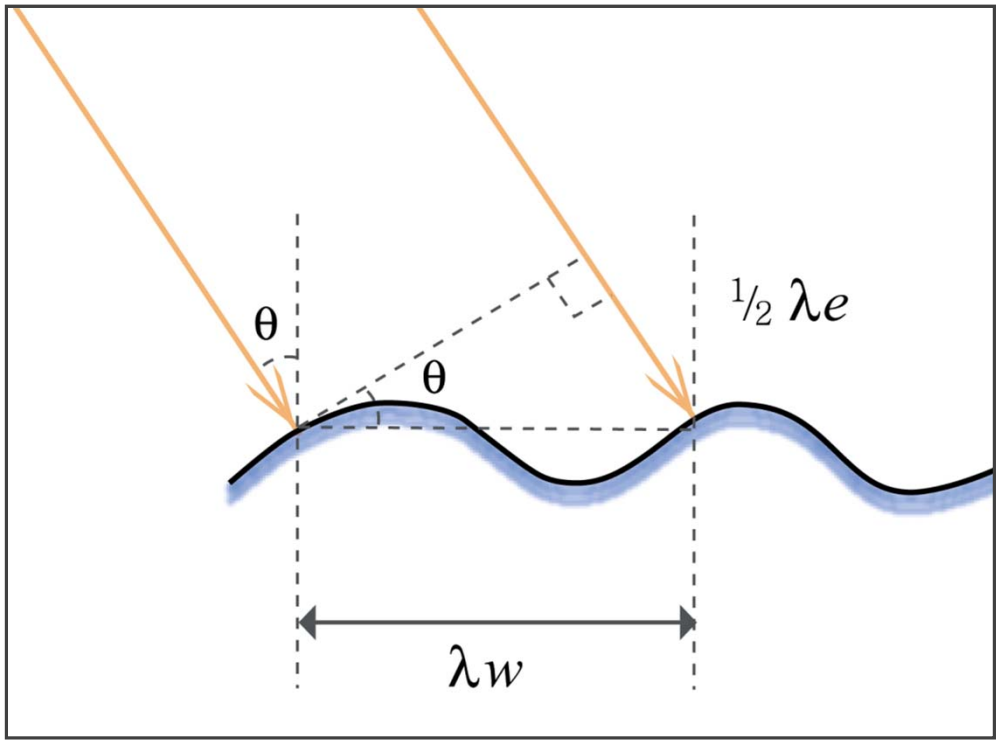
Bragg Resonance Condition

$$\lambda_w = \frac{\lambda_e}{2\sin\theta}$$

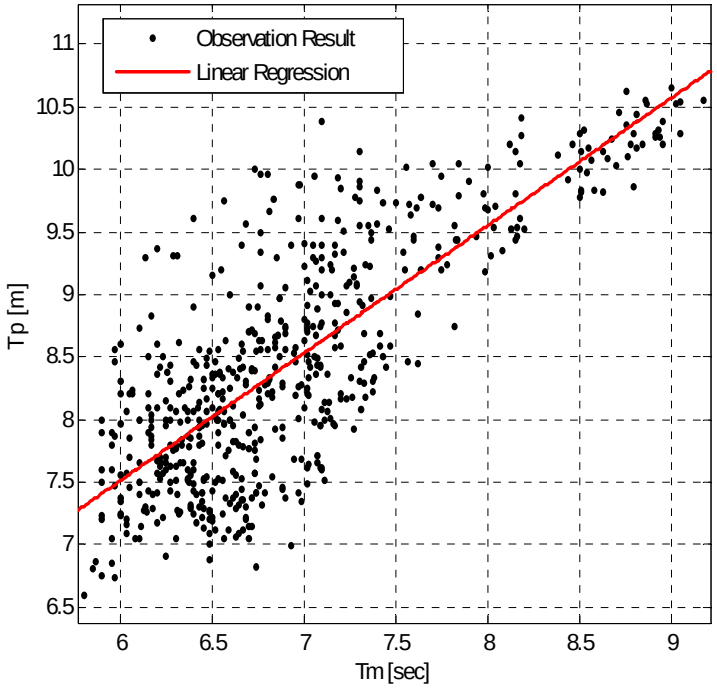


where

λ_w = ripple wave length

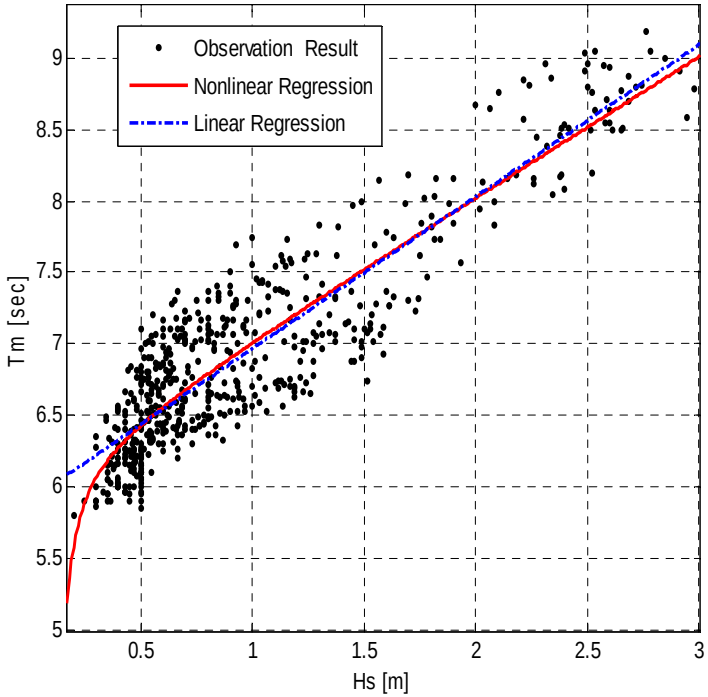
λ_e = electromagnetic wave wavelength

Correlations between wave parameters



Correlation between Tp and Tm

$$T_m = 0.8203T_p + 0.2678$$



Correlation between Hs and Tm

$$H_S = 0.8497T_m - 4.997$$

$$H_S = 0.0076e^{0.8657T_m}$$

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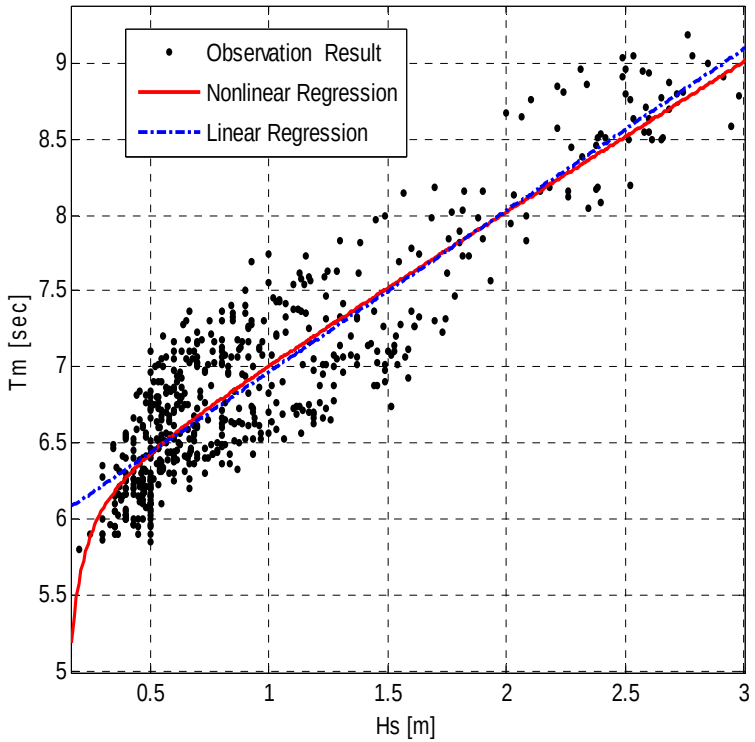
Correlations between wave parameters



Correlation between Hs and Tm

Linear relationship

$$H_s = 0.6970 T_p - 4.7695$$

Noninear relationship

$$H_s = 0.007568 e^{(0.6657(0.8203 T_p + 0.2678))}$$

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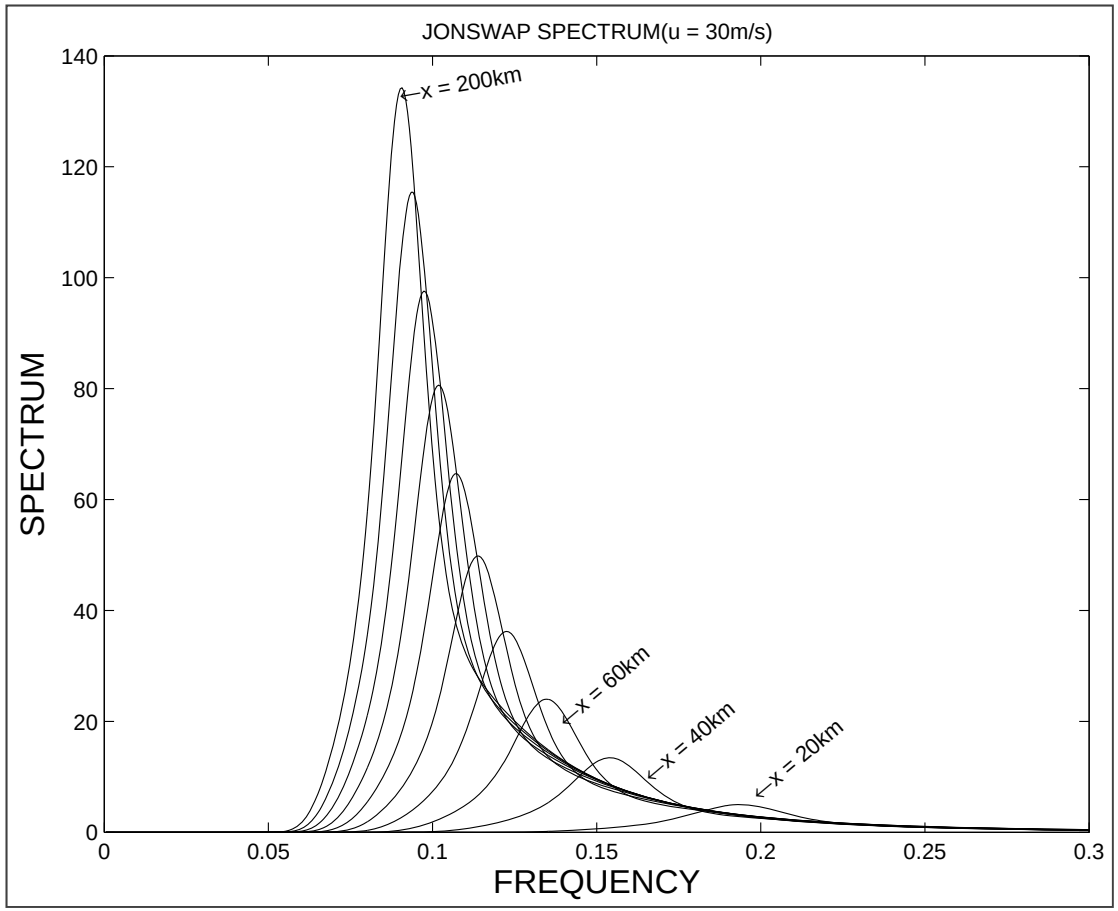
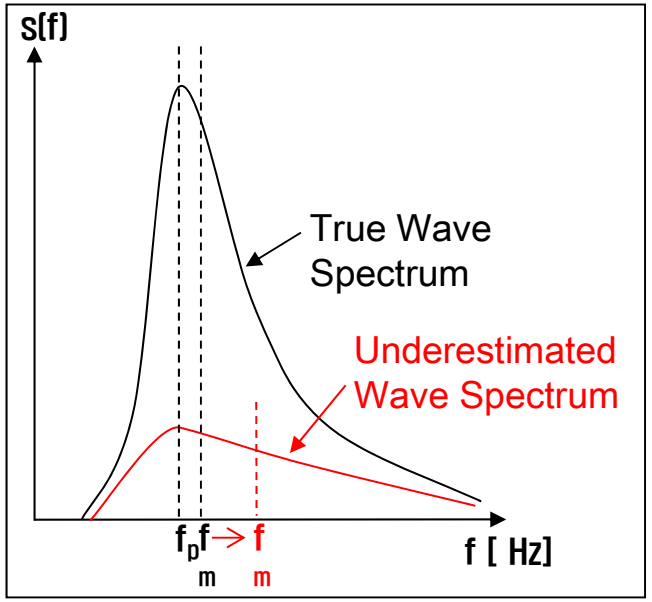
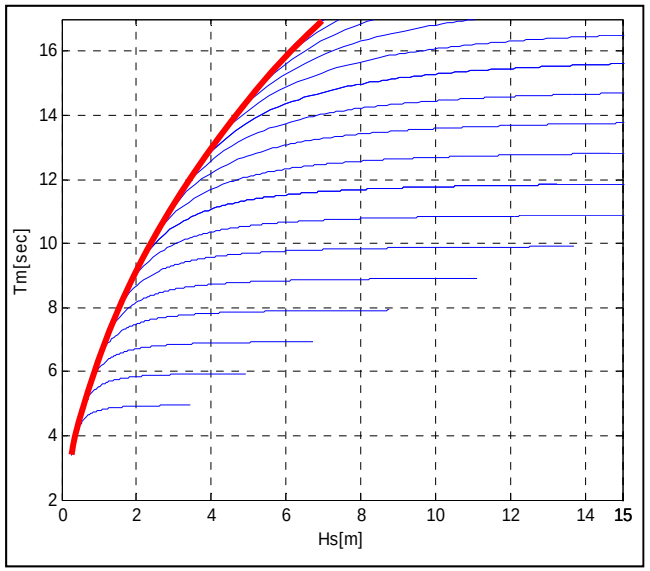
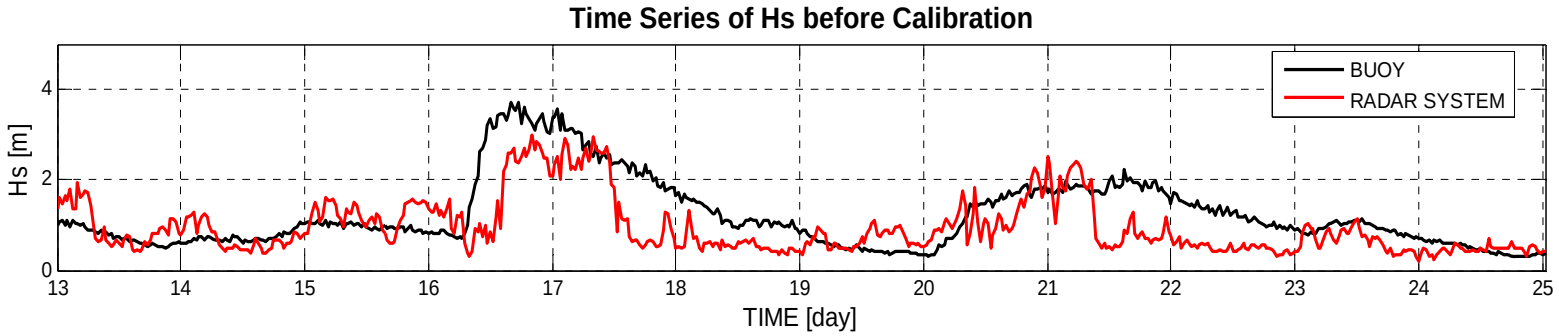
Theoretical background

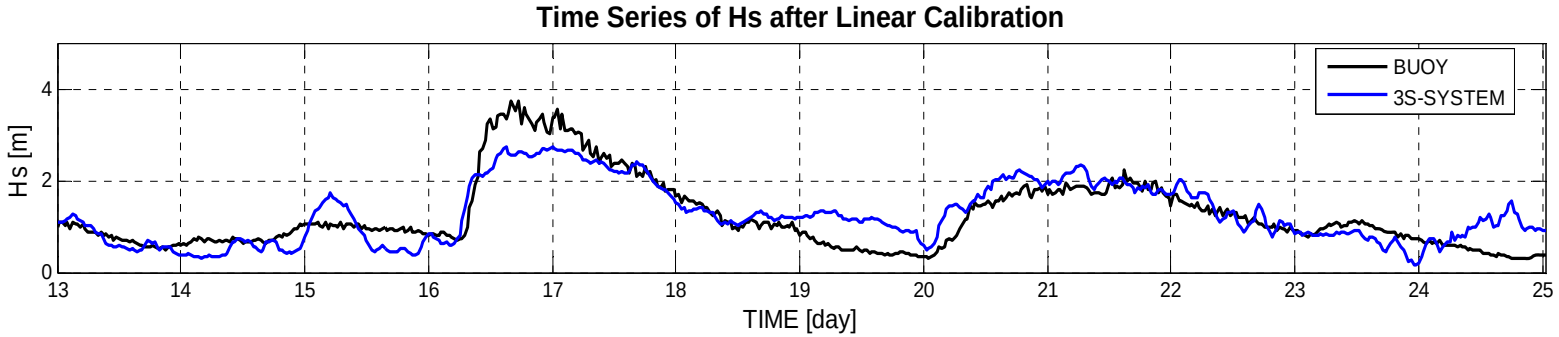


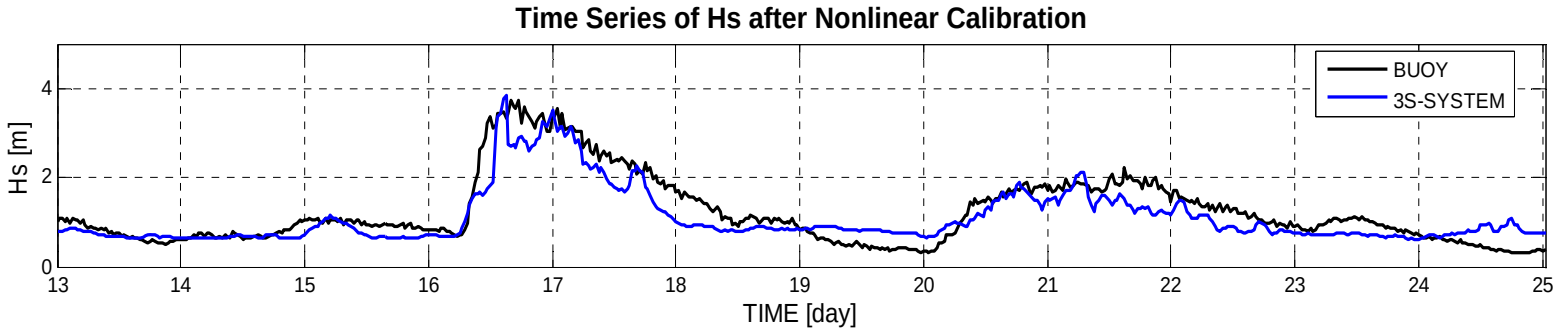
Evolution of Spectra due to Fetch Distance











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Conclusion

1. New calibration procedure is suggested based on the measured peak frequency and mean frequency
2. New calibration procedure of significant wave heights for X-band marine radar was shown to improve the accuracy of the wave height estimation

Acknowledgement :

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3S-system Sea Surface Scanning