

CRISIS management in the forecasting department of Croatian Met service: COVID-19 and Zagreb Earthquake

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Introduction

A major earthquake (5.5 on the Richter scale) hit Zagreb, the capital of the Republic of Croatia, on 22 March at 6.24 a.m. Soon afterwards there followed another earthquake (5.0 on the Richter scale) at 7.01 a.m. The headquarters building of the Croatian Meteorological and Hydrological Services (DMHZ), dating from the 17th century, where meteorological measurements began on December 1st 1861, was severely damaged (Figure 1). Luckily, nobody was hurt in the incident. All employees on duty (forecasters, technicians and IT support) had to evacuate the building so after the earthquake only the automatic weather station Zagreb-Grič (WMO 14236) was left to continue measuring the temperature, wind and humidity. Since structural engineers have estimated that the building would be unsuitable for further use, all the work is being done from ad hoc offices established at the homes of employees until a new space is secured. The computer infrastructure will remain in the building until a step-by-step relocation can occur.

Forecasting from home and provisional offices

On Sunday March 22nd the forecasting activities were briefly interrupted, which we reported to the public as quickly as possible via Twitter (Figure 2). Thanks to the preparations following the COVID-19 epidemic it was possible to continue the work from employees' homes, using various remote protocols to reach the servers and display the operational working environment. After the call for help to other colleagues, several of whom responded very quickly, almost all the daily duties had been completed. Only a few radio reports were not compiled and broadcasted, but even that part of the work was resumed later in the day in spite of further tremors, power and internet outages.

Operational work in the Forecasting office is performed on several IBL Software Engineering Visual Weather working stations (VW) and associated servers but the working tasks depend also on other servers. This makes it very difficult to work from home since only one server can be



▲ Figure 1. Headquarters of Croatian Meteorological and Hydrological Services after the earthquake (source: DHMZ)

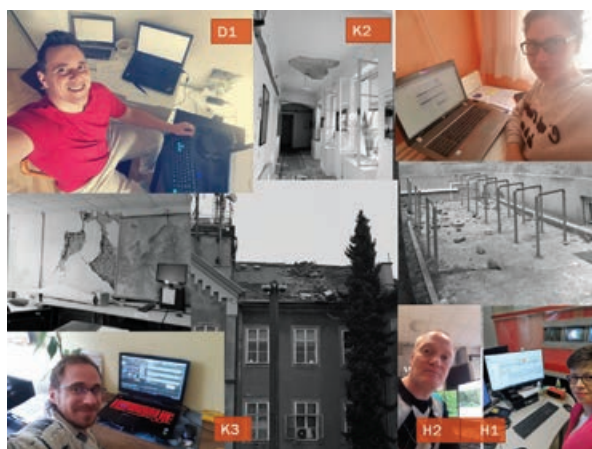
reached from the external network at the time. There has also been a constant fear that the computer infrastructure would not survive due to the extensive damage to the building. Moreover, the working conditions were additionally limited due to numerous restrictions due to COVID-19, such as travel restrictions, physical distancing etc. In the days that followed a great effort was undertaken

to ensure a continuous and complete operation of the forecasting service (Figure 3). Some tasks were temporarily suspended, but this was indeed a minimal reduction (e.g. we stopped creating the surface synoptic maps for the web etc.). Radio reports that we normally provide to the national radio network (HRT) and local stations have now been limited to national radio only. At the same time, the presentation of weather forecasts on national television continued with almost the usual content. Most of the communication between forecasters has been via Slack, WhatsApp and Viber. For internal meetings and daily briefings (Figure 4) we have used Google Hangouts. This has enabled us to virtually socialize, thereby giving us the needed satisfaction in challenging times.

The quest for new office space for the entire Service was started immediately by the Director General, however, the more urgent need for a provisional location of the Forecasting office was given priority. A solution was found within a fairly short time in the Service's complementary building at another location which has the Service's local LAN and all the data available. VW workstations were moved, reconnected and almost usual operations were resumed, at least for chief forecaster on duty (Figure 5). This has brought comfort and hope to the exhausted forecasters who, owing to the harsh conditions, had to support and encourage each other daily. It must also be emphasized that in spite of these difficulties the commitment to work has never been greater. Notwithstanding the very limited facilities, which usually meant using only one monitor and unreliable internet connection, the accuracy of the forecasts was high, as shown by the verification of the temperature forecast in Figure 6.



▲ Figure 2. A post on Twitter describing possible occupational difficulties after the earthquake.



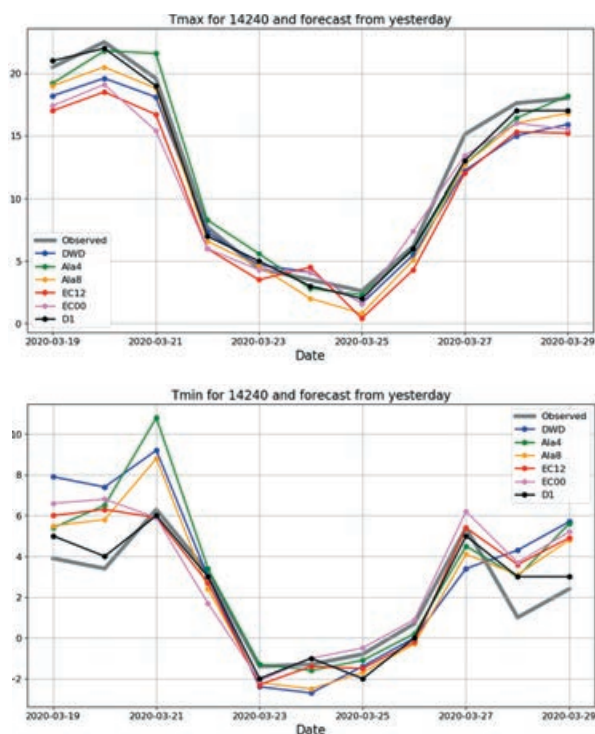
▲ Figure 3. Forecasters on duty working from home on the World meteorological day 23rd March 2020., only one day after the earthquake. (Thanks to Izidor Pelajić)



▲ Figure 4. Daily briefing of forecasters



▲ Figure 5. Provisional Forecasting office in the complimentary building. (photo: Ivana Havrle Kozarić)



▲ Figure 6. Verification for Tmax and Tmin for Zagreb in the period from 19-29 March 2020 (Thanks to Tomislav Kozarić)

Second critical phase of the disaster management was relocation of the remaining computer servers from the damaged building to the complimentary building and establishing a temporary parallel network. Although a 2 hour partial disruption was planned for, unfortunately a total blackout lasted for almost 24 hours, causing the forecasters to briefly activate the worst case (so called “guerilla”) scenario: sending forecasts by email, manually uploading xml’s for the official website, loading the MeteoAlarm web page through its very rudimentary intranet interface etc. For a time the emails were shut down, so an alternative email group was activated and although the Service’s web page was mostly unavailable or severely dysfunctional all the forecasts were still uploaded properly and on time. During this period even the on-line amateur observation network was used.

European Weather Cloud and new Service premises

Although this low and medium-end approach was planned and performed successfully through the whole crisis, another high-end enterprise has been initiated in parallel as a potential backup alternative. Intensive actions have been undertaken to migrate the existing forecasting Workstation to the

European Weather Cloud (EWC). Thanks to quick and devoted help from ECMWF, EUMETSAT and IBL experts, most of the operational environment and functionality was reconstructed in the Cloud using several Virtual machines. Although so far it has not been needed operationally this presents a pioneering achievement and we hope it will remain a strong backup solution for any possible further crisis. During this crisis the operational NWP suite (Aladin HR) has been successfully migrated to the EWC also.

At the time of writing, new appropriate premises for the Service have been arranged for lease. It is still not officially approved by the Government, but we expect to move within a few weeks. Relocating and designing the new operational office will present another challenge, particularly with restrictions due to COVID-19, but with experience from this crisis we are very optimistic and look forward to new and improved working conditions.

Conclusion and Summary

Ultimately this whole situation made us think about managing risks and developing better defined protocols and solutions that would help us overcome extremely difficult and unpredictable situations such as this one, which was a combination of COVID 19 epidemic and earthquake in the capital city. Fast and organized flow of information turned out to be crucial but also suffered greatly immediately after the earthquake. In addition to mutual understanding, a good organization often depends on only a few key people and this case proved to be no exception to that rule. Our experience is that it is necessary to define a working group that would systematically and calmly coordinate certain procedures and maintain cooperation between different departments within the Service as well as towards other state institutions. Solutions such as EWC will have a greater importance and can provide necessary technical independence, so more emphasis should be put on projects like this. DHMZ would like to express our gratitude to ECMWF, EUMETSAT and IBL which responded promptly to our requests for help and provided us with technical, IT and human assistance as soon as possible.