Preliminary comparison of ozone concentrations provided by the emission inventory/WRF-Chem model and the air quality monitoring network from the *Distrito Metropolitano de Quito (Ecuador)*

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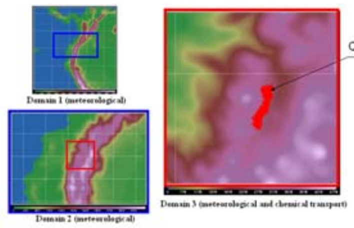
The first version of the emission inventory is used with WRF-Chem to simulate air quality in the *Distrito Metropolitando de Quito (DMQ)*.
Different emission models are being coded into a unique GIS tool called the *Sistema de Gestión de las Emisiones del DMQ (SIGIEQ). E*missions are speciated according to the RADM chemical mechanism.
To date, diagnostic simulations of gas-phase are developed. O3 mixing ratios obtained by modeling during the period 11th – 28th Sep/2006, were compared with data of the air quality monitoring network.

DOMAINS

The two first domains (d01: 27x27 km, d02: 9x9km, Fig. 1) are used only for meteorology. For the second subdomain (d03: 3x3 km), the chemical transport option is activated. IC and BC were derived from one-way nesting using Final Analysis datasets from NCAR.



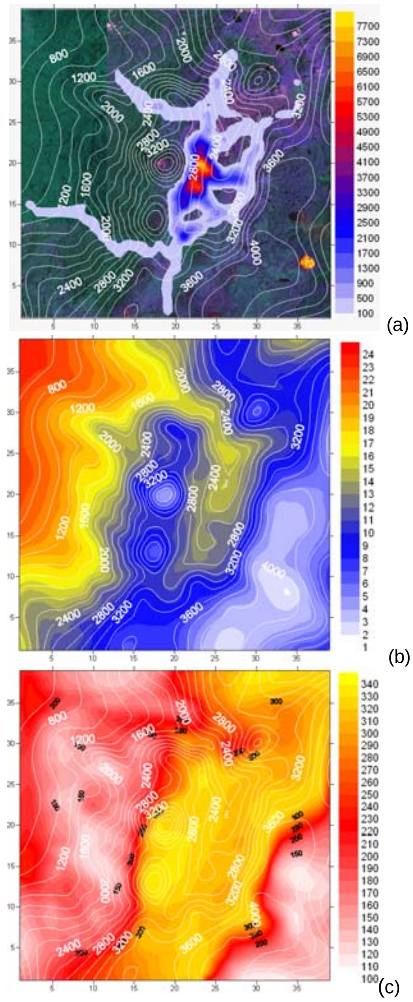
(Fig. 1: location of Quito and domains)

THE ZONE OF STUDY

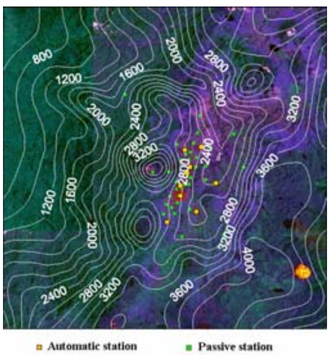
The DMQ is allocated near the Equator. It has a complex topography (Fig. 2), its altitude is around 2800 masl. Subdomain d03 has zones with height lower than 800 and higher than 4000 masl. Meteorological WRF-Chem results show the expected reverse variation of the surface temperature with altitude.

RESULTS

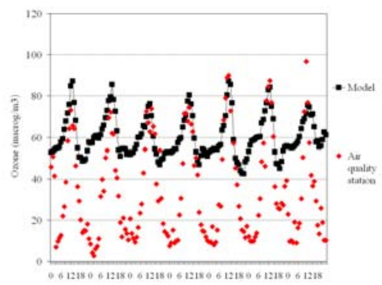
Fig. 3 shows the allocation of automatic (yellow dots, 9 stations) and passive (green dots, 43 stations) stations, and a comparison between the model results and data recorded by El Camal air quality station.
During daytime hours O3 concentrations are well captured by the model for most of the days (peak values until 90 µg m^{-3}). During nighttime the model provides concentrations between 50 – 60 µg m^{-3}, as long as records reach values until 5 µg m^{-3} in both urban and suburban areas.This behavior is similar to others air quality stations.



(Fig. 2: (a) topography (masl) and CO emissions (mol km^{-2} h^{-1}) 07h00-08h00 weekday); (b) and (c), average surface temperature (ºC) and incoming solar radiation (W m^{-2}) during Sep/2006

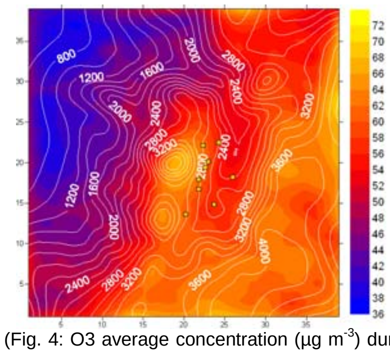


El Camal air quality station (red circle)

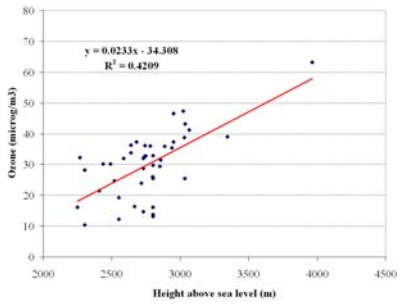


11th – 17th Sep/2006

(Fig. 3: hourly O3 concentration. Model results vs. records for the period 11th–17th Sep/2006. El Camal station)



(Fig. 4: O3 average concentration (µg m^{-3}) during 11th – 28th Sep/2006)



Passive network

(Fig. 5: O3 average concentrations (µg m^{-3}) with altitude (masl) during 11th – 28th Sep/2006)

It seems that O3 background concentrations are lower than background values reported in the literature. Results actually provided by the model are useful to track the behavior of O3 during daytime, when it is important to follow its increase owing to photochemical reactions.
Average concentrations for the simulation period are directly related with altitude (Fig. 4). This tendency was verified by records of the passive network. There is a significant increase in average O3 concentrations with altitude ($y = 0.0233x - 34.308$; $F_{1,41}=29.8$; $p<0.01$) (Fig. 5).
Model averages are higher than records due to its higher values during nighttime.

CONCLUSIONS

The particular features of the region and uncertainties of the emission inventory, could affect the performance of the model during nighttime.
Determination of own emission factors is a priority field of investigation.
Updating the emission inventory is believed will improve the performance of the model.
WRF-Chem needs to be tuned for the DMQ's conditions in order to capture well O3 mixing ratios during the whole day. In the future, aerosols should be included.
At present SIGIEQ/WRF-Chem shows promising performance in the DMQ.

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