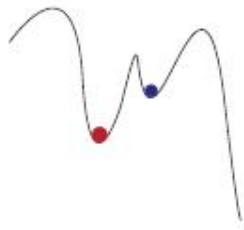EMS Annual Meeting/ECAM 2011

11th EMS Annual Meeting
10th European Conference on Applications of Meteorology

**Forecasting the weather –
ensemble techniques in probabilistic weather prediction**

Programme

Berlin | Germany | 12 – 16 September 2011

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Freie Universität Berlin

ECSN
European Climate Support Network

DMG
Deutsche Meteorologische Gesellschaft

EMS

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Conference Theme
Forecasting the weather - ensemble techniques in probabilistic weather prediction

Ensemble weather prediction systems are widely used today providing the means for a better representation of uncertainties in both the initial conditions and the forecast models.

The challenges are to develop further a wider range of probabilistic forecast products, and to support customers in using uncertainty information to manage weather-related risks effectively. Special emphasis will be given to forecasts of high-impact weather events.

ECAM: applied meteorology
The ECAM-sessions will cover the different perspectives of forecasters, developers and users. Probabilistic forecasts require both new products and new ways to communicate probabilistic information to the public and customers; customer requirements will be discussed under all topics. The development of high resolution guidance will be discussed with respect to the difficulty forecasters face in translating this abundant information into forecast products. Customer requirements for extreme weather forecasts will focus on areas such as aviation, energy, transportation and agriculture.

The atmospheric system and its interactions
The ASI session programme is intended for papers addressing our understanding, observing and modelling of atmospheric processes and the water cycle, including feedback mechanisms and integrative studies. The ASI session papers thus mostly describe scientific activities upstream of thoses addressed in the NWP and ECAM programme. The sessions also provide plenty of hooks for related sciences and applications: hydrology, agrometeorology, air quality, oceanography, etc.

General Information
The official language of the 11th EMS / 10th ECAM is English. Simultaneous interpretation is not provided. It is therefore expected that authors are able to present their research more or less fluently in the English language.

Local Organization
The conference will be organized jointly by the Deutsche Wetterdienst, the Deutsche Meteorologische Gesellschaft, the Institut für Meteorologie, FU Berlin, and the European Meteorological Society.

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Analysis and Forecasting of Urban PM10 Air Pollution Episode in Very Stable Conditions in Istanbul, Turkey on 6-9 November 2010

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ABSTRACT

The causes of air pollution episodes in urban areas are complex and depend on various factors including local emissions, meteorological variables and topographical conditions. Istanbul is the largest city of Turkey, with a population well over 13 million people. Particulate Matter episodes have been in winter and spring/fall seasons in some locations of Istanbul. The higher concentrations occur in winter mostly with the effect of residential heating in the city due to the some of the coal using residents. The ratio of the days with daily PM10 concentrations exceeding the limit value of 50 µgm^{-3} in the monitoring stations of urban area is varied in between 23-60 % of the stations in winter season (Celebi et al., 2010). The local emission sources may have been responsible for daily mean concentrations > 50 µgm^{-3} at several ratios of the monitoring sites each year. Furthermore, a new air quality station in Kagithane region is located at the valley of Golden Horn harbour, experiencing the higher PM10 concentrations along the year in the region. The region is exposed to many industrial facilities and busy urban traffic in this creek valley. Valley topography and industrial and traffic emissions may lead to significant episodic conditions of PM10 in the region. These conditions result in high PM10 concentrations higher than 300 µgm^{-3} hourly, sometimes reaching 570 µgm^{-3} occuring mainly in some locations of Istanbul during the strong episode.

In this study an analysis and evaluation of the air pollution episode on 6-9 November 2010 was presented. We carried out simulations with the Weather Research and Forecasting-Chemistry model (WRF-Chem) v3.3 to produce PM10 forecasts during the episode in Istanbul. WRF-ARW is run with two-way nesting option for domains with 18 km, 6 km and 2 km resolutions and 44 vertical levels. The episode was associated with the influence of high pressure with warm core over Istanbul and surrounding areas. It is also leaded to low wind speed and strong inversions throughout the episode period near the ground level.
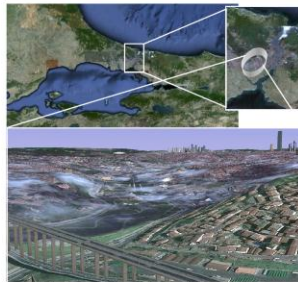
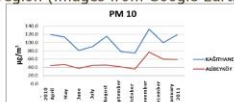Figure 1: Location of Kagithane region (images from Google Earth)

Figure 3: Monthly average PM10 observations at Kagithane and Alibeyköy.

Figure 2: PM10 observations of Kagithane station from 05.11.2010 00UTC to 11.11.2010 00UTC.

ANALYSIS

Kagithane region is located at western part of Istanbul (Fig. 1). The PM10 concentrations at Kagithane usually exceeds other stations in Istanbul. A comparison of recent monthly averages with the most close station Alibeyköy can be seen at Fig. 3. As seen from the figure, high values are observed at both stations in November 2010. Values between 5 and 11 Nov are given at Fig. 2. Extreme values are observed especially between 7 Nov 17UTC and 9 Nov 13UTC.

A warm-core high presssure exist over Turkey during the episode (Fig. 4). According to 850 hPa level charts, warm air is advected over Marmara. This warming and near-ground radiative cooling creates a strong inversion at lower levels. The inversions have their strongest form in the morning hours. Fig. 5 gives the thermodynamic diagrams of 06UTC for the episodic days. This phenomena also results in an advection fog over the sea (Fig. 7).

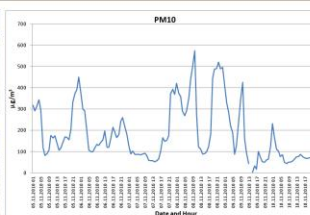A HYSPLIT output at Fig. 6 shows that the backward trajectories don't imply a long range transport.

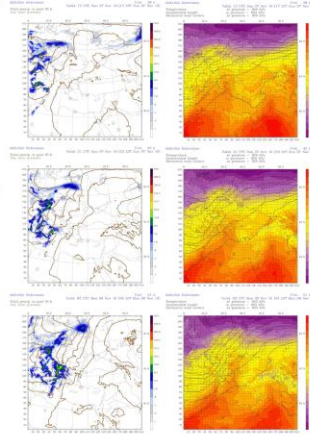
Figure 4: Sea-level pressure & precipitation vs 850 hPa (geopotential, temperature, wind) charts for 07.11.2010 15UTC, 21UTC and 08.11.2010 03UTC.

CONFIGURATION OF THE MODEL

Model Core: Advanced Research WRF V3.3 (ARW)
Chemistry: WRF/CHEM
Atmospheric Input Data: NCEP GFS Analysis 1.0x1.0º
Simulation Period: 06.11.2010 00UTC to 10.11.2010 00UTC
Domains: 3 domains with 211x211 hor. grids, two-way nesting.
Horizontal Resolutions: 18 km, 6 km, 2 km
Number of Vertical Levels: 44 (plus 1 surface, 4 soil layers)
Time Step: Adaptive
Microphysics: WSM6
Radiation Scheme: RRTMG SW and LW schemes
Surface Physics: ETA similarity
Cumulus Parameterization: Kain-Fritsch for the first two domains, no parameterization for the innermost domain
PBL Scheme: Mellor-Yamada-Janjic
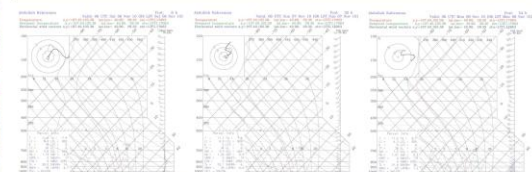**LSM: NOAH Land Surface Model**

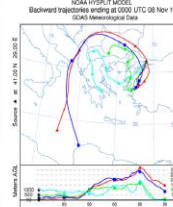Figure 5: Skew-T log-p diagrams for 06.11.2010, 07.11.2010 and 08.11.2010 06UTC.

Figure 6: Backward trajectories ending at 08.11.2010 00UTC for Istanbul (NOAA HYSPLIT output).

Figure 7: Visible channel satellite image from MODIS Terra (NASA) for 06.11.2010 09:27UTC. The White color over Marmara Sea indicate a dense fog.

PRELIMINARY RESULTS AND CONCLUSIONS

The preliminary results show that synoptic and mesoscale meteorological conditions favour trapping the pollutants near the surface over the area. It is considered that the local emmission sources and orography of Kagithane region also contributes to the high PM10 concentrations. The analysis of WRF/CHEM concentrations output will help explaining the episodic values. These simulations will be performed with CPTEC global data and also a recent emissions inventory for Marmara region.

This study is a part of the Turkish Scientific and Technical Research Council Project No: 109Y132.

REFERENCE

Celebi H.M., Incecik S., 2010, A study of the PM10 levels in urban atmosphere of Istanbul.