

Stevens Institute of Technology Summer Project

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07/03/15

Disaster Mitigation

Introduction

Disaster resilience refers to the *ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.*¹ Three of the main factors for achieving resilience are: preparedness, reaction time and adaptability. For each of these factors, tools that enable monitoring and event identification are extremely important.²

The lack of information during and after a disaster is one of the main problems for public policy makers for disaster mitigation and even conflict prevention.^{3,4} Knowing how people are moving, sharing information and the range the information flow is vital for generating proper solutions, especially under emergency situations.⁵

Efforts have been done to direct user-generated content on social media to identify damaged zones in disasters.⁶ These efforts have focused on mapping crisis in areas of limited statehood or limited resources in which local disaster mitigation agencies have limited resources.

This work will analyze information flow and its correlation with damage metrics using precipitation and news data. The main objective is to work towards an open and real time visualization platform for coordinating disaster mitigation decision making. For this purposes we will analyze a case of study for Mexico during September of 2013.

In September of 2013 two hurricanes category 1 in the Saffir-Simpson scale, affected 19 of the 31 states in Mexico. Hurricane “Ingrid”⁷ took place during 12-17 of September and hurricane “Manuel”⁸ 13-20 of September.⁹ Even though both tropical storms were not as destructive as other hurricanes (scales 3 -5) the interaction between the two storms (one in the Pacific Ocean and the other at the Atlantic Ocean) was catastrophic. Added to the fact that a lot of people went out for short vacations during 13-17 of September and the government was preparing for the independence holiday celebrations. Given the unpredictability and quickness in which disasters affect communities, a real time open visualization platform could help in these situations.

¹IPCC, 2012: Glossary of terms. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change

²Ramirez-Marquez JE, Rocco CM. (2009) Stochastic network interdiction optimization via capacitated network reliability modeling and probabilistic solution discovery. Reliability Engineering and System Safety; 94(5):913–921

³Meier, Patrick. (2014). Crisis Mapping in Areas of Limited Statehood. In Information and Communication Technologies in Areas of Limited Statehood, ed. Steven Livingston and Gregor Walter-Drop. Oxford University Press

⁴Meier, Patrick. (2014). Human Computation for Disaster Response. In Handbook of Human Computation, ed. Pietro Michelucci et. al, Springer

⁵Sakaki T, Okazaki M, and Matsuo Y. (2010) Earthquake shakes Twitter users real-time event detection by social sensors. Proceedings of the 19th international conference on World wide web: 851-860

⁶Meier, Patrick. (2014). Using Advanced Computing to Verify User-Generated Content on Social Media, in The Verification Handbook, eds. Craig Silverman and Rina Tsubaki.

⁷In the Atlantic Ocean

⁸In the Pacific Ocean

⁹CONAGUA(2014), “Reporte del Clima en México 2013”, Coordinación General del Servicio Meteorológico Nacional



Natural disasters 2013

In September of 2013 two hurricanes category 1 in the Saffir-Simpson scale, affected 19 of the 31 states in Mexico. Even though both tropical storms were not as destructive as other hurricanes (scales 3-4) the interaction between storms (one in the Pacific Ocean and the other at the Atlantic Ocean) was catastrophic.

SEPT. 12, 2013
Tropical Depression INGRID

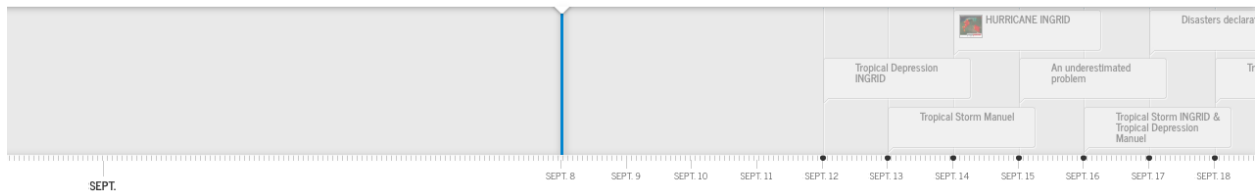


Figure 1: Disaster Timeline September 2013

Follow the [Disaster Time Line](#) to learn more about the evolution of Ingrid and Manuel tropical storms.

Objectives

The objective of this project is to develop and apply methods to assess the suitability of using news flows and precipitation data to characterize disaster damages in Mexico looking forward to resource allocation improvement.

The extension of the project depends on the data needed and gathered. As mentioned above we will work towards an open, real time visualization platform for coordinated disaster mitigation for decision making.

Working plan

- Analyze information flows using Newspaper, TV and radio data.
- Correlation of online activity with precipitation data.
- Correlation of online activity with damage metrics.
- Accompanying interactive visualization tools

The workflow of the project is the following:

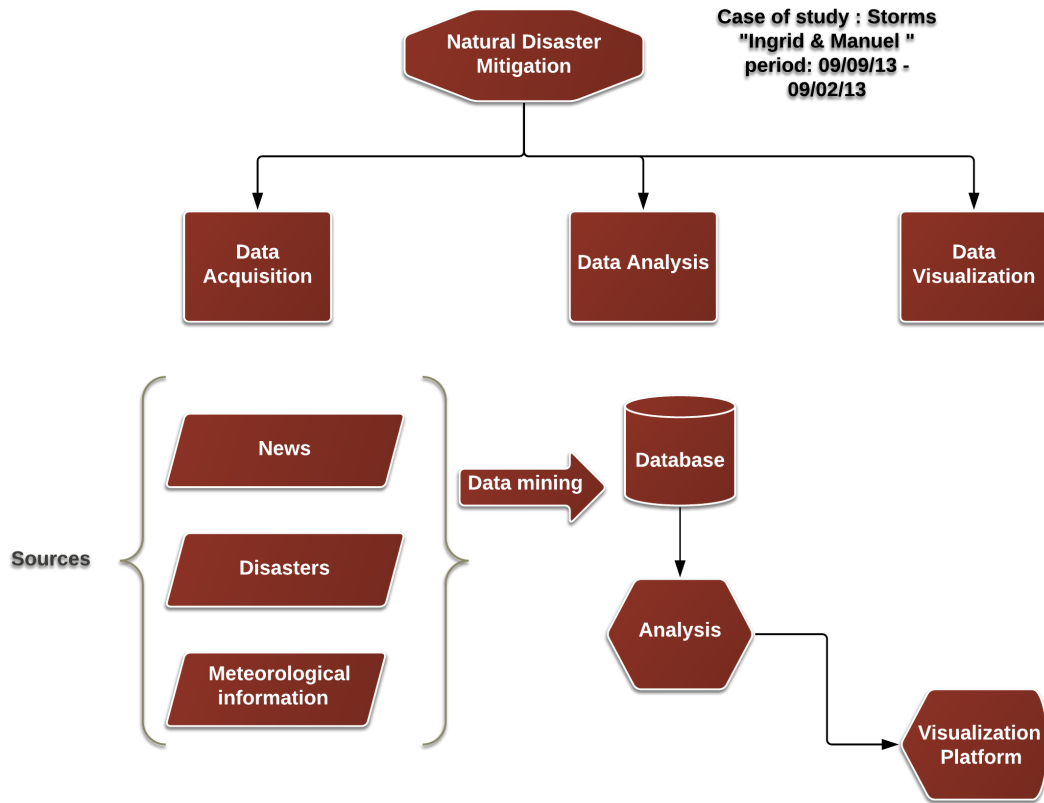


Figure 2: Workflow

Data

The period of study is September 9th (3 days before hurricane Ingrid started) till October 2th (15 days after hurricane Manuel finished). The following section describes the 3 data groups needed for this project:

Information Sources for Event Analysis

Meteorological Information	Tropical Storms route	NOOA	<ul style="list-style-type: none"> • Day • Location
	Precipitation	SMN	<ul style="list-style-type: none"> • Daily precipitation • station
Damage Assessment	Damage Assessment	CENAPRED	<ul style="list-style-type: none"> • State • Date • Affected population • Damages
	Public Expenditure	FONDEN	<ul style="list-style-type: none"> • State • Public expenditure • Affected sector
	Disaster Relief Assistance	SEGOB	<ul style="list-style-type: none"> • Municipality • latitude and long • type of assistance
News	National News	EI	<ul style="list-style-type: none"> • Radio • TV • Newspaper • Web

Figure 3: Sources

- **News data:** The Company “Eficiencia Informativa” [EI](#) gathers information from electronic, newspaper, radio and TV news. The idea is to scrap all the news related to Ingrid and Manuel during the period of study. The company gave an acces for using their information till the endo of the year.

The screenshot shows the website 'eficiencia informativa' with a search bar containing 'Ingrid y Manuel'. The search results display several news items, including a headline about the Secretary of Social Development, Rosario Robles, and another about the impact of Hurricane Manuel on Acapulco. The interface includes navigation menus, a calendar, and various search filters.

Figure 4: Eficiencia Informativa System

They have different formats for downloading the information. The best is CSV

ID	Fecha	Hora	Medio	Tipo de Medio	Autor	Genero	Titulo	Resumen	Transcripción	Tema	Programa	Duración	Sección	Página	Precio	URL del Testigo
41009670	2013-09-16	18:58:04	Sin Embargo.com	Periodismo Digital	Redacción	Nota Informativa	Aerolíneas buscan "puente aéreo" para sacar a turistas de Acapulco; autoridades instalan 10 refugios	<p>http://www.sinembargo.mx/16-09-2013/756281</p> <p>Las aerolíneas Interjet y Aeroméxico informaron que apoyarán a los turistas que quedaron varados en el Puerto de Acapulco, en el estado de Guerrero, a causa de los daños en la Autopista del Sol que ocasionó la tormenta tropical Manuel. Por medio de su cuenta de Twitter Interjet indicó a sus usuarios que sino no pudieron viajar este lunes podrán hacerlo el día de mañana sin cargos adicionales. Indicó que también se podrán hacer cambios de ruta y fecha sin que se cobren cargos por las operaciones. Sin embargo, precisó que si existe una diferencia entre las tarifas deberá ser cubierta la diferencia. Aeroméxico comunicó que realizará vuelos extraordinarios de Acapulco a México en cuanto sea reabierto el Aeropuerto Internacional de Acapulco. Aeroméxico también ha dispuesto una tarifa especial en estos vuelos, de mil 599 pesos viaje sencillo, para apoyar a todos los pasajeros que por algún motivo busquen viajar durante esta contingencia, informó la aerolínea en un boletín de prensa. Indicó que ten las próximas horas se darán a conocer los horarios de los vuelos a través de nuestra página web (www.aeromexico.com) y recordamos que, la página oficial de facebook, cuentas de twitter @Aeromexico.com y @iam_escucha, así como el call center 51-33-40-00 desde la Ciudad de México, se encuentran a disponibles para atender a los pasajeros, agregó. Las fuertes lluvias que han originado la tormenta y depresión tropical Manuel en el Pacífico e Ingrid en el Golfo, respectivamente, han golpeado principalmente a los estados de Guerrero en una costa y Veracruz en la otra. Desde el fin de semana ambos fenómenos meteorológicos han generado lluvias y afectaciones en las dos costas del país, con un saldo de al menos 34 muertos y 1 millón 200 mil afectados. Tan sólo en Guerrero, Luis</p>	<p>http://www.sinembargo.mx/16-09-2013/756281</p> <p>Las aerolíneas Interjet y Aeroméxico informaron que apoyarán a los turistas que quedaron varados en el Puerto de Acapulco, en el estado de Guerrero, a causa de los daños en la Autopista del Sol que ocasionó la tormenta tropical Manuel. Por medio de su cuenta de Twitter Interjet indicó a sus usuarios que sino no pudieron viajar este lunes podrán hacerlo el día de mañana sin cargos adicionales. Indicó que también se podrán hacer cambios de ruta y fecha sin que se cobren cargos por las operaciones. Sin embargo, precisó que si existe una diferencia entre las tarifas deberá ser cubierta la diferencia. Aeroméxico comunicó que realizará vuelos extraordinarios de Acapulco a México en cuanto sea reabierto el Aeropuerto Internacional de Acapulco. Aeroméxico también ha dispuesto una tarifa especial en estos vuelos, de mil 599 pesos viaje sencillo, para apoyar a todos los pasajeros que por algún motivo busquen viajar durante esta contingencia, informó la aerolínea en un boletín de prensa. Indicó que ten las próximas horas se darán a conocer los horarios de los vuelos a través de nuestra página web (www.aeromexico.com) y recordamos que, la página oficial de facebook, cuentas de twitter @Aeromexico.com y</p>	"Default: 0:00 -> 0:00"	00:00:00			\$	1.00	http://data4.efinf.com/reafer/diaglog?id=-138a9c19f64877db51055114235c7abc-11

Figure 5: Example of the DB

The idea is to do text mining for processing this database and follow the coverage of the disasters in the news.

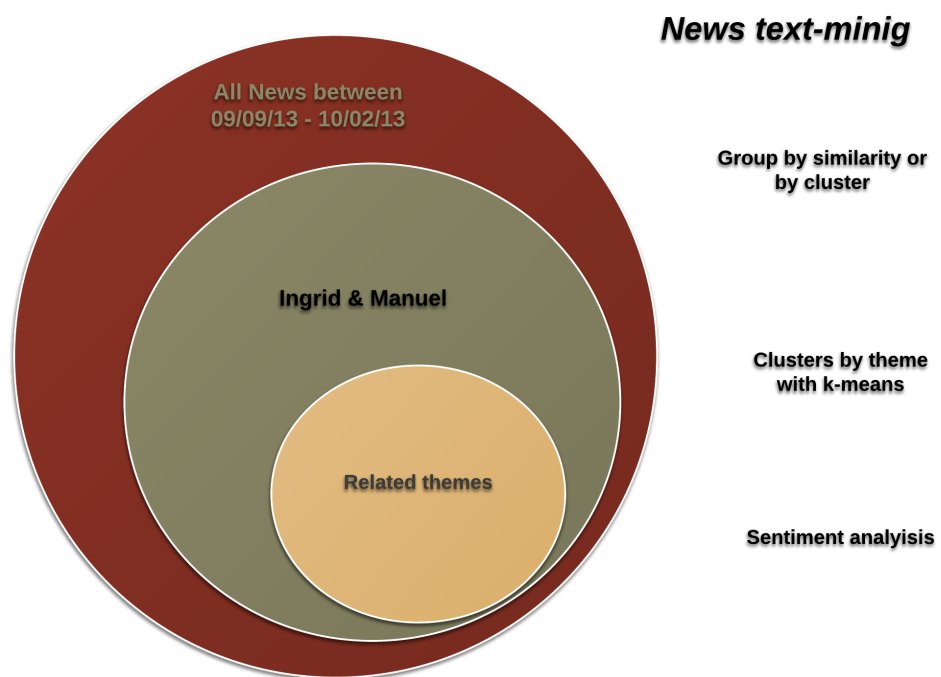


Figure 6: news

- **Disaster Database:**

- *Disaster Evaluation:* The National Center for Natural Disaster Prevention (CENAPRED) is in charge of the disaster damage and loss evaluation for the affected states. They gave us an access to the National Risk Atlas [ANR](#) and the evaluation dataset. Since Ingrid and Manuel Storms affected 19 of the 31 mexican states the government could not make a comprehensive damage evaluation. They were only able to do 5 damage evaluations (Durango, Guerrero, Nuevo Leon, Sianloa and Veracruz). The access to the ANR is not working so good since an older versión of explorer is needed. We are trying to access the platform in other system. ¹⁰
- *Public Spending:* The Ministry of Interior(SEGOB) manages the Disaster Relief Fond (FONDEN) through the National Civil Protection Service (SINAPROC) ¹¹. The public spending records are available online [Recursos Autorizados](#). Ingrid y Manuel disasters have a lag of 3 years of public spending. Each year has diferent format and information. We are working on the data cleaning. For following up the disasters, SEGOB open a platform to inform the reconstruction actions and the money expedited [Presidencia](#). The data in this platform does not match with the data obtained in FONDEN web site in spite of being the same govenment entity. We already send a mail asking for this inconsistencies.

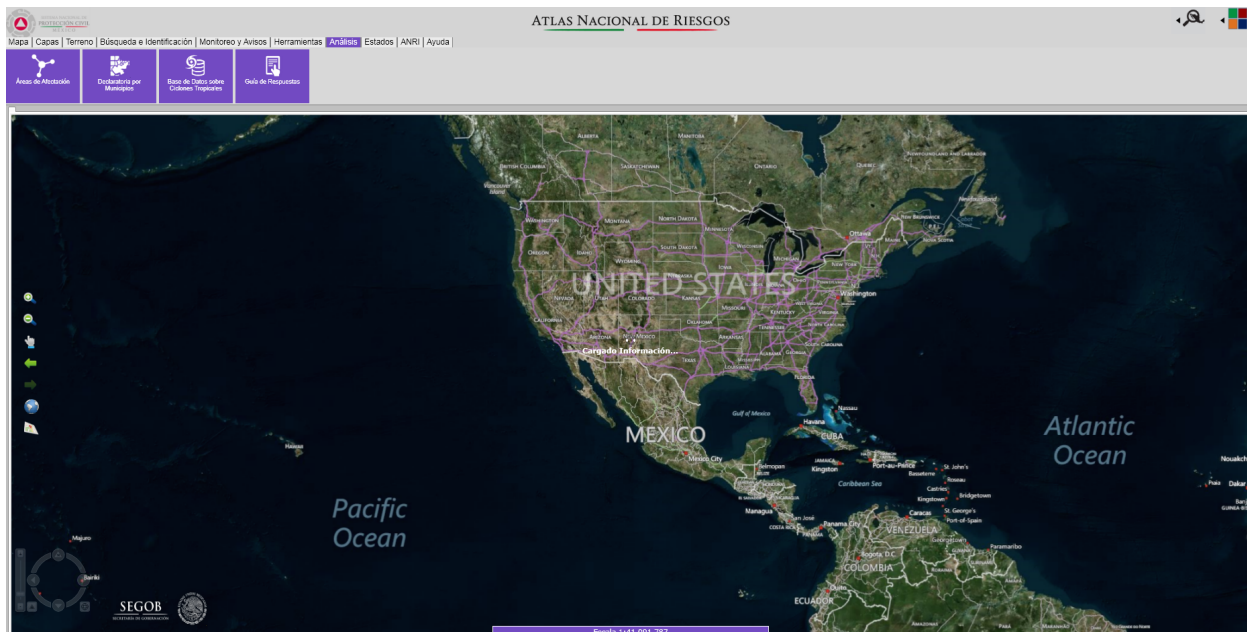


Figure 7: National Risk Atlas

- **Micro blog:** Use Twitter information to measure mobility during Ingrid and Manuel.
- **Meteorological Information:** The precipitation data could help us as a proxy for damage metrics. The data could be obtained by NASA precipitation grid or by the National Meteorological System.

¹⁰if the acces is not working next week we will procede to ask for each data base

¹¹For more information about FONDEN system see Garcia, A. (2014) "Desastres Naturales: Destrucción Creativa?",Chapter2, BA thesis ITAM

Data Set	Status	Process
News	Obtained	text mining
Disaster Evaluation	Obtained	cleaninig
Disaster Public Spending	Obteined	cleaning
Twitter	waiting for acces to the DB	
Precipitation Data	waiting for acces to DB	

Project Time Line 07/03/13 - 08/16/13

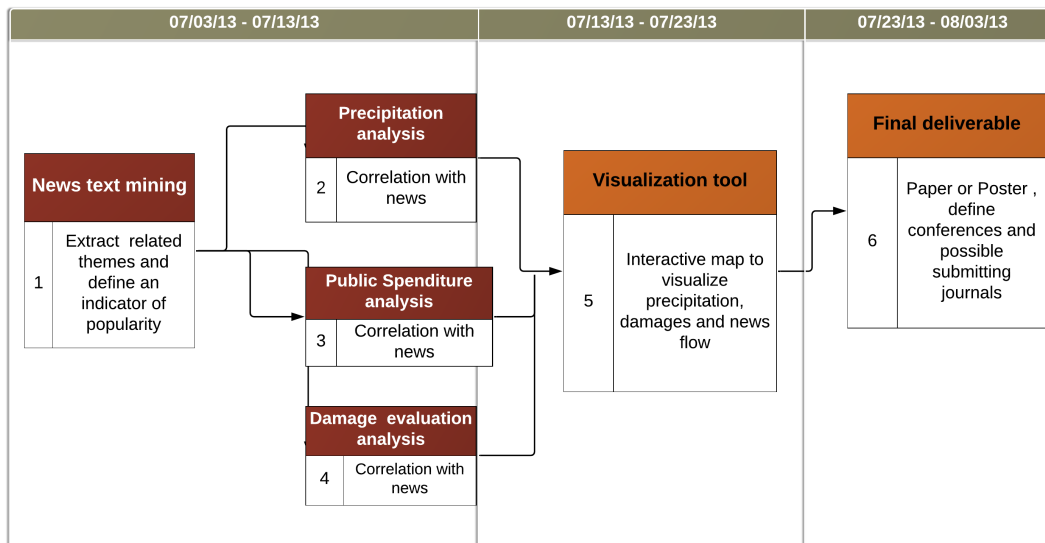


Figure 8: Project Time Line