TRUSTED SPOTTER NETWORK AUSTRIA – NEW DEVELOPMENTS AND APPLICATIONS AT ESWD

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I. INTRODUCTION

The TRUSTED SPOTTER NETWORK AUSTRIA (TSN) constitutes the collaboration between the Austrian meteorological service ZAMG (www.zamg.ac.at), SKYWARN AUSTRIA (www.skywarn.at) and the ESSL (European Severe Storms Laboratory) with its EUROPEAN SEVERE WEATHER DATABASE ESWD (http://www.eswd.eu).

A “trusted spotter” is a member of SKYWARN AUSTRIA, providing reports about significant or severe weather and consecutive damages to the Austrian national weather service ZAMG. With TSN the reliability of the information for operational forecasters had been improved significantly.

For this purpose ZAMG offers an individual training program, regular workshops and scientific support. This program for collaborating TSN spotters and storm-chasers seems to be unique among European national weather services. It also consists of job-shadowing, which is obligatory for each individual TSN member and is following a comprehensible and standardized procedure provided at every regional centre in Austria.

Further, the activity of a “trusted spotter” is facilitated by real time weather information from ZAMG, easily accessible via the internet.

Additionally, a web based, real time platform allows displaying ESWD data base reports for the operational forecaster at ZAMG (FIG.1). These reports are strictly following the ESWD data format and threshold guidelines.

A trusted spotter is only allowed to give information from personal experience, secondary or forwarded information should be excluded. Therefore, reports from “trusted spotters” are accepted by ESWD with the higher QC1 clearance.

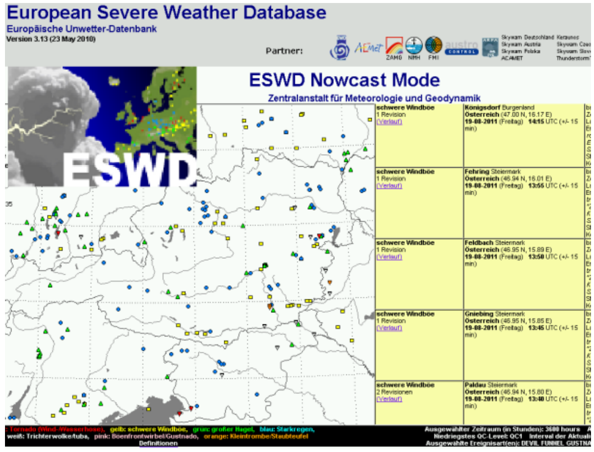

FIG. 1: Real time nowcasting platform for the operational ZAMG forecaster.

In order to use available potential for further collaboration between ZAMG and Skywarn Austria a joint web page for extreme weather reports was constructed. In this way, ESWD criteria are now also applied for reports from the general public.

The operational forecaster is now able to rely on weather information from TSN in real time to evaluate and verify warnings during severe weather periods and to conduct adjustments to warnings if necessary. Joint case studies can be swiftly released to the public.

Within the framework of a short term ZAMG project during the year 2012 the frequency of reports in ESWD according to heavy or extreme precipitation was investigated in relation to measurements with the ZAMG climate station network in Austria.

The presented results allow first conclusions about the growth, development and performance of the Trusted Spotter Network Austria.

II. PRESENTATION OF RESEARCH, METHOD

In this investigation, realized at ZAMG, the daily and hourly datasets of the ZAMG climate stations were used as a first dataset (see station network in FIG. 2 below).

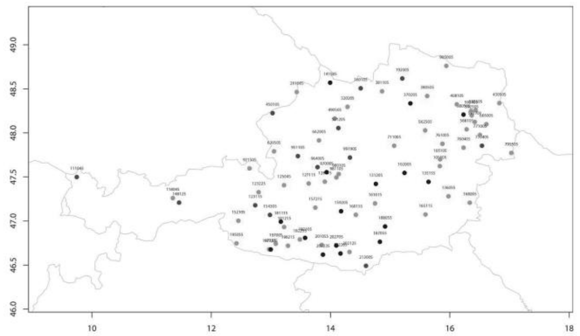

FIG. 2: Selected set of ZAMG Climate stations in Austria, used for the investigation.

To be used for the study, the stations had to fulfill the following criteria:

*) Data availability for at least 15 years
*) A 70% consistency between the sum of the hourly precipitation data of the station and the daily total precipitation value

Differences between hourly and daily precipitation data can occur if the daily data was corrected by the data quality control. This correction is taken into account for all the coarser timely resolutions (e.g. monthly values), but not in the hourly resolution. Therefore the hourly data was adjusted towards the daily values. In this respect the quotient of the daily precipitation amount and the sum of the hourly measurements was calculated and used as an adjustment for the hourly values.

To use the station data for long term climatological analyses, the same series of daily precipitation data had to be homogenized because of inconsistencies in the data sets (e.g. caused by station relocation)

For these series a second adjustment was based on the quotient of homogenized and original daily values.

As minimization criteria for heavy precipitation a precipitation amount of more than 40mm within 6hrs has been chosen (see also e.g. Wussow, 1922).

For Austria this corresponds to precipitation events with a 5 year return period. Due to the length of the hourly data series the applied investigation period (2000-2010) seems to be an appropriate choice of time scale.

In order to distinguish two separate precipitation events a dry interval of at least 6 hours is chosen in order to avoid large precipitation sums over longer time periods with no importance for the applied thresholds.

Additionally, overlapping precipitation events from different stations where used as one event starting with the first time step of the station with the earliest data and ending with the last time step of the station with the latest measurement.

The European Severe Weather Database (ESWD) is used in the investigation as a second dataset, using its observations and reports of extreme weather events (here precipitation).

The criteria for a report of heavy precipitation event in ESWD are defined as following:

*) Flooding of several streets, roads, cellars and agricultural properties
*) Significant economical damage (i.e. long time road closure, agricultural damage)
*) Damage from resulting flashfloods and mud slides
*) Extreme precipitation rates at a calibrated weather station (e.g. ZAMG)

The ESWD data base is open to public reports including date, location, type of event and additional information (e.g. intensity and type of damage). The main task of ESWD is to collect detailed and high quality information on extreme weather events. The uniform data format valid for all European reports and the web based freely accessible user interface (www.eswd.eu) is so far unique among comparable facilities.

Since not all of the meso- and small scale damage-producing-events can be observed by the national weather- and climate station networks, the increased recognition and reporting efficiency from ESWD offers additional sources for e.g. climatological analyses of extreme weather events all over Europe.

This is possible through the collaboration between the interested public, spotter communities and the national weather services. The reports can be filed to the database independently from the time of occurrence of the event.

In order to correlate locations of the ESWD reports and the respective ZAMG climate stations, precipitation events fulfilling the above defined thresholds were divided into 3 different classes within a common time period for observation and measurement:

*) X – Type: ESWD report and precipitation measurement within 30km distance. This type provides a correlation between report and measurement for mesoscale – e.g. convective precipitation events.
*) M – Type: ESWD report and precipitation measurement within 300km distance. Representative for large scale / synoptic scale events (e.g. Adriatic low pressure system).
*) O – Type: distances exceeding thresholds.

The image below (FIG. 3) shows the mean number (per month) of heavy and extreme precipitation events regarding the data source. Naturally, the functions represent the average amount of precipitation at an Austrian weather station with their respective maxima during the summer months. A high share of convective precipitation within the analyzed events can be assumed from this information.

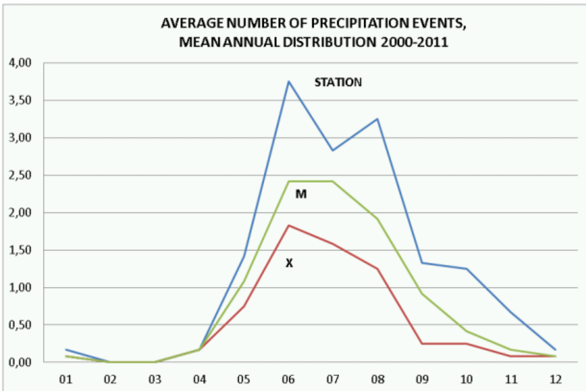

FIG. 3: Mean annual distribution of precipitation events derived from station data and ESWD reports (X and M Type) between 2000 and 2011.

The investigation starts from the year 2000, since the number of ESWD reports has grown into reasonable proportions. During the analyzed period between 2000 and 2011 the annual distribution of ESWD reports shows distinct variations (FIG. 4).

Due to the increasing use of ESWD and the growing number of reports also the hit rate was increasing, in total about 1416 ESWD reports were connected to 392 station measurements.

The trend of ESWD hits for observed heavy precipitation can be seen in FIG. 4. All class types show similar trends for the respective years.

The first peak could be related to the severe flooding event during August 2002. The hit rate increases between 2006 and 2010, the curvature represents the increasing activity among the spotter and chaser community in Austria.

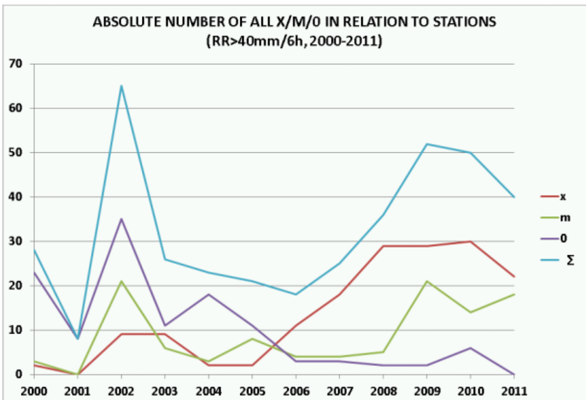

FIG. 4: Annual absolute numbers in relation to data and ESWD reports (X, M and 0 Type) between 2000 and 2011.

III. RESULTS AND CONCLUSIONS

FIG. 5 shows the temporal delay of ESWD entries in Austria during the investigated period. It may be concluded, that only very few reports are sent to the data base during an active chase or within a few hours after the individual observation of an extreme event. Most entries will follow the day after and a week after the event, respectively.

Fewer will be uploaded to the data base at least after a year. Only a small amount of Austrian reports will originate from historical studies (most probable by ESWD quality control or scientific projects).

For the future, activities between ZAMG and TSN aim towards a significant increase of the number of real-time reports.

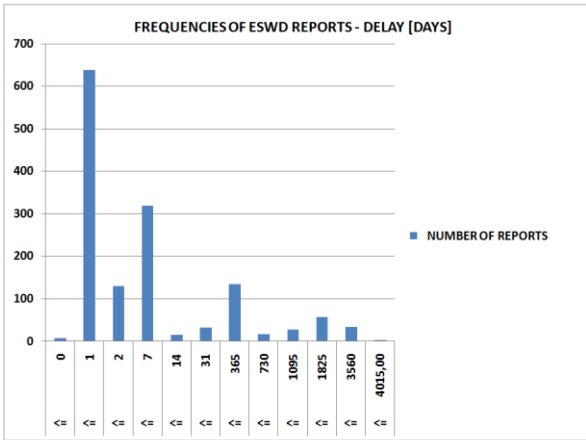

FIG. 5: Time lag between reported severe weather event and generating the DB-entry (for 1416 analyzed events, 2000-2011)

The distribution of the ESWD entries regarding the quality clearance is shown below (FIG. 6).

The quality levels of the ESWD data base can be distinguished as:

.) QC0: as received
.) QC0+: plausibility check passed
.) QC: report confirmed
.) QC2: event fully verified

Reports with QC0 can be related to reports from the public, whereas Reports with QC0+ originate from spotter organizations (i.e. SKYWARN AUSTRIA or others). This group represents individuals who will supply ESWD on a regular basis.

Reports with QC1 can be allocated to individual observations from the Trusted Spotter Network Austria and to members from ESWD quality control, the latter with the majority of entries. This fact is also fitting to the large number of entries which are delayed 1 to 7 days.

Only a small portion of reports is fully verified.

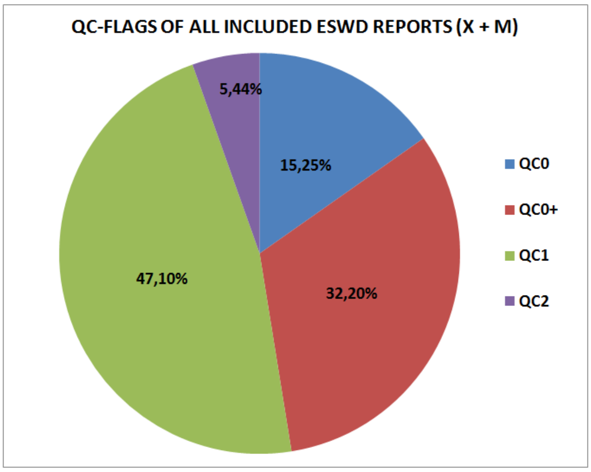

FIG. 6: ESWD QC- Flags of all hits between 2000 and 2010

The distribution of the ESWD QC flags for the period of investigation (FIG. 7 below) shows the distinct change in the quality of the reports between 2004 and 2011. The sustainable decrease of QC0 is related to increase of reports from higher QC. The peak of reports from spotter organizations (QC0+) around the years of 2006 and 2007 can be related to the increase of activity during this time.

From the year 2008 the formation of TSN (QC1) can also be related to the peak during the following years. The second reason would be the increasing activity of the quality control group within ESSL during this time.

So far, there is no reasonable explanation for the trends in 2011.

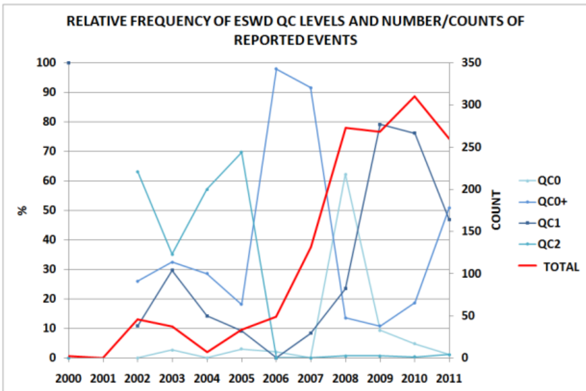

FIG. 7: Temporal distribution for ESWD QC-flags

In the last plot (FIG. 8) the development and growth of spotter organizations contributing to ESWD and the Trusted Spotter Network Austria can be seen clearly. The blue line represents the decline of events, measured at ZAMG stations but not reported to ESWD.

During the same period the increase of the red line, representing both X-type and M-type of observations can be related to the growth of the number of members of TSN and spotter organizations, the increased accuracy of the observations (green curve) and the augmented motivation of all involved persons to contribute to ESWD. The M-type stays at a lower level during the whole period.

Finally, in the year 2011 the red line approaches a ratio of about 100% of reports for heavy/extreme precipitation larger than 40mm/6hrs. In other words, during the investigated period 2000 – 2011 nearly every event measured by the ZAMG climate station network with the applied criteria is individually observed and reported to ESWD.

In this respect it can be assumed, that the current collaboration between ESWD, spotters and ZAMG represents a solid foundation for further developments.

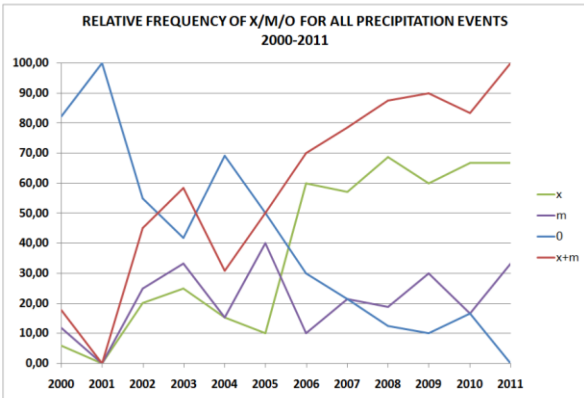

FIG. 8: Relative frequency of all types and their summation for the investigation period

IV. REFERENCES

Wussow, G., 1922: Untere Grenze dichter Regenfälle. *Meteorologische Zeitschrift*, 39, 173–178

V. ACKNOWLEDGMENTS

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