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CHAIR OF METEOROLOGICAL FORECASTS

MASTER OF SCIENCE IN APPLIED HYDROMETEOROLOGY

PRACTICE REPORT

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PLACE OF PRACTICE:

TURKISH STATE METEOROLOGICAL SERVICE

REGIONAL DIRECTORATE OF METEOROLOGY

ISTANBUL, MARMARA REGION

RUSSIAN FEDERATION

SAINT PETERSBURG

2014

CONTENT

INTRODUCTION

This report aims to summarize and publicize the process of academic practice developed in the facilities of the Turkish State Meteorological Service at the Regional Directorate of Meteorology in the city of Istanbul.

The inner operation of the named entity is described, as well as the principal activities, which are carried out by monitoring the atmospheric processes taking place in the Marmara region, northwest Turkey.

Finally, practitioners' impressions are expressed in their stay in the entity, in terms of human and technological resources that are used there.

1. DESCRIPTION OF THE PLACE OF PRACTICE

1.1. ABOUT TURKISH STATE METEOROLOGICAL SERVICE

The Turkish State Meteorological Service (TSMS) was founded in 1937, and is responsible to the Ministry of Environment and Forestry. TSMS is the Turkish government bureau commissioned with producing the meteorological and climatic data pertaining to Turkey. Approximately 1000 people are employed at their headquarters, and another 2000 are located throughout different parts of the country. It is the only legal organization, which provides all meteorological information in this country.

The main objectives of the TSMS are:

- To make observations,
- To provide forecasts,
- To provide climatological data, archive data, and other information,
- To communicate these to the public,
- To provide meteorological needs of army and civil aviation.

TSMS is a member of WMO since 1949 and represented in all Technical Commissions, and hosts one of the Regional Training Centres of WMO and tries to meet the training needs of the NHMSs of member states. In addition, the TSMS has the membership of the following international organizations: ECMWF, EUMETSAT, ECOMET, ICAO.

1.2. ISTANBUL REGIONAL DIRECTORATE OF METEOROLOGY

The first Regional Directorate of Meteorology in Turkey was established in Istanbul city. It is located on Orhantepe Mah. 30 Ağustos Cad. No:2 Cevizli 34865 Kartal, Istanbul. The main objectives of IRDM are to make synoptic observations and to provide regional forecasts and weather alerts to Marmara region. There is a population of about 23 million and an area of 70.000 Km^2, which includes the cities: İstanbul, Kocaeli, Yalova, Sakarya, Edirne, Kırklareli, Tekirdağ.

The Istanbul Regional Directorate of Meteorology has the following observation and measurement instruments:

- 80 Automatic Weather Observing Systems (AWO) in the Marmara's region, 25 of them in Istanbul city.
- 13 synoptic meteorological stations.
- 10 Marine Automatic Weather Observing Systems (M-AWO) in the Black Sea and in the Sea of Marmara.
- 1 buoy in Silivri region (inside Marmara Sea).
- 8 points to upper air observation in Turkey, 1 of them in Istanbul City.
- 10 meteorological radars in Turkey, 1 of them in Istanbul City.

2. PRACTICE ACTIVITIES

2.1. DAILY BRIEFINGS

Everyday briefings are carried out to discuss the meteorological forecasts for whole territory of Turkey. All 15 Regional Directorates of Meteorology meet through video conference at 11 o'clock to see the NWP (Numerical Weather Prediction) models summary-report and to do corrections using the experience of their professional staff.

Figure 1. Meteorological briefing.

2.2. CALIBRATION, LAUNCH AND DATA ANALYSIS OF METEOROLOGICAL RADIOSONDE

To understand in more detail the development of the atmospheric processes, is launched a meteorological sounding balloon twice a day. The collected data is used then to plot a skew-T diagram to observe the instability of the atmosphere and to do better the short-range forecasts of precipitations and snow events.

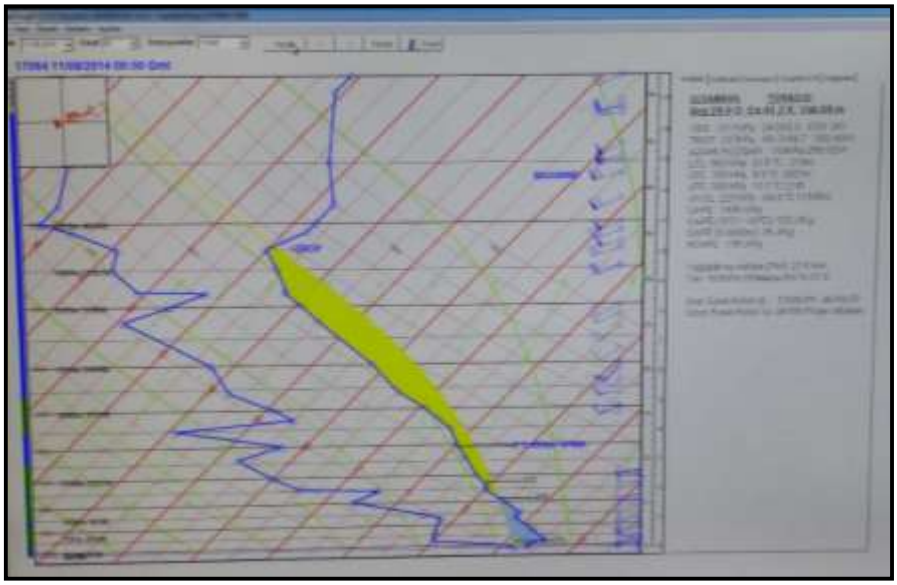

Figure 2. Skew-T diagram example.

There are used two different types of radiosondes: GRAW radiosonde DFM-09 and Vaisala radiosonde RS92-AM. The first one is launched at 12z and the second one at 00z.

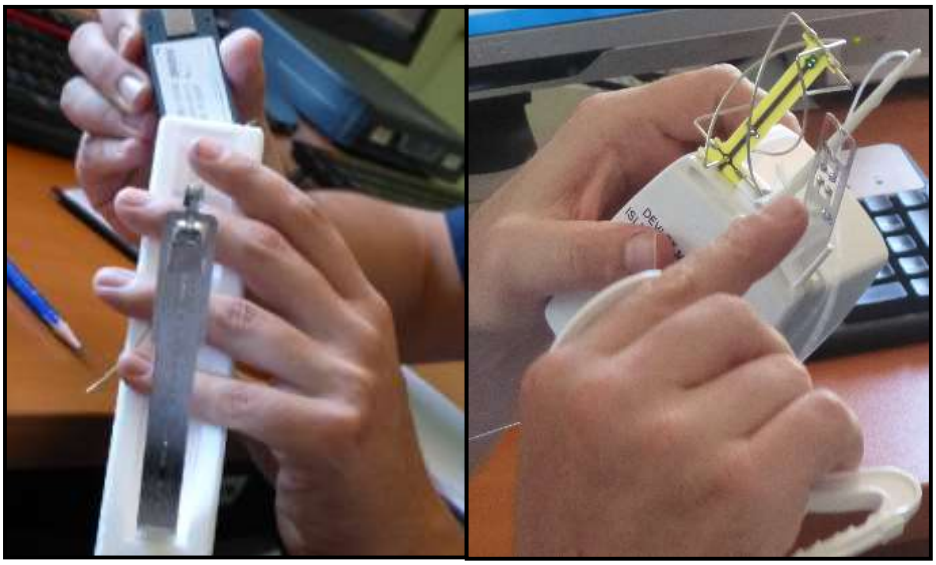

Figure 3. Radiosondes GRAW DFM-09 (right) and Vaisala RS92-AM (left).

To launch the radisondes is necessary to perform the following tasks:

a) To inflate the balloon with the support of a hydrogen generator.
b) To calibrate the radiosonde sensors with data from the meteorological automatic station.
c) To synchronize the radiosonde geopositional instrument with the reception station.
d) To attach the radiosonde to the balloon.
e) To launch the radiosonde.
f) To track the radiosonde verifying the quality of received data.

(a) (b)

(c) (f)

(d) (e)

2.3. SYNOPTIC ANALYSIS AND ALERTS SYSTEM

The weather forecasts are given by the local forecasters, which work at the Istanbul Directorate of Meteorology. At first, the synoptic analysis is carried out with the factual data (pressure charts with atmospheric fronts) and satellite imagery. After that, the evolution of cyclones and anticyclones is analyzed with the NWP models support. In the short-range weather forecasts are indicated the following variables: cloudiness, speed and wind direction, daily minimum and maximum temperatures, and the expected precipitation. Also it includes maritime and meteorological alerts like thunder storms, strong winds or floods.

Now casting reports and short-range forecasts and storm warnings for the next 2-4 hours are given with the aid of radar observations, inasmuch as the complexity of the physical and geographical conditions of Turkey tend to be unstable. If extreme event appear, the local forecasters immediately must to notify the authorities and civilians (via Internet, radio, television or other communication means).

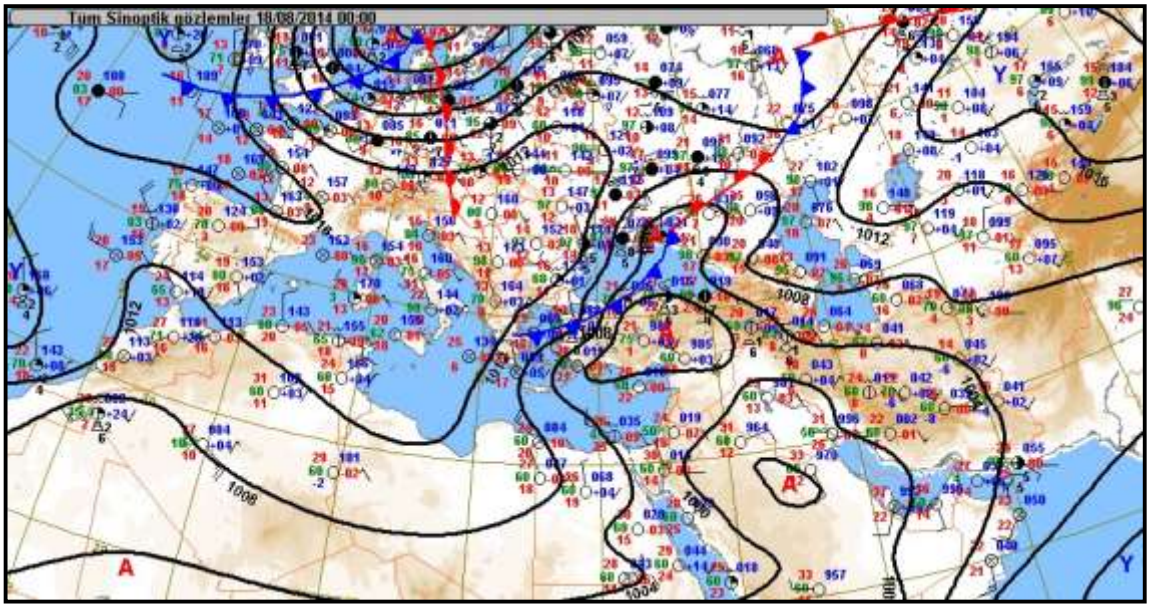

Figure 4. Example of surface pressure chart.

Additionally, a meteorological radiosonde is launched twice a day to examine the state of the atmosphere. With this information is possible to understand the presence of instability and improve the weather forecast for the next 24 hr.

2.4. DESCRIPTION OF NUMERICAL WEATHER PREDICTION MODELS

The meteorological modeling in Turkey is centralized in the Ankara city. There are processed the meteorological data from the automatic stations and are run different NWP models to generate 5-day forecasts. Below are described all the models used in Turkey:

- *Integrated Forecast System (IFS/ECMWF):*

  It is the European operational global meteorological forecasting model used to generate the initial data for the other models. The model runs every twelve hours and has a horizontal resolution of 16 km. It describes the atmosphere processes to Europe, part of Middle East and north of Africa.

- *Weather Research and Forecasting Model (WRf):*

  This American model is a next-generation mesoscale numerical weather prediction system designed to serve both atmospheric research and

operational forecasting needs. The Turkish State Meteorological Service runs the model with a horizontal resolution of 7 km.

- *Fifth-Generation Penn State/NCAR Mesoscale Model (MM5):*

  It is a regional mesoscale model used for creating weather forecasts and climate projections. It is a community model maintained by Penn State University and the National Center for Atmospheric Research. The Weather Research and Forecasting model (WRF) was designed as the successor to MM5 and includes all capabilities available within the MM5. The model has a horizontal resolution of 7 km and gives hourly precipitation outputs.

- *Aire Limitée Adaptation Dynamique Développement InterNational (ALADDIN/ALARO):*

  The goal of the ALADIN is to improve the value of the meteorological, hydrological and environmental warning and forecast services. This NWP system is capable of resolving horizontal scales from the meso-beta to the meso-gamma scale and improving the prediction of severe weather phenomena such as heavy precipitation, intensive convection and strong winds. The model has a horizontal resolution of 7 km and gives outputs every six hours.

- *ECMWF Ensemble Prediction System (EPS):*

  Ensemble Prediction Systems (EPS) are numerical weather prediction (NWP) systems that allow us to estimate the uncertainty in a weather forecast as well as the most likely outcome. Instead of running the NWP model once (a deterministic forecast), the model is run many times (51 outputs) from very slightly different initial conditions.

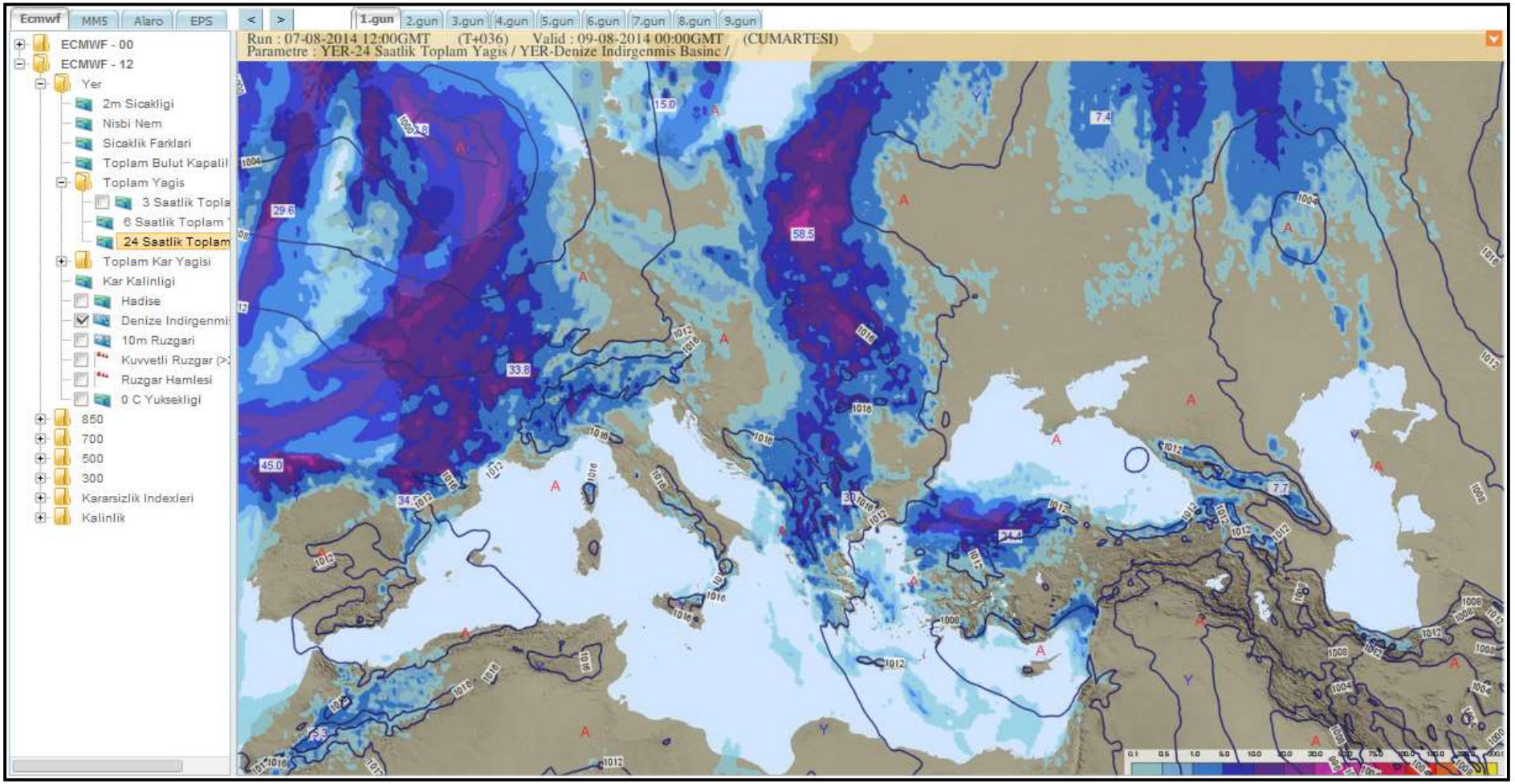

Figura 5. Example of the IFS (ECMWF) model output.

2.5. VISIT TO THE AIRPORT SABIHA GÖKÇEN

Sabiha Gökçen Airport was opened on 8 January 2001 and became the first privately operated airport of Turkey. The airport is located on the Anatolian side of Istanbul in Pendik/Kurtköy, at a distance of 40 km to Kadıköy, 12 km to Pendik and 50 km to Taksim. It was established as the first stage of 6 main elements of Technocity, which would be developed as a "Center of Perfection" within the framework of "Advanced Technology Industrial Park and Airport Project" (İTEP) prepared by Undersecretariat for Defense Industries.

Figure 6. Sabiha Gökçen Airport.

The airport has a meteorological service office to improve safety and efficiency of air traffic, in concordance with the international regulations. For this purpose, this office work every day of the week, 24 hours a day.

There was established two stations at airport ends to measure the speed and wind direction, and a station at the middle of the airport to measure minimum and

maximum temperatures, dew point, relative humidity and atmospheric pressure. About cloud cover and visibility measures, they are done by an observer, which reports all parameters every 30 minutes to pilots through METAR codes.

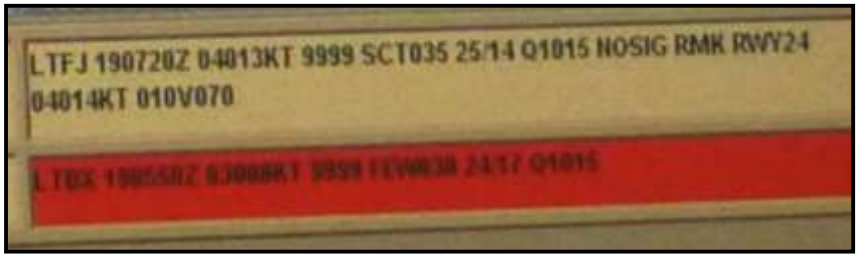

Figure 7. METAR code for the Sabiha Gökçen Airport on 19 July 2014 at 07:20z.

The METAR code includes the next information:

- Airport code.
- Date and hour of observation.
- Speed and wind direction.
- Visibility.
- Height and cloud cover.
- Air temperature and dew point.
- Atmospheric pressure.
- Expected weather for the next 2 hours (trend).

3. EVALUATION AND CONCLUSION

- The Istanbul Regional Directorate of Meteorology has modern systems and equipment like automatic stations, radar, satellite data and radiosonde monitoring.

- Models used by IRDM give forecast with high precision. The most suitable model for this region is the global model IFS/ECMWF.

- In addition to the models, are used satellite and radar observations to improve the short-range weather forecasting.

- At the Istanbul Regional Directorate of Meteorology, the meteorological observations are done every hour, and at the airport every 30 minutes.

- On weekdays, a briefing is carried out, where forecasters from the 15 regions discuss and constitute a general forecast for different periods for whole territory of Turkey.

- Every day at 00z and 12z a meteorological radiosonde is launched and are constructed upper air charts.

- Sabiha Gokcen International Airport provides meteorological reports to the pilots in METAR code format. Systems and equipment at the airport are of high level.

- We recommend all students of RSHMU to develop a practice in the Istanbul Regional Director of Meteorology.

4. ACKNOWLEDGEMENTS

The authors wish to thank staff of the Turkish State Meteorological Service at the Istanbul Meteorological Directorate of Meteorology for the assistance and cooperation, especially to Director Ergun Guller, Emine Gunseli Ozgul, Abdullah Kahraman.

Our sincere thanks also go to Mrs. Anna Kanukhina and Mrs. Maria Mamaeva at the International Relations Office of RSHU for doing everything necessary to carry out this practice in Turkey.

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ANNEXES

Facilities of Istanbul Regional Directorate of Meteorology

ANNEXES

Meteorological Station at Istanbul Regional Directorate of Meteorology