

COMMUNICATING EARTHQUAKE INFORMATION TO THE PUBLIC IN ITALY: 10 YEARS OF INGV **terremoti**

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FOREWORD

- Communicating earthquake scientific information is very important in countries like Italy, where seismic sequences are frequent, seismic risk is high, and people's perception of risk is strongly affected by fear.
- After the 2009 earthquake in L'Aquila (central Italy), which claimed 309 casualties and triggered a long lasting dispute among scientists, journalists, citizens, including a suite of criminal and civil trials involving scientists and civil protection officers, the scientific and risk communication in Italy (not only on earthquakes) was facing a crossroad.
- The first choice (feared at that time by many reporters) was to minimize or even elude public communication, in order to avoid misunderstandings and involvement in litigations.
- The second possibility was to increase the efforts in public communication, getting closer to citizens.

INGVTerremoti 2009-2020

- INGV definitely opted for the second choice.
- In the past ten years the INGVterremoti platform has augmented and differentiated its activities on the web and social media, substantially increasing the number of involved people, which amounts today to several hundreds thousand citizens. The platform consists of a coordinated suite of social media channels, including Facebook, Twitter, Youtube and a blog (on wordpress), where we publish both updating during earthquake sequences and scientific topics.
- Our end users are mostly citizens, but also media and authorities. Our tweets on earthquake activity are often in the first pages of web and TV news magazines.

2018-2020: AUTOMATIC SOLUTIONS

- In September 2018, we started publishing automatic locations/magnitudes for earthquakes in Italy with magnitude equal to or larger than 3, after a careful analysis of the thresholds and of the best format to use, in order to warrant message understandability and to minimize false or incorrect information.
- This issue is very critical both to provide the best and fastest information to citizens, and to increase people's trust in scientific information and institutions. These are often blamed by citizens and by media when contradictory information is offered to the public.
- We will present an analysis of the first 18 months of this testing phase, which has been widely appreciated by the public.

A COMBINED PLATFORM FOR RELEASING INFORMATION ON EARTHQUAKES IN ITALY



INGV terremoti

l'informazione sui terremoti

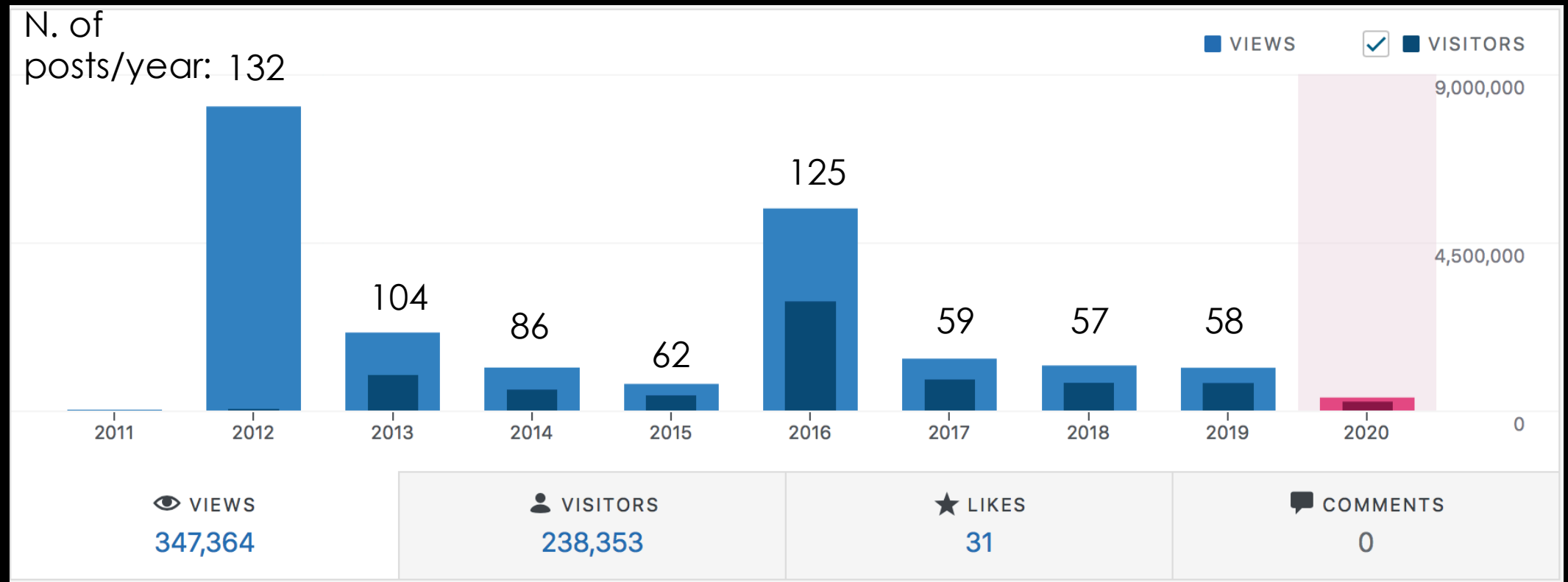


TWITTER	FACEBOOK	YOUTUBE	BLOG	APPLE IOS + Android
open since 2009	on line from may 2013	on line from february 2010	open since may 2012	Available on Apple Store since march 2011
255.700 followers	211.600 friends	12.200 members	700 posts published	900.000 downloads
24.480 tweet published	bidirectional communication	5.640.901 views	48.000.000 views	last update 2019, new version in 2020



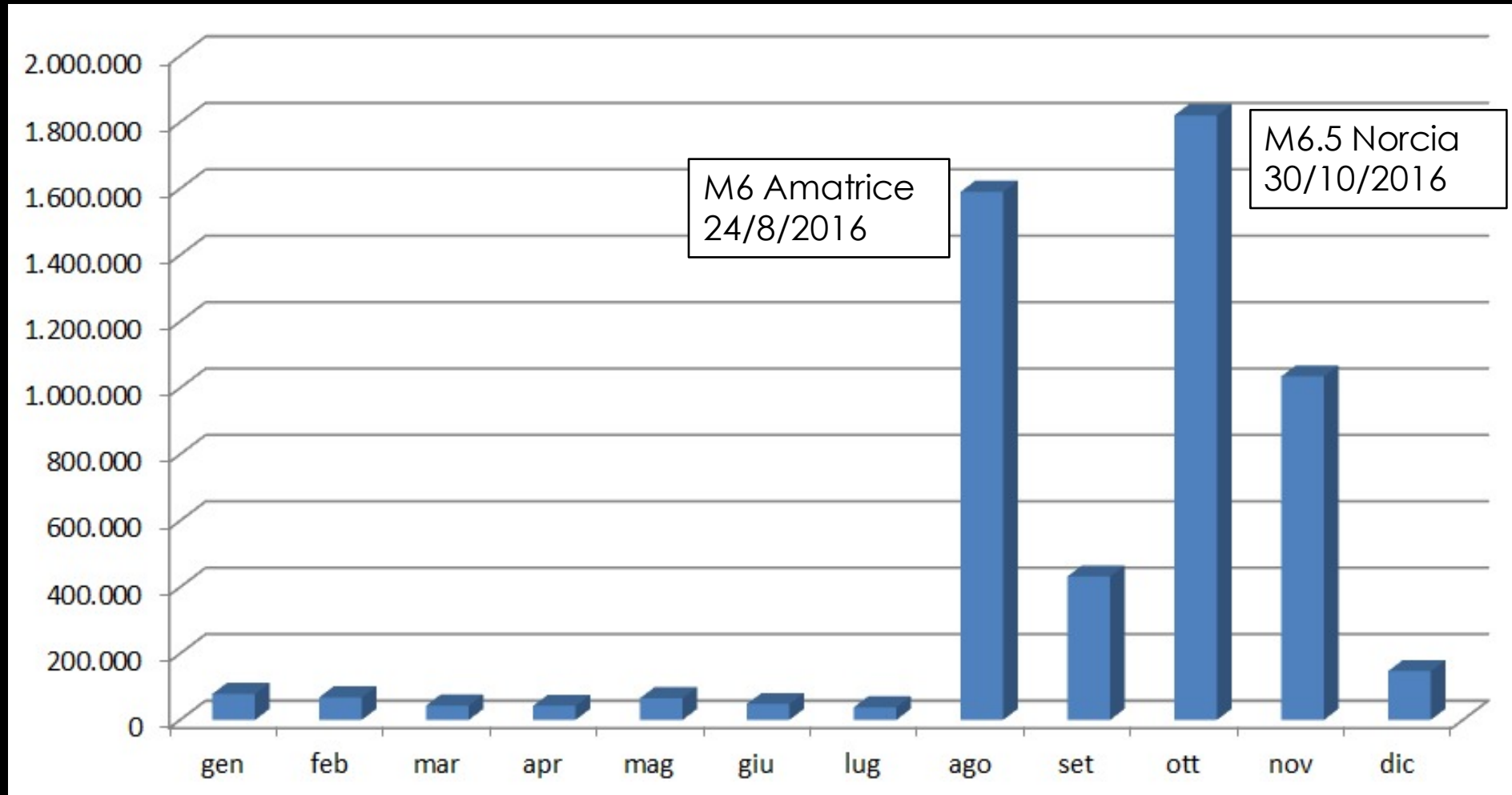
INGV terremoti

EQ INFO: STRONG VARIATIONS THROUGH TIME (BLOG) 2012-2020



After 2016: higher number of visitors on average

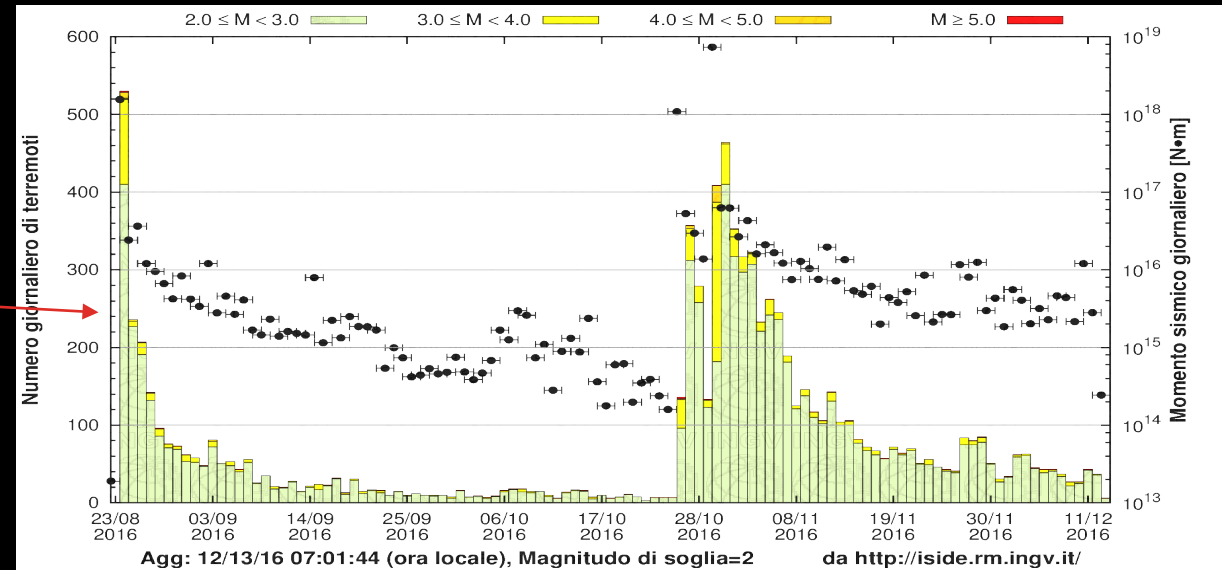
STRONG VARIATIONS THROUGH TIME (BLOG) DURING 2016



OMORI'S LAW APPLIES TO PEOPLE'S ATTENTION FOLLOWING THE TREND OF SEISMIC ACTIVITY

Seismic activity during 2016 in Central Italy (number of eqks and seismic moment release)

Visitors at the INGVterremoti blog



IN 2020, NEW STRUCTURE OF INGVTERREMOTI - BLOG → MAGAZINE

 **INGV**terremoti

CHI SIAMO ALLA SCOPERTA DEI TERREMOTI GLOSSARIO COMUNICAZIONE E DIVULGAZIONE ▼ RUBRICHE ▼ CONTATTI

giovedì, Aprile 30 2020

TERREMOTI IN ITALIA TERREMOTI NEL MONDO TERREMOTI NELLA STORIA MONITORAGGIO E ATTIVITÀ IN EMERGENZA PERICOLOSITÀ E RISCHIO MAREMOTI



26 Aprile 2020
Sciame sismico nella notte in area flegrea (26 aprile 2020)



22 Aprile 2020
Sala sismica vuota? Solo in apparenza...



Ricostruzione dello scuotimento sismico durante il terremoto di Gubbio del 29 Aprile 1984

TERREMOTI IN ITALIA

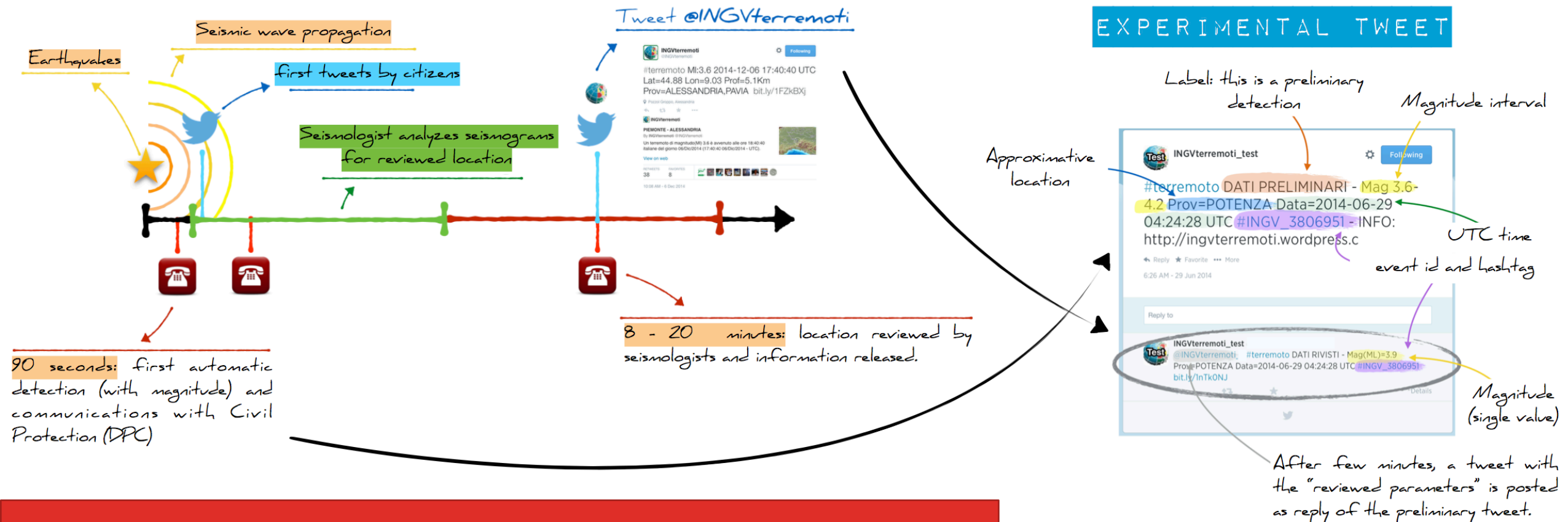


24 Febbraio 2020
Evento sismico del 24 febbraio 2020, MI 4.4 (Mw 4.3), in provincia di Cosenza

PUBLISHING AUTOMATIC SOLUTIONS 2013-2018: A LONG PATH

- A study on the semantics:
 - Automatic solution vs. Preliminary estimate
 - Zone/Province vs. Municipalities
 - Magnitude range instead of single values
- Steps:
 - Link to a post with explanations, FAQs, etc.
 - Discussion with Civil Protection

CONCEPTUAL SCHEME FOR TWITTING AUTOMATIC SOLUTIONS (from: AGU 2014)



INGV: Timeline of locations and communications to Civil Protection



INGVterremoti

THE ONLINE SURVEY (from: AGU 2014)

ONLINE SURVEY: 28 JULY 2014 - 12 SEPTEMBER 2014

as reply of the preliminary tweet.

WHY:

Recent episodes show that “evolving” value of earthquake parameters are seen as: “errors due to ineptitude”, “you are hiding the truth”, “conspiracy to sedate”. Tweeting the automatic detection could increase the risk of debates around magnitude and conspiracy theory (sic!)

GOALS:

- ☐ Improving the comprehension of @INGVterremoti tweets and timeline, especially of the automatic detection experimental tweets
- ☐ Selecting words, structure and information of automatic detection experimental tweets
- ☐ Educating citizens and media to the automatic detection experimental Tweets (and earthquake parameters as evolving estimate)



SURVEY: <https://ingvterremoti.typeform.com/to/bahSfj> (sorry in Italian)

- ☐ 51 questions, not easy, 10000+ access to the presentation of the survey, 2400+ access to the survey, **1244 complete response**
- ☐ 67% Male, 42% Academic degree, 5% Phd (0.7% geology or geophysics): it is not a representative sample of Italian population
- ☐ Evaluation of basic knowledge in seismology (question about difference of magnitude/intensity and MI5/MI6 in size)

unique visits	responses	completion	avg. time to complete																				
2468	1,224	50%	24:45																				
<table border="1"> <thead> <tr> <th>Phone & Laptop</th><th>Tablets</th><th>Smartphones</th><th>Other</th></tr> </thead> <tbody> <tr> <td>1091 unique visits</td><td>236 unique visits</td><td>995 unique visits</td><td>146 unique visits</td></tr> <tr> <td>613 responses</td><td>140 responses</td><td>455 responses</td><td>16 responses</td></tr> <tr> <td>56% completion</td><td>59% completion</td><td>46% completion</td><td>11% completion</td></tr> <tr> <td>22:55 avg. time to complete</td><td>30:59 avg. time to complete</td><td>25:31 avg. time to complete</td><td>18:44 avg. time to complete</td></tr> </tbody> </table>				Phone & Laptop	Tablets	Smartphones	Other	1091 unique visits	236 unique visits	995 unique visits	146 unique visits	613 responses	140 responses	455 responses	16 responses	56% completion	59% completion	46% completion	11% completion	22:55 avg. time to complete	30:59 avg. time to complete	25:31 avg. time to complete	18:44 avg. time to complete
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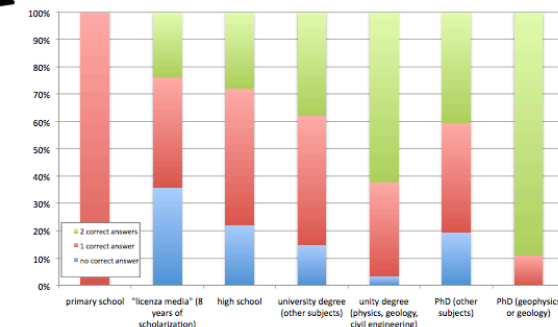
good general comprehension of all the proposed of tweet (better a **conversational** structure) **60% wrong** understanding of **UTC** time (are we going local?)

for 35% it is **complicated** to find the corresponding automatic and reviewed tweets

80% want an estimation of **damages** and casualties (only 45% requested intensity)

only 28% understand correctly the **hashtag** id (too tech?)

after a felt event, **92%** want official information in **2 minutes**
(4% only reviewed tweet, 0.3% no information at all)



INGVterremoti

2018: AFTER SOME YEARS OF TESTING AND INTERACTION WITH CIVIL PROTECTION...

1

LOCALIZZAZIONE AUTOMATICA
I PARAMETRI SONO PROVVISORI

INGVterremoti @INGVterremoti

{STIMA PROVVISORIA} #terremoto Mag tra 3.1 e 3.7 ore 17:54 IT del 25-08-2018, prov/zona Campobasso #INGV_20497831

5:57 PM 25 Aug 2018

E' INDICATA LA ZONA O LA PROVINCIA COLPITA PER ESPRIMERE L'INCERTEZZA SULLA POSIZIONE DELL'EPICENTRO

2

LOCALIZZAZIONE RIVISTA
I DATI SONO STATI ANALIZZATI DA UN SISMOLOGO

INGVterremoti @INGVterremoti · Aug 25

{DATI RIVISTI} #terremoto ML 3.3 ore 17:54 IT del 25-08-2018 a 4 km SE Montecilfone (CB) Prof=22Km #INGV_20497831

6:08 PM 25 Aug 2018 from Montecilfone, Molise

36 Retweets 43 Likes

ED HANNO LO STESSO CODICE NUMERICO (ES. #INGV_20497831)

I TWEET CON LOCALIZZAZIONE AUTOMATICA E RIVISTA FANNO PARTE DELLA STESSA CONVERSAZIONE

AUTOMATIC SOLUTION

- [PRELIMINARY ESTIMATE]
- Magnitude range instead of single value
- Zone/Province instead of precise location

REVIEWED SOLUTION (reply to automatic)

- [REVISED DATA]
- Magnitude ML
- km from closest municipality
- Depth

FAQS

Will all earthquakes be communicated?

Only those with $M > 3$ and reliable quality

Dal **19-GIUGNO** anche su **WEB**: epicentro e magnitudo provvisori dopo 2 minuti da un terremoto.

SARANNO COMUNICATI IN QUESTO MODO TUTTI I TERREMOTI?

SOLO I TERREMOTI CON MAGNITUDO SUPERIORE A 3 E INDICI DI QUALITÀ AFFIDABILI



ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

Why not a single magnitude?

Because of the uncertainty, we will indicate a range. We expect that for 5% of the events the revised mag will be out of range

Dal **19-GIUGNO** anche su **WEB**: epicentro e magnitudo provvisori dopo 2 minuti da un terremoto.

PERCHÈ NON VIENE COMUNICATO UN SINGOLO VALORE DI MAGNITUDO?

VISTA L'INCERTEZZA, INIZIALMENTE SARÀ COMUNICATO UN INTERVALLO DI MAGNITUDO MINIMA E MASSIMA. ESISTE UNA PROBABILITÀ (5%) CHE LA MAGNITUDO FINALE NON SIA COMPRESA IN QUESTO INTERVALLO.



ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA



INGV terremoti

FAQS

How many earthquakes will not have a quick, preliminary estimate?

About 25% of the $M > 3$ earthquakes, possibly some of large magnitude too.

Dal 19-GIUGNO anche su WEB: epicentro e magnitudo provvisori dopo 2 minuti da un terremoto.

QUANTI SARANNO I TERREMOTI PER CUI NON CI SARÀ UN'INFORMAZIONE RAPIDA E PRELIMINARE?

CIRCA IL 25% DEGLI EVENTI CON MAGNITUDO SUPERIORE A 3, TRA QUESTI CI POTRANNO ESSERE ANCHE EVENTI CON MAGNITUDO SIGNIFICATIVA



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Which earthquakes will not have a reliable fast estimate?

Those at sea, in volcanic areas, along or out of the borders, during a seismic sequence...

Dal 19-GIUGNO anche su WEB: epicentro e magnitudo provvisori dopo 2 minuti da un terremoto.

QUALI SONO I TERREMOTI CON INDICI DI QUALITÀ NON SUFFICIENTI PER AVERE UNA LOCALIZZAZIONE AUTOMATICA AFFIDABILE?

SONO EVENTI CHE AVVENGONO SOPRATTUTTO:

- IN MARE,
- IN AREE VULCANICHE,
- AI CONFINI DELL'ITALIA,
- DOVE ALCUNE STAZIONI POSSONO AVERE TEMPORANEAMENTE PROBLEMI TECNICI,
- DURANTE UNA SEQUENZA SISMICA.



ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA



INGV terremoti

FAQS

Is it possible that a non-existing event will be communicated?

Yes, although with a very low probability (1 event out of 1,500 after 7 years of tests).

Dal 19-GIUGNO anche su WEB: epicentro e magnitudo provvisori dopo 2 minuti da un terremoto.

SARA' POSSIBILE CHE SIANO ANNUNCIATI TERREMOTI NON AVVENUTI? DEI FALSI ALLARMI?

ESISTE LA PROBABILITÀ, SEBBENE MOLTO BASSA, DI UN FALSO ALLARME: 1 EVENTO SU 1500 (IN 7 ANNI DI SPERIMENTAZIONI)



ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

What does “reliable quality indexes” mean?

Earthquakes recorded by a sufficient number of seismometers with a good geographical distribution and low location errors.

Dal 19-GIUGNO anche su WEB: epicentro e magnitudo provvisori dopo 2 minuti da un terremoto.

COSA VUOL DIRE TERREMOTI CON INDICI DI QUALITÀ AFFIDABILI?

TERREMOTI REGISTRATI DA UN NUMERO SUFFICIENTE DI SISMOMETRI CON UNA BUONA DISTRIBUZIONE GEOGRAFICA E BASSO ERRORE



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INGV terremoti



FROM JUNE 2019
AUTOMATIC INFORMATION
ALSO ON THE WEB PAGE
AS
A BANNER REPORTING TIME
ELAPSED FROM THE EVENT

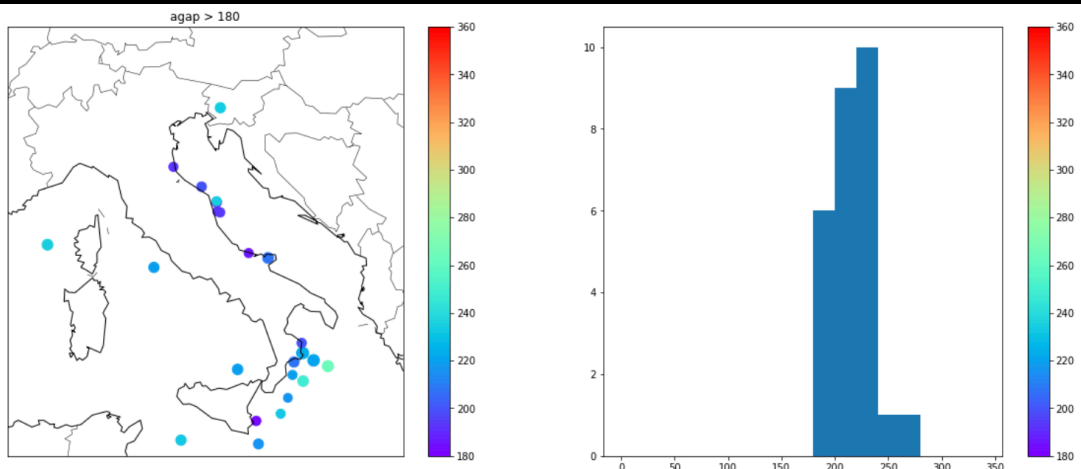
12 minuti fa - STIMA PROVVISORIA - Terremoto di magnitudo tra 2.8 e 3.3 ore 20:18 IT del 03-05-2019, prov/zona Palermo -

▼ Fuso Orario: Italia ▼ Ultimi 7 giorni ▼ Magnitudo: 2+ ▼ Mondo Personalizza Ricerca Mappa

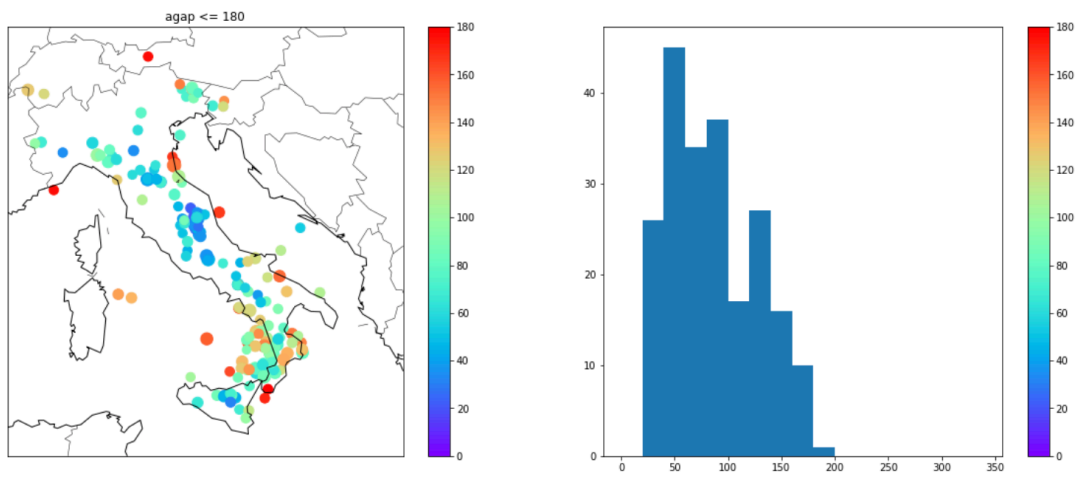
Visualizzati terremoti da 1 a 30 dei 44 trovati (Ordinamento Tempo Decrescente) Esporta lista (UTC)

Data e Ora (Italia) ⚙ ⓘ	Magnitudo ⚙ ⓘ	Zona ⓘ	Profondità ⚙ ⓘ	Latitudine	Longitudine
2019-05-03 17:04:41	ML 2.1	4 km S Monte Cavallo (MC)	10	42.96	13.01
2019-05-03 13:46:09	ML 2.2	3 km SE Montieri (GR)	10	43.11	11.04
2019-05-03 11:15:36	ML 2.1	5 km SW Roccaraso (AQ)	11	41.81	14.04
2019-05-03 09:25:31	Mwp 6.1	Solomon Is. [Sea]	20	-6.91	160.18
2019-05-03 04:30:02	ML 2.1	11 km N Valfabbrica (PG)	9	43.26	12.62
2019-05-02 23:02:25	ML 2.1	1 km W Rodi Milici (ME)	5	38.11	15.16
2019-05-02 23:01:36	ML 3.1	1 km E Rodi Milici (ME)	7	38.11	15.18
2019-05-02 02:16:56	ML 2.1	Tirreno Meridionale (MARE)	180	38.95	15.65
2019-05-01 23:31:33	ML 2.1	5 km NE Vallarsa (TN)	11	45.81	11.18
2019-05-01 19:00:25	ML 2.6	1 km NE Scafa (PE)	20	42.28	14.01

SEVERAL CRITERIA FOR SELECTION (AZIMUTAL GAP, RESIDUALS, ETC.)



Gap > 180°



Gap < 180°



SOME NUMBERS AFTER 18 MONTHS

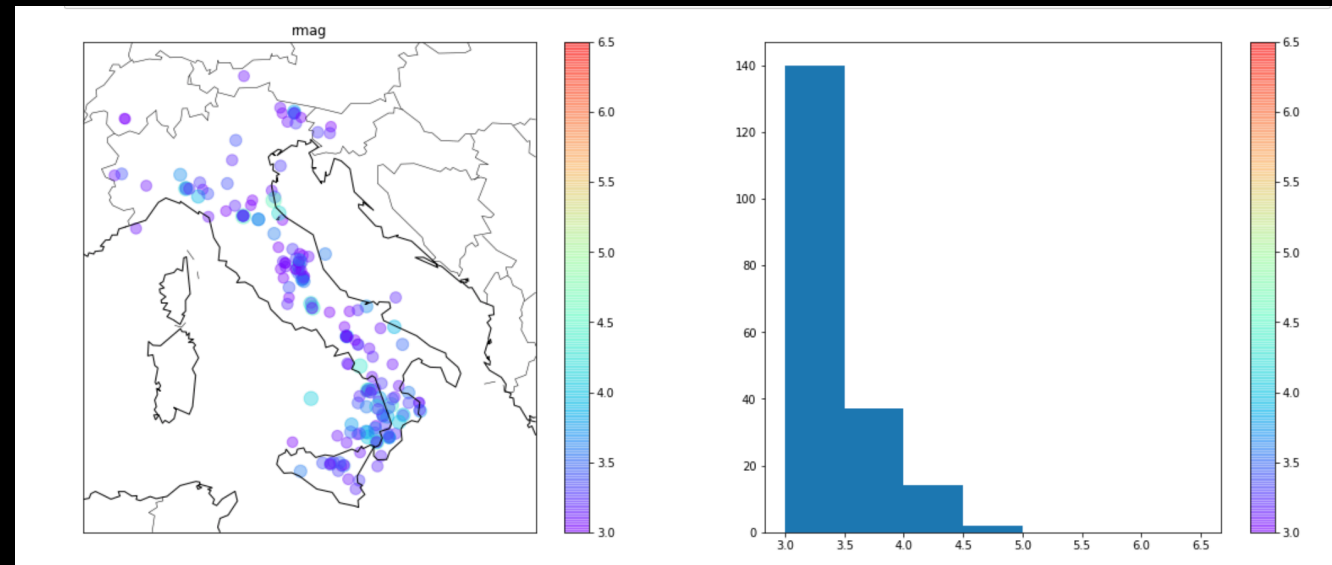
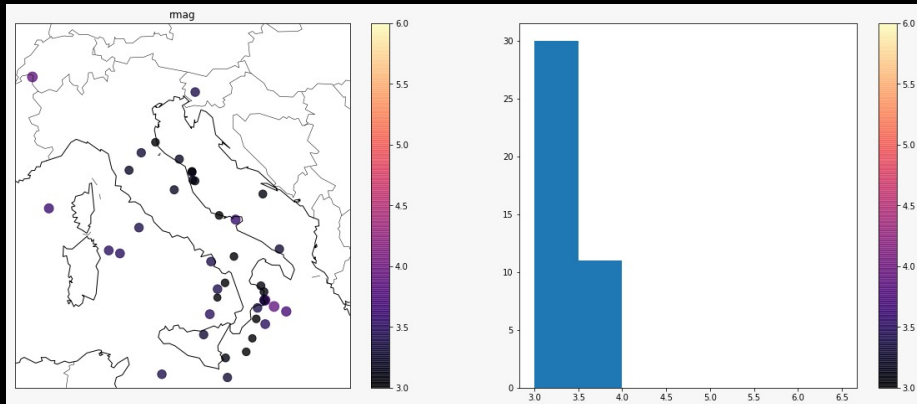
TOTAL Number of eqs ($M \geq 3$)
Tweeted
Missed
False tweeted (mag overestimated)

240

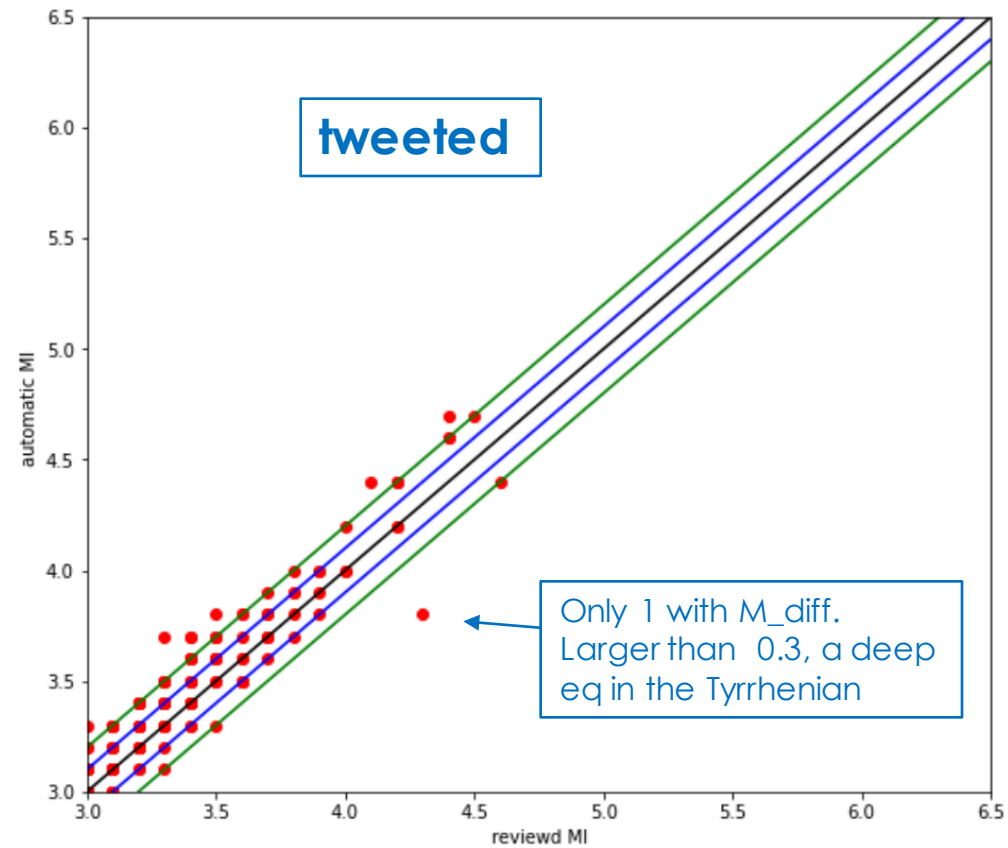
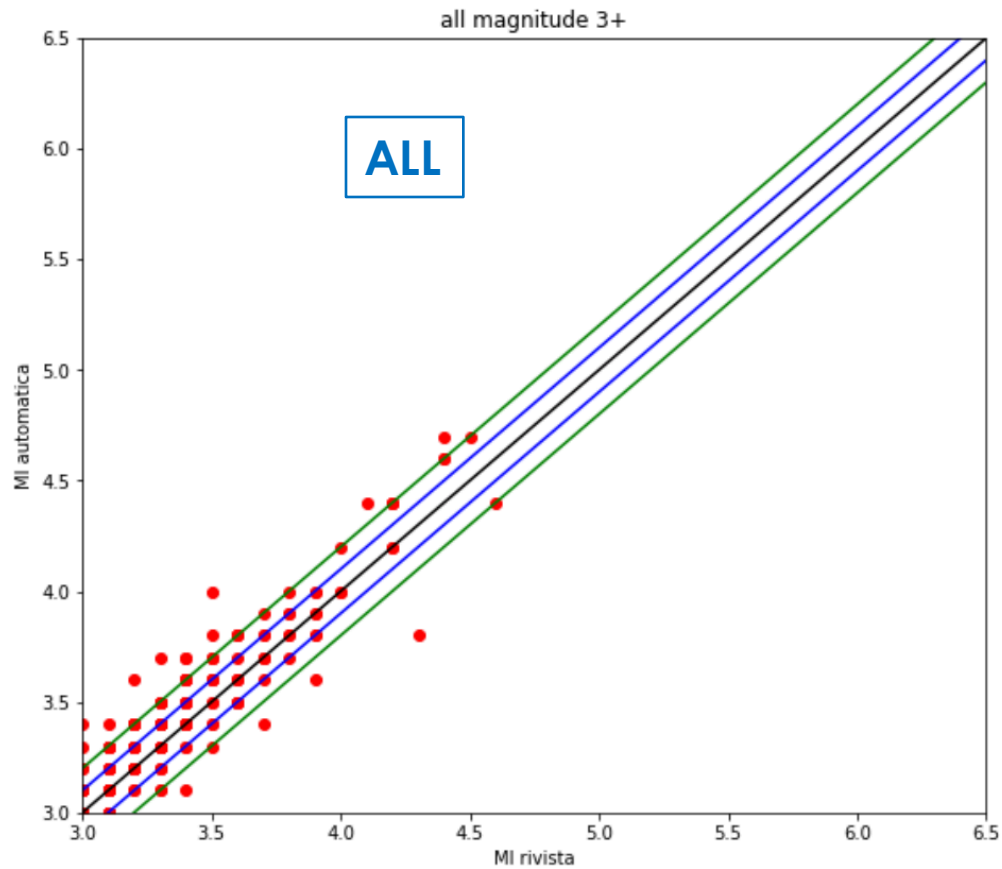
197 (83%)

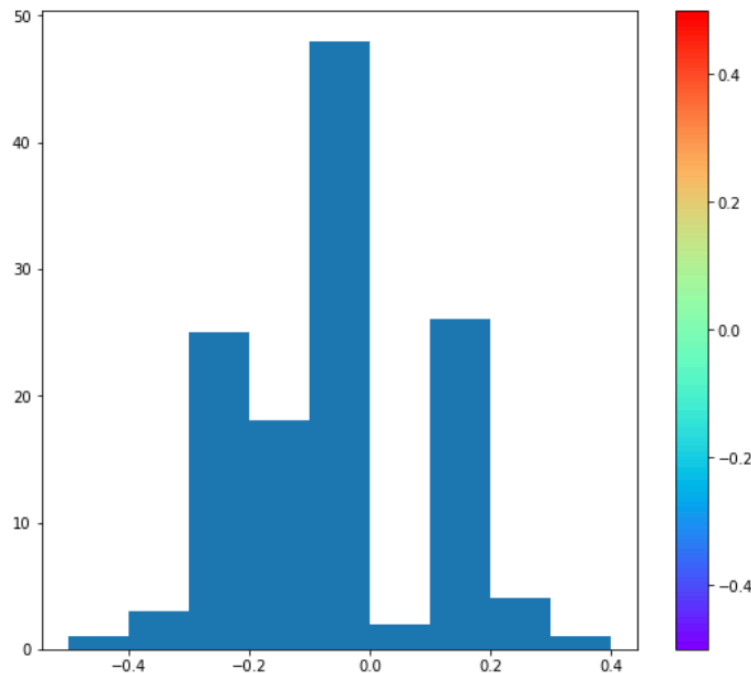
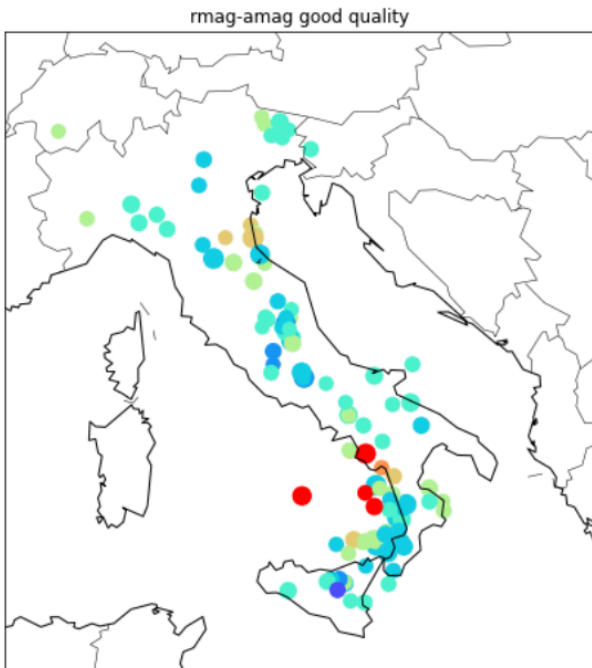
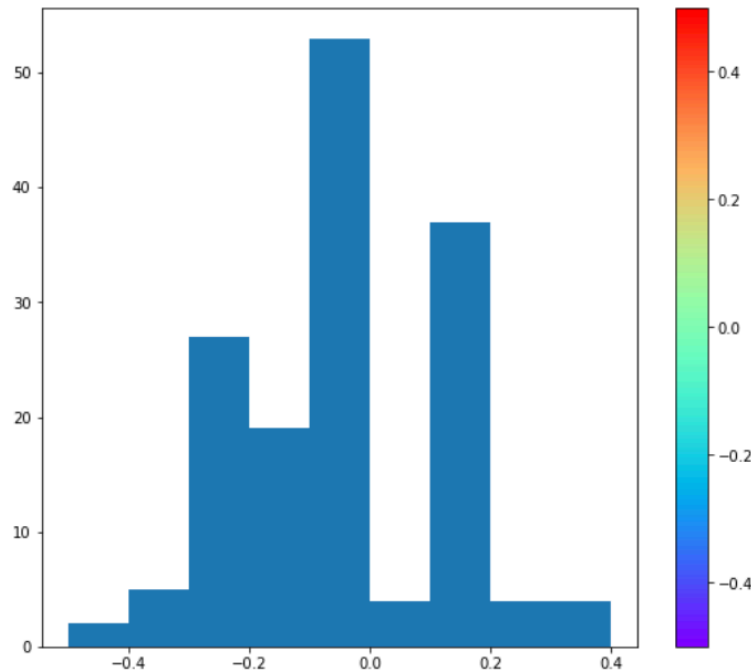
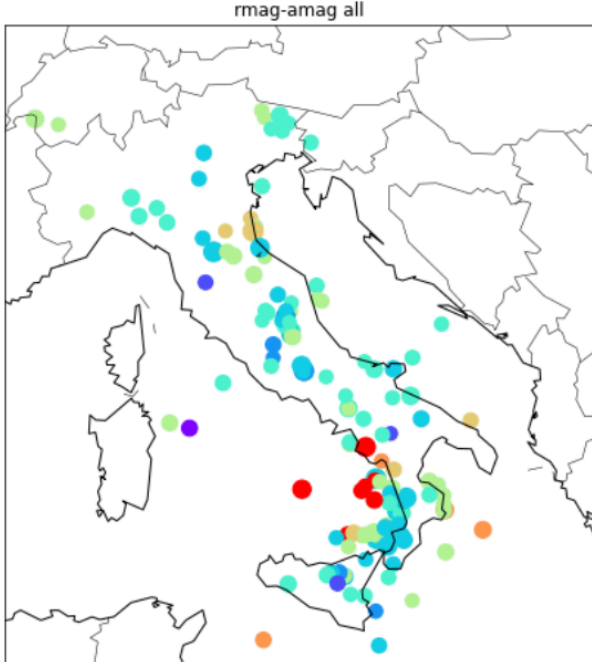
43 (17%) (better than 25% expected)

6 (3.4%) (better than 5% expected)



QUALITY OF AUTOMATIC MAGNITUDES COMPARISON WITH REVISED (18 MONTHS)





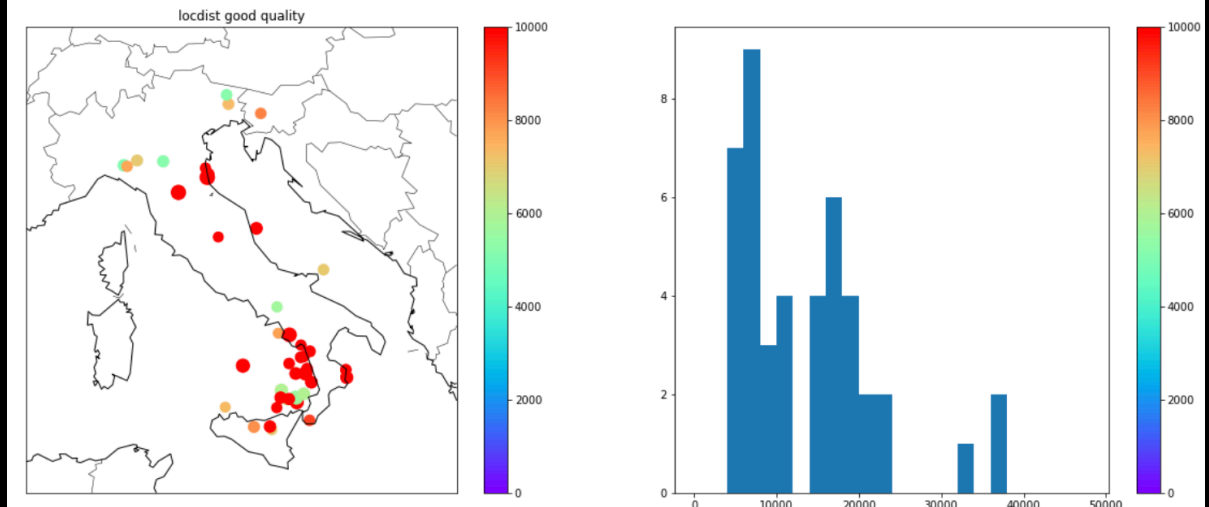
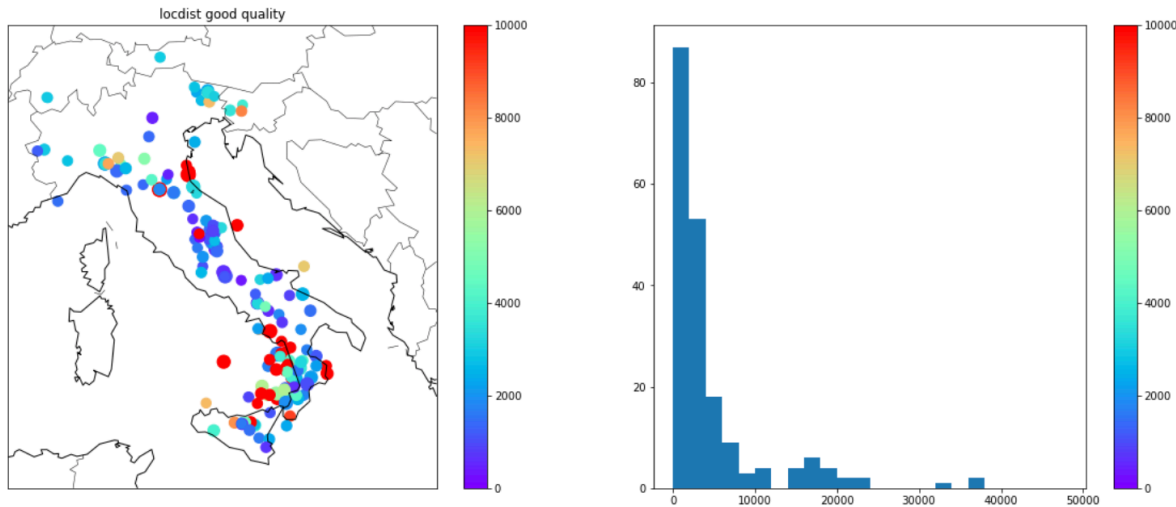
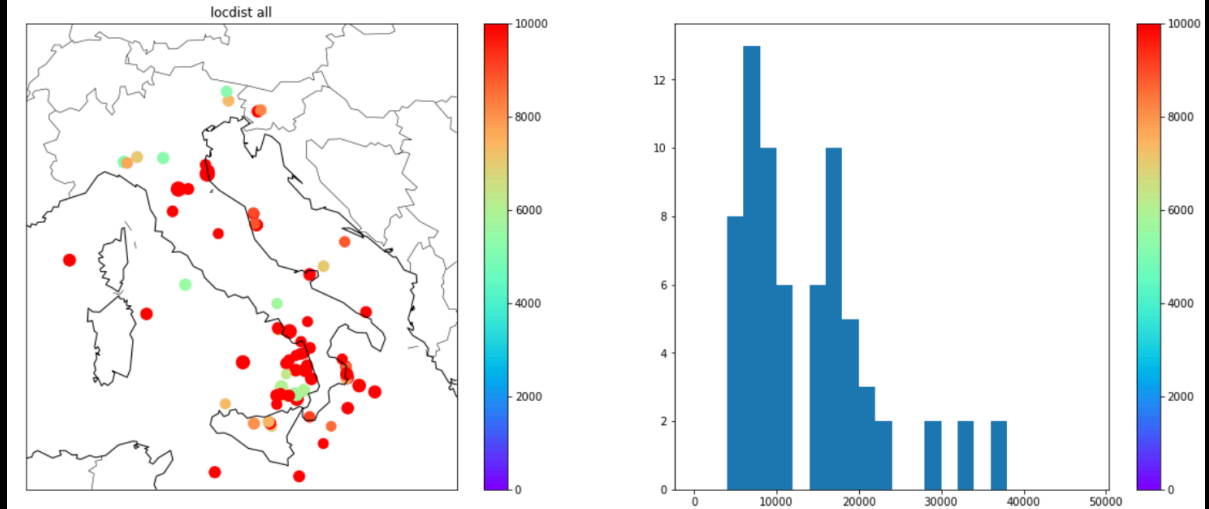
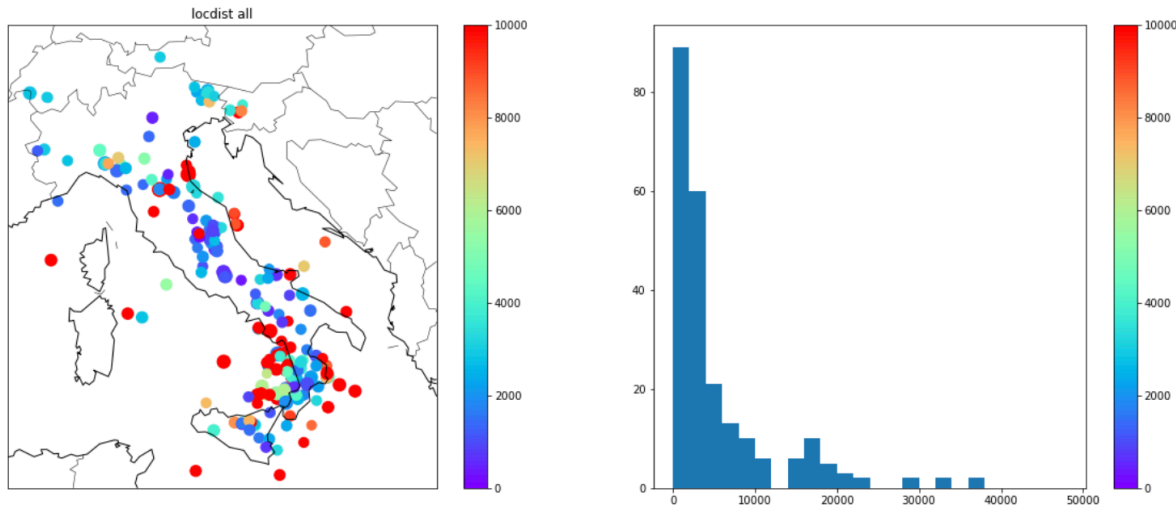
AUTOMATIC
VS. REVISED
MAGNITUDES
(ALL)
(TWEETED)



INGV terremoti

all / tweeted

Location Difference (m)
discarded / good quality



Automatic solutions are tweeted 2' after the event.

This innovation has been strongly appreciated by citizens.



CONCLUSIONS

- The INGVterremoti social platform has grown and has provided an important contribution for **raising awareness** in a seismic country like Italy.
- After the downfall provoked by the L'Aquila earthquake and trials, INGVterremoti has contributed to raise again the **credibility of scientists and scientific institutions**.
- The release of quick, unchecked, solutions is very important and is highly **appreciated by citizens**.
- However, a **careful choice** of quality parameters is important in order to avoid issuing very fast but wrong information: corrections are not easy, sometimes impossible and expose scientific Institutions to criticism and unfair reprimands by citizens, media and even institutions.