

Stevens Institute of Technology Summer Project

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06/17/15

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 (plan A) and/or population mobility (plan B) and its correlation with damage and loss metrics using microblogging 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

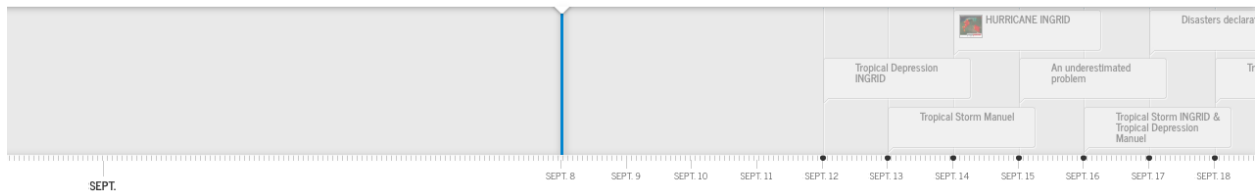


Figure 1: Disaster Timeline September 2013

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

Objectives

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

Plan A

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

Plan B

- Analyze population mobility using Twitter data.
- Correlation of online mobility with precipitation data.
- Correlation of online mobility with damage and loss metrics.
- Accompanying interactive visualization tools

The workflow of the project is the following:

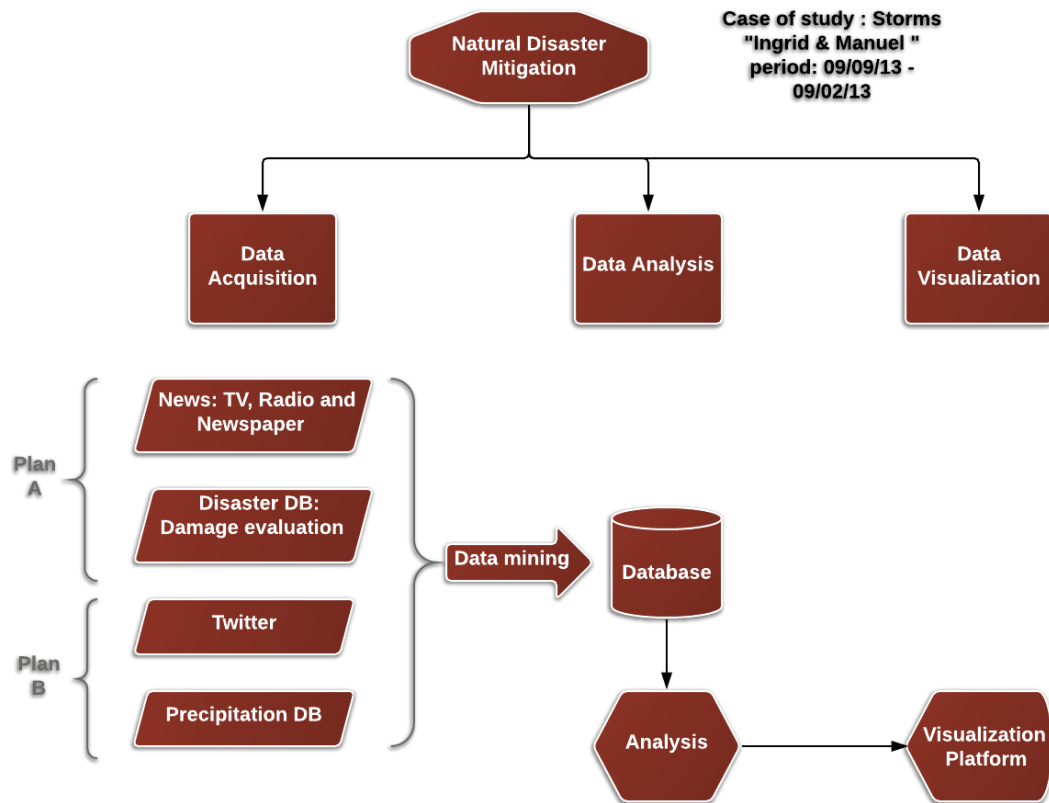


Figure 2: Workflow

Data

The period of study is September 9th (3 days before hurricane Ingrid started) till October 4th (15 days after hurricane Manuel finished). The following section describes the 5 data sets needed for this project:

- **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.

eficiencia informativa

Miércoles 17 Junio 2015

Síntesis Informativa

Andrea García ITAM

Aviso de privacidad

[Ayuda al usuario](#)

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[La Nueva](#)

[Salir](#)

<<	JUNIO 2015	>>				
D	L	M	M	J	V	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Buscador (-)

Básica **A avanzada**
Borrar

Ayuda
Buscar

Idioma búsqueda:
Español

Limitar fechas:

Borrar

Del: 2013-09-09
SEPTIEMBRE 2013

D	L	M	M	J	V	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

al: 2013-10-02
OCTUBRE 2013

D	L	M	M	J	V	S
	1	2	3	4	5	
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Otras opciones:
 Géneros:
 Tipos de medio:
 Guardar búsqueda:

Seleccionar: Todas, Ninguna

[Actualizar](#)

[Aplicar etiqueta](#)

<< Resultado 1 al 500 de 7177 ≥ >>

18:46:42 En entrevista para Enfoque la secretaria de Desarrollo Social, Rosario Robles, informó que el objetivo principal del gobierno en la zona de La Pintada es habilitar los caminos para llevar la ayuda.

(2013-10-02) 100.1 Stereo Cien , Enfoque Tercera Emisión, Raúl Sánchez Carrillo, Duración: 0:08:31

RAÚL SÁNCHEZ CARRILLO, CONDUCTOR: Te agradezco tomarme llamada de Enfoque y me da mucho gusto saludar a la licenciada Rosario Robles Berlanga, ella es Secretaria de Desarrollo Social y fue quien se hizo cargo por instrucciones del Presidente, que luego ha acudido más de seis veces a la emergencia en Acapulco por **Manuel e Ingrid**. Rosario, buenas tardes. ROSARIO ROBLES, SECRETARÍA DE DESARROLLO SOCIAL: Raúl, me da mucho gusto saludarte, muchas gracias por platicar con nosotros, acá

[Ver Transcripción](#)

18:45:33 Titulares de periódicos Contraportada

(2013-10-02) 104.1 Radio Fórmula , Contraportada, Carlos Lorel de Mola, Duración: 0:02:19

*La Razón/Sumaron 155 las personas muertas por **Ingrid** y **Manuel** *Milenio/Salió la CNTE de la SEGOB pero no informa avances *El Universal/Consideró el 68 por ciento que su ciudad es insegura: INEGI *Radio Fórmula/Movimiento por la Paz pidió impulsar nuevo modelo de política de drogas A: HSBC, Miguel Ángel Osorio Chong

[Ver Transcripción](#)

Estados se recuperan del paso de las lluvias

(2013-10-02) EsMas, Nota Informativa , Genero: RSS , Seccion: General

, que así continúa, a más de dos semanas de la tragedia que trajo la tormenta **Manuel**. Yo no alcancé a sacar... en Tampico. SINALOA **Manuel**, como huracán, afectó a unos 230 mil sinaloenses en nueve municipios... kilómetros de la red carretera siguen dañados, tras el paso de **Manuel**. Mire cómo andamos aquí, trabajando..., una de las más devastadas, llovió al doble del promedio anual. En total **Ingrid** dejó 40 muertos, cientos de miles de afectados, y daños en afectaciones en Veracruz por **Ingrid** - 40 muertos - 117 mil 948 viviendas

[Ver Transcripción](#)

18:09:33 Teaser Las Noticias de las 18

(2013-10-02) Canal 4 Foro TV, Las noticias de las 18:00, Óscar Hernández, Duración: 0:00:52

* Tarde de marchas en la ciudad, conmemoran los 45 años del 2 de octubre de 1968. * Ordenan evacuación en Quintana Roo por sistema de baja presión. * No se

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

Figure 4: Example of the DB

- **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 opend a platform to inform the reconstruction actions and the money expeded [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.

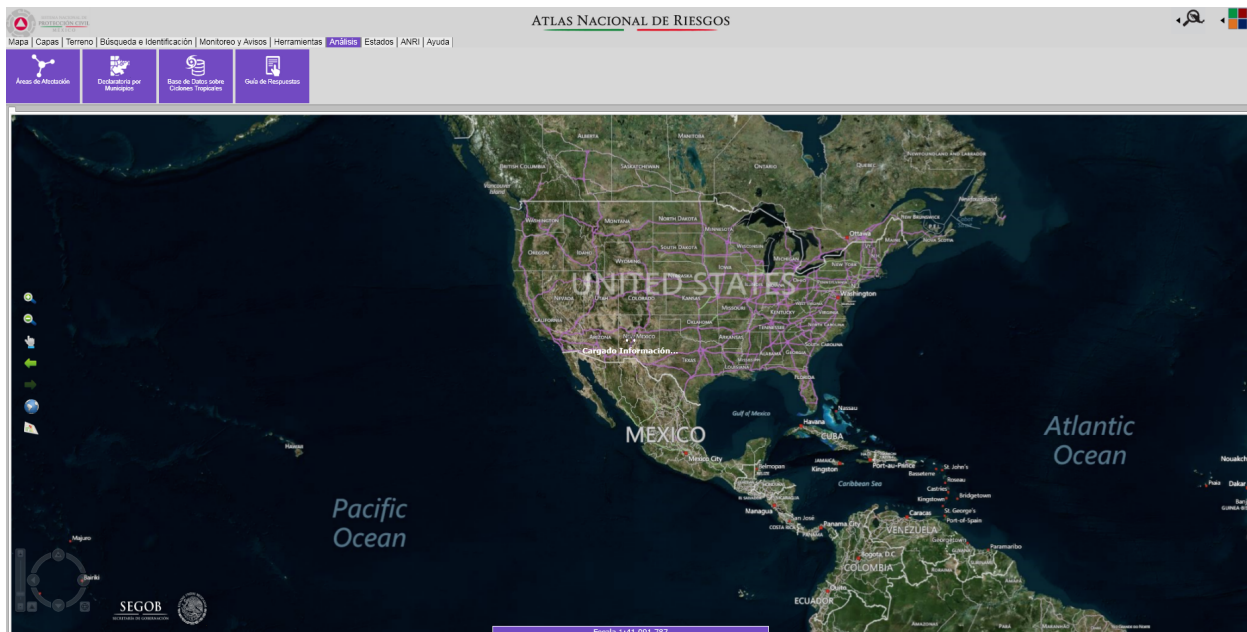


Figure 5: National Risk Atlas

- **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	

Since we have only 3 of the 5 datasets we will proceede with the plan A.