

Supplement Material to Directional Spectra-based Clustering for Visualizing Patterns of Ocean Waves and Winds

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1 Buoy Data Analysis with HDS clustering in 2D

We applied the HDSd (direction-only) method to cluster directional spectra corresponding to the Red sea data. The results are similar to those of the HDS method presented in the main paper.

We use the scree plot to choose the number of clusters. We select 10 clusters for the HDSd method. Since clusters with a small number of members are not very informative, we only present the first 9 leading clusters. Figure 1 shows the clustering visualization plots and Figure 2 is the corresponding calendar plot. Compared to the calendar plot using the HDS method (Figure 8(a) in main paper) to Figure 2, we can see that the temporal patterns of identified clusters are very similar, although the same color in the two calendar plots does not necessarily mean the detected clusters are identical. For example, Figure 3 shows the first two largest clusters detected by the HDS method. They are very similar to the largest cluster identified by the HDSd method. The two clusters from the HDS together contain about 69% of the spectra and the first cluster from the HDSd has 64% of them.

2 Calendar Plots with sugrrants Package

The sugrrants package (<https://github.com/earowang/sugrrants>) provides supporting graphs with R for analyzing time series. We implement the clusters ID as a time series and build the calendar plot (daily scale) with the *frame_calendar* function. Figure 4 shows the

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same information that Figure 8 in the main paper. The main difference is that Figure 4 is in lower resolution (daily) compare to Figure 8 (hourly). However, the conclusion is the same.

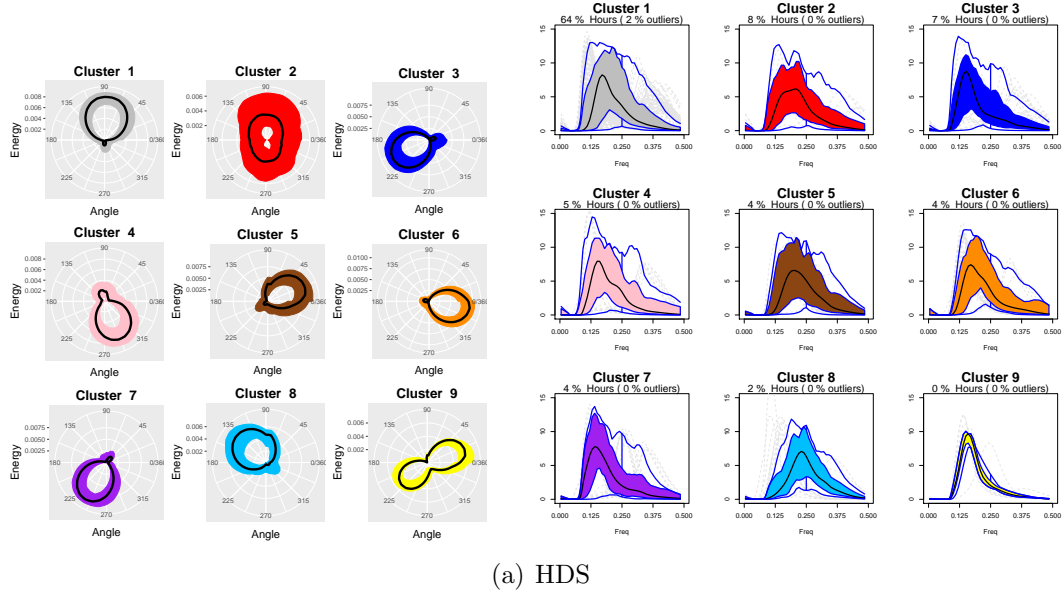


Figure 1: Clustering Visualization. Right: directional fbplot using polar coordinates. Cluster IDs and colors between buoy data and physical model clusters match when considering similarities between the spectral features (peak direction and peak frequency). Left: fbplot of the frequency spectra per cluster. Subtitles indicate the percentage of the total period of hours that belong to the corresponding clusters and the percentage of detected outliers (curves outside the fences). Clustering when considering the model output data is highly similar to clustering when considering the buoy data.

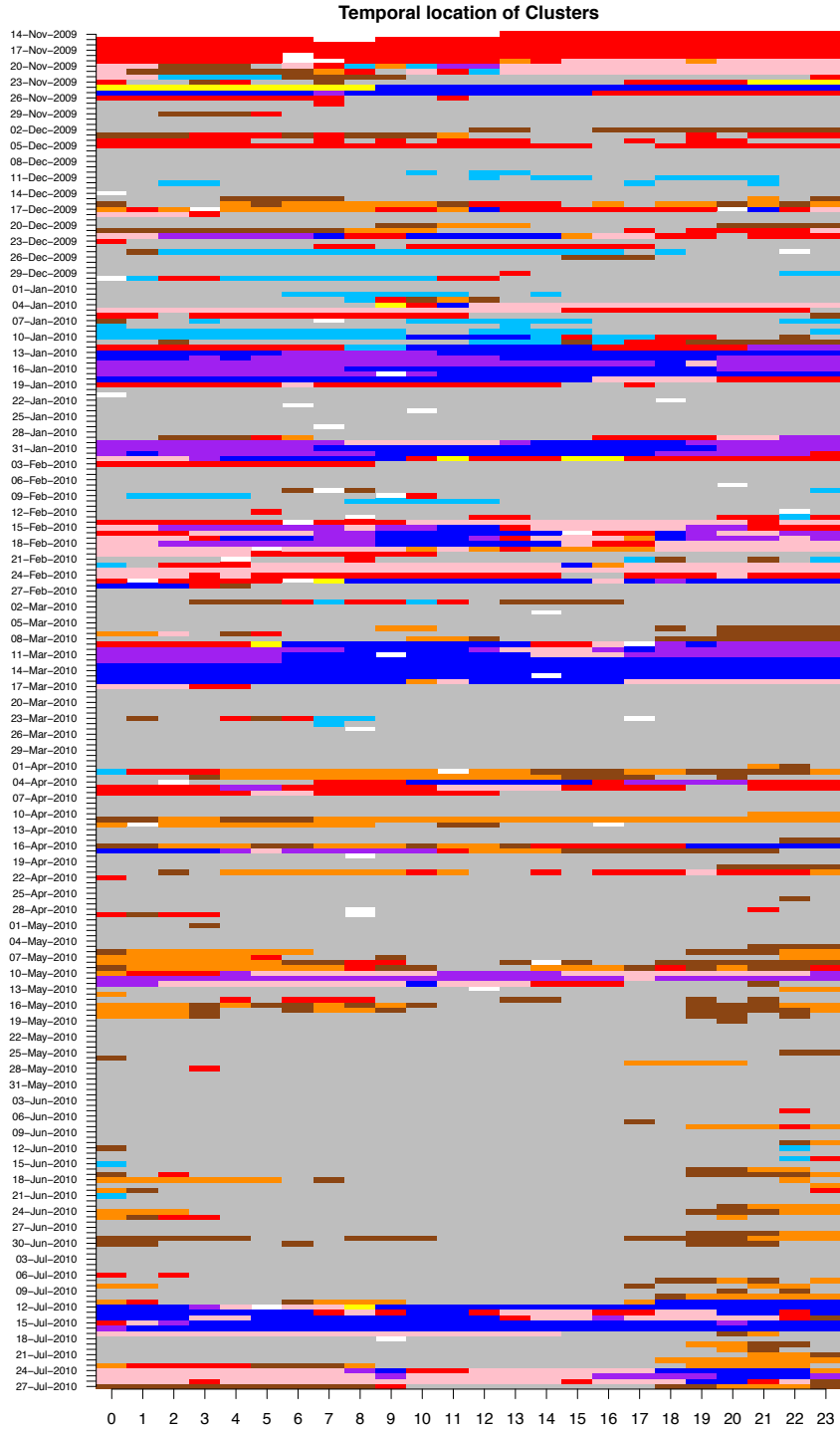
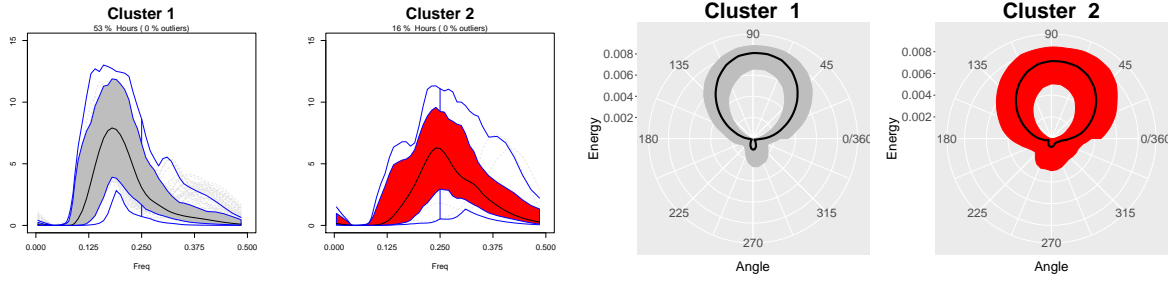
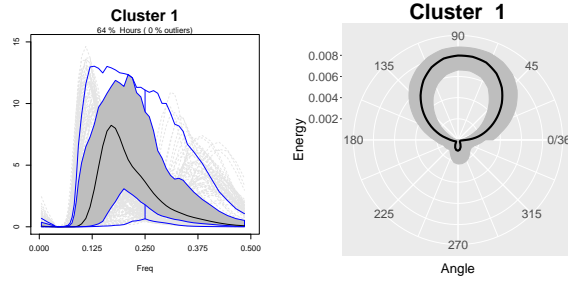


Figure 2: Color-coded calendar plot for buoy data and physical model data. Dates are mapped by row and hours are mapped by column. Color represents cluster IDs.

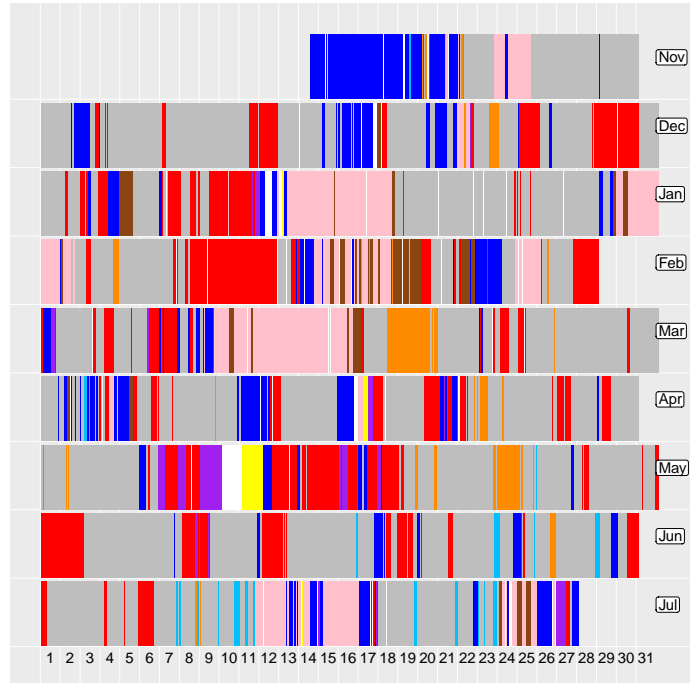


(a) HDS



(b) HDSd

Figure 3: Clustering comparison of major clusters identified by HDS and HDSd. (a) Cluster 1 and Cluster 2 based on HSD, together they contain about 69% of the directional spectra. (b) Cluster 1 based on HDSd (direction-only), it contains 64% of the directional spectra.



(a) KAUST buoy

Figure 4: Clustering results HDS. Color-coded calendar plot for buoy data. Color represents cluster IDs.