

ANNUAL REPORT 2015



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About the Laboratory

The *European Severe Storms Laboratory e.V.* (ESSL) was founded as a private, non-profit research organisation in December 2006. It is a spin-off of German Aerospace Centre DLR in Oberpfaffenhofen, and relies on the expertise of its international team. The ESSL office is located at the DLR-Institute for Atmospheric Physics.

In Europe, severe thunderstorms inflict an estimated annual damage of about 5 billion euro and lead to dozens of fatalities. ESSL's mission is to make Europe more resilient to severe weather. It does so by

- Performing fundamental and applied research on severe convective storms in Europe;
- Operating the European Severe Weather Database, ESWD;
- Organizing the European Conferences on Severe Storms, ECSS.

ESSL closely cooperates with its Austrian subsidiary *European Severe Storms Laboratory – Science & Training*, which pursues similar goals and operates the Research and Training Centre, which is the venue of various seminars, workshops and the ESSL Testbed.

1 Introduction

This is the ESSL Annual Report of 2015, a year in which ESSL's greatest highlight was arguably the European Conference on Severe Storms organized in Wiener Neustadt, one of ESSL's two hometowns. Almost 200 people from around Europe and the world visited Lower Austria to exchange the latest severe weather research results during five days in September. The conference was praised by many for its high scientific level.

Other highlights include the launch in December of an app to collect weather reports from the general public, the European Weather OBserver or EWOB app, with which ESSL aims to improve the collection of severe weather data to benefit ESSL's European Severe Weather Database, forecast verification efforts and near real-time information collection on weather hazards.

Regarding severe weather, 2015 was again an interesting year. Rather close to ESSL's home bases a number of intense tornadoes occurred. Three tornadoes classified as F3 occurred in May in Germany, and ESSL conducted a survey of a particularly intense tornado on 8 July in Northern Italy jointly with the regional weather service ARPA-Veneto and with ZAMG, which it classified as F4. This tornado fortunately occurred right between the two major cities of Padua and Venice, so that the number of fatalities was quite low (3). During the entire year no fewer than 13 449 new reports of severe weather were made into the ESWD, which is a new record number.

Regarding research, ESSL saw the continuation of work for the projects RAIN and STEPCLIM. For the EU-funded project RAIN, ESSL organized a workshop jointly with the Free University of Berlin in February, which dealt with the identification of the impacts of severe weather on critical infrastructure, and lead-authored two reports. Among other things, ESSL reported on interviews performed with critical infrastructure managers and weather services in order to find where the bottlenecks in their joint handling of severe weather lie.

For STEPCLIM, ESSL continued its work on the assessment of the decadal climate forecast system developed within the overarching research programme MiKlip. Within that project, a statistical model to derive the probability of severe weather from climate models has been developed, which has a great potential for being used in upcoming projects dealing with forecasts on various timescales as well as reanalyses. The STEPCLIM project is continued in a second phase in 2016.

Besides these third-party funded projects, ESSL has carried out another edition of the ESSL Testbed, during which it again welcomed forecasters and researchers from throughout Europe. A highlight of the Testbed 2015 was the work on high-resolution numerical models from MeteoSwiss along side those of DWD, which enabled a comparison of the different model configurations. An important aspect of the Testbed, besides the evaluation of forecast-supporting products, is forecaster training. In 2015, forecaster trainings were additionally offered in two expert courses by Drs. Johannes Dahl and Charles Doswell.

Furthermore, ESSL conducted research on the topics of the environmental conditions of severe thunderstorms, on the climatology and the conditions leading to tornado outbreaks and on the probability of lightning.

Financially, 2015 was an improvement after the very poor situation in 2014. The main difference was caused by the fact that another large project (RAIN) has started in 2014. In addition, two new institutional members could be welcomed. That said, the situation was still far from good. This situation is, as it always has been, caused by the lack of means to cover its overhead costs, such as accounting and secretarial work, rent, electricity and office equipment. This is why it will continue to be a priority of ESSL to find new members and data users, as well as funded tasks and responsibilities less transient than projects with a 3-year duration.

Having said this, I believe that with the limited available means, ESSL has again provided many great results in 2015, which are detailed in this report. That is why I am happy to present you this Annual Report, which constitutes a review of ESSL's achievements in its ninth full business year.



Pieter Groenemeijer
ESSL Director

Weßling, 17 May 2016

2 Severe Weather Data Collection

An important resource for scientific research into severe storms are “ground-truth” observations of severe storm events. The central theme of many research projects carried out at ESSL and elsewhere is to combine these with other data, such as data from remote sensing systems or numerical models is. Furthermore, they are important for the verification of severe weather forecasts and warnings. Therefore, ever since ESSL was founded, it has put much effort into the collection of such observations in collaboration with networks of voluntary observers throughout Europe. In 2015, ESSL launched a new initiative to collect even more reports through crowd-sourcing by means of its App called EWOB (European Weather OBserver), the deployment of which will continue through 2016.

2.1 The European Severe Weather Database

The operation and extension of the European Severe Weather Database (ESWD) is one of ESSL’s three statutory purposes. The ESWD has already been used in many dozens of peer-reviewed studies. Members of ESSL can obtain access to the ESWD (*see: ESWD Data Policy*).

ESWD data use and user support

The studies for which the ESWD is used include investigations of the severe weather, climate and risk assessment, as well as forecasting and calibration of new radar and satellite detection techniques. The ESWD is also used for forecast verification at various weather services and at the ESSL Testbed.



ESWD Data Policy

ESSL provides ESWD data free-of-cost to individual academic scholars who carry out small studies, but will request a contribution for data usage within large or (partly) commercially-funded projects. This contribution serves to cover ESSL’s expenses for the collection and quality-control of the data and to finance further database enhancements. The preferred form of contribution is a multi-year supporting membership of ESSL, which includes ESWD access as a benefit.

Development of ESWD data in 2015

In 2015, the ESWD was expanded by 13,449 new severe weather reports, which is a **new record** for the number reports added to the database in any single year (Figure 2.1). The majority of reports that was collected in 2015 consisted of severe wind gusts (7855 reports; 58.4 %), followed by heavy rain (1978 reports 14.7 %) and large hail (1960 reports; 14.6 %). The absolute number of reports in the ESWD up to 2015 exceeded **95,000**.

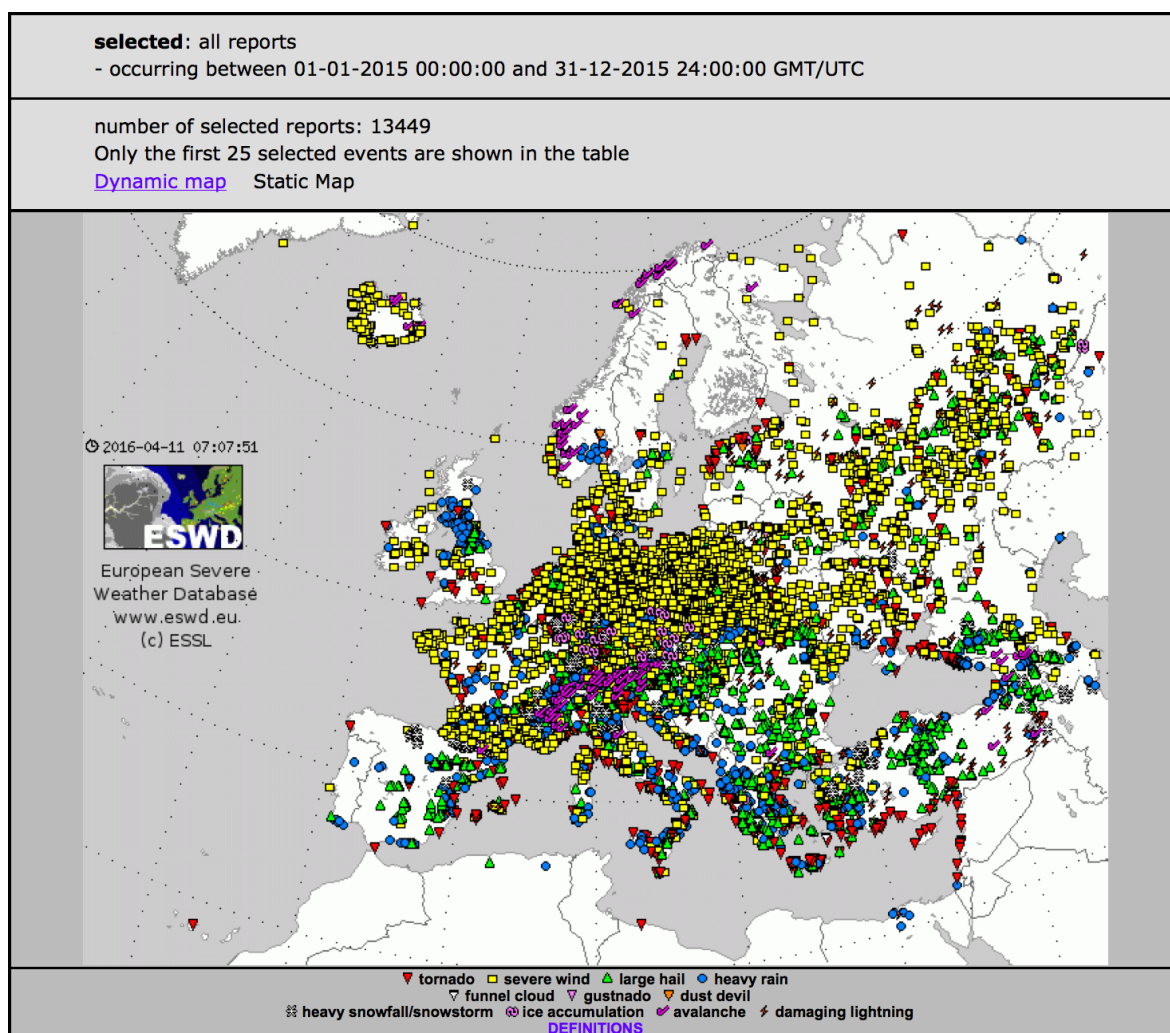


Figure 2.1. All 13449 ESWD reports of events occurring in 2015. Numbers as of 11 April 2016.

The absolute numbers and percentage in terms of weather type are listed in

Table 2.1. Number of ESWD reports for the year 2014 per severe weather type.

<i>Event Type</i>	<i>Number of reports</i>	<i>Percentage</i>
tornado	508	3.8
severe wind gust	7855	58.4
large hail	1960	14.6
heavy rain	1978	14.7

funnel cloud	8	0.1
gustnado	4	0
dust devil	27	0.2
heavy snowfall	254	1.9
ice accumulation	34	0.3
avalanche	174	1.3
damaging lightning	647	4.8
Total	13449	100

. All reports of 2014 have passed the first quality control level QC0+ and 91% are considered “confirmed by reliable sources”,

i.e. QC1 or higher and thereby usable for most types of analyses (Table 2.2).

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Table 2.2. Number of ESWD reports in 2015 per Quality Control category.

<i>Quality Control level</i>	<i>Number of reports</i>	<i>Percentage</i>
QC0 , as received	0	0
QC0+ , plausibility checked	703	5.2
QC1 , report confirmed by reliable sources	12437	92.5
QC2 , event fully verified	309	2.3

ESWD Partner Network

During 2014 and 2015 ESSL has put much effort in formalizing its cooperations with partners who contribute data to the ESWD. They include weather services that have concluded an Agreement upon becoming full members, but also many nationally-organized associations. These associations, sometimes called Skywarn, have members with a high interest in severe weather and typically organize storm spotter courses. Jointly, we call them Voluntary Observer

Networks (VONs). Furthermore, some partners of ESSL are individuals who are not a member of any association, or Voluntary Observer Persons (VOPs). By signing a Partner Agreement, VONs and VOPs agree that they will report any severe weather without delay to the ESWD. On the 31st December 2015, ESSL has terminated informal collaborations that were not based on an agreement. The Partner network consists of:

National Weather Services:

- Central Institute for Meteorology and Geodynamics – ZAMG (Austria)
- Czech Hydrometeorological Institute – CHMI (Czech Republic)
- Deutscher Wetterdienst – DWD (Germany)
- Finnish Meteorological Institute – FMI (Finland)

- Institute for Hydrometeorology and Seismology of Montenegro – HMZCG (Montenegro)
- Meteorological and Hydrological Service – DHMZ (Croatia)
- National Meteorological Administration – NMA (Romania)
- Slovak HydroMeteorological Institute – SHMU (Slovakia)

Voluntary Observer Networks:

- SKYWARN Polska (Poland)
- Czech Thunderstorm Research Association – CTRA (Czech Republic)
- Amateur Meteorological Society – AMS, former Skywarn CzechoSlovak (Czech Republic)
- Asociación ACAMET (Spain)
- Associazione ONLUS MeteoNetwork (Italy)
- SKYWARN Austria (Austria)
- SKYWARN Deutschland (Germany)

Voluntary Observer Persons (VOP)

- Stavros Dafis (Greece)
- Mario Sekulić (Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, Serbia and Kosovo)
- George Papavasileiou (Greece)
- Marko Korošec (Slovenia, Croatia)
- John Teunissen (Netherlands)
- Konstantin Kazakov (Belarus, Russian Federation, Ukraine)
- Mathias Stampfl (Austria)
- Darian Martens (France)
- Christophe Valois-Barthe (France)
- Manuel Oberhuber (Austria, Italy)
- Mr. Massimo Enrico Ferrario (Italy)
- Mr. Ruben Hallali (France)
- Mr. Abdullah Kahraman (Azerbaijan, Cyprus, Turkey)

2.2 EWOB - European Weather OBserver



In December 2015, ESSL has launched a free app to collect every day weather reports. EWOB users are able to get an idea of how the weather nearby is behaving and are aware early when severe weather approaches. At the same time, individuals can support researchers and weather

forecasters as well as other interested parties.

For ESSL, an important goal of EWOB is to add information to the European Severe Weather Database (ESWD). In contrast to EWOB, ESWD is a quality-controlled database and EWOB reports can be checked manually for quality and be added to the

ESWD. To find the app, search simply for „EWOB“ in Google Play or in the App Store. EWOB is available for Android and iOS.

In 2016, ESSL will fix a number of bugs and translate the app to a large number of languages with the help of volunteers from its network. As new translations become available, they will be promoted intensively in individual countries.

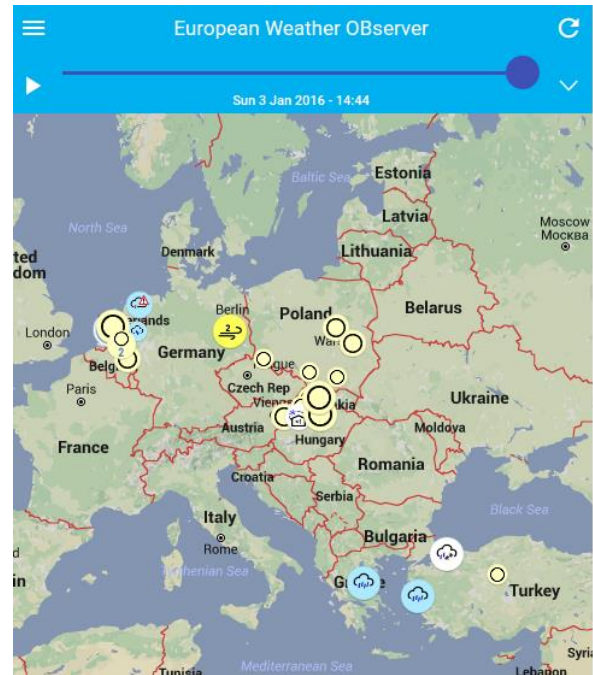


Figure 2.2. EWOB “screenshot”.



Figure 2.3. EWOB advertisement.

3 Severe Weather Research

3.1 Severe Thunderstorm Predictability in CLimate Models (STEPCLIM)

Funded by: German Ministry of Education and Research
Amount: EUR 389 000
Duration: November 2011 – December 2015 (4 years)
Subject: Severe thunderstorm evaluation and predictability in climate models
Project Website: <http://www.fona-miklip.de/en/350.php>



ESSL's first large multi-year third-party funded project STEPCLIM ended in December 2015. The project, part of the research programme MiKlip on decadal climate prediction, was funded by the German Ministry of Education and Research. In 2016, a second phase of the project starts.

Within MiKlip, ESSL has carried out a number of tasks. First, it evaluated the decadal forecasts produced by the MiKlip consortium with respect to their ability to correctly simulate parameters that are relevant for the occurrence of severe

thunderstorms (Fig. 3.1). Second, a statistical method was developed to derive the probability of severe weather occurrence from numerical models that are too coarse to explicitly simulate the storms themselves. Last, the European Severe Weather Database was enhanced with the purpose to optimize its use in climate studies, and a review of the level of inhomogeneity of the dataset was performed. As a corollary result, the first modern publication mapping the frequency of tornadoes in Europe was produced in 2014.

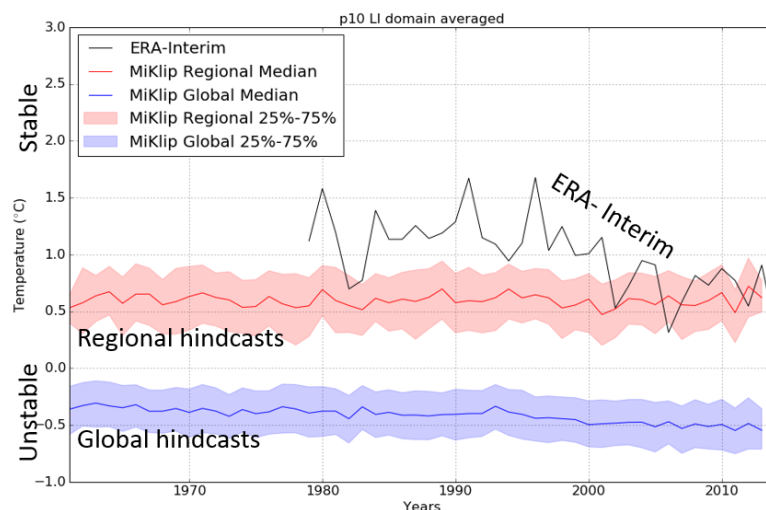


Fig. 3.1. Comparison of the 90th percentile Lifted Index, a measure of instability, between the global MiKlip decadal climate model, the regional (downscaled) model and reanalysis (ERA-Interim). Clear differences between the modelled parameters and their trends are evident, which require bias corrections in order to derive the severe thunderstorm probability.

3.2 The RAIN project: Extreme weather impact on critical infrastructure

Funding agency: European Commission
Grant: 327 720 euro
Personnel: 0.5 Researcher, 0.5 Researcher
Period: 1 May 2014 – 30 April 2017



Since May 2014, the ESSL is engaged in the FP7 EU-project RAIN in which it leads Work Package 2 on **Hazard Identification**.

ESSL has conducted a survey among European weather services and analysed the responses. In combination with the analyses of the project partners at the Free University of Berlin, the Finnish Meteorological Institute and the Technical University Delft a number of conclusions were drawn. For instance, the use of probabilistic forecasts is still open to improvement. It was also found that critical infrastructure operators are not very aware of some low-risk high impact events. The monitoring of such events, which include coastal floods, convective hazards and forest fires could be improved at a European level.



Fig. 3.2. Damage to suburban rail system.
Photo: Rainer Klute.

Furthermore, a potential was discovered for stimulating innovation regarding weather warnings for particular user groups, that could be driven by academics and other sectors, provided that more meteorological data, warning data and data on warning verification were to be made publicly available.

In addition to this work, the effects of climate change on severe weather using an ensemble of regional EuroCordex climate simulations are being investigated. Within this task, each of the partners in the RAIN project develops an analysis for their respective area of expertise, e.g. the Finnish Meteorological Institute concentrates on winter weather, the FU-Berlin on windstorms and heavy rainfall and TU-Delft with floods. ESSL deals with the projections of severe thunderstorm-related hazards.

The results of the RAIN Work Package 2 were published in two reports that have been approved by the European Commission. For these reports (see also the list of publications) and more background information on the RAIN project, please visit:

<http://www.rain-project.eu>

3.3 Study of environments of severe and (non-)severe thunderstorms in Europe

ESSL researchers Tomáš Púčik and Pieter Groenemeijer conducted an investigation of the environmental conditions of severe weather in Europe supported by David Rýva (Charles University Prague, and Czech Hydrometeorological Institute) and Miroslav Kolař (Masaryk University in Brno, Czechia)

The study used radiosonde measurements to characterize the environment of the severe and non-severe storms and intended

to identify predictors of severe weather. It was a continuation of earlier work of Tomáš Púčik, which he had carried out as part of his Master's Thesis at Masaryk University. The study was by far the largest of its kind in Europe and combined no fewer than 16421 soundings from central European countries with ESWD severe weather reports and lightning data kindly provided by the EUCLID network.

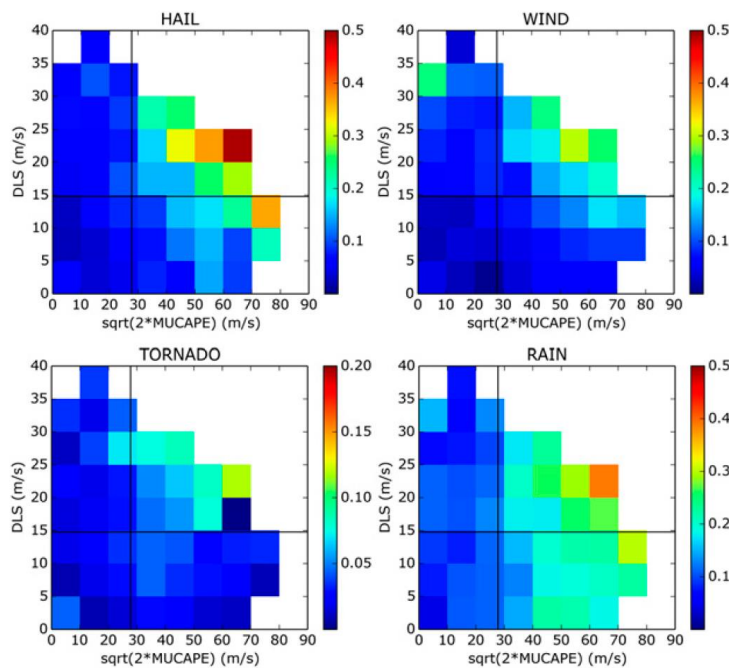


Fig. 3.3. Probability of severe (including extremely severe) as a function of most-unstable CAPE (MUCAPE) and 0 to 6 km above ground wind shear. From Púčik et al (2015).

The study revealed that CAPE (convective available potential energy) and wind shear between the surface and 6 km above ground are good predictors for hail, wind and for tornadoes. For hail, high CAPE is the most important of the two, whereas for wind gusts and tornado, wind shear is important. In addition, it was found that given a particular amount of CAPE and

deep-layer shear large hail is favoured by high cloud bases (LCL). For very heavy rainfall it was found that its probability is not influenced as much by wind shear as the other phenomena and that these events occurred when both low- and mid-tropospheric humidity was high. The results of the study have been published in *Monthly Weather Review*.

3.4 Modelling severe thunderstorm risk in collaboration with Munich Re

The ESSL team works together with Munich Re in a research effort to map the risk of convective storms in Europe and Germany. As a first step in this research, Anja Westermayer, who has worked in the ESSL team since January 2014, has studied influence of a number of environmental conditions on the probability of thunderstorm occurrence. A prominent

result was the strong dependence of the probability of storms on the humidity in the mid-troposphere. This finding, among others is used to develop a model to predict thunderstorm probability on the basis of reanalysis, climate model, and weather forecast model data in the project Analysis of the Risk of Convective Storms in Europe (ARCS) that will start in 2016.

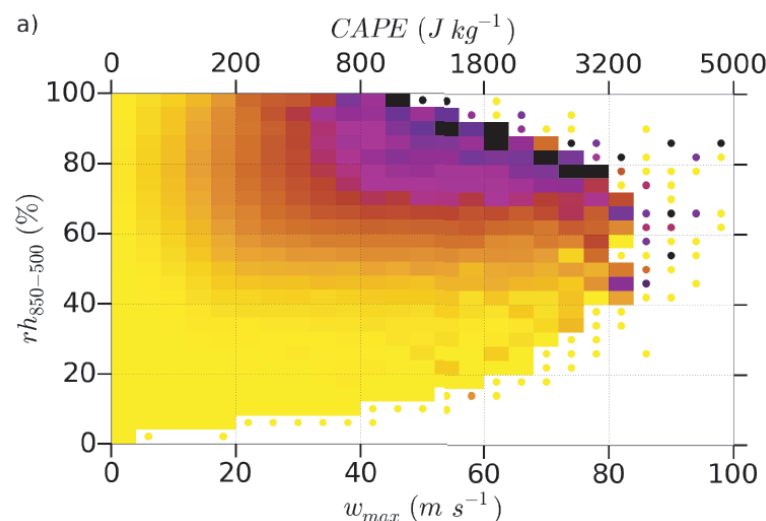


Fig. 3.4. Relative frequency of lightning for (a) CAPE and the average relative humidity between 850 and 500 hPa (rh850-500) in ERA-Interim. From Westermayer et al. (2016), accepted in *Meteorologische Zeitschrift*.

3.5 Study of tornado outbreaks in Europe

Since October 2014, Lars Tijssen from Utrecht University has worked at ESSL on an investigation of the occurrence of tornado outbreaks in Europe (Fig. 3.5), and the conditions under which these extreme events occur. Important questions he dealt with were how a workable tornado outbreak definition can be defined and how

the environments of tornado outbreaks can be characterized and compared to those of single tornadoes. Furthermore, he investigated the differences of the representation of these environments between two reanalysis data sets. After completing his M.Sc. research, he continued to work for ESSL for the project STEPCLIM.

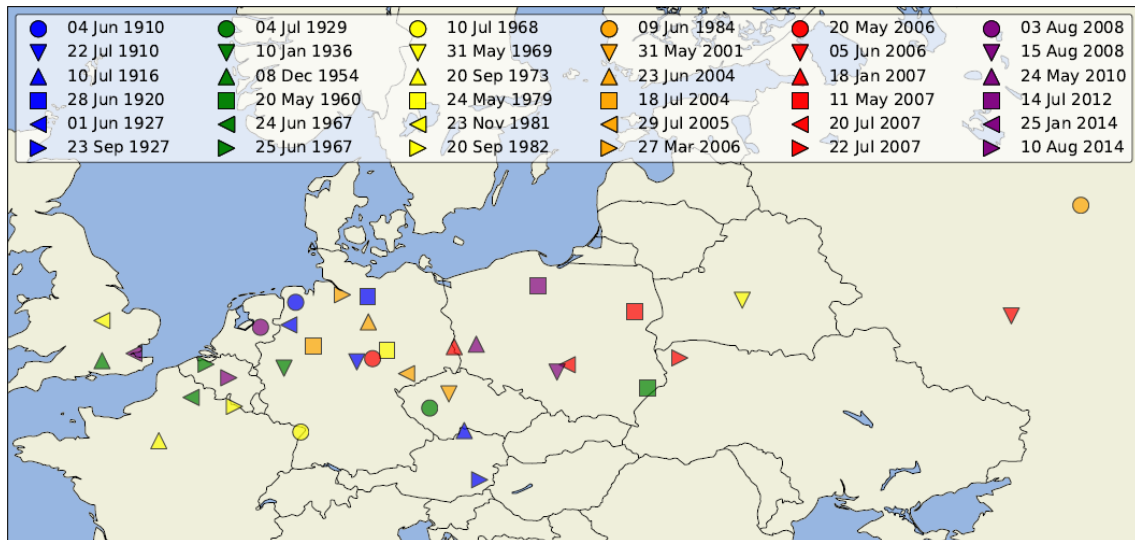


Fig. 3.5. Geographical centres of all 36 tornado outbreaks in the ESWD in the period 1900-2014.

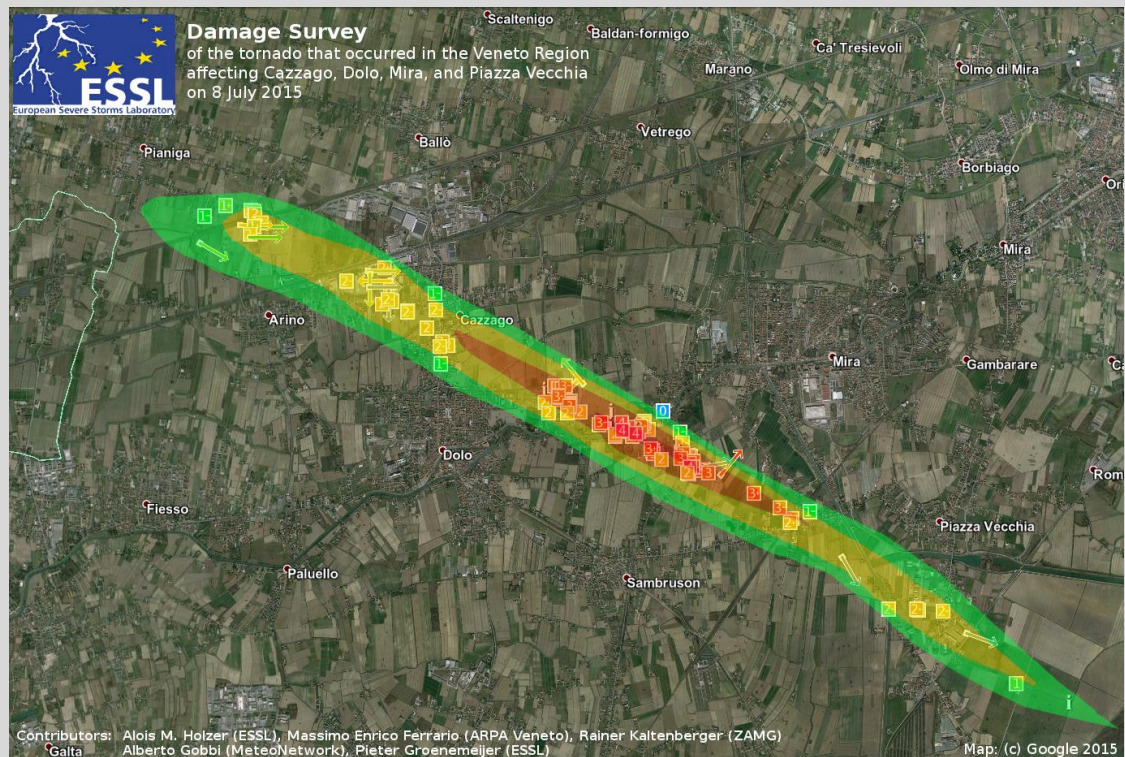
3.6 EF-scale International Working Group

In the United States, a formal process was launched to revise the framework for the estimation of wind speeds in tornadoes. The EF-Scale currently in use in the United States will undergo a mayor revision and also new measurements and remote sensing techniques will be included in a new formal standard. This standard will be “owned” by the American Society of Civil Engineers (ASCE), as there is a strong link to construction codes. Experts from different fields of meteorology, but also engineers and forest damage experts became members of a committee that will steer this formal process over the coming years. Alois M. Holzer from ESSL for this purpose was invited to become an ASCE Associate Member and represents the European

Severe Storms Laboratory and in general the European view on this topic as the only representative from Europe. The ASCE activities are linked to an International Tornado Working Group, where not only ESSL is active, but also researchers from countries like Canada, China and Japan. The final goal is to develop a method for tornado wind speed estimates that is interlinked with national approaches and which is consistent worldwide. The next meeting of this International Tornado Working group will be at our ESSL Research and Training Centre in Wiener Neustadt on 6 September 2016. Persons interested to participate in this tornado workshop are invited to register at the ESSL website.

Mira, Italy: Survey of a violent tornado

Shortly after reports came in that a deadly tornado had taken place in Italy's Veneto region, a team of ESSL and several partners was formed to assess the damage of the tornado. The team consisted of Alois M. Holzer (ESSL), Massimo Enrico Ferrario (ARPA-Veneto), Rainer Kaltenberger (ZAMG) and Alberto Gobbi (MeteoNetwork) who jointly surveyed the damaged area. The effort of mapping damage from broken branches to fully destroyed homes lead to the conclusion that a rare violent F4 tornado had occurred that, within approximately 20 minutes produced a damage track of 11 kilometres length and 700 to 1000 metres wide, in the region right between the large cities of Padua and Venice. One person was killed as the driver's car was picked up by the winds of the tornado and at least 72 people were injured. The full report can be found on the ESSL Website under News or by following this link: <http://www.essl.org/cms/mira-ve-italy-f4-tornado-report/>



Top: F4 damage in Mira (Photos: Alberto Gobbi). Bottom: Map of damage locations and F-scale intensity.

4 Conferences, workshops and outreach

4.1 The ESSL Testbed

The fourth edition of the ESSL Testbed has taken place in June 2015. The ESSL Testbed is a project to enhance severe weather forecasting across Europe.

The Testbed provides forecaster training, testing of forecasting tools, and is a platform for interaction for researchers and forecasters, who attend the Testbed typically for one week.

The 2015 edition of the Testbed included a number of new and improved forecast tools, such as the high-resolution COSMO-1 model with 1 km grid-spacing run at MeteoSwiss. The Swiss also provided a high resolution ensemble model that provided forecasts up to 120 hours. The evaluation showed that this model indeed was skilful to a few days in advance, and sometimes surprisingly accurate two or three days ahead. A number of very interesting weather situations occurred, including an outbreak of tornadic supercells in southern Germany on 13 May.



ESSL evaluated several tools, such as the NowcastMIX, the mesocyclone detection algorithm and other radar-derived products of the German Weather Service DWD, various NWP visualizations and Vaisala's GLD360 Lightning Detection. For details on the Testbed 2015, you can visit the blog at <http://www.essl.org/testbed/blog>

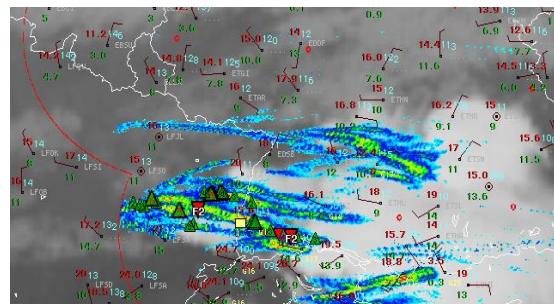


Fig. 4.1 VIL tracks and severe weather reports on the evening of 13 May 2015 in Southwest Germany. Source: DWD/ESSL

4.2 8th European Conference on Severe Storms - ECSS 2015

From 14 to 18 September 2015, ESSL organized a new edition of the ECSS conference series. This time the venue was in Wiener Neustadt, Austria, location of ESSL's Research and Training Centre.

Awards for contributions at the ECSS 2015

Heino Tooming award
for the best international contribution:

Alexander Keul*

Jury award for best oral presentation:

Matthew Clark*

Jury award for best student contribution:

Kenta Sueki*

Jury award for best poster:

Lisa Schielicke

Audience award for best oral presentation:

Christoph Gatzen* and **Bogdan Antonescu**
and **Tomas Pucik*** (ex aequo)

Audience award for best poster:

Lisa Schielicke*



The Conference took place in the baroque Sparkassensaal Ballroom located in the centre of town.

The Scientific Programme Committee was lead by co-chairs Johannes Dahl, Bogdan Antonescu and David M. Schultz. The programme that they put together ranged from remote sensing to numerical modelling and from forecast applications to severe weather impacts. The programme of 74 oral presentations and 108 poster presentations was of a very high scientific level and included a panel and forum discussion about the advances in storm forecasting and warning. The Conference had a total attendance of 172 persons from 29 countries.

A social programme that included a tour to the part of Wiener Neustadt, which was destroyed by a violent tornado in 1916, a visit to a nearby spa and a conference dinner complemented the scientific programme.

The best oral and poster conference contributions were given awards (see Awards for contributions at the ECSS 2015). In addition, ESSL presented for the third time the prestigious Nikolai Dotzek Award. Winner of the award was Dr. Harold Brooks



Fig. 4.2. Dr. Harold Brooks holding the Nikolai Dotzek award trophy: a large hailstone. Photo: Mateusz Taszarek.

for his innumerable and diverse contributions to the science of severe storms. The Nikolai Dotzek Award was established in 2011 in the memory of ESSL's first director and founding father,

Dr. Nikolai Dotzek, who passed away in May 2010. The next edition of the ECSS conference will take place in Pula, Croatia from 18 to 22 September 2017.



Fig. 4.3. ECSS2015 participants. Photo: Thomas Schreiner.

4.3 Convection Working Group



ESSL continued its support to the EUMETSAT Convection Working Group (CWG), hosting the CWG Secretariat. The tasks of the secretariat include updating and hosting its web site, taking minutes of CWG meetings and several smaller tasks. The CWG convened for a Splinter Meeting

alongside the ECSS conference in Wiener Neustadt in September. The CWG is now chaired by Mateja Irsic-Zibert (Slovenian Environment Agency), Vesa Nietosvaara (EUMETSAT), Jochen Grandell (EUMETSAT) and Martin Setvák (CHMI).

4.4 Publications, courses and seminars

A wide range of outreach and PR activities took place in 2015. ESSL was well represented with scientific contribution. At various other occasions, ESSL employees and members engaged in interaction with particular interest groups and the general public. The ESSL Research and Training Centre was used to host several events with a focus on training, namely two seminars on Forecasting Severe Convection, and, of

course, the ESSL Testbed. The ESSL website was further developed to include more downloadable information such as upcoming activities. Furthermore, an interactive blog was established during the Testbed (www.essl.org/testbed/blog). Two ESSL Newsletters were released in 2015 to keep its members informed of the Association's activities.

4.5 Seminars on Forecasting Severe Convection

Two training seminars took place in 2015 at ESSL's Research and Training Centre in Wiener Neustadt. In the week starting 2 June, a week-long course entitled **Forecasting Severe Convection II, Dynamics and Prediction of Severe Thunderstorms** was organized with lecturer Dr. Johannes

Dahl, who is Assistant Professor in Meteorology at Texas Tech University. The second course took place from 21-25 September and was given by Dr. Charles A. Doswell III, and was entitled **Seminar Forecasting Severe Convection I**.

4.6 Social Media

Before the ECSS Conference in September, ESSL opened its own Twitter account @essl_ecss. Through this account, ESSL will post and share news regarding severe weather, ESSL's research and tweet about activities such as the ECSS and the ESSL Testbed, when these take place.

4.7 List of publications

Peer-reviewed journal articles

- Púčik, T., Groenemeijer, P., Rýva, D. and Kolář, M., 2015: **Proximity Soundings of Severe and Nonsevere Thunderstorms in Central Europe**. Monthly Weather Review, 143, 4805–4821, doi: 10.1175/MWR-D-15-0104.1.
- Sanderson, M. G., Hand, W. H., Groenemeijer, P., Boorman, P. M., Webb, J. D. C. and McColl, L. J., 2015: **Projected changes in hailstorms during the 21st century over the UK**. Int. J. Climatol., 35: 15–24. doi:10.1002/joc.3958

Reports

- Groenemeijer, P., N. Becker, M. Djidara, K. Gavin, T. Hellenberg, A.M. Holzer, I. Juga, P. Jokinen, K. Jylhä, I. Lehtonen, H. Mäkelä, O. Morales Napoles, K. Nissen, D. Paprotny, P. Prak, T. Púčik, L. Tijssen, A. Vajda, 2015: **RAIN Deliverable 2.2: Past Cases of Extreme Weather Impact on Critical Infrastructure in Europe**, available at: <http://rain-project.eu/wp-content/uploads/2015/11/D2.2-Past-Cases-final.compressed.pdf>
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Informal articles

- Holzer, A.M., 2015: **Europäische Unwetterkonferenz 2015 – ein Rückblick**, in ÖGM Bulletin 2015/2 (Austrian Meteorological Society), available at: http://www.meteorologie.at/docs/OEGM_bulletin_2015_2.pdf

4.8 List of presentations and conference contributions

Oral presentations

- Pieter Groenemeijer, **Impact of thunderstorm-related hazards on critical infrastructure**. RAIN Workshop on Past Severe Weather Hazards, Meteorologisches Institut, Freie Universität Berlin, 27 February 2015.
- Pieter Groenemeijer, **Hazard Identification in the RAIN Project**. RAIN Workshop on Past Severe Weather Hazards, Meteorologisches Institut, Freie Universität Berlin, 27 February 2015.
- Holzer, Alois M., Pieter Groenemeijer, Thilo Kühne, Georg Pistotnik and Zhongjian Liang, 2015: **The European Severe Weather Database and other databases as a resource for severe weather research in Europe**, SNORRE Workshop, ZAMG, Vienna, 16 April 2015.
- Holzer, Alois M., 2015: **Tornados in Österreich**. Presentation at “Naturwissenschaftlichen Verein für Kärnten” in Klagenfurt, Austria, 27 April 2015.
- Groenemeijer, P., Kühne, T., Pucik, T., Tijssen, L., Westermayer, A. and Holzer, A.M., 2015: **Interannual variability in recent data of the European Severe Weather Database**. 8th European Conference on Severe Storms (ECSS2015), 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Holzer, A. M., Groenemeijer, P., Púčik, T., Nissen, K., Becker, N., Ulbrich, U., Vajda, A., Gregow, H., Juga, I., van Gelder, P., Morales-Napoles, O. and Paprotny, D., 2015: **Assessment of Severe Weather Warning Systems in Europe**, 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Tijssen, L. and Groenemeijer, P., 2015: **Tornado Outbreaks in Europe**. 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Holzer, A. M., and Groenemeijer, P., 2015: Subtropische und tropische Stürme im Mittelmeerraum - A Satellite Based Climatology of (Sub-) Tropical Cyclones in Europe. Geowissenschaftliche Runde der Münchner Rückversicherungsgesellschaft,
- Westermayer, A., Groenemeijer, P., Pistotnik, G., Sausen, R., and Faust, E., 2015: **Identification of thunderstorms in reanalysis data and development of a statistical convective initiation model**. 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.

- Pucik, T., Tijssen, L., Groenemeijer, P., and Westermayer, A., 2015: **The representation of (severe) thunderstorm environments in Europe using different reanalysis datasets.** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Kühne, T. and Groenemeijer, P., 2015: Impact-based evaluation of European severe weather reports. 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Feuerstein, B. and Kühne, T., 2015: **A violent tornado in mid-18th century Germany: The Genzmer Report.** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Kollmohr, A., Kühne, T., Dirksen, E. and Hubrig, M., 2015: **The Tornado-Arbeitsgruppe Deutschland (TAD) - Introducing a work group in the field of tornadoes in Germany.** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Alois M. Holzer and Pieter Groenemeijer, 2015: **ESSL Tornado and Windstorm (Downburst) Rating Practice and Outlook.** EF Scale ASCE Committee Meeting USA (remote presentation), 17 November 2015.
- Tomas Pucik and Pieter Groenemeijer: **Modelling severe thunderstorm risk in Europe,** RAIN Workshop on Climate change and Weather modelling, Trinity College, Dublin, 9 November 2015.
- Alois M. Holzer and Tomas Pucik: **A detailed review of severe weather warning systems in Europe,** RAIN Workshop on Climate change and Weather modelling, Trinity College, Dublin, 9 November 2015.

Poster presentations

- Pfeifer K., and Alois M. Holzer, 2015: **Magnitude Assessments of Historical Weather Events in Lower Austria (1713-1754).** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Schreiner, Thomas M.E., Mathias Stampfl, Alois M. Holzer, 2015: **Historical Damage Photograph Details of the Wiener Neustadt Tornado of 1916.** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Schreiner, T. M. E., Stampfl, M. and Holzer, A. M., 2015: **Historical Damage Photograph Details of the Wiener Neustadt Tornado of 1916.** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Pistotnik, G., Groenemeijer, P., Kühne, T., Rust, H. and Sausen, R., 2015: **STEPCLIM - Probabilistic Modeling of the European Severe Thunderstorm Climate.** Miklip Status Seminar 2015, Offenbach.

- Groenemeijer, P., Holzer, A. M., Púčik, T. and Taszarek, M., 2015: **The ESSL Testbed: Forecaster Training and Evaluation of Forecast and Nowcast Tools.** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Westermayer, A., Pucik, T., Groenemeijer, P. and Tijssen, L., 2015: **Comparison of sounding observations and reanalysis of thunderstorm environments.** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Wapler, K., Hengstebeck, T. and Groenemeijer, P., 2015: **Mesocyclones in Central Europe as seen by Radar.** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.
- Pucik, T., Groenemeijer, P., Ryva, D. and Kolar, M., 2015: **Proximity soundings of severe and non-severe thunderstorms in Central Europe.** 8th European Conference on Severe Storms – ECSS 2015 Wiener Neustadt, Austria, 14-18 September 2015.

Other

- Alois M. Holzer, 2015: Moderation of panel discussion on Past Severe Weather Hazards, at the RAIN Workshop on Past Severe Weather Hazards, Meteorologisches Institut, Freie Universität Berlin, 27 February 2015.

5 Financial and administrative report

5.1 ESSL General Assembly 2015

The ESSL General Assembly took place on 13 September 2015. At this occasion, a number of important decisions were made by the ESSL members including the acceptance of the Executive Board's Annual Report over 2014.

Two new members of the Advisory Council were elected, namely **Dr. Martin Benko**, Director of the Slovak Hydro-Meteorological Institute and **Prof. Dr. Uwe Ulbrich** of the Institute for Meteorology of the Free University of Berlin.

The current members of the ESSL Executive Board, Pieter Groenemeijer (Director), Alois M. Holzer (Treasurer) and Kathrin Riemann-Campe (Deputy Director) were re-elected for a period of three years until 31 December 2018. In addition, **Dr. Bogdan Antonescu** was elected as Deputy Director. He will strengthen the Board with respect to communication with partners, dissemination and the ESWD database.

Other topics of discussion included the next ECSS and the status of the new EWOB app. More details regarding the General Assembly can be found in the meeting minutes.

5.2 Employment and Payroll accounting

An external payroll accountant (Andreas Schnaubelt in Schongau, Bavaria) was mandated during 2015 to take care of paperwork and bureaucratic handling of taxes and social insurances, which would otherwise have exceeded ESSL's internal administrative capacity.

In 2015, the European Severe Storms Laboratory e.V. employed **one full time employee** (ESSL Director) and **six part-time employees, including two so-called "Mini-Jobbers"**, a form of minor employment according to the German law (scientific staff, ESWD quality control manager, IT – software engineer). The joint Secretariat of ESSL and the European Severe Storms Laboratory – Science and Training was hosted by the latter entity and employed two persons. Other tasks were taken over by voluntary workers (i.e. without payment) at least for periods, in particular the positions of the Deputy Director and the Treasurer.

5.3 Auditing of the Annual Accounts

ESSL's finances for 2015 were audited by the independent and sworn certified financial auditor Andreas Schnaubelt, Loewenstrasse 5, 86956 Schongau, Germany. Summarizing our certified financial auditor states:

"Record of Income and Expenses

... during our work no indications occurred which would give raise for objections against the correctness of the record.

Financial Statements

... during our work no indications occurred which would give raise for objections against the correctness of the financial statements.”

The original was duly forwarded to the Advisory Council.

5.4 Financial status 2015

European Severe Storms Laboratory e.V.

The accounting year was dominated by income from the STEPCLIM project and the RAIN project. The detailed annual accounts for 2015 were presented to the ESSL Advisory Council and can be inspected in the original and in person by each member at the General Assembly. Digital copies of the full document can alternatively be requested from the ESSL Treasurer. Attachment A2 provides a condensed version of the annual accounts.

The financial situation in 2015 was only slightly better than in the previous years. The EU-FP7-project RAIN provided reliable income, but the unclear situation about two projects funded by the German ministry of research - one project to be continued for a second term (STEPCLIM), another project to be started (ARCS/ACROSS) – again caused troubles in the financial planning. Especially several unexpected delays of the start of ARCS/ACROSS resulted in a tough liquidity at the end of the year, that needed to be bridged by a short-term enlargement of our “account negative limit” (see “Liabilities to the bank” in section “Assets and Liabilities 2015” of Attachment A2). On 31 December 2015 the liabilities amounted to EUR 18,046.98.

As required by the tax authorities, in the detailed accounting, cost centres distinguish between the ideational branch of ESSL (*Idealistic Purpose*, i.e. management of the association and its core activities) and its branches directly serving the statutory purposes of the ESSL (dedicated activities). No activities had to be booked under the commercial type branch (minor activities of this kind would have been permissible), thus fulfilling the requirements of the tax authorities.

The following figures from the annual accounts evidence the business conditions:

ESSL obtained EUR 73,289.48 (2014: EUR 70,235.00) in membership fees and ESWD data sales, EUR 223,740.01 (2014: EUR 165,485.77) from scientific projects, and EUR 100.00 (2014: EUR 5,368.11) from donations.

Total income amounts to **EUR 297,129.49** (2014: EUR 236,588.88).

Total expenses amount to **EUR 293,577.19** (2014: EUR 240,546.03).

The major cost factors were personnel costs with EUR 235,520.06 (2014: EUR 193,874.12) including taxes and social security, and travel expenses with EUR 17,928.91 (2014: EUR 24,148.94). Tax advisor and external bookkeeping costs sum up to EUR 7,300.00 (2014: EUR 10,860.00) and shared administration (with ESSL Science and Training) to EUR 12,490.59.

The costs of third-party funded projects pose a challenge to ESSL, since overhead costs are almost not covered. In 2015, this was the case for the STEPCLIM project. The tight cooperation with the Austria-based association “European Severe Storms Laboratory – Science and Training” reduces costs for administrative work substantially, since common services and their associated costs are shared between the two associations. Personnel costs for the Assistant to the Board were paid through this ESSL subsidiary at first hand.

At the end of the business year, liquid assets at our bank accounts amounted to EUR -18,046.98 (liability to the bank). At the end of the year 2015 accounts receivables amounted to EUR 501.26 (2014: EUR 6,206.34), deferred expenses (payments made for future accounting periods) to EUR 22,178.00 (2014: EUR 0.00), deferred income (payments received for future accounting periods) to EUR 0.00 (2014: EUR 116,067.64).

ESSL was still running without noteworthy reserves.

The **annual result is a positive EUR 3,552.30** (compare: negative EUR 3,957.15 in 2014, positive EUR 2,625.89 in 2013, negative 34,365.67 in 2012, positive EUR 7,093.32 in 2011, negative EUR 46,859.77 in 2010, positive EUR 60,599.84 in 2009).

The financial planning for 2016 foresees a slightly better liquidity development, mainly because of three projects will run in parallel for the first time in ESSL’s history: RAIN, STEPCLIM and ARCS. As requested by the General Assembly 2015, the Executive Board foresees to build a current reserve by the end of 2016. Such savings can only be built up slowly as there are no sources of income available that generate a substantial surplus. Most income is tightly connected with (strictly defined) personnel expenses. Projects from the German ministry of research even require ESSL to bear part of the project costs, i.e. cause a structural deficit, if not covered by other sources of income.

Subsidiary European Severe Storms Laboratory - Science and Training

The financial result of the subsidiary association “European Severe Storms Laboratory – Science and Training” can be summarized as follows:

At the end of the business year, liquid assets at its bank accounts amounted to EUR 10,121.36, out of this EUR 10,000.00 are a current reserve for the ESSL Testbed 2016. The remaining annual result for the subsidiary association in 2015 is a positive EUR 121.36 (2014: positive EUR 1,689.65).

The result for the main cost centre ECSS was a positive EUR 4,848.17 (including deferred income), the result for the second most important cost centre in 2015 – Testbed and Seminars – was a positive EUR 25,988.49.

The financial planning for 2016 again foresees a near neutral annual result.

Internal auditors (according to Austrian law) for 2015, Dr. Kathrin Riemann-Campe and Prof. Dr. Robert Sausen have approved of its annual accounts.

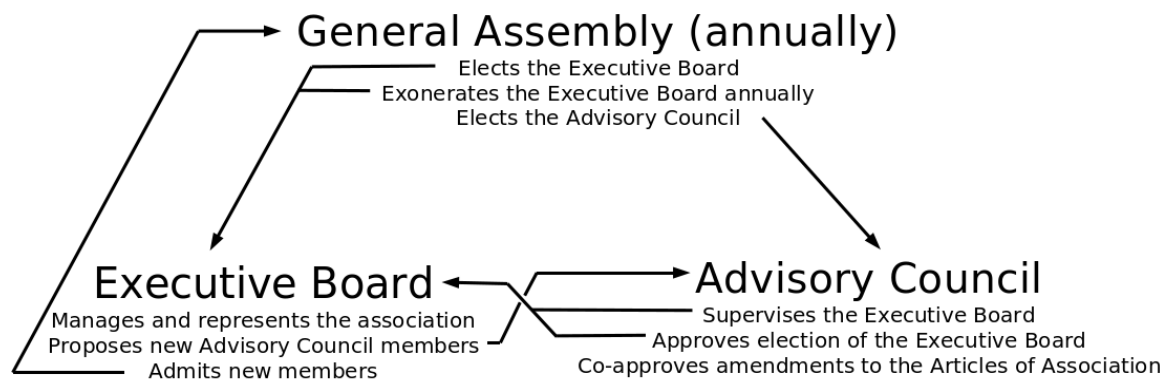
5.5 ESSL members

Members are at the core of ESSL and provide essential support to ESSL activities. Membership fees form an important source of income for ESSL. However, ESSL members are also important in catalysing the pursuit of the Association's goals. This type of support is sometimes provided in-kind and sometimes by financial support. Examples include the Austrian Central Institute of Meteorology and Geodynamics (ZAMG) co-organizing the ESSL Testbed. Important support to the Testbed was also provided by EUMETSAT and Deutscher Wetterdienst (DWD). All these organizations are ESSL members.

In 2015, ESSL was happy to welcome two new Institutional Supporting Members. See Appendix A1 for the full member list.

5.6 Executive Board and Advisory Council

The Executive Board and the Advisory Council are two of the three bodies forming the ESSL. The figure outlines these and their responsibilities.



Bodies of the ESSL. The Advisory Council consists of six members from two groups - three members each: (1) Science, (2) NMHS / EUMETNET.

Executive Board

In 2015, the Executive Board consisted of:

- Dr. Pieter Groenemeijer, Director
- Dr. Kathrin Riemann-Campe, Deputy Director.
- Mr. Alois M. Holzer, Treasurer

Advisory Council

In 2015, the Advisory Council consisted of:

Robert Sausen, chair (DLR, Deutsches Zentrum für Luft- und Raumfahrt, Germany) 1 Jan. 2012 - 31 Dec. 2015 (second term)

Hans-Joachim Koppert, vice-chair (DWD, Deutscher Wetterdienst, Germany) 1 Jan. 2015 - 31 Dec. 2018 (second term)

Vincenzo Levizzani (CNR, National Research Council, Italy) 1 Jan. 2013 - 31 Dec. 2016 (second term)

Pertti Nurmi (FMI, Finnish Meteorological Institute, Finland) 1 Jan. 2013 - 31 Dec. 2016 (first term)

David M. Schultz (University of Manchester, United Kingdom) 1 Jan. 2013 - 31 Dec. 2016 (second term)

Michael Staudinger (ZAMG, Zentralanstalt für Meteorologie und Geodynamik, Austria) 1 Jan. 2012 - 31 Dec. 2015 (second term)

Appendix A1: Member list 2015

The following table shows all ESSL members as of 31 December 2015, sorted according to their ESSL-ID (which corresponds in ascending order to the beginning date of the ESSL membership). The 8 remaining founding member names are *printed in italics*. The given country corresponds to the main residence or statutory seat, not necessarily to the nationality.

INDF Individual Full Member

INDS Individual Supporting Member

INSF Institutional Full Member

INSS Institutional Supporting Member

HMEMHonorary Members and special status partners (Memorandum of Understanding)

<i>INDF</i>	<i>Dr. Bernold Feuerstein</i>	<i>GERMANY</i>
<i>INDF</i>	<i>Dr. Pieter Groenemeijer</i>	<i>GERMANY</i>
<i>INDF</i>	<i>Alois M. Holzer</i>	<i>AUSTRIA</i>
<i>INDF</i>	<i>Dr. Maria-Carmen Llasat-Botija</i>	<i>SPAIN</i>
<i>INDF</i>	<i>Dr. Romualdo Romero</i>	<i>SPAIN</i>
<i>INDF</i>	<i>Dr. Martin Setvák</i>	<i>CZECH REPUBLIC</i>
<i>INDF</i>	<i>Dr. Fulvio Stel</i>	<i>ITALY</i>
<i>INDF</i>	<i>Jenni Rauhala</i>	<i>FINLAND</i>
INDF	Thilo Kühne	GERMANY
INDF	Helge Tuschy	GERMANY
INDF	Georg Pistotnik	AUSTRIA
INDF	Zhongjian Liang	GERMANY
INDF	Lionel Peyraud	SWITZERLAND
INDF	Thomas Krennert	AUSTRIA
INDF	Dr. Johannes Dahl	USA
INDF	Martin Hubrig	GERMANY
INDF	Oliver Schlenczek	GERMANY
INDF	Dr. Victor Homar Santaner	SPAIN
INDF	Dr. Sanjay Sharma	INDIA
INDF	Dr. Aurora Bell	ROMANIA
INDF	Sorin Burcea	ROMANIA
INDF	Bogdan Antonescu	ROMANIA

INDF	Dr. Michael Kunz	GERMANY
INDF	Erik Dirksen	GERMANY
INDF	Emmanuel Wesolek	FRANCE
INDF	Christoph Gatzen	GERMANY
INDF	Dr. Alexander Keul	AUSTRIA
INDF	Dr. Kathrin Riemann-Campe	GERMANY
INDF	Dr. Koji Sassa	JAPAN
INDF	Tomáš Pučík	CZECH REPUBLIC
INDF	Patrick Marsh	USA
INDF	Marcus Beyer	GERMANY
INDF	Lisa Schielicke	GERMANY
INDF	Dr. Charles A. Doswell III	USA
INDF	Abdullah Kahraman	TURKEY
INDS	Casper ter Kuile	NETHERLANDS
INDS	Stefan Meulemans	SWITZERLAND
INDS	Francesco Meneguzzo	ITALY
INDS	Jan Jacob Groenemeijer	NETHERLANDS
INDS	Christopher Claude Valois Barthe	FRANCE
INDS	Mathias Stampfl	AUSTRIA
INSF	DWD, Deutscher Wetterdienst	GERMANY
INSF	EUMETSAT	GERMANY
INSF	AUSTRO CONTROL	AUSTRIA
INSF	ZAMG, Zentralanstalt für Meteorologie und Geodynamik	AUSTRIA
INSF	NMA, National Meteorological Administration of Romania	ROMANIA
INSF	FMI, Finnish Meteorological Institute	FINLAND
INSF	CHMI, Czech Hydrometeorological Institute	CZECH REPUBLIC
INSF	Institute for Hydrometeorology and Seismology of Montenegro	MONTENEGRO

INSF	DHMZ, Meteorological and Hydrological Service of Croatia	CROATIA
INSF	SHMU, Slovak Hydrometeorological Institute	SLOVAKIA
INSF	Consorzio LaMMA	ITALY
INSS	Münchener Rückversicherungs-Gesellschaft AG	GERMANY
INSS	Tokio Marine Technologies LLC	USA
INSS	Willis Ltd	UNITED KINGDOM
INSS	Deutsche Rückversicherung	GERMANY
INSS	DLR; Deutsches Zentrum für Luft- und Raumfahrt	GERMANY
INSS	SJNK Risk Management	JAPAN
INSS	Guy Carpenter Limited	UNITED KINGDOM
INSS	Air Worldwide	USA
INSS	Dents & Dings	USA
INSS	Research Center for Environmental Changes	TAIWAN
INSS	AccuWeather Enterprise Solutions, Inc.	USA
INSS	Renaissance RE Services Ltd	BERMUDA
HMEM	Birgit Büsing	GERMANY
HMEM	Gregor Dotzek	GERMANY
HMEM	Armin Dotzek	GERMANY
HMEM*	European Meteorological Society (EMS)	GERMANY

HMEM* Memorandum of Understanding

Appendix A2: Annual Accounts 2015

The following presents in extract a copy of the “Report on the Preparation of the Financial Statements for 2015”, as prepared by the financial auditor, and in addition figures of the previous year for comparison.

	2015	2014
INCOME		
Membership fees personal members	3,514.48	3,325.00
Membership fees institutional members and ESWD data fees	69,775.00	66,910.00
Public project funding Federal Republic of Germany	102,820.01	96,059.77
Public project funding European Union	120,920.00	64,926.00
Donations	100.00	5,368.11
Total income	297,129.49	236,588.88
EXPENSES		
Depreciations	825.00	684.00
Personnel	231,640.06	192,034.28
Travel costs	17,928.91	25,994.50
Office costs and insurance	1,882.51	5,552.33
Phone and data (internet) services	6,173.63	2,206.30
Tax advisor including software	7,300.00	10,950.00
Shared administration	12,490.59	725.00
Value added tax	4,856.49	-46.84
Lump sums for small support jobs	3,880.00	1,839.84
Third party services (DLR for project STEPCLIM)	6,600.00	606.62
Total expenses	293,577.19	240,546.03
Result	3,552.30	-3,957.15

Assets and Liabilities 2015

	2015	2014
Fixed Assets (office equipment)	1,595.00	1,321.00
Current Assets		
Receivables	501.26	6,206.34
Bank balances	0.00	116,067.64
Deferred Expenses	22,178.00	0.00
Assets total	24,274.26	123,594.98
Equity (own capital)		
Retained earnings brought forward	2,674.98	6,632.13
Remaining result of the year	3,552.30	-3,957.15
Deferred Income	0.00	120,920.00
Liabilities to the bank	18,046.98	0.00
Equity and Liabilities total	24,274.26	123,594.98