



RAIN

PROJECT

Security Sensitivity Committee Deliverable Evaluation

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- The content is not related to general project management
 - The content is related to general outcomes as dissemination and communication
- Diagram path: 1-2. Therefore the evaluation is: Public.

Decision of Evaluation	Public	Confidential
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RAIN – Risk Analysis of Infrastructure Networks in Response to Extreme Weather

Project Reference: 608166

FP7-SEC-2013-1 Impact of extreme weather on critical infrastructure

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D8.7 Final Conference

D8.8 Final Joint Conference

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1. Executive Summary

In the framework of the RAIN Project, a final event has been organised with the participation of the RAIN consortium and a representative of the EU project INTACT, with which the RAIN consortium liaised during the past 3 years.

The conference has been organised and hosted by Trinity College Dublin in March 2017, focusing on *Extreme weather event infrastructure: assessing the impacts, mitigating the consequences*. More than 60 experts, with a good mix of RAIN partners and external stakeholders, attended the event.

The event has been promoted and disseminated before, during and after the event: all the possibly interested stakeholders were invited, all the presentations made during the workshop have been made available on the RAIN project website and the events were covered with live tweeting made by the official RAIN profile.

This document is a merger of D8.7 and 8.8, since the final conference and the final joint conference has been merged in one unique event to maximise the attendance and the impact of the event, as agreed with the RAIN project officer. Members of Infrarisk project (FP7), Resilens project (H2020) and INTACT project (FP7) participated actively in the event.

2. Introduction

This document provides a report on the activities made by the RAIN consortium in preparing for and conducting the final official event which was held at the end of the project: the agenda, the information and dissemination activities undertaken are described in detail. Furthermore, the deliverable outlines the main topics discussed, the exchange of ideas which occurred and the solutions proposed. Finally, the document presents the proceedings of the conference that are also available on the project website, including presentations and speeches.

3. Final Event

3.1 Title

Rain Final Event: Extreme weather events and infrastructures: assessing the impacts, mitigating the consequences.



Extreme Weather Events and Infrastructure: Assessing the Impacts, Mitigating the Consequences

3.2 Abstract

The RAIN vision was to develop a systematic risk management framework considering the impacts of extreme weather events on critical infrastructure, and developing a series of mitigation tools to enhance the security of the pan-European infrastructure network.

This final event aimed at reporting and disseminating the project results, while also communicating and networking with relevant stakeholders so to ensure optimal exploitation of Project results.

After a brief introduction and contextualization of the conference done by the Project Coordinator, Prof. Alan O'Connor from TCD, the event developed further through presentations and debates on the following topics:

- Development of relevant climate modelling and projections as an input for impact assessment
- Risk and impact assessment of different weather events on functionality of services (both transport infrastructures and services and energy/telecommunication)
- Social impact (evaluating elements of both vulnerability and resilience) of different weather events and methodologies to effectively involve stakeholders for informed decision-making and resilience enhancement

- Integration of models and methodologies developed for risk and impact assessment into a risk-based decision support system as well as into dedicated strategies of tackling mitigation of impacts of extreme weather

The presentations made during the event are listed below:

- [An overview of RAIN project](#) – Alan O’Connor, coordinator of RAIN project (TCD)
- [Establishing and Modelling the Exceedance of Severe Weather Thresholds: Today and Considering Climate Change](#) – Pieter Groenemeijer (European Severe Storms Laboratory)
- [A Risk Assessment Tool for Assessing the Vulnerability of Electrical and Telecommunication Infrastructures to Extreme Weather Events](#) – Xavier Clotet (Aplicaciones en Informática Avanzada, S.L.)
- [Assessing Societal Vulnerability to the Failure of Critical Land Transport Infrastructure during Extreme Weather Events](#) – Maria Luskova & Michal Titko (The University of Žilina)
- [Decision Support Tools for Infrastructures’ Owners and Operators. Improving Resilience in the face of Extreme Weather Events](#) – Peter Prak (PSJ Project) & Chiara Bianchizza (Istituto di Sociologia Internazionale di Gorizia)
- [Application of a Risk-Based Decision Making Framework for Critical Infrastructure Exposed to Extreme Weather Events](#) – Julie Clarke (Roughan & O’Donovan Innovative Solutions)
- [Crisis Coordination and Response Planning under Extreme Weather Events. A Finnish Case Study](#) – Timo Hellenberg (Hellenberg International)
- [Technical Solutions for Risk Mitigation](#) – Kenneth Gavin (TU Delft)
- [The National Road Network – Implementing a Strategy for Adapting to Extreme Weather Events and Climate Change – Current Status and Future Challenges](#) – Billy O’Keeffe (Transport Infrastructure Ireland) – INTACT Project

3.3 Target

The workshop is beneficial for a broad range of critical infrastructure professionals, including engineers (geotechnics, hydraulics, pavements, traffic management), transport, energy and telecommunications infrastructure managers and operators, climate change adaptation professionals, innovation managers and project managers. The presenters are research scientists, engineers and sociologists who have worked on the RAIN project. Members of the RAIN Advisory Board also attended the event.

3.4 Location and Date

The event took place in Trinity College Dublin (Ireland) on 24th March 2017, 10:00 - 17:00.

3.5 Agenda

Time table	Topic	Speaker
10.00 -10.15	Welcome and Introduction	Alan O'Connor , coordinator of RAIN project (TCD)
10.15 -10.30	An overview of RAIN project	Alan O'Connor , coordinator of RAIN project (TCD)
10.30 -11.00	Establishing and Modelling the Exceedance of Severe Weather Thresholds: Today and Considering Climate Change	Pieter Groenemeijer (European Severe Storms Laboratory)
11.00 -11.30	A Risk Assessment Tool for Assessing the Vulnerability of Electrical and Telecommunication Infrastructures to Extreme Weather Events	Milenko Halat (Aplicaciones en Informática Avanzada, S.L.)
11.45 -12.15	Assessing Societal Vulnerability to the Failure of Critical Land Transport Infrastructure during Extreme Weather Events	Maria Luskova & Michal Titko (The University of Žilina)
12.15 -12.45	Decision Support Tools for Infrastructures' Owners and Operators. Improving Resilience in the face of Extreme Weather Events	Peter Prak (PSJ Project) & Chiara Bianchizza (Istituto di Sociologia Internazionale di Gorizia)
13.45 -14.15	Application of a Risk-Based Decision Making Framework for Critical Infrastructure Exposed to Extreme Weather Events	Julie Clarke (Roughan & O'Donovan Innovative Solutions)
14.15 -14.45	Crisis Coordination and Response Planning under Extreme Weather Events. A Finnish Case Study	Timo Hellenberg (Hellenberg International)
14.45 -15.15	Technical Solutions for Risk Mitigation	Kenneth Gavin (TU Delft)
15.30 -16.00	The National Road Network – Implementing a Strategy for Adapting to Extreme Weather Events and Climate Change – Current Status and Future Challenges	Billy O'Keeffe (Transport Infrastructure Ireland) – INTACT Project
16.00 -17.00	Panel discussion and workshop closure	

3.6 Participants

The workshop involved the participation of 60 National and International attendees, including a broad range of critical infrastructure professionals, including academics, infrastructural managers and consultants:

- University of Surrey (UK), University College Dublin (Ireland), Trinity College Dublin (Ireland), University of Exeter (UK), National University of Ireland Galway (Ireland), Technical University of Cartagena (Spain);

- Department of Transport Tourism and Sport (Ireland), Dublin City Council (Ireland), Kildare County Council (Ireland), Office of Public Works (Ireland), Department of Communications, Climate Action and Environment (Ireland);
- Irish Rail (Ireland), ESB International (Ireland);
- Arup (Ireland), Roughan and O'Donovan (Ireland), Gavin and Doherty Geosolutions (Ireland).



Figure 1. Participants during the RAIN Final Event in Trinity College University, March 24th 2017.

The complete list of attendees is presented in Annex 1.

3.7 Dissemination Activities

The promotional activities focused on the invitation to the workshop. A preparatory *Save the date* was sent to 219 contacts to allow everyone to keep the date free.

The official invitation was sent to all the stakeholders who have submitted to the RAIN website and to additional contacts suggested by partners (250 contacts in total).

The information about the workshop was also disseminated on the RAIN website and on social media: on Twitter, through the RAIN profile, and in the RAIN LinkedIn group.

Additionally, some partners promoted the event in other conferences and workshops, such as the IX Forum on Engineering Decision Making hold in Stoos (Switzerland) in December 2016, and the DRMKC workshop on critical infrastructure protection hold by the JRC in Brussels in March 2017.

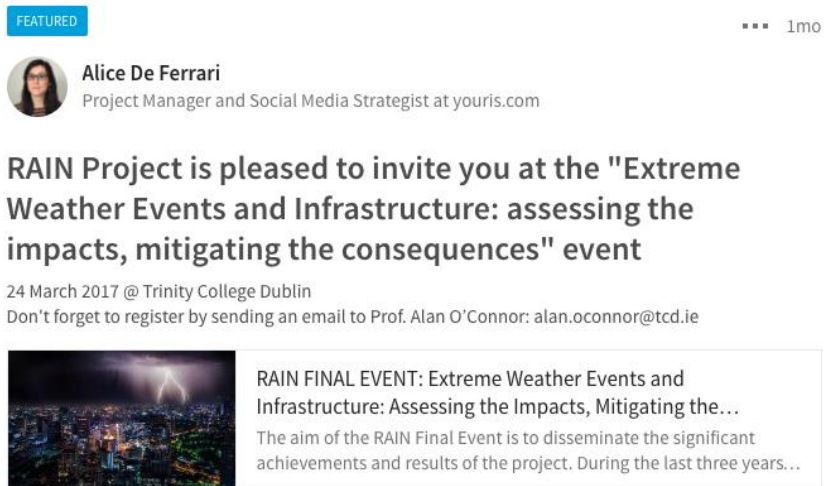


Figure 2 Promotion of the final event on LinkedIn



Figure 3 Promotion of the final event on Twitter

The workshop was promoted on Twitter with the publication of live tweets during the event. Remarkable quotes from speakers and updates were posted on the RAIN account, as well as retweets from participants.



Figure 4 Tweets made live during the event with the official RAIN account

A journalist from youris.com network, Fiona Dunlevy, attended the event with the final aim to produce an article and an interview to the project coordinator. The articles have been published on the website and distributed to all the main information multipliers.

- Storm ahead – How to prepare Europe for extreme weather (<http://rain-project.eu/storm-ahead-prepare-europe-extreme-weather/>)
- Investing to future-proof infrastructure against extreme weather events (<http://rain-project.eu/investing-future-proof-infrastructure-extreme-weather-events/>)

After the workshop, a press release was published on the RAIN website (<http://rain-project.eu/extreme-weather-events-infrastructures-assessing-impacts-mitigating-consequences-rain-final-event/>) and all the presentation were released, available for download.

3.8 Hot Topics

RAIN research on hazard modelling and climate changes (WP2) showed that climate change leads to an increased probability of many extreme weather events. This increase is more significant for certain hazards (such as floods, wildfires, thunderstorm-related wind gust) and less evident or relatively uncertain for others (such as wind storms). Due to climate change, the probability of certain hazards could decrease or shift geographical location (this is the case of snowfall). These results were obtained through several new methods, which were developed in the RAIN project, to extract these data from climate model data and observations. The results were important input for the further tools that the project developed.

Namely, these inputs were fed into a web-based tool (WP4) for the Electricity & Tele Communication infrastructure, to evaluate different potential impacts of failures and most cost-effective mitigation actions (providing different cost and recovery possibility scenarios, given different prevention/mitigation investments). The tool can also be used for assessment of transportation networks (WP3).

The web-based tool is integrated with the risk based decision making framework developed in WP 5, this tool which will be deployed by the project via the RAIN website contributes to the development of methods for the quantitative analysis of risks for interconnected infrastructures. In fact, the whole and overall project approach focused on interconnections and systems, as well cascading effects of extreme weather impacts. In this sense, also the decision-making framework addresses in its development the modelling approaches for critical infrastructures which are highly interconnected and form 'systems of systems', that tend to be vulnerable during extreme weather events.

The developed risk based decision making framework has the aim to assess the societal, security and economic impacts of critical infrastructure failures, based on single and multi-mode failures. Based on the impacts of the failures, quantifiable benefits (from a societal, security and economic standpoint) of providing resilient infrastructure can then be identified, as detailed in WP6 and WP7.

This decision-making framework based its approach also on the social vulnerability assessment (linked to land based infrastructure failures due to extreme weather events) performed within WP3 and WP4. Beside the technical input for expert advice to infrastructure managers, WP3 further developed a more stakeholder-oriented tool (Objective Ranking Tool) to be used for the

infrastructure managers/operators themselves to assess their own level of potential vulnerability and resilience to the impact of certain extreme weather events.

The combination of expert tools and self-assessment tools for decision-support ensures the possibility for an integrated approach, where infrastructure managers can both benefit from a systematized understanding of strengths and weakness of their own systems, and then interact with an in-depth awareness with experts that propose further and more elaborated tools as a support for informed decision-making.

Additionally, RAIN also worked on mitigation strategies (WP7) from a purely technical point of view, divided in remediation and prevention strategies. Of course solutions differ for different extreme weather events and within different geographical contexts. In order to offer a vast array of possible mitigation options, in depth research was conducted to reach a detailed understanding of potential failure mechanisms for different critical transport infrastructures. All mitigation means identified were then analysed considering technical feasibility, human and environmental impact and costs. This gave a final portfolio of most relevant and feasible solutions, which could be further integrated merging also the outcomes from the web-based tool on land based infrastructure systems, for an even further integrated model.

3.9 Challenges Emerged

In order to make the best use of all of the methodologies and tools developed by the project, it will be key to integrate further elements of analysis in order to assess resilience of networks, especially to future extreme weather events. In this sense it might be very relevant to upgrade for example flood mapping, so to identify clearly the most vulnerable areas, also making use of the different tools developed by WP3 and WP4 of the project (i.e. Vulnerability assessment and ORT self-assessment for resilience).

Taking into account the many valuable insights from climate modelling delivered by WP2, it will be very important for infrastructures managers to re-shape certain specific infrastructures, so to make them more resilient. For example, although rainfall variations seem to be less evident in the next 25-years span period, it must be for instance acknowledged that the intensity of rain fall per event has increased. Thus water pipe sizing must be re-designed so to avoid emergency flooding due to over-carrying. On the same line, the predicted widespread increase in river floods all over Europe calls for a revision of storm design return periods. The Pan European Datasets of Extreme Weather Probability of Occurrence under Present and Future Climates produced by WP2 represents an invaluable resource. This datasets, which cover all of the extreme weather events studied in the project, are made free available to engineers and scientists at <https://data.4tu.nl/repository/collection:ab70dbf9-ac4f-40a7-9859-9552d38fdccd>.

The main findings highlight the necessity for adaptability and for re-thinking. The risk quantification tools and proposed mitigation strategies for land based infrastructures are based on the very detailed climate modelling performed for different hazards, considering their

impacts and their potential consequences both on the functionality of systems and the well-being of the population.

3.10 Insight from Discussion

Based on the future challenges for European infrastructure managers and operators, the discussion highlighted the need to ensure always close collaboration between climate modellers and design engineers, so to define appropriate modification and risk mitigation measures. Also, hazard analysis emerged as a key-factor to understand risk as well as opportunities for improving risk mitigation.

Involvement of all stakeholder to this end is seen as crucial, so to make sure to deliver user-oriented solutions and to integrate all knowledge available at all levels in efficient processes of informed and evidence-based decision making.

The possibility to refine the tools developed for the analysis of specific hazards' impacts and within context-based scenarios was expressed as a significant advance by several participants, who expressed a willingness to further test these tools on their own networks in cooperation with the RAIN partners.

Finally, the 6 members of the panel expressed their appreciation for the RAIN final event especially for the delivery of user – oriented and practical tools. The importance of knowledge and information sharing between agencies and stakeholders was further stressed, as an element to ensure resilience when facing climate change impacts on European systems, infrastructures and ultimately societies.

4. Conclusion

The RAIN final event offered a good opportunity to make visible the interesting outputs of RAIN project. The selection of the topics presented during the event provided a good overview of the RAIN outputs. Moreover, the INTACT project was also presented by Dr. O’Keeffe of the Transport Infrastructure Ireland.

The active campaign of information on the event guaranteed a large number of participants from a broad range of critical infrastructure professionals, including academics, infrastructural managers and consultants.

The discussions generated during the course of the event highlighted the practicality of the results presented. Other relevant observations were exchanged during the panel discussion, such as sharing data between agencies, real time monitoring of critical infrastructure and the importance of quantifying the resilience.

The success of the event is a testament to the legacy which the RAIN project leaves. The wide audience and the active participation marked a very good result and the perfect conclusion for the RAIN project.

5. Annex 1. List of attendees

Participant	Company	Country
Xavier Clotet	AIA - RAIN consortium member	ES
Josu Reilly	ARUP	IE
Matilda Djidara	ARUP	IE
Matilda Djidara	ARUP	IE
Hans Peter Koslowski	AXA Matrix Risk Consultants (Germany)	DE
Fiona Dunlevy	Axcience Science Communications	IE
Martin Klose	BAST (Germany)	DE
Brian Ahearn	DCC	IE
Ann Dunleavy	Dept. of Communications, Climate Action & Environment	IE
Saorla Begley	Dept. of Communications, Climate Action & Environment	IE
Seosamh Olaio	Dept. of Communications, Climate Action & Environment	IE
Carlos Barcena	Dragados - RAIN consortium member	ES
Owen McManus	Dublin City Council	IE
William Mongey	EirGrid	IE
Paul Alexander	EPA	IE
Phillip O'Brien	EPA	IE
Robert Arthur	ESBI	IE
Terry McGrouh	ESBI	IE
Tommy Bree	ESBI	IE
Pieter Groenemeijer	ESSL - RAIN consortium member	DE
Karen Faulkner	Exeter University (UK)	UK
Andrea Vadja	FMI - RAIN consortium member	FI
Pertti Nurmi	FMI - RAIN consortium member	FI
Uwe Ulbrich	FU Berlin - RAIN consortium member	DE
Gerry Murphy	GDG - RAIN consortium member	IE
Kenneth Gavin	GDG - RAIN consortium member	IE
Pekka Vissuri	Hellenberg - RAIN consortium member	FI
Timo Hellenberg	Hellenberg - RAIN consortium member	FI
Charalambos Pitas	IPTO - RAIN consortium member	GR
Cathal Mangan	Irish Rail	IE
Tommy Johnson	Irish Rail	IE
Valerie Scott	Irish Rail	IE
Chiara Bianchizza	ISIG - RAIN consortium member	IT
Daniel O'Dwyer	Kildare Co Fire Services	IE
Marco Guerrini	MAREI Cork	IE
Paraic Ryan	NUIG	IE
Joan Carlos Johnson	OPW	IE
John Martin	OPW	IE

Noel Darcy	OPW	IE
Paul Kiernan	OPW	IE
Stephen Jones	OPW	IE
Peter Prak	PSG - RAIN consortium member	NL
Harry Meighan	ROD	IE
Jim Thorpe	ROD	IE
JP Rooney	ROD	IE
Mark Tucker	RODIS - RAIN consortium member	IE
Robert Corbally	RODIS - RAIN consortium member	IE
Ciaran Carey	RODIS - RAIN consortium member	IE
Julie Clarke	RODIS - RAIN consortium member	IE
Beatriz Martinez	TCD - RAIN consortium member	IE
Eileen Murphy	TCD	IE
Florence Lamouline	TCD	IE
Karin Dubsky	TCD	IE
Alan O'Connor	TCD - RAIN consortium member	IE
Maria Nogal	TCD - RAIN consortium member	IE
Pilar Jimenez	Technical University of Cartagena (Spain)	SP
Billy O'Keefe	TII	IE
Dominik Paprotny	TU-Delft - RAIN consortium member	NL
Oswaldo Morales-Napoles	TU-Delft - RAIN consortium member	NL
Pieter van Gelder	TU-Delft - RAIN consortium member	NL
Alexander Arpaci	UBIMET (AT)	AT
Eadaoin Doddy	UCD	IE
Seanie Griffin	UCD	IE
Vikram Pakrashi	UCD	IE
Elena Mora	University of Cantabria (Spain)	SP
Brian Bell	University of Surrey (UK)	UK
Maria Luskova	UNIZA - RAIN consortium member	SK
Michal Titko	UNIZA - RAIN consortium member	SK
Zdenek Dvorak	UNIZA - RAIN consortium member	SK
Alice de Ferrari	YOURIS - RAIN consortium member	IT