

Particulate matter from wildfires and its local/regional impacts over Portugal

M. Tomé¹, E. Nunes², C.A. Alves³ and J.M. Alonso²

¹Escola Superior de Tecnologia e Gestão, IPVC, Avenida do Atlântico, 4900-348 Viana do Castelo; Portugal

²Escola Superior Agrária, IPVC, Refóios do Lima, 4990-706 Ponte do Lima; Portugal

³Centre for Environmental and Marine Studies (CESAM), Department of Environment, University of Aveiro, 3810-193 Aveiro, Portugal

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Between 20 and 23 August 2005, a large wildfire occurred close to Viana do Castelo city, in the North-west of Portugal. High emissions and wind direction have favoured the transport of both primary and secondary air pollutants to the city centre. This was one of the most critical events in terms of air pollution affecting directly thousands of inhabitants during more than 24 hours. The health impact upon population was significant, increasing the number of hospital admissions due to respiratory problems. It was considered the possibility of evacuation of the district hospital due to bad indoor air quality.

Taking into account that there was only one nearby rural background air quality station, several studies to characterise the 3D meteorology, emissions and transport/dispersion have been made in order to assess, with high resolution, the air quality in a more broad area. These studies involved field data from the national air quality network (as the impact was extended hundreds of kilometers from the fire location), field data from the fire propagation each 12 hours, meteorology data, fuel cover and topography. Records of several air quality stations in the North and Central regions of Portugal registered atypical PM_{10} levels exceeding $200 \mu\text{g}\cdot\text{m}^{-3}$ during these days

In order to model this air quality event, several numerical tools were used, namely: i) Farsite model (for fire progression); ii) Nuatmos model (prognostic wind model accounting for local topography effect); iii) lagrangian code (transport and dispersion of passive pollutants). Moreover, it was used ADMS-Urban to assess the impact of traffic emissions upon the air quality in Viana do Castelo. Aiming to confirm easily the smoke plume trajectory, forward trajectories HYSPLIT have been computed. This event is being further studied by using WRF model and its chemistry module in order to better assess the real photochemical impact of such a suburban forest fire. Indeed, during a typical summer day, the high biogenic emissions from regional vegetation reacting with the anthropogenic and forest fire emissions can produce extreme levels of ozone and related oxidants. During this event, there were not records of ozone in the city centre and the nearby regional station was not influenced by this episode of bad air quality.

Figure 1 shows the forest fire progression, wind and PM_{10} field concentration at 15h00, 20 August 2005. One can see high levels of particles

whose effects have synergies with those of other pollutants emitted by wildfires. According to our simulations, there were PM_{10} levels exceeding $100 \mu\text{g}\cdot\text{m}^{-3}$. Figure 2 illustrates the trajectories of the smoke plume above the Atlantic Ocean and Iberian Peninsula released by several simultaneous fires.

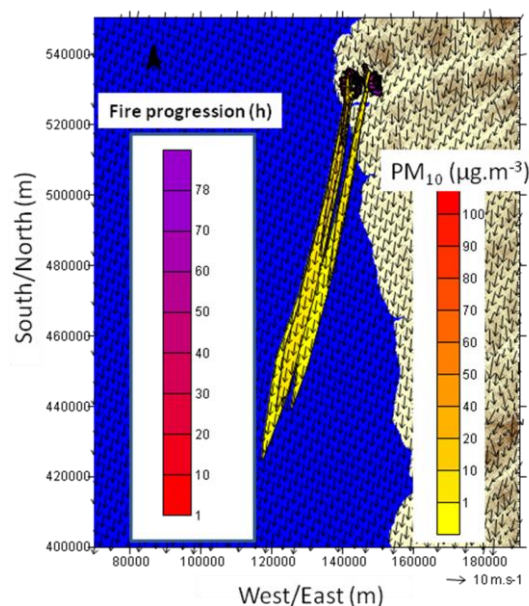


Figure 1. Fire progression, wind and PM_{10} field concentrations at 15h00, 20 August 2005.

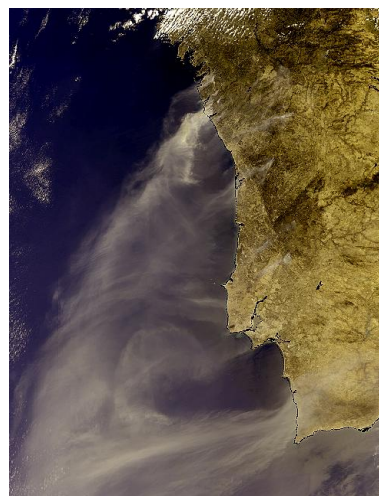


Figure 2. Satellite view of forest fires smoke above Iberian Peninsula on 21 August 2005 (Source: www.esa.int).