



## **Sea-land breezes at Huelva (Spain) and its main features**

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In this work, we present the study that we have developed in order to know the main characteristics of sea-land breeze in the province of Huelva, which is located in the southwest of Spain. This area is characterised to present several air pollution problems, which are related to emissions from both transportation and the industrial chemical complexes located in the Huelva town surroundings. In order to know the behaviour that show these pollutants into the atmosphere it is necessary to study the atmospheric dynamic of this region, and for that we have analysed the coastal breeze in this area, because of must be a significant atmospheric process that affect and influences widely the behaviour of the pollutants.

We have used the wind database coming from meteorological tower of Punta del Sebo, located closed to Huelva town. We have analysed the wind data of the period 1999-2002. It was studied the wind regime, and from it we have obtained several conclusions as that in autumn and wintertime the wind direction more frequent have north component (NW or NE). However, in spring and summertime the wind blows with more frequency from southwest, caused for the air masses Atlantic or for the diurnal breeze regime.

In order to extract the breeze days, three criteria to this historical wind data have been applied. Firstly, we calculated the relative frequency of occurrence, obtaining that between May to September the coastal breeze occurs with a frequency higher 30%, with a maximum of 70% in August. Secondly, we have also demonstrated, in opposite as it is expected, that sea-land breeze have three different patterns in the study area. The first pattern is the typical breeze where the wind direction is perpendicular

to the coast. Next pattern found presents a direction of sea breezes no perpendicular to the coast, being this one affected by the synoptic conditions. In this case nocturnal breeze is coupled with a synoptic flow from northwest that determines the land breeze; in addition, we have obtained high wind speed under this type of breeze. The third type of breeze identified is characterised to be developed under synoptic flows from southwest, being its direction the same of marine breeze, and for that the sea breeze have a long duration.

It will be expected that occurrence of a specific breeze pattern will determine significantly the behaviour of the atmospheric pollutants in Huelva area. Thus, for example, we have detected that under the first or third one breeze patterns have been measured high ozone concentrations, but however with the second breeze patterns the ozone concentrations are lower.