



## Seasonal variability of sulfur plumes in the Peruvian coastal area off Pisco

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In the Peruvian eastern boundary upwelling system hydrogen sulfide outbreaks and their coastal sulfur plumes influence the marine ecosystem, the local fisheries and the tourism due to their toxic properties. They may cause mass mortalities of marine organisms and represent a major limitation for coastal aquaculture. In the past, the local inhabitants recognized these outbreaks by the nasty smell of hydrogen sulfide and by the paint darkening of boats and houses. Up to now, the coastal surface-sulfur plumes have been investigated by few studies in the Peruvian area. There are large gaps in the knowledge about these sporadic events.

The objective of this study was to investigate the seasonality of sulfur plumes in the coastal area off Pisco because most of them were reported in this region. For this purpose, the coastal sulfur plumes were identified in remote-sensed data of ocean color satellite sensors of MERIS (medium resolution imaging spectrometer) and MODIS (moderate resolution imaging spectroradiometer) using their discolored effects in the surface water layer. Other satellite data and in-situ measurements like the sea surface temperature, the concentration of dissolved oxygen and the wind conditions were used for the discussion of the seasonal cycle of sulphur plumes.

Overall, our study illustrates that the seasonal variability of sulfur plumes is characterized by well pronounced off and main-seasons. The activity of sulfur plumes is low in the middle and at the end of the Peruvian winter. However, a higher activity is observed in the late Peruvian summer. The lowest size of sulfur plumes is detected in September straight after an enhanced oxygen supply which probably reduce the formation of hydrogen sulfide on the Peruvian shelf. This time period is in the upwelling season with maximum upwelling intensity (highest v-component of pseudo wind stress, lowest sea surface temperature). The highest sizes of sulfur plumes are observed between April and May at the same time of increasing upwelling intensity and a decreased oxygen concentration which enhances the probability of their occurrence.