

Using the WW3 model as a tool for the mitigation of extreme waves events

FIRST INTERNATIONAL WORKSHOP “CARIBBEAN WAVES”

Francisco José Gavidia Medina
National Oceanographic Service
National Territorial Studies Service
Environment and Natural Resources Ministry

Table of contents

- Methodology: 3-5
- Results: 6-15
- Conclusions: 16-18
- Future works: 19-25

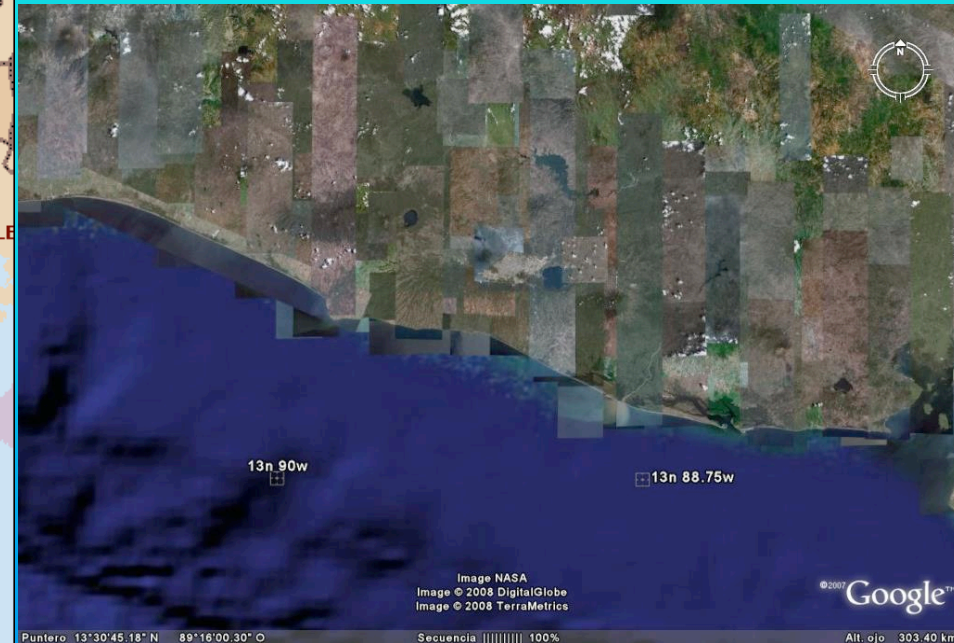
Methodology

- WAVEWATCH III (Tolman 1997, 1999a) is a third generation wave model developed at NOAA/NCEP in the spirit of the WAM model (WAMDIG 1988, Komen et al. 1994).
- Archived data from the WW3 hindcast reanalysis can download from MMAB FTP <ftp://polar.ncep.noaa.gov/pub/history/waves>

Methodology

- Obtain time series (data vectors sampled over time) from the information of specific nodes of the output grid.
- The time series represent the time-evolution of the waves generation and propagation.
- The information are: from February 1 1997 to November 30 2007; height (meter), period (second) and direction of the wave; speed (meter/second) and direction of the wind.

Methodology

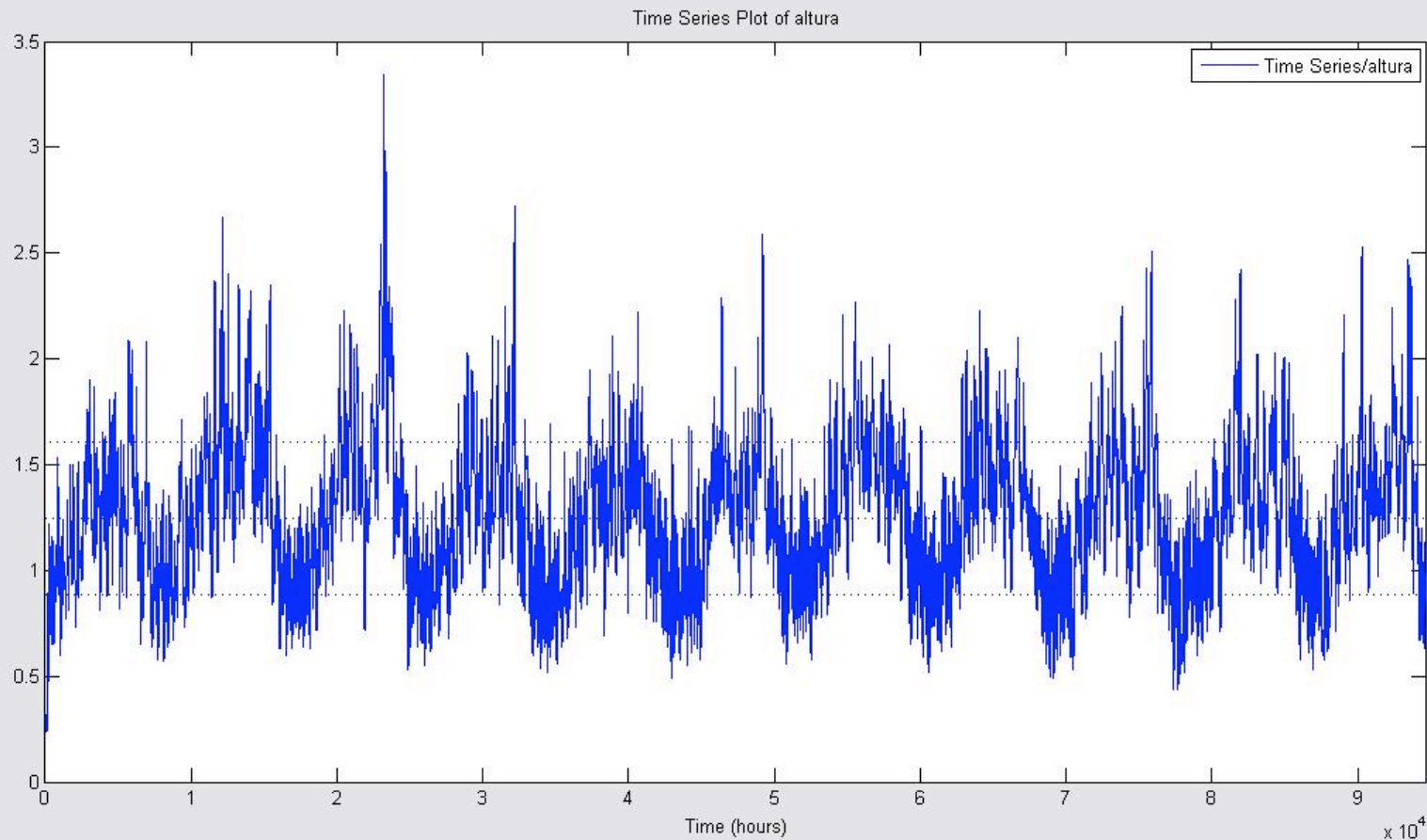


The nodes are: 13° N – 88.75° W (15 NM from the coast, around 50 meter of depth); and 13° N – 90° W (30 NM from the coast, around 150 meter of depth).

Results

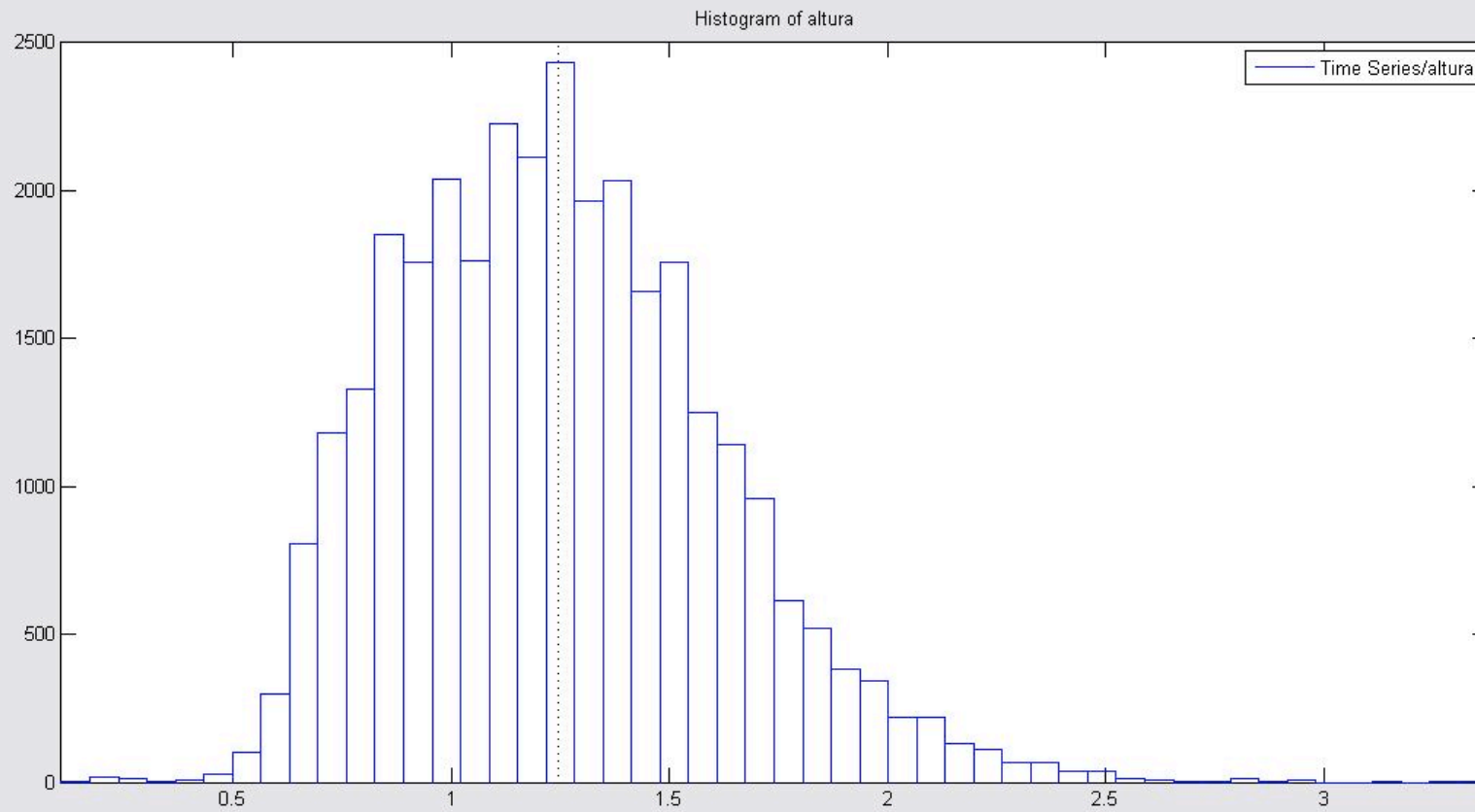
13° N - 88.75° W

Results



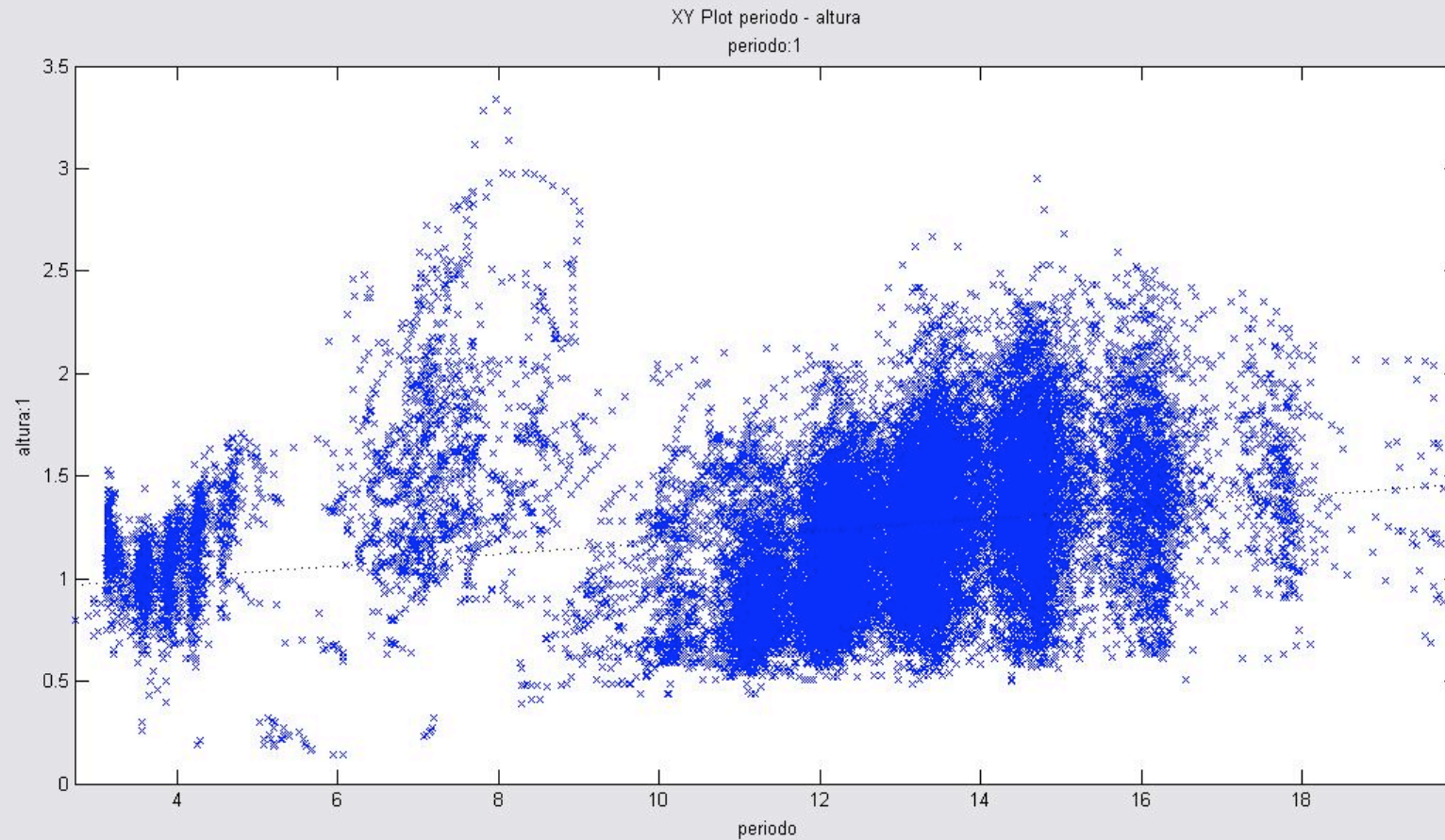
Descriptive statistics. Mean: 1.3 m. STD: 0.4 m. Minimum: 0.1 m. Maximum: 3.4 m.

Results



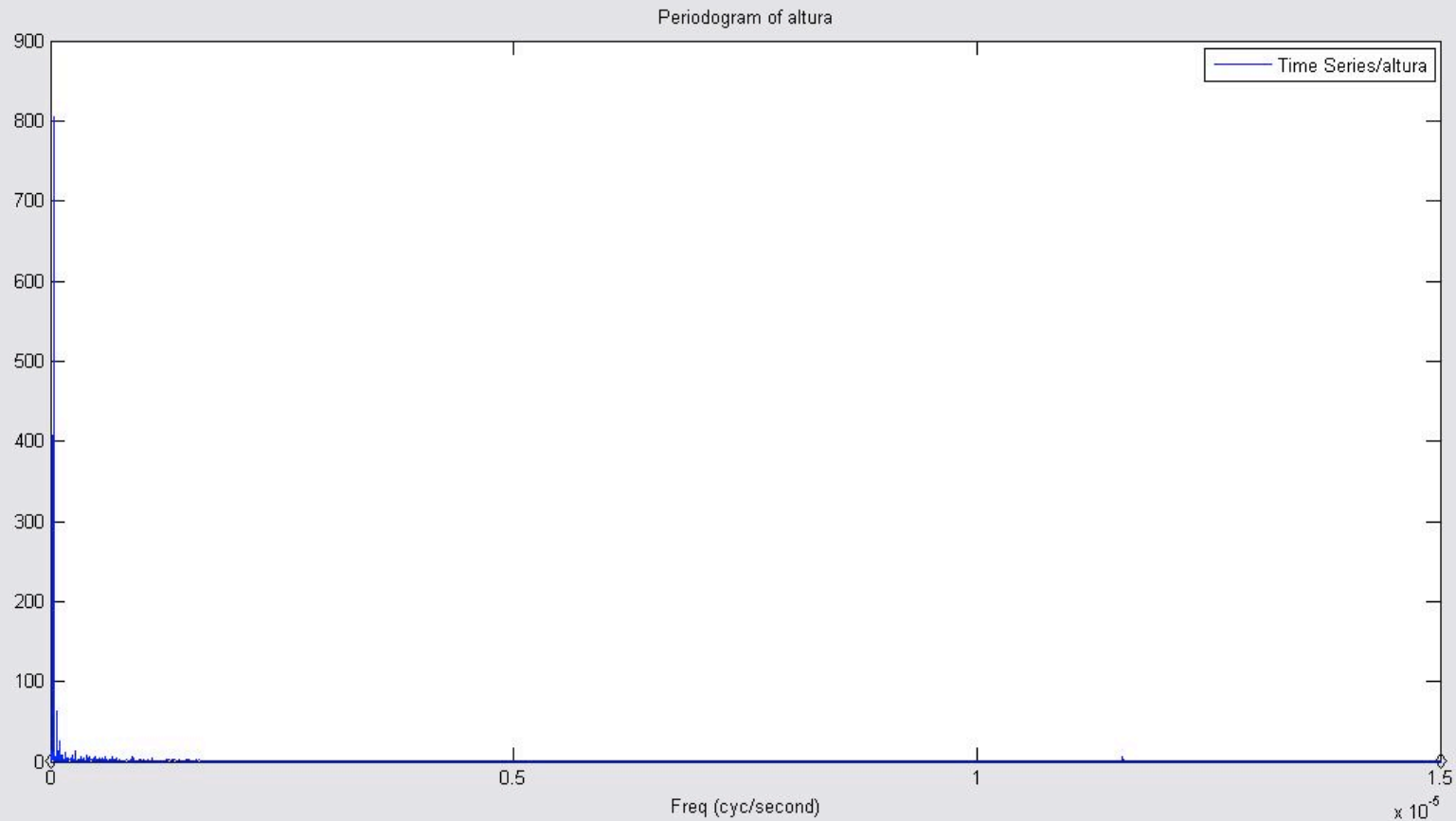
Outliers. H_s : 1.4 m. $H_{0.99}$: 2.2 m

Results



Trends. Height = $0.89 + 0.029 \cdot \text{Period}$

Results

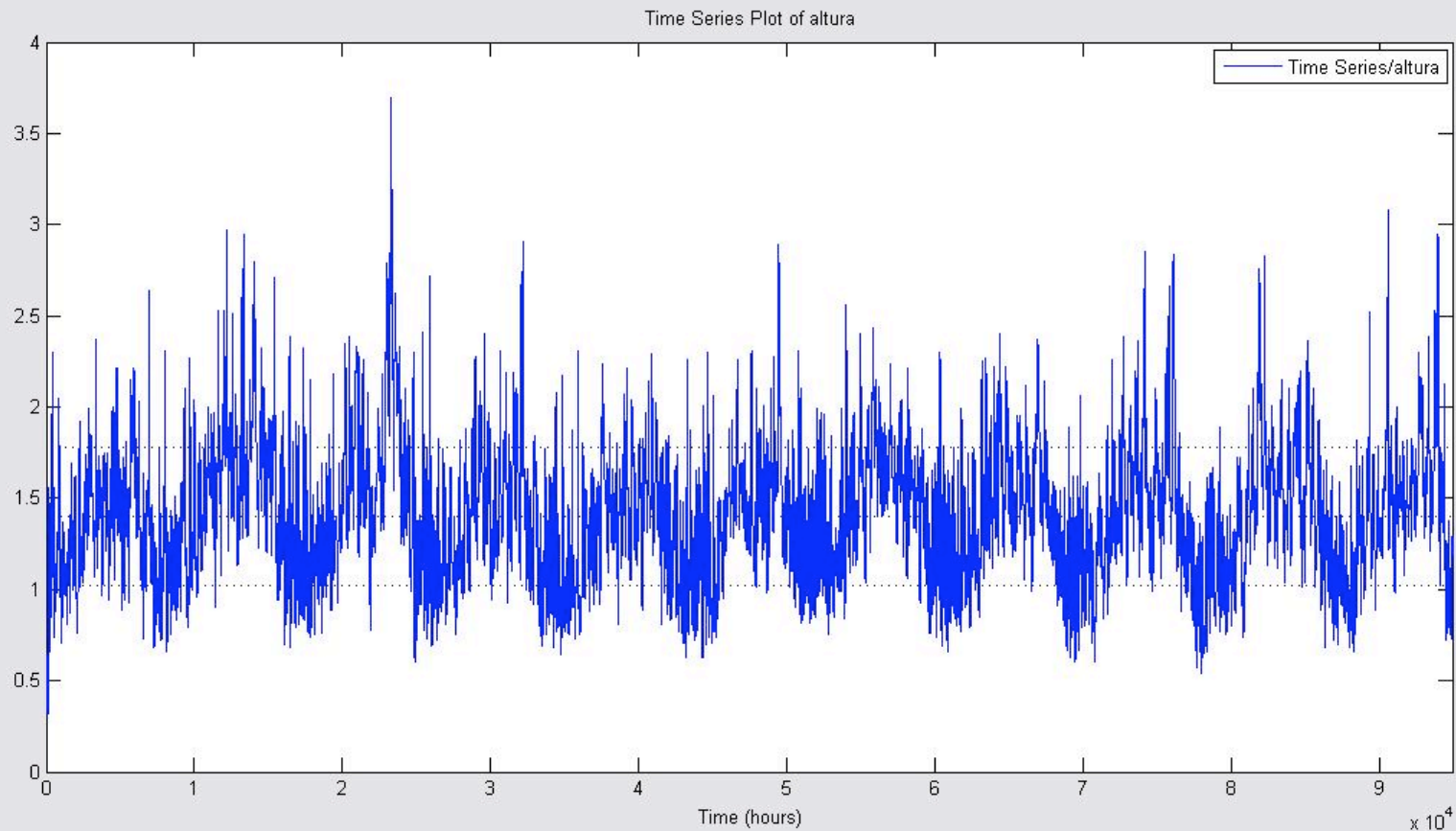


Periodicities. Annual: 3.2×10^{-8} Hz.

Results

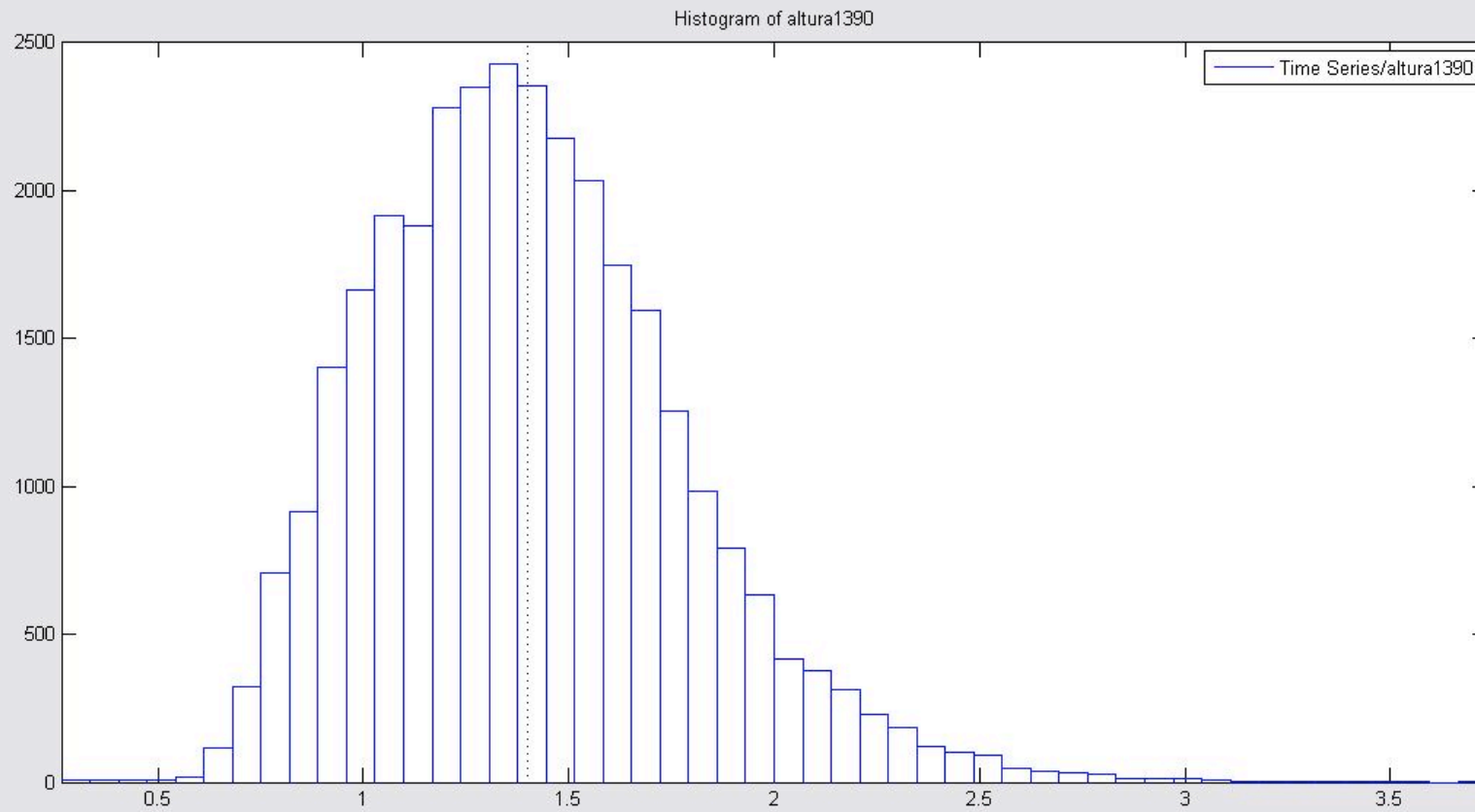
13° N - 90° W

Results



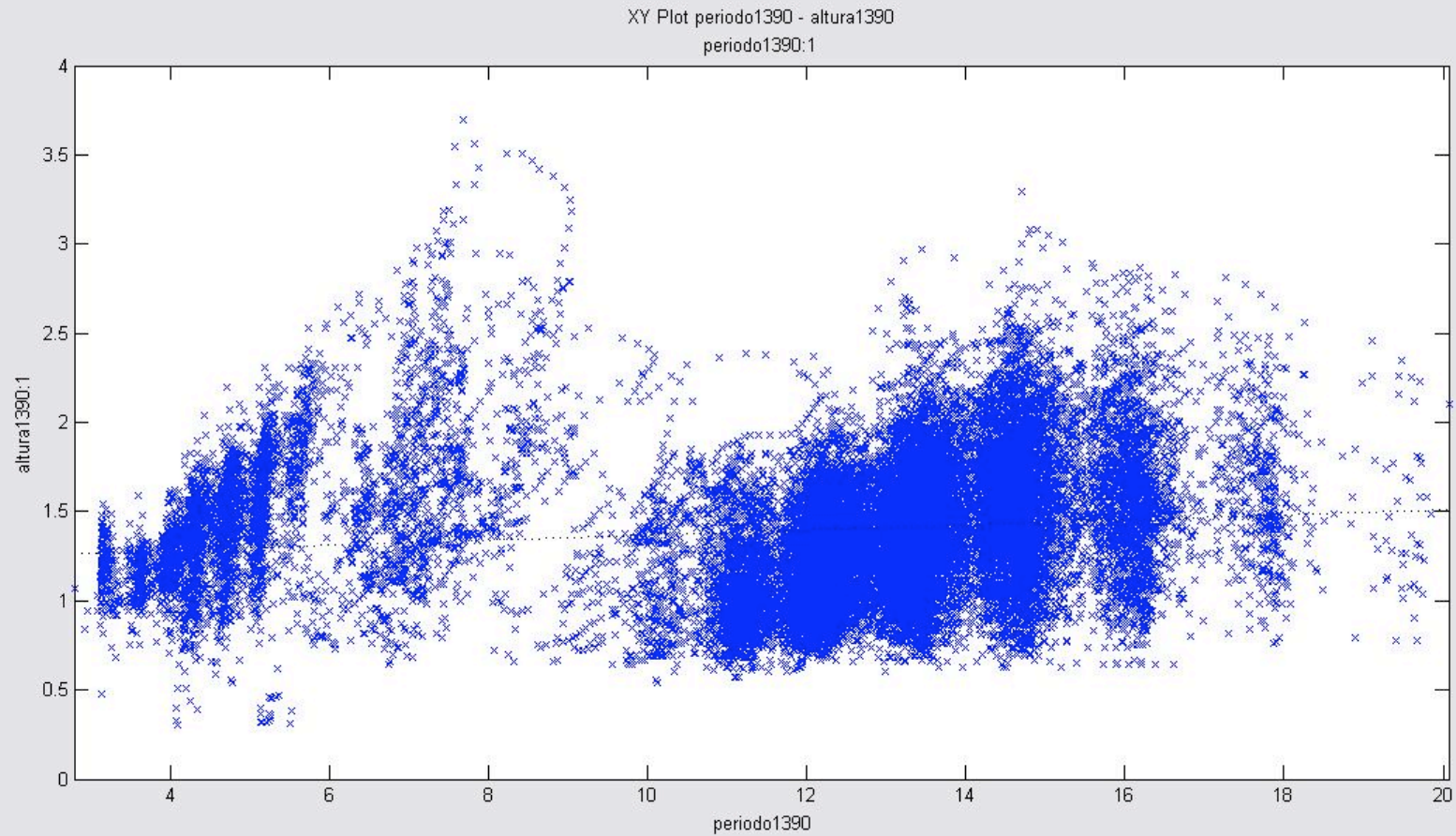
Descriptive statistics. Mean: 1.4 m. STD: 0.4 m. Minimum: 0.3 m. Maximum: 3.7 m.

Results



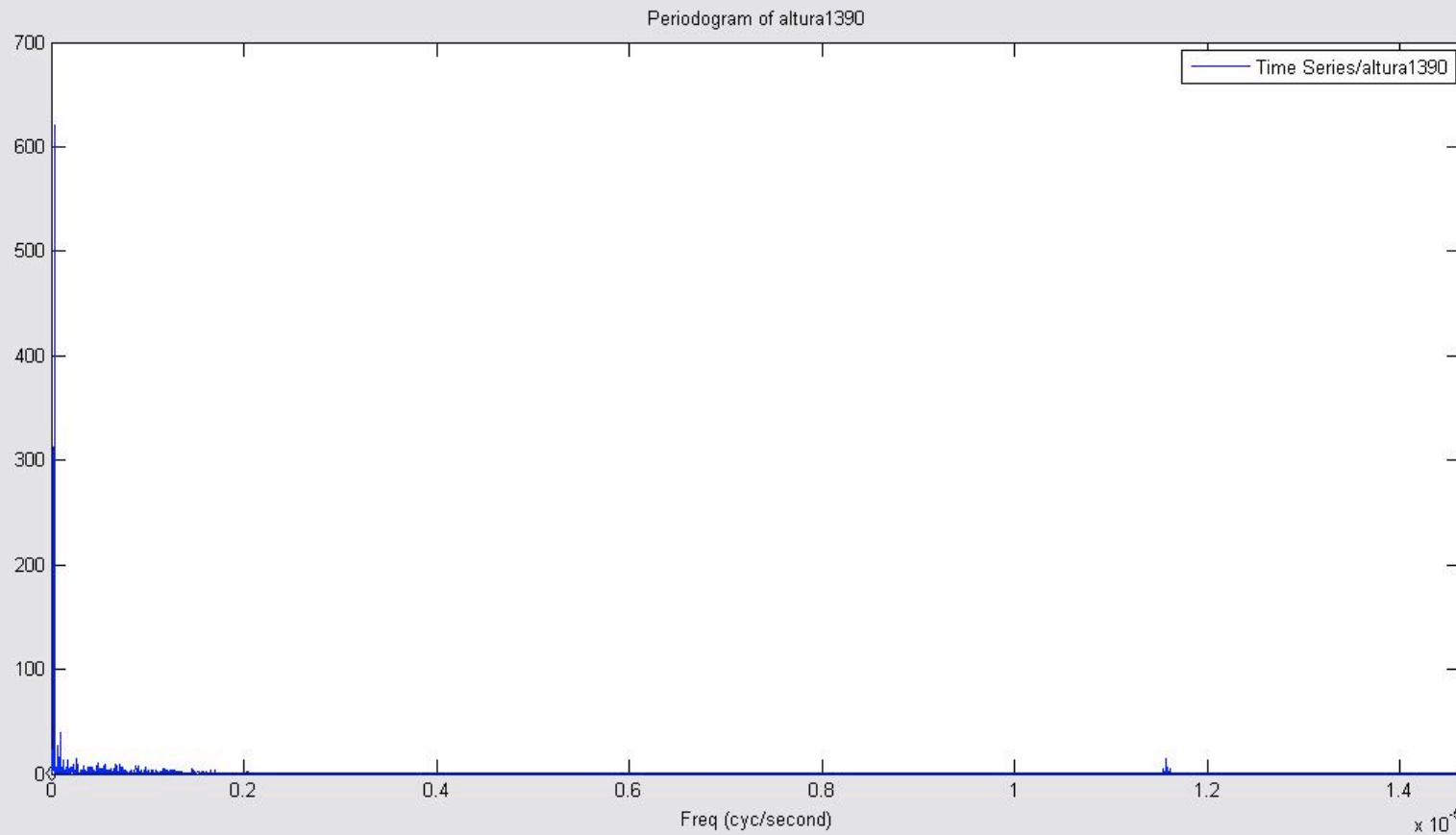
Outliers. H_s : 1.5 m. $H_{0.99}$: 2.5 m.

Results



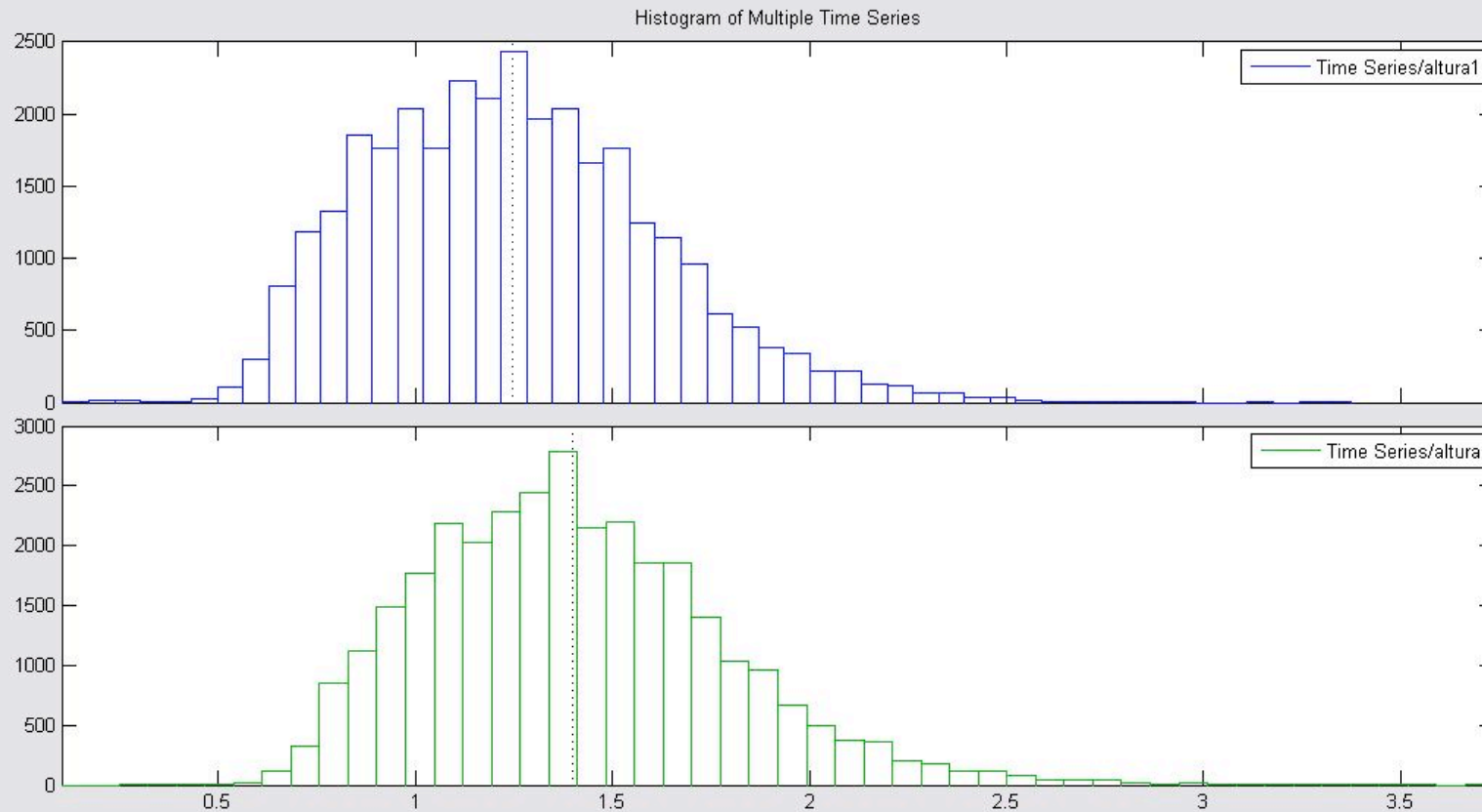
Trends. Height = $1.2 + 0.014 \cdot \text{Period}$.

Results



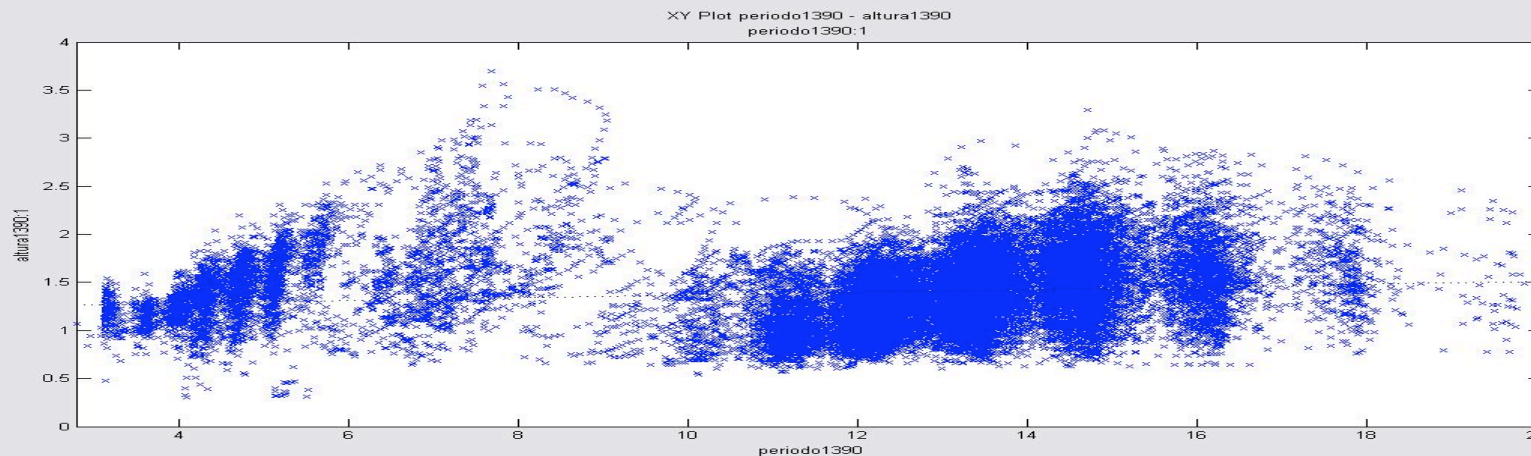
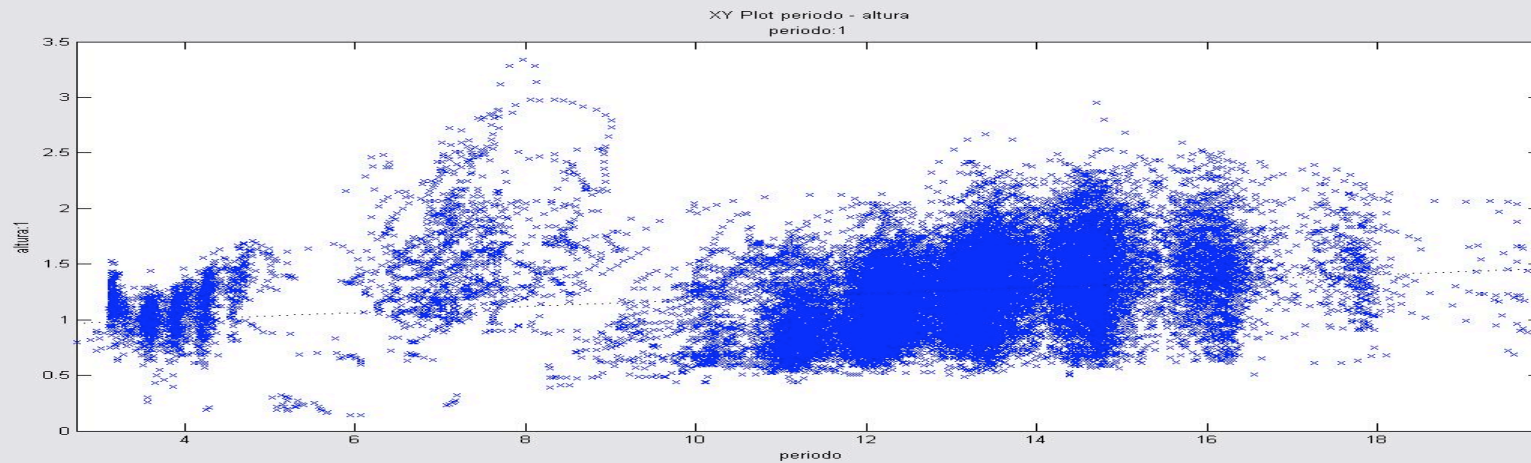
Periodicities. Annual: 3.2×10^{-8} Hz.

Conclusions



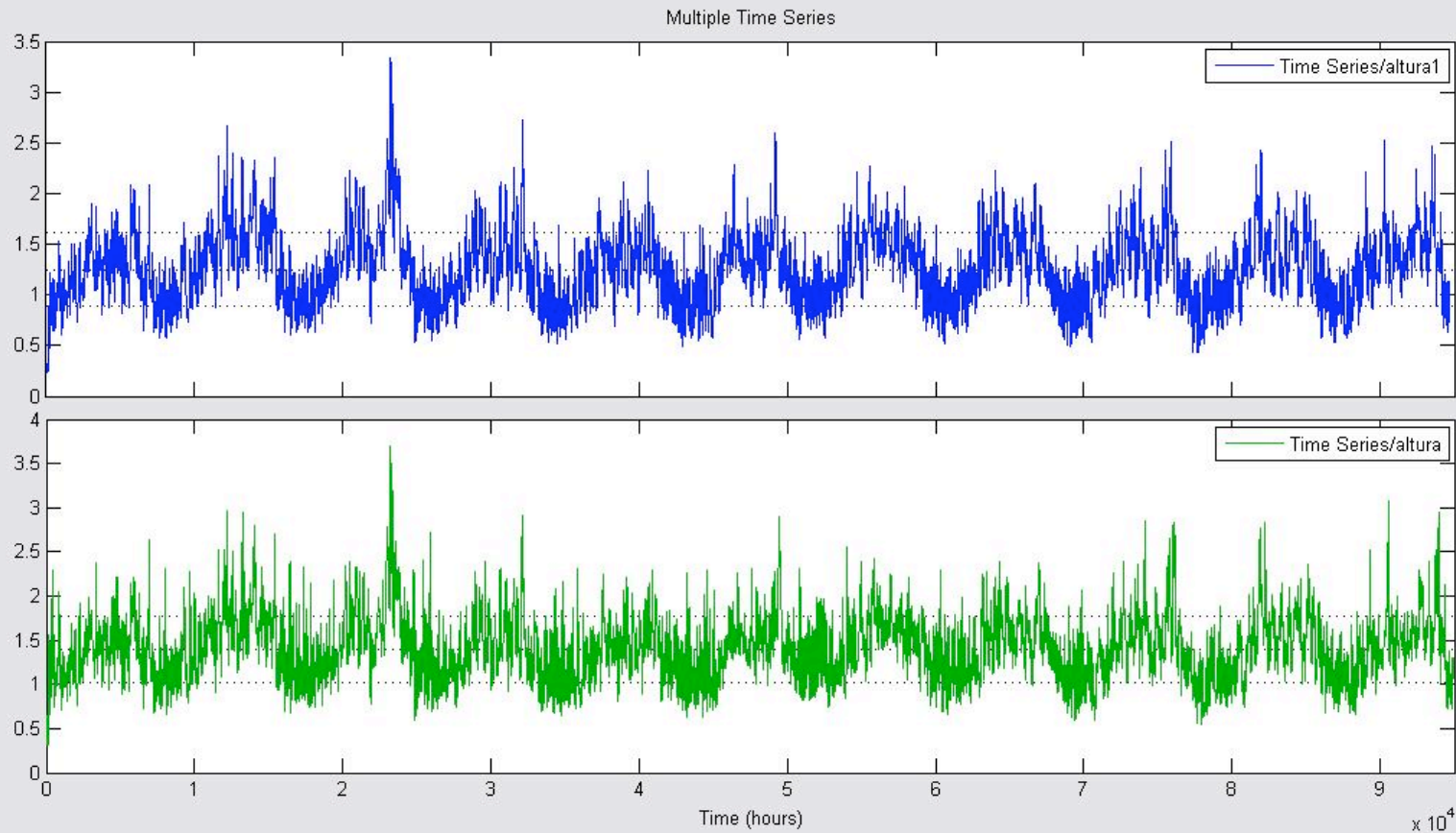
Outliers. The threshold height for the monitoring stage of the operative procedure is 2.4 m (1% of the highest heights) while the significant wave height is 1.5 m (33% of the highest heights).

Conclusions



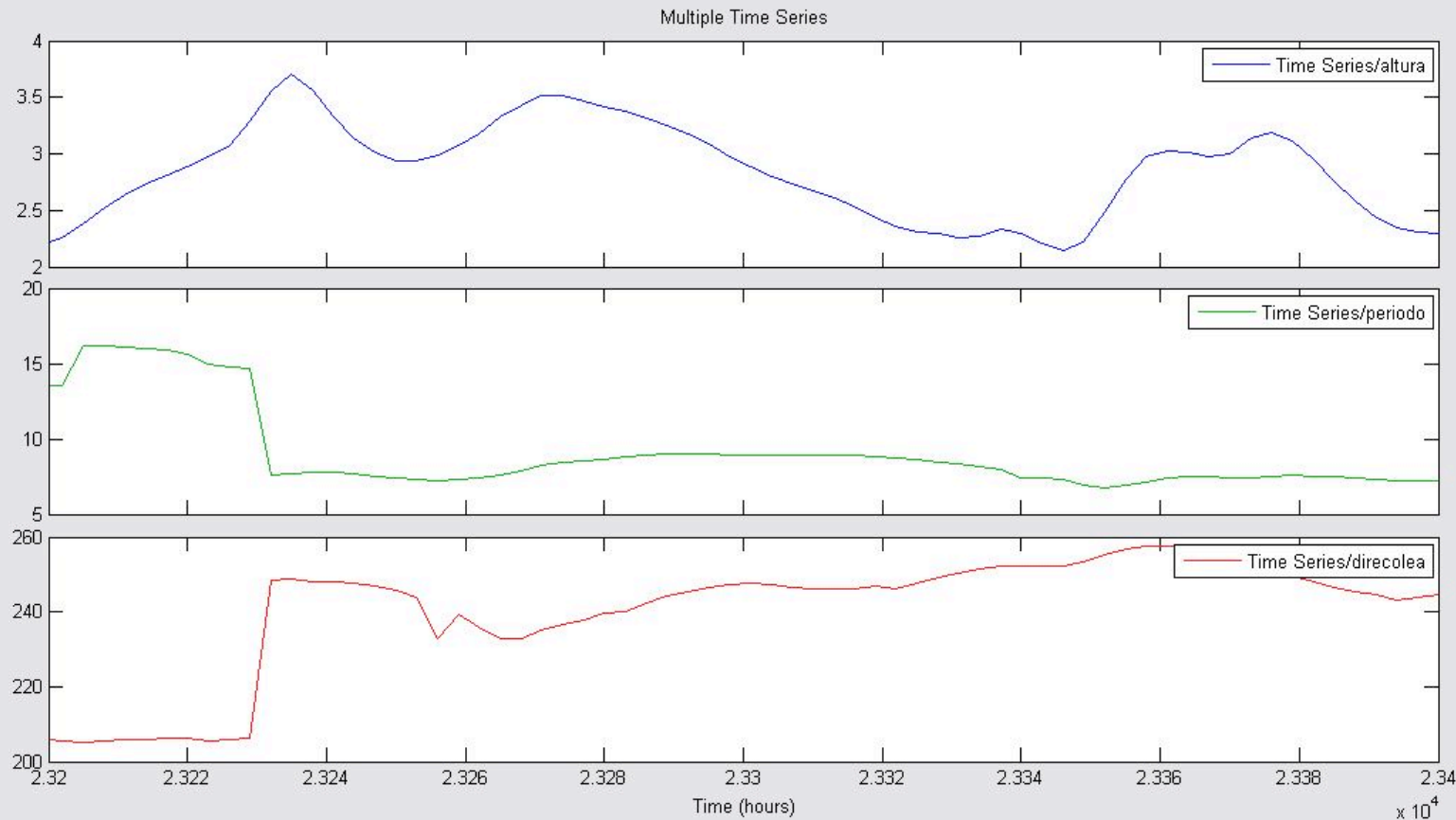
Trends. Wind swell are less frequent but could have height greater than 2.4 m. The ground swell are more frequent and occasionally has period greater than 18 s (1% of the highest periods).

Conclusions



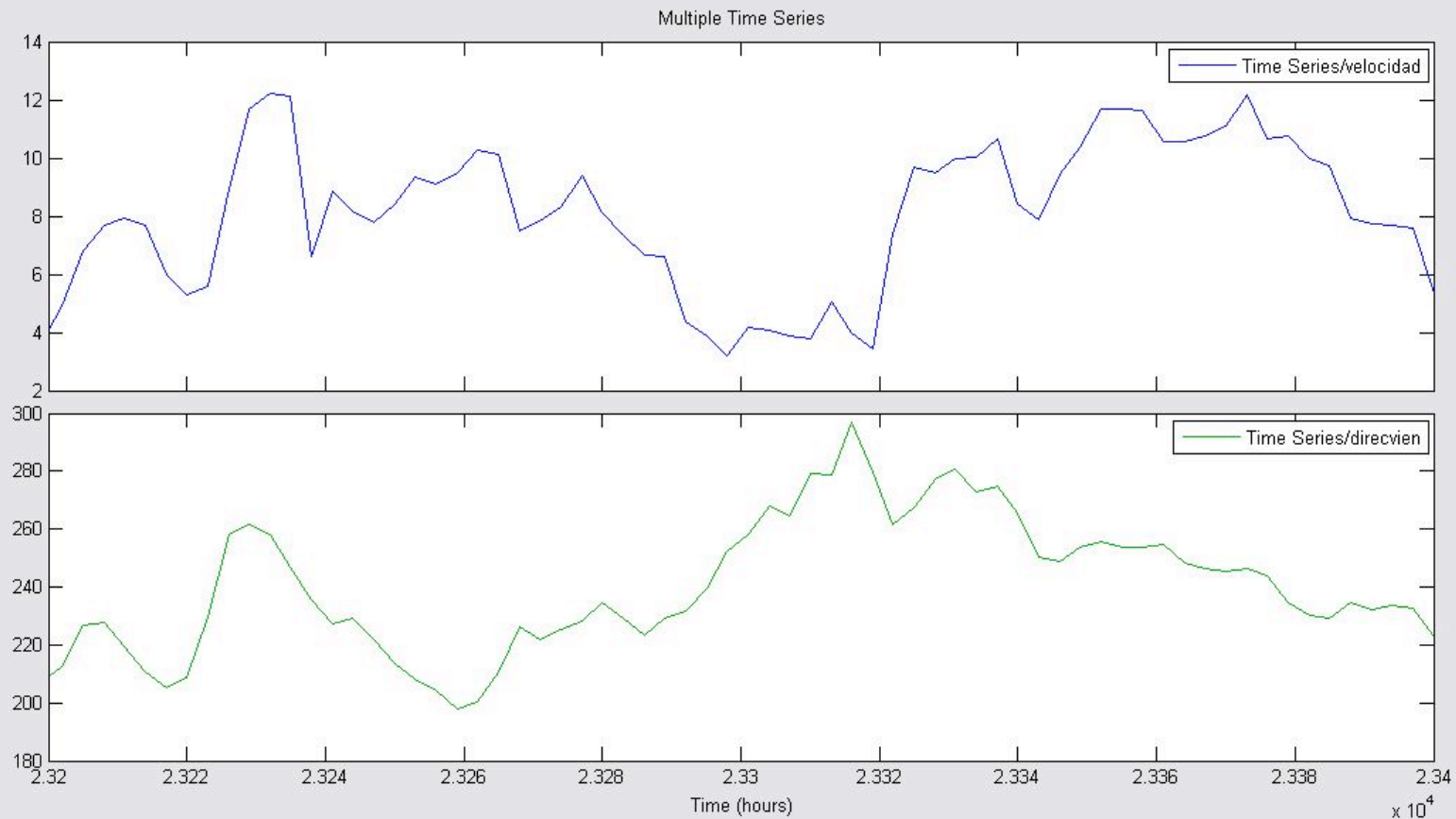
Periodicities. At the rainy season (May – October) most of the heights are greater than the mean and vice versa at the dry season (November – April).

Future works



Characterize the extreme waves events. On September 27, 1999 there was an extreme waves event with height of 3.7 m, period of 8 s, and direction of 250° (coming from West-South-West).

Future works



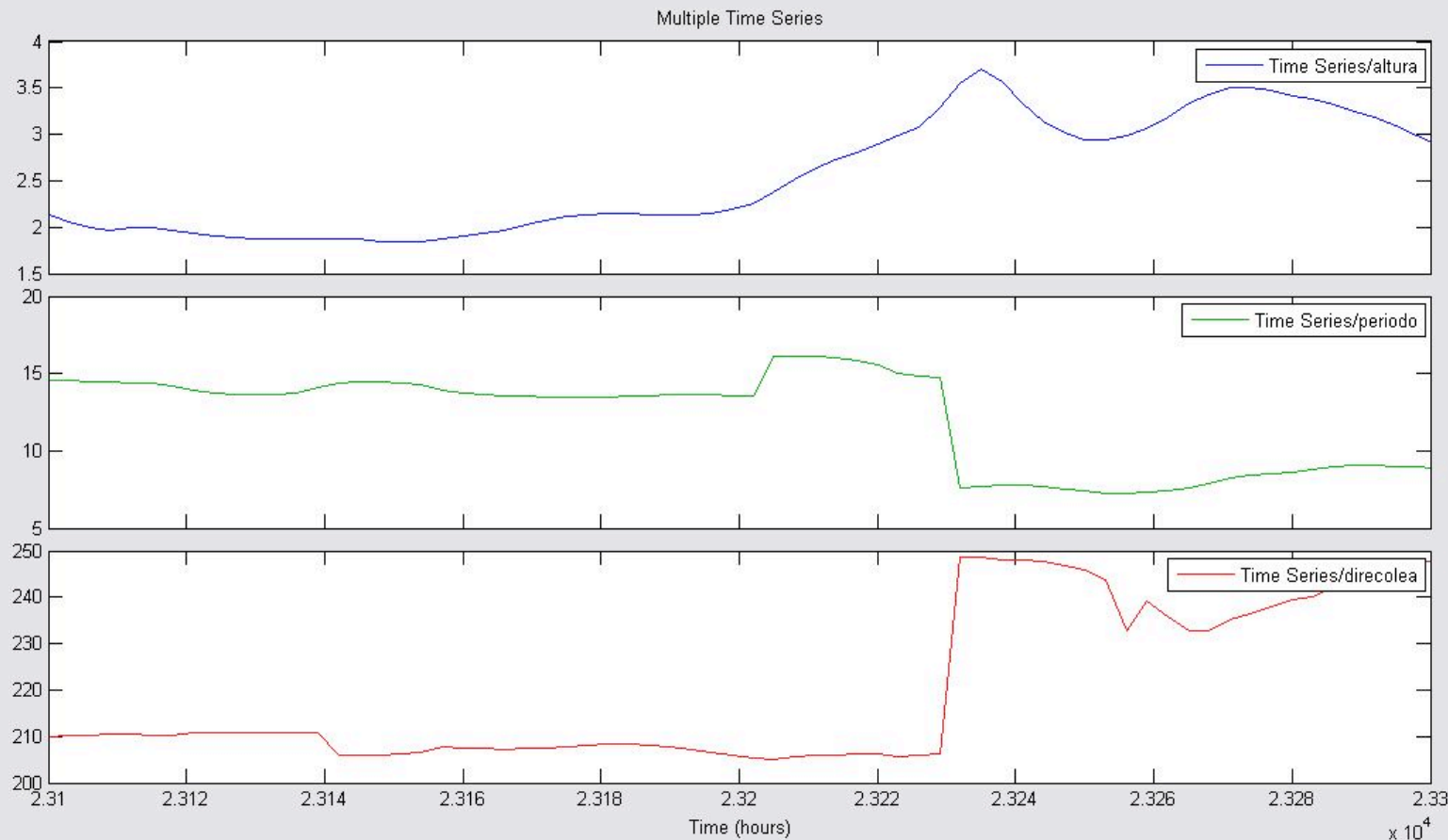
Characterize the extreme waves events. This wind swell was generated by a wind field with velocity of 40 kilometer/hour and direction of 260° (coming from West-South-West). 20

Future works



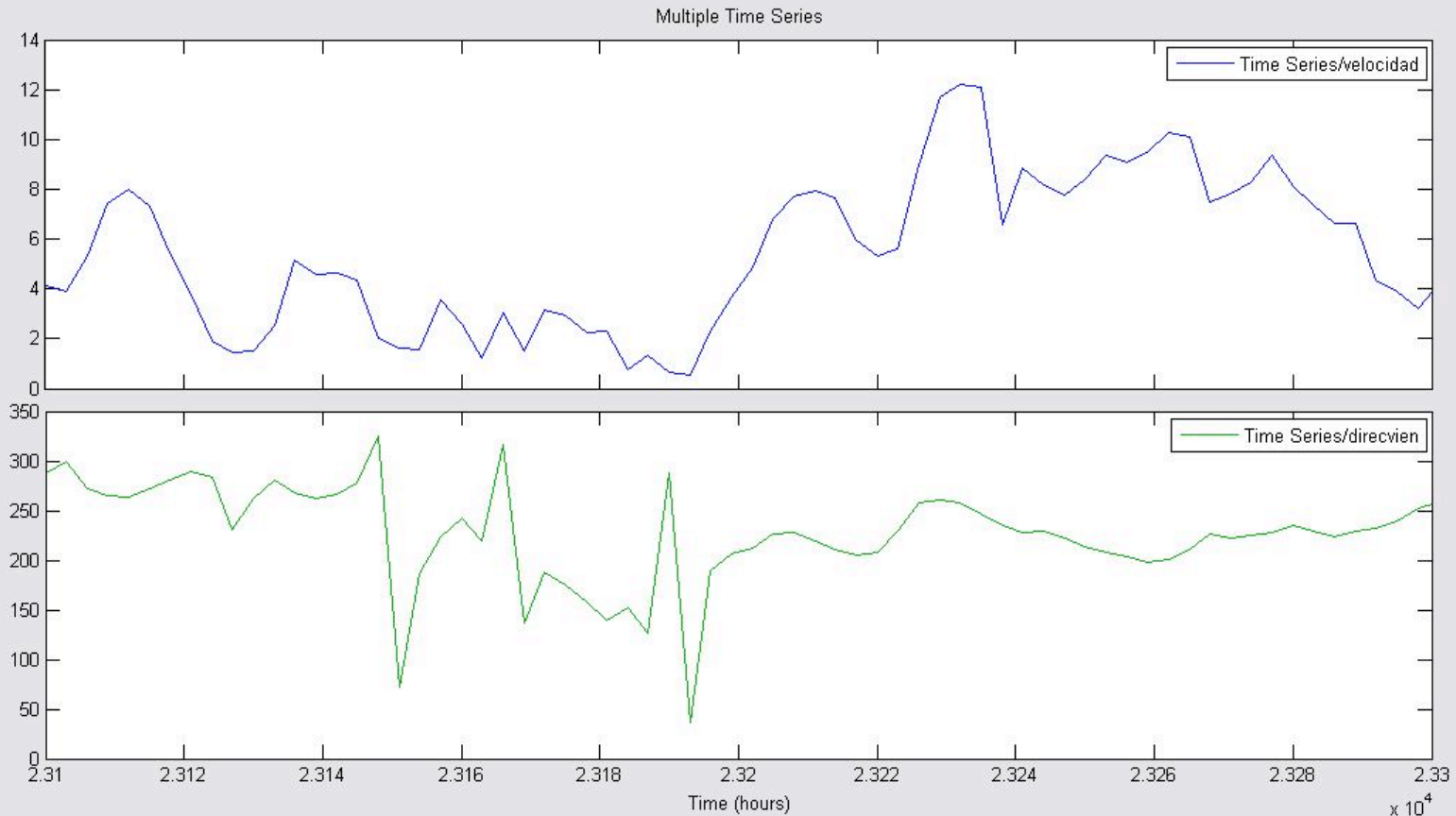
Characterize the extreme waves events. The effects was flood at different places of the coast with people of town and village evacuated and fisheries activities suspended.

Future works

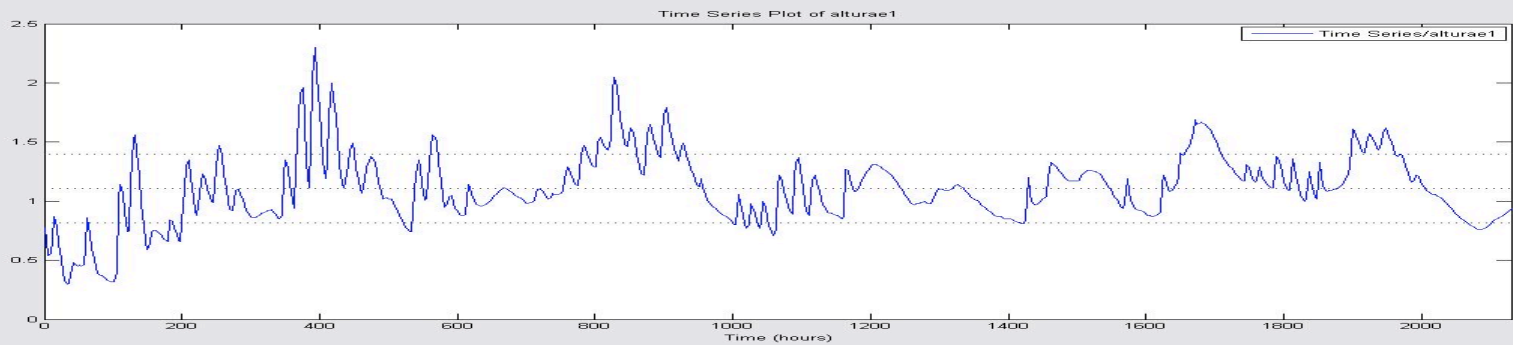
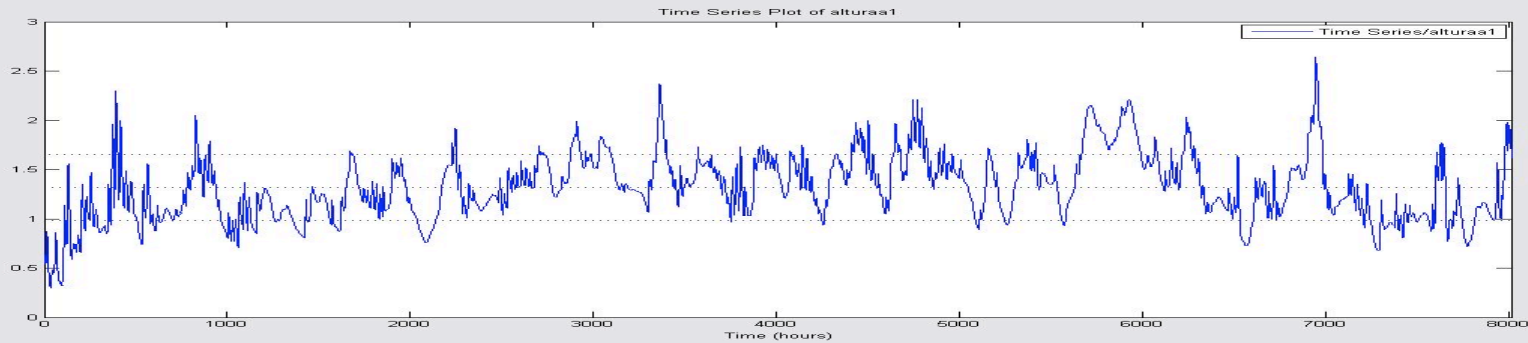
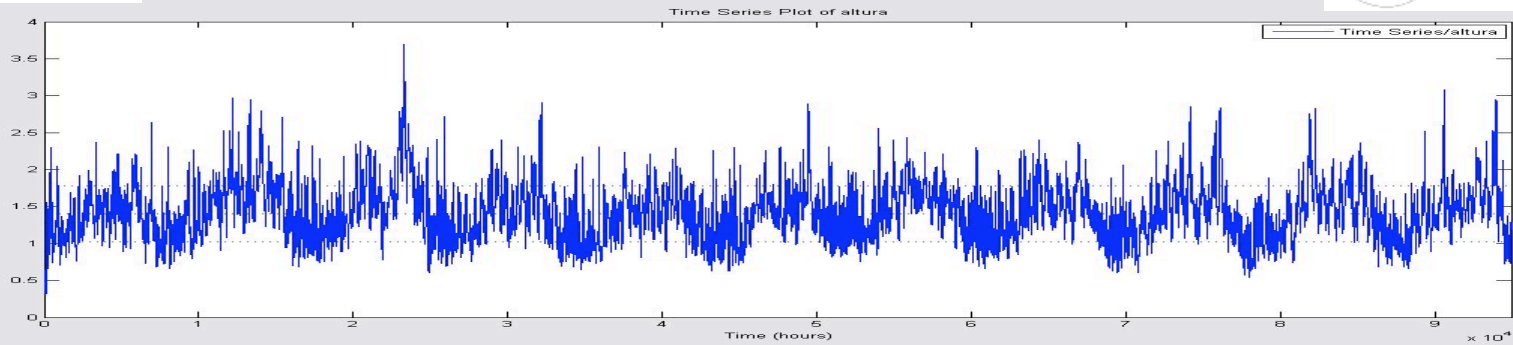


Evaluate the pre-conditions for the extreme waves events. Before September 27, 1999 we have a ground swell (period: 15 s) waves (height: 2.0 m) coming from South-South-West (direction: 210°).

Future works

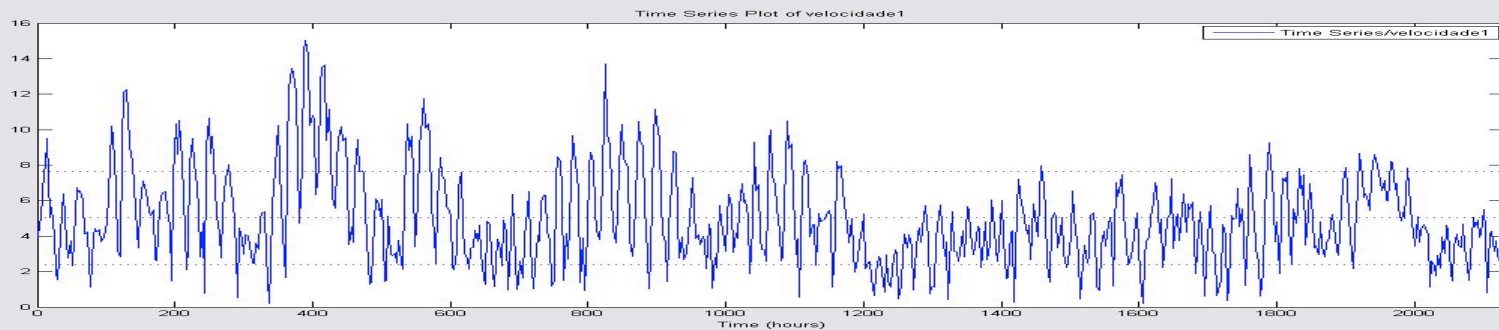
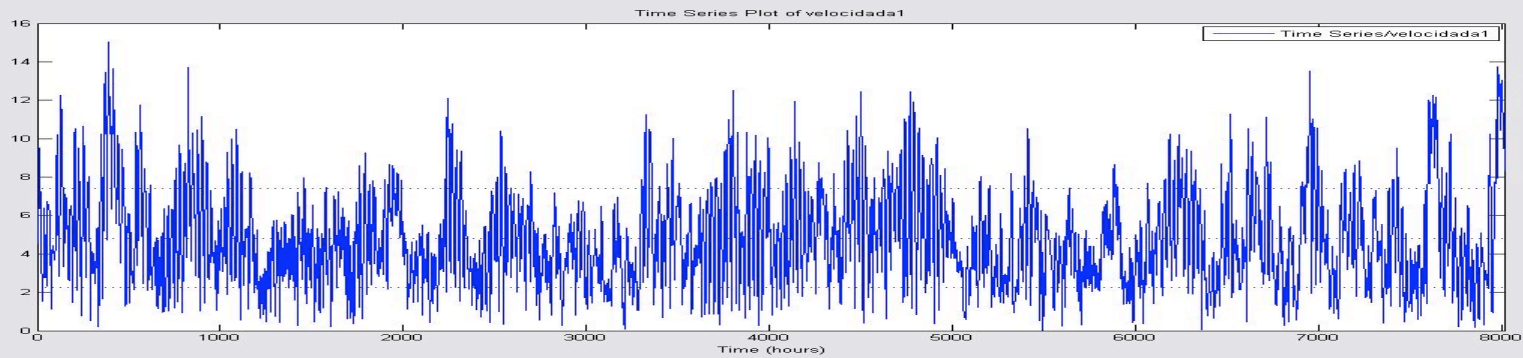
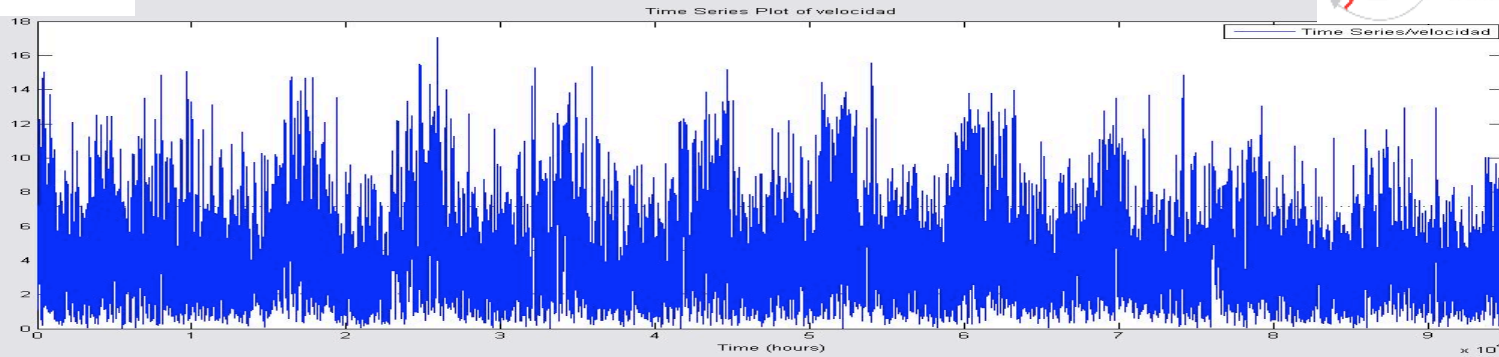


Evaluate the pre-conditions for the extreme waves events. This ground swell interact with a wind swell generated by a wind field with at least three behavior: velocity of 30 kilometer/hour and direction of 300° ; velocity of 10 kilometer/hour and variable direction; velocity of 30 kilometer/hour and direction of 230° .



Analyze the total, annual and seasonal windows of the wave and wind fields parameters.

Future works



Analyze the total, annual and seasonal windows of the wave and wind fields parameters.

Thank you