World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:10, No:06, 2016

Analysis of Ozone Episodes in the Forest and Vegetation Areas with Using HYSPLIT Model: A Case Study of the North-West Side of Biga Peninsula, Turkey

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Abstract : Surface ozone, which named as one of the most critical pollutants in the 21th century, threats to human health, forest and vegetation. Specifically, in rural areas surface ozone cause significant influences on agricultural productions and trees. In this study, in order to understand to the surface ozone levels in rural areas we focus on the north-western side of Biga Peninsula which covers by the mountainous and forested area. Ozone concentrations were measured for the first time with passive sampling at 10 sites and two online monitoring stations in this rural area from 2013 and 2015. Using with the daytime hourly O3 measurements during light hours (08:00–20:00) exceeding the threshold of 40 ppb over the 3 months (May, June and July) for agricultural crops, and over the six months (April to September) for forest trees AOT40 (Accumulated hourly O3 concentrations Over a Threshold of 40 ppb) cumulative index was calculated. AOT40 is defined by EU Directive 2008/50/EC to evaluate whether ozone pollution is a risk for vegetation, and is calculated by using hourly ozone concentrations from monitoring systems. In the present study, we performed the trajectory analysis by The Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model to follow the long-range transport sources contributing to the high ozone levels in the region. The ozone episodes observed between 2013 and 2015 were analysed using the HYSPLIT model developed by the NOAA-ARL. In addition, the cluster analysis is used to identify homogeneous groups of air mass transport patterns can be conducted through air trajectory clustering by grouping similar trajectories in terms of air mass movement. Backward trajectories produced for 3 years by HYSPLIT model were assigned to different clusters according to their moving speed and direction using a k-means clustering algorithm. According to cluster analysis results, northerly flows to study area cause to high ozone levels in the region. The results present that the ozone values in the study area are above the critical levels for forest and vegetation based on EU Directive 2008/50/EC.

Keywords : AOT40, Biga Peninsula, HYSPLIT, surface ozone
Conference Title : ICEPCP 2016 : International Conference on Environmental Pollution Control and Prevention
Conference Location : Vienna, Austria
Conference Dates : June 16-17, 2016