



WAVE STATISTICS AND SPECTRAL ANALYSIS IN THE MEDITERRANEAN SEA (i.e. SICILY CHANNEL) : 9 YEARS OF WAVE DATA MONITORING

by

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GOALS

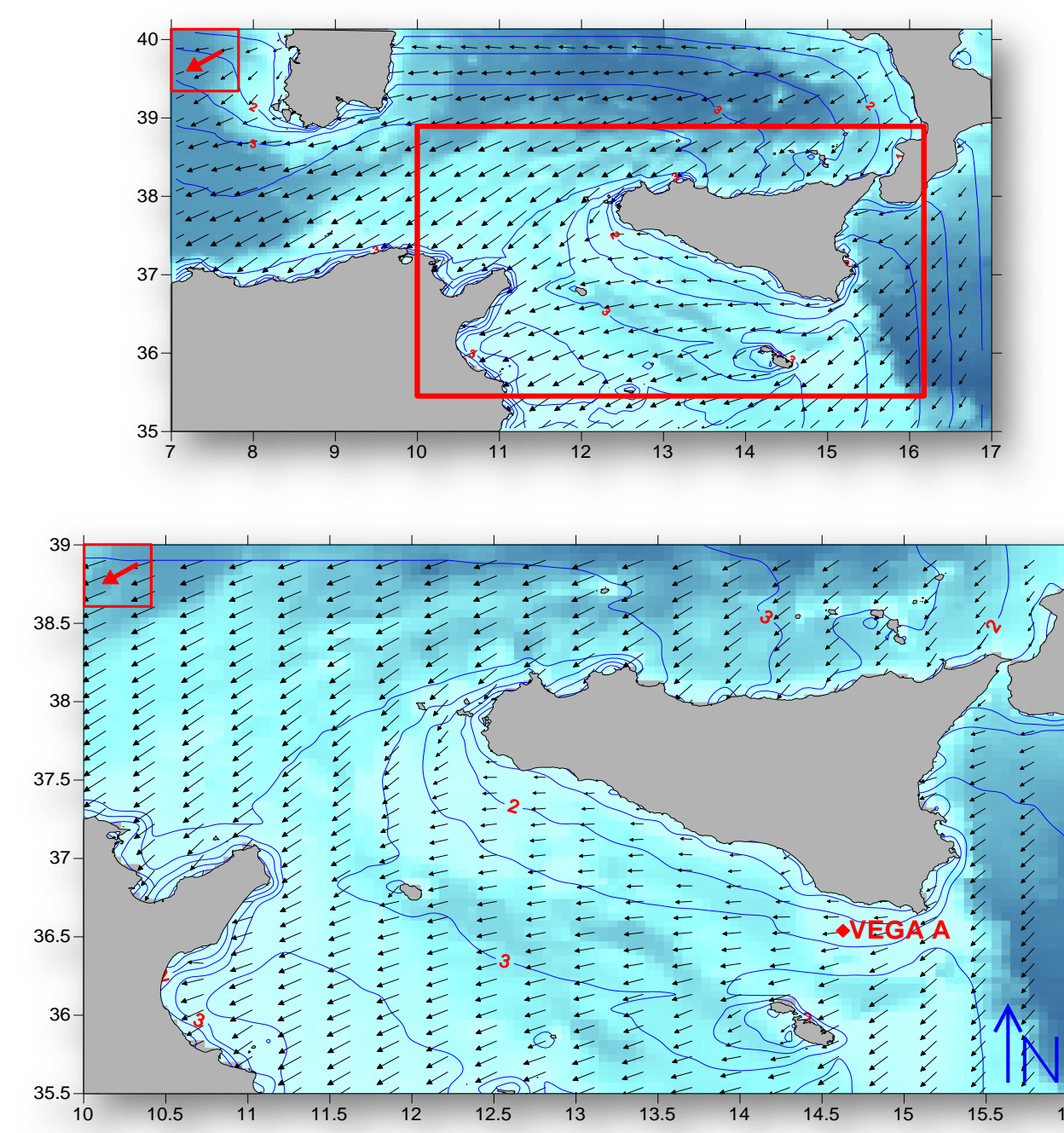
- Monitoring of the VEGA-A oil-platform, as required by EDISON ;
- Define and characterize the wave field in the Mediterranean Sea, i.e. Sicily channel.

INTRODUCTION

Even if it is not always the appropriate wave spectrum, the JONSWAP spectrum is often used in the Mediterranean Sea as input for the most common 3rd-generation spectral wave models. The definition of site-specific spectral parameters by means of measured wave data allows to get a better assessment of the wave field in the coastal area with consequent better description of the wave characteristics to be used as design basis for coastal structures.

VEGA-A OIL-PLATFORM and METOCEAN study

VEGA-A is the largest oil-platform in the Mediterranean Sea, Sicily channel, ~ 20 km far from the coast; EDISON has been actively supporting along the years the whole monitoring system at VEGA-A.



MONITORING SYSTEM

Ad hoc Monitoring System for VEGA-A location build-up by DEAM on the basis of the metocean analysis, as required by EDISON

Simultaneous measures of **Pressure** and orbital wave **Velocities** (x- and y- directions)

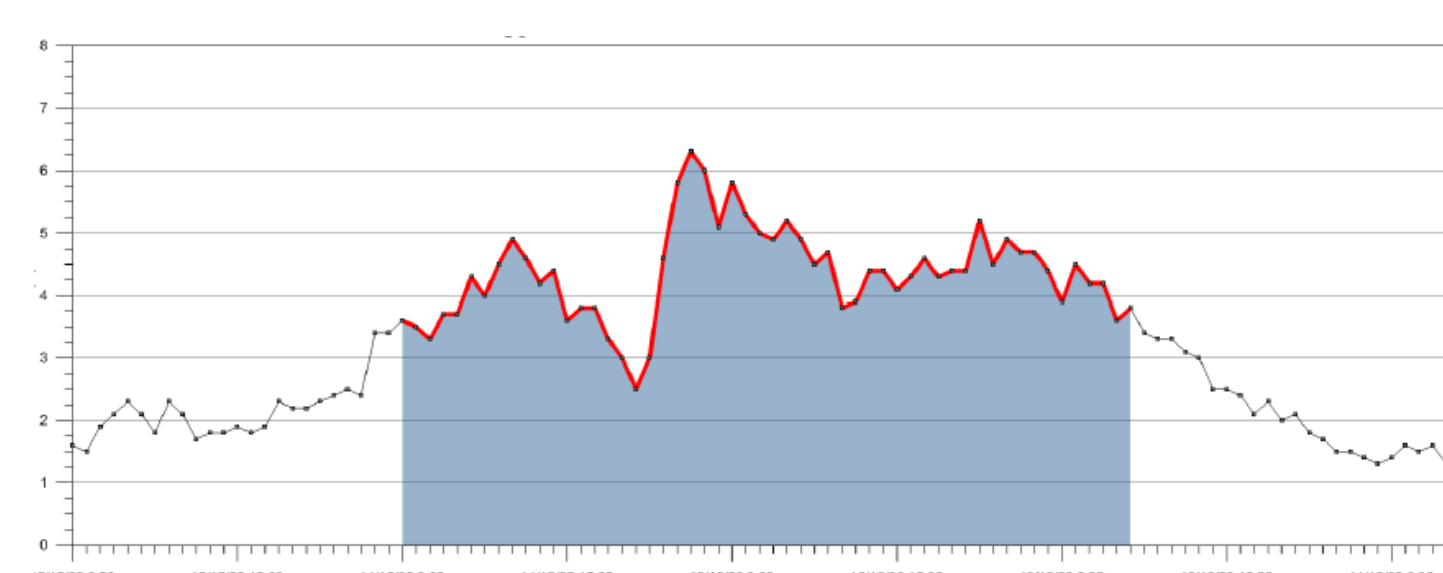
RAW DATA Sampling Frequency: 2 Hz

As usually done in oceanography every single raw data is recorded in ~ 20min, i.e.1024 s, to get 2048 records.

WAVE DATA ANALYSIS

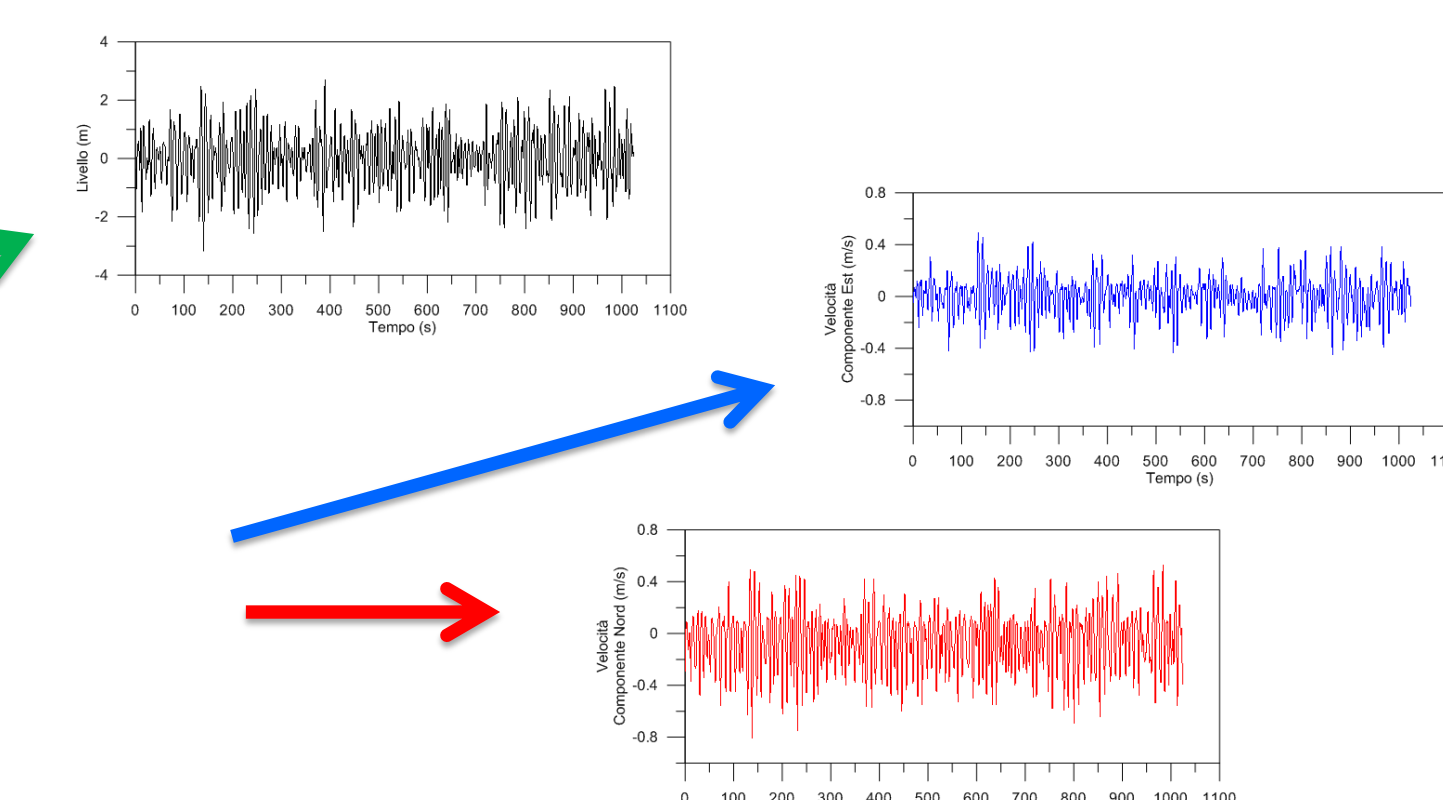
Selection of raw data for storms with $H_s > 3.5$ m

A total of **16 storms** in 9 years (2002-2010)

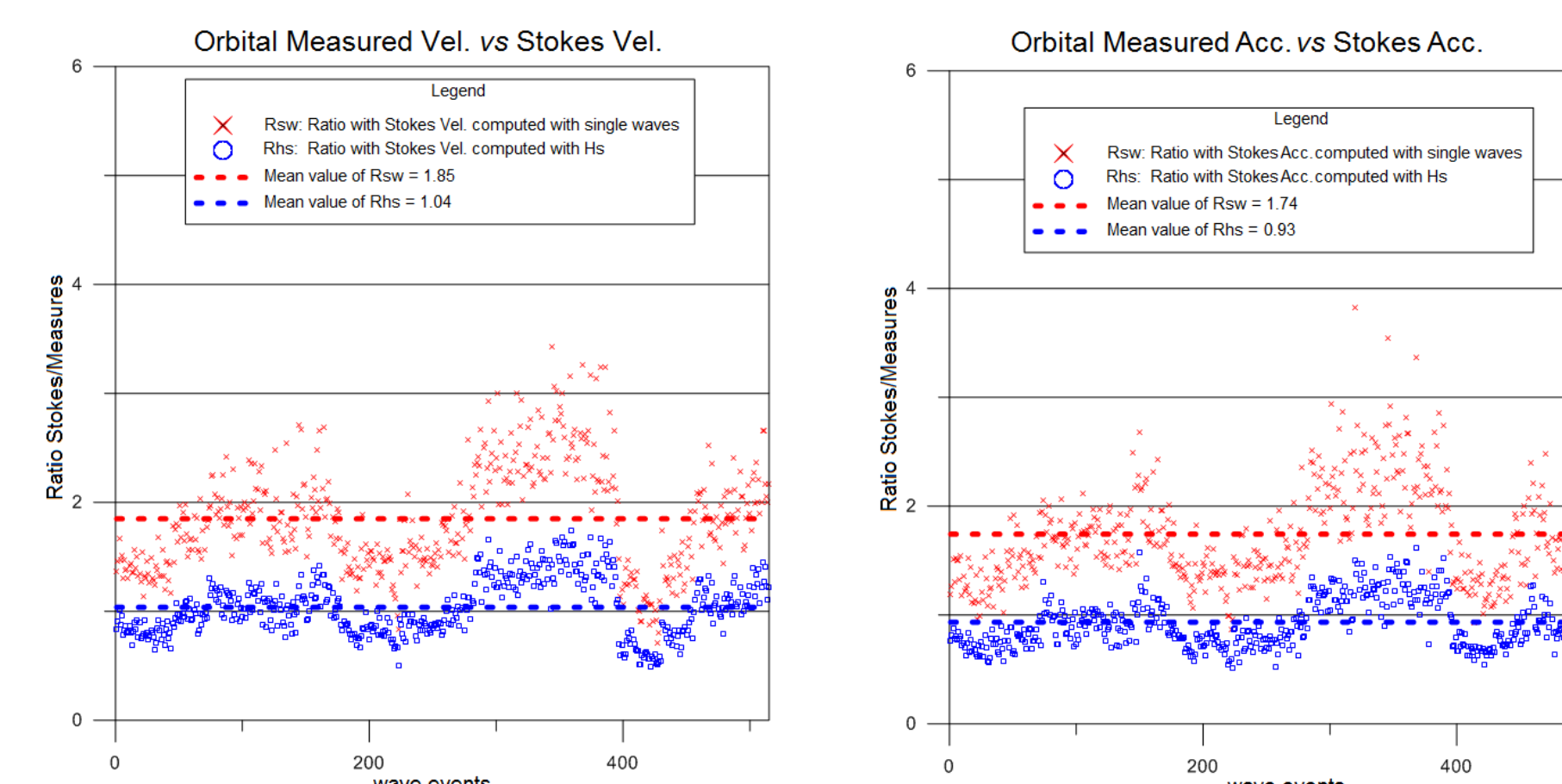


Orbital Velocities

water level raw data
orbital velocity EAST components
orbital velocity NORTH components



Measured data vs classical Stokes IV order theory



$$\frac{\text{Stokes Vel}_{\text{from single waves}}}{\text{Measured Vel.}} = 1.85$$

$$\frac{\text{Stokes Vel}_{\text{from Hs}}}{\text{Measured Vel.}} = 1.04$$

$$\frac{\text{Stokes Acc}_{\text{from single waves}}}{\text{Measured Vel.}} = 1.74$$

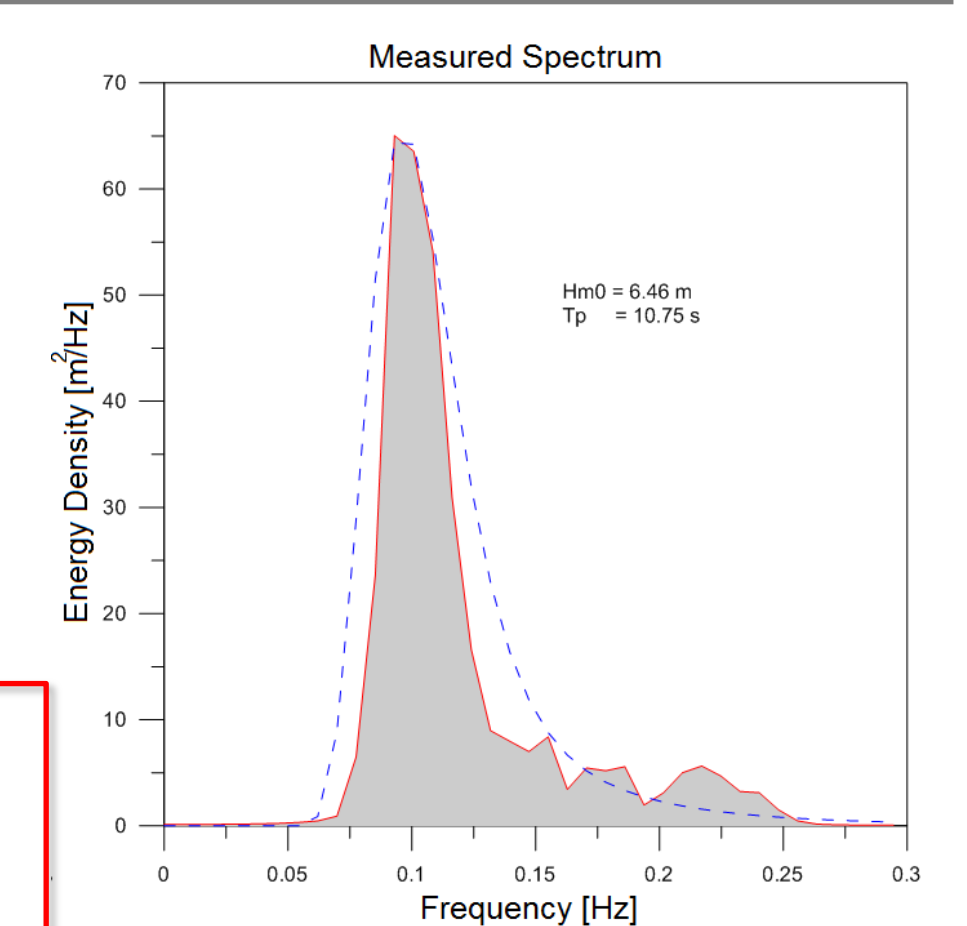
$$\frac{\text{Stokes Acc}_{\text{from Hs}}}{\text{Measured Vel.}} = 0.93$$

Spectral Analysis

FFT (Fast Fourier Transformation) Method

Proposed JONSWAP parameters - fitting

$$\gamma = 0.1783 \exp\left(1.352 + 0.2225 \frac{T_p}{\sqrt{H_s}}\right) \text{ valid for } \frac{T_p}{\sqrt{H_s}} > 4.2$$

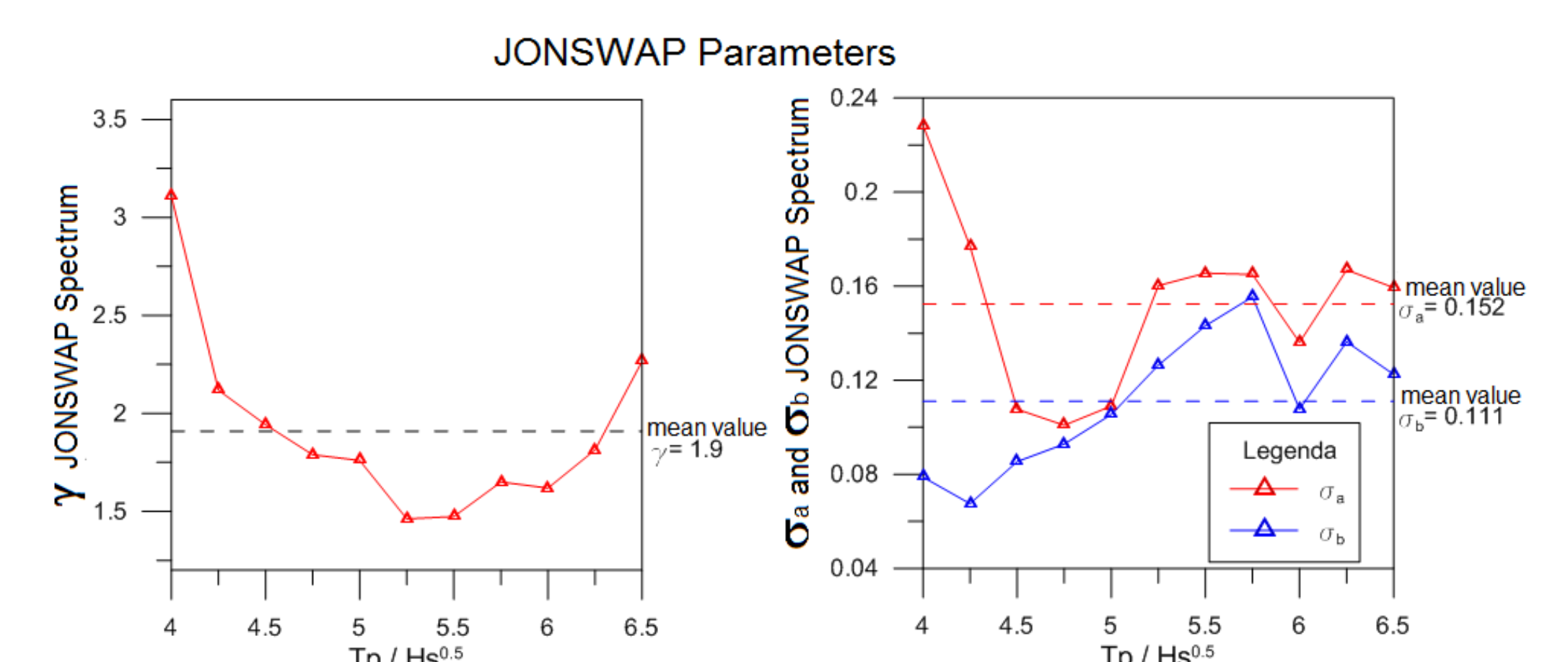


For $f < f_p$

σ_a mean value = 0.152

For $f > f_p$

σ_b mean value = 0.111



Single Wave Analysis

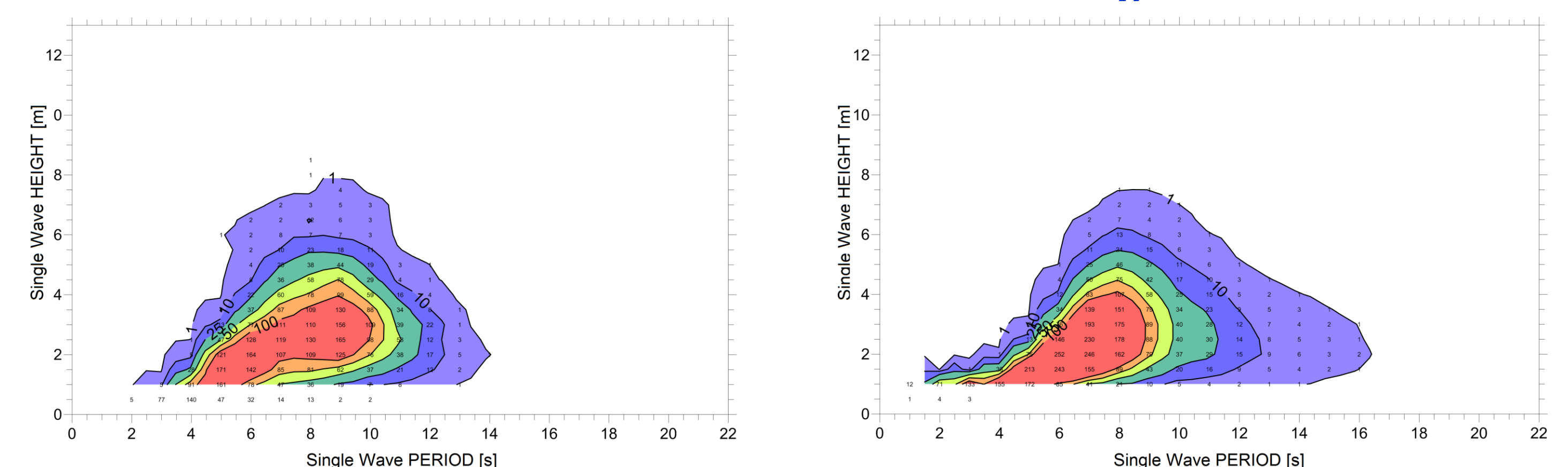
For **each couple of H_s - T_z**
(significant wave height and zero-crossing wave period)

number of couple H-T

(wave height and single wave period)

Measured in raw data

Theory, i.e. Cavanié et al. 1976



REFERENCES

Cavanié, Arhan, and Ezraty, 1976. A statistical relationships between individual heights and periods of storm waves. 5th SPE Int.Conf. Stavenger, Norway

AKNOWLEDGEMENTS

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