The relationship between monthly mean SLP and mean wave height is obtained from the CCA shows Fig. 2. Reduced pressures over the North Atlantic and Northern Europe indicate more low pressure systems in this region and this indicates increased mean wave heights. The simulated results and the observed time series are shown in figure 3.

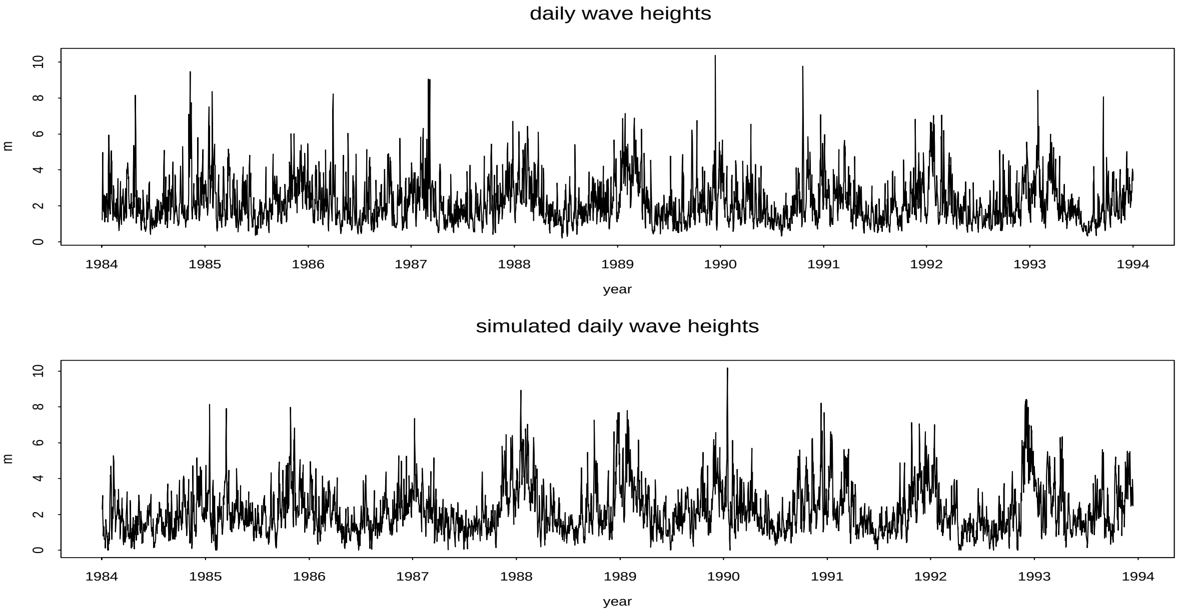

Fig.3: Observed and simulated daily wave heights (1.1.1984 - 13.12.1993)

Using diagnostics suchs as autocorrelation functions, quantiles, spectrum and distribution functions the wave generator was quite successfully validated against the observed wave statistics in the independent period . Figure 4 shows a quantiles - quantiles plot, Fig. 5 ,the comparison for the spectrum resolving periods up to 400 daysa quantiles - quantiles plot.

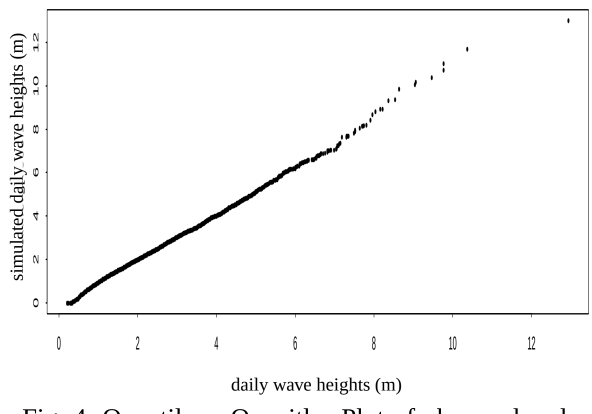

Fig. 4: Quantiles - Quanitles Plot of observed and simulated daily wave heights (1.1.1974 - 31.12.1994)

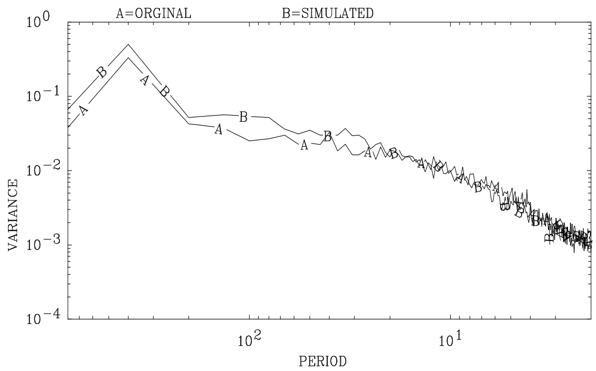

Fig. 5: Comparison of orginal and simulated spectrums. Periods up to 400 days.

Reference

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A conditional first-order autoregressive wave-generator

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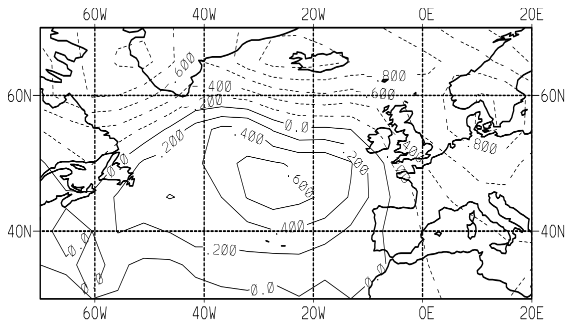
A statistical model was developed, that describes the daily wave statistics at one selected location in the North Sea was developed. With its help we can produce synthetic time series for Climate Impact studies.

As input data we used observed daily sea level pressure (SLP) over the North Atlantic and Europe and daily wave heights (1954-1994) at one selected grid point in the North Sea from a 40-year hindcast performed in the WASA project (WASA group, 1998).

To produce time series of wave heights we used an autoregressive first-order model

$$W(t) = aW(t-1) + b(t')e(t) \qquad (1)$$

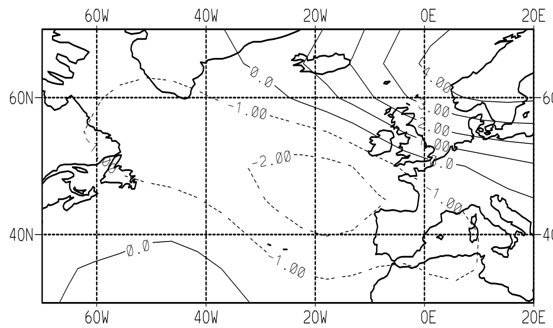
(ar[1]model) (1). Where W is the wave height, a is the autocorrelation, b the estimated varianz, e a random time series with normal distribution N (1,0), t daily time steps and t´ the seasonal cycle. To fit the model we need to transform our observed data to a normal distribution. After substracting the seasonal cycle of the data we transformed them to a normal distributionvia Probability Integral Transformation (Bürger, 1996). In the fitting period (1955-74) we found a constant autocorrelation parameter (0.61), a seasonal cycle for the estimated variance and also monthly anomalies of the estimated variance. With statistical downscaling technique (CCA, v. Storch, 1998) we found a relationship between the monthly standard devitation of the highpass filtered (5 days) daily SLP and the monthly anomalies of the variance for dailys wave heights. (Fig. 1) for winter (DJF). The SLP-pattern shows less variability over the North Sea and a contemporaneous decrease of the wave variance. The resulting improvement is marginal, so



correlation: 0.60

-0.44

Fig.1: CCA-pattern for the monthly stdv of high passfilterd daily SLP and the estimated monthly variance of an ar[1] model for daily wave heights.



correlation: 0.67

0.47

Fig.2: CCA-pattern for monthly mean SLP and the montly mean wave height

was not integrate into the results showing here.

After retransforming our time series from normal distribution to the orginal distribution we add the seasonal cycle and the intra-monthly anomalies of mean wave height (2). There W is the

$$W = [W_s + W_{s'}] + W(t) \qquad (2)$$

resulting wave height, W(t) the retransformed wave height from the ar[1] model, W_s the seasonal cycle and $W_{s'}$ the monthly anomalies of wave height.