6.17 APPLICATION OF THE ARPS AND MM5 MODELS IN EPIRUS, GREECE. IMPLICATIONS TO AIR QUALITY. FIRST RESULTS.

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INTRODUCTION

Northwestern Greece and especially the areas of Epirus, Western Thessaly and Northwestern Macedonia are characterized by significant landscape variability with high mountains, deep valleys, mountain ranges, abrupt slopes, rivers, small lakes and plateaus etc. Since this area has topography resembling Alpine regions it should be handled with special attention in terms of selecting and applying the appropriate meteorological modeling options for describing the air flows and the other meteorological fields.

In Greece, the Fifth-Generation Mesoscale Model Version 5 or MM5 (Grell et. al. 1995) is in use operationally by the National Observatory of Athens (Kotroni and Lagouvardos, 2001) during the past 3 years. In this application, mainly focusing in routine meteorological predictions on a country level, the region of Epirus is represented with a rather coarse grid spacing (20 Km) that is inadequate to describe the special air flow characteristics of the area. In order to cover this gap, Mironakis and Kassomenos (2004) applied, a four nest procedure of MM5, focusing in Northwestern Greece and using a 3-Km grid spacing for the inner grid, representing Epirus, to reveal meteorological phenomena that could not be detected by coarser grids. Following and extending this work we applied MM5 and ARPs models for a more detailed grid spacing of the inner grid (less than 1 Km) for both models.

RESULTS

Figures 1 represent the position of the four domains, topography and land use distributions of the inner grids.

The MM5 model was run in nonhydrostatic mode with 23 vertical layers. The model was run for one day 0000 UTC 03 August 2001 to 0018 UTC 03 August 2001 with 12 hours step for initial and 6 hours step for boundary conditions.

Due to lack of space we present the second nest of the domain at the surface for two hours, 12 and 18 UTC (e.g. 14 and 20 LT). As we could see for the figures 2a a strong northern flow was established over the Aegean Sea and Western Minor Asia, but over western Greece the wind flow was from the west during noon hours, while during evening hours the wind flow was turned from NW directions but remained weak as during the noon hours. The temperature over Epirus was about 24-26^{o}C. Over the Aegean Sea a strong pressure gradient was also detected.

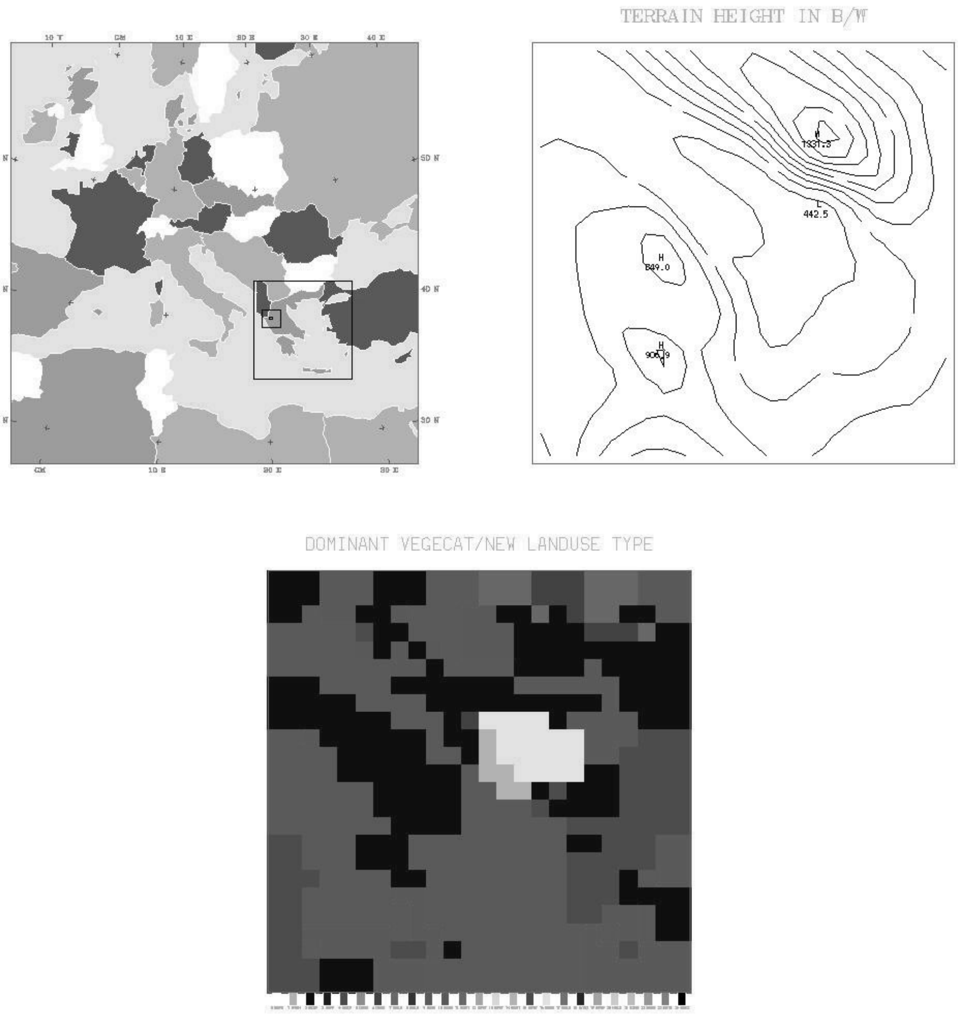
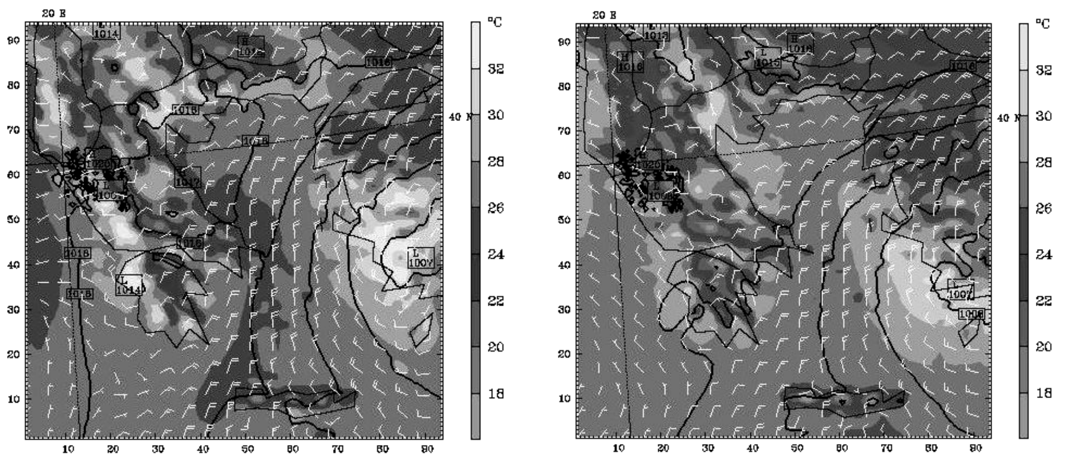


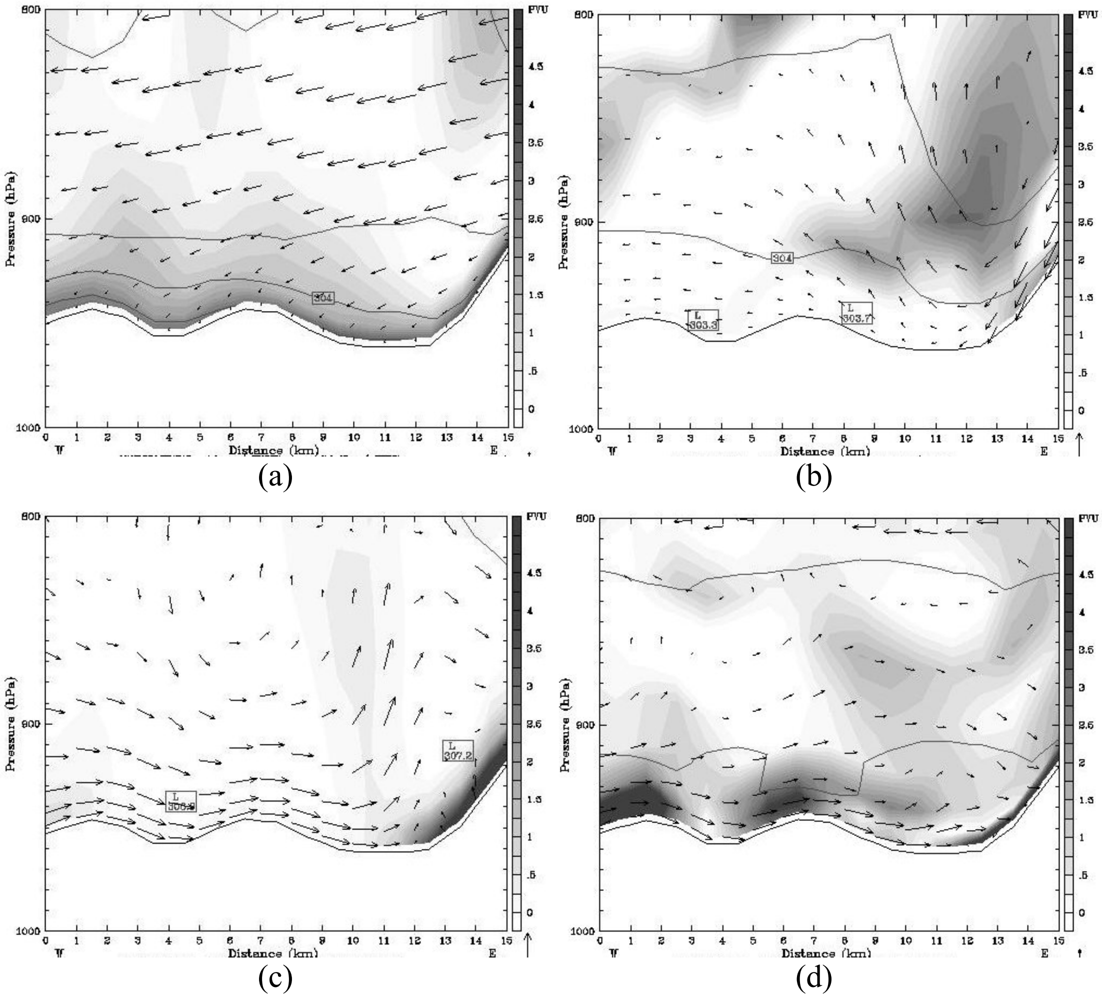
Figure 1. (a) The nests used in this study, (b) the topography of the inner domain, (c) the land use of the inner domain.



(a) (b)

Figure 2. Sea-level pressure, temperature and horizontal wind fields at 12 (a) and 18 (b) UTC for second domain.

In the inner domain figure 3 represents the X-Z cross section passing through the central part of the Ioannina Basin. This cross section represents the W-E direction.
As we could see from these figures the u component of the wind was from eastern directions during the night hours while during the morning hours the warming of the land was developed a turbulent behaviour. After that a western flow was established for the rest of the day. It is apparent also that during the night hours a strong inversion and stagnation conditions were established over the basin. The potential vorticity was strong over the ground during night hours, but during morning and noon hours was became weaker. Besides over the paries of the mountains was remained strong during the whole day.
Figures 4 represent the Y-Z cross sections in the centre of the Ioannina Basin. This cross section represents the S-N direction. From these figures we could see that the vertical component of the wind flow was from northern directions during the night while during the morning and especially noon hours a significant turbulence was detected leading to updraft motions. During the night hours it is apparent a vortex over the basin.

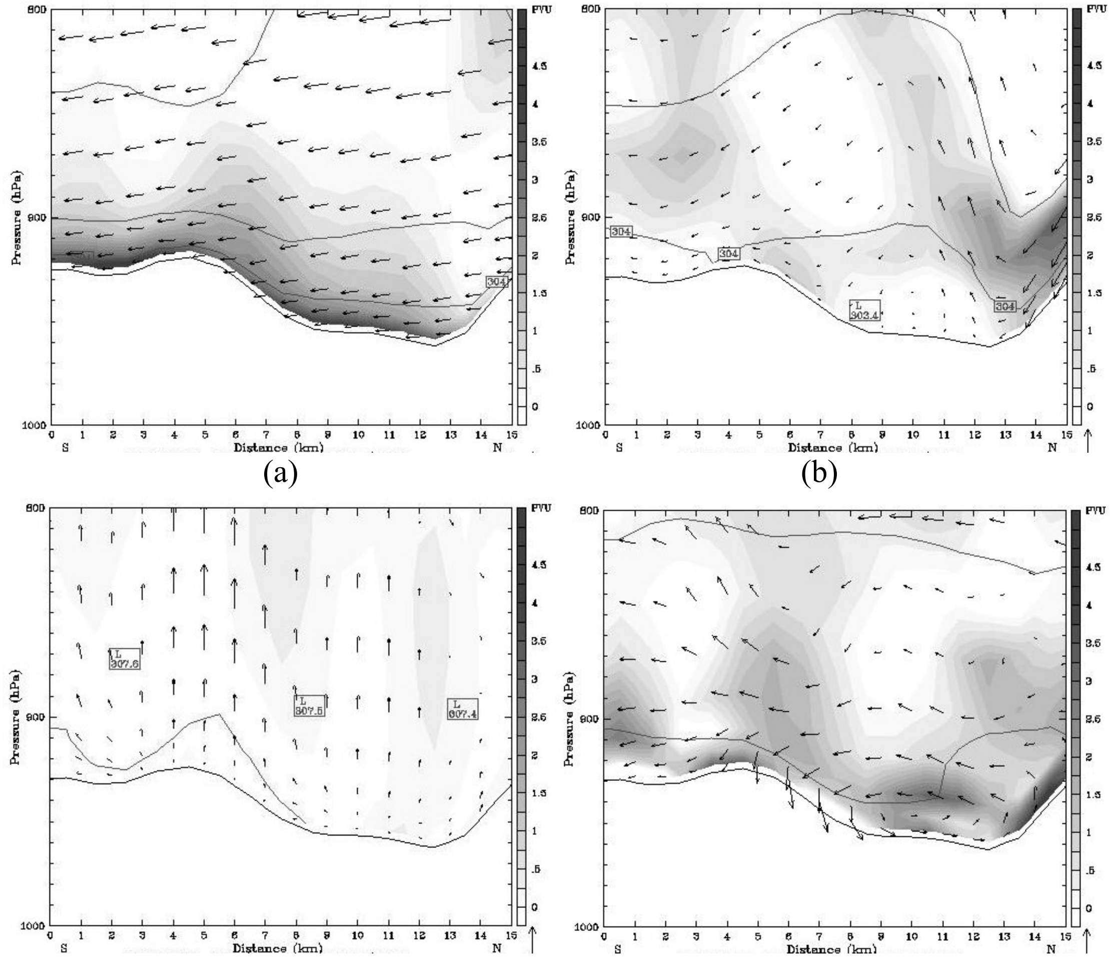


Figures 3. The corresponding vertical cross section of wind over the central area of Ioannina, from West to East (coordinates (X, Y) :(5,17) through (20,17)) for the fourth domain at 00 (a), 06 (b), 12 (c) and 18 (d) UTC.

The potential vorticity was strong near the ground during the night hours (figures 4a, 4d) while during the morning and the noon hours (figures 4b, 4c) was became significantly weaker. Over the slopes of the mountain the potential vorticity was strong during the whole day except the noon hours.

CONCLUSIONS

In this work an attempt was made to study the mesoscale weather patterns during an air pollution episode in the city of Ioannina NW Greece. The analysis revealed significant mesoscale circulations especially shown in the vertical cross-sections (E-W & N-S) of the inner domain.



(a) (b) (c) (d)

Figures 4. The corresponding vertical cross section of wind over the central area of Ioannina, from South to North (coordinates (X, Y) :(15,5) through (15,20)) for the fourth domain at 00 (a), 06 (b), 12 (c) and 18 (d) UTC.

ACKNOWLEDGEMENTS

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