Social Media and its Impact on Crisis Communication: Case Studies of Twitter Use in Emergency Management in Australia and New Zealand

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ABSTRACT

There is a growing awareness worldwide of the significance of social media to communication in times of both natural and human-created disasters and crises. While the media have long been used as a means of broadcasting messages to communities in times of crisis – bushfires, floods, earthquakes etc. – the significance of social media in enabling many-to-many communication through ubiquitous networked computing and mobile media devices is becoming increasingly important in the fields of disaster and emergency management.

This paper undertakes an analysis of the uses made of social media during two recent natural disasters: the January 2011 floods in Brisbane and South-East Queensland in Australia, and the February 2011 earthquake in Christchurch, New Zealand. It is part of a wider project being undertaken by a research team based at the Queensland University of Technology in Brisbane, Australia, that is working with the Queensland Department of Community Safety (DCS) and the EIDOS Institute, and funded by the Australian Research Council (ARC) through its Linkages program. The project combines large-scale, quantitative social media tracking and analysis techniques with qualitative cultural analysis of communication efforts by citizens and officials, to enable both emergency management authorities and news media organisations to develop, implement, and evaluate new social media strategies for emergency communication.

Keywords: social media; emergency management; natural disasters; crisis communication; Twitter.

Introduction

There is a growing awareness worldwide of the significance of social media to communication in times of both natural and human-created disasters and crises. While the media have long been used as a means of broadcasting messages to communities in times of crisis – bushfires, floods, earthquakes etc. – the significance of social media in enabling many-to-many communication through ubiquitous networked computing and mobile media devices is becoming increasingly important in the fields of disaster and emergency management. As the Director of the International Association of Emergency Managers, Craig Fugate, has observed:

> As social media becomes more a part of our daily lives, people are turning to it during emergencies as well. We need to utilize these tools, to the best of our abilities, to engage and inform the public, because no matter how much … officials do, we will only be successful if the public is brought in as part of the team (IAEM, 2010).

This paper undertakes an analysis of the uses made of social media during two recent natural disasters: the January 2011 floods in Brisbane and South-East Queensland in Australia, and the February 2011 earthquake in Christchurch, New Zealand. It is part of a wider project being undertaken by a research team based at the Queensland University of Technology in Brisbane, Australia, that is working with the Queensland Department of Community Safety (DCS) and the EIDOS Institute, and funded by the Australian Research Council (ARC) through its Linkages program. The project aims

to combine large-scale, quantitative social media tracking and analysis techniques with qualitative cultural analysis of communication efforts by citizens and officials, to enable both emergency management authorities and news media organisations to develop, implement, and evaluate new social media strategies for emergency communication (c.f. Shaw *et. al.*, 2012; Burgess and Bruns, 2012).

The project investigates the role of social media and related online and mobile tools for public communication in responding to natural disasters in Australia and internationally. Emergency services are increasingly seeking to add social media elements to their disaster response strategies (Shi *et. al.*, 2010), but rigorous research that takes account of both the opportunities and challenges of using social media in disaster situations is needed in order to shape these strategies effectively. The project is contributing new knowledge about the use and utility of social media and related tools as an additional two-way channel of communication between emergency organisations and the general public, and amongst the public themselves, in addition to established media forms. By highlighting successful approaches to the use of social media in crisis communication, as well as potential pitfalls for communication with the public through social media, the project team is enabling authorities to better develop and test the use of social media in order to make emergency responses in natural disasters faster and more effective.

Research Context and Methodology

Governments around the world are now making greater use of online and social media as a platform for communication and engagement with their citizens, in order to deliver better services and enhance citizen participation in policy deliberation. In Australia, such work has been led by the Government 2.0 Task Force (Australian Government Information Management Office, 2009), while the United States Open Government Directive has been focused on achieving a greater transparency for government information, drawing on the insights of social media theorists (Noveck, 2009). In practice, however, a range of administrative and political roadblocks can mean that such initiatives are yet to generate the significant innovations that were hoped for, especially as far as social media is concerned.

Disaster and emergency management has proven to be a field of communication where innovative uses of social media have begun to have a substantial positive impact on the quality of disaster responses and the resilience of affected local communities. Substantial interest in these questions is already evident among policymakers and government authorities, as well as NGOs and the media. Events in 2011 such as the Queensland Floods, Tropical Cyclone Yasi, the Christchurch earthquake and the Tōhoku earthquake and tsunami in Japan have highlighted the key role that social media now play during natural disasters. The role of social media has been documented in the media coverage of these events, by statements from the emergency services, and in our own research (Bruns, 2011). For example, the Queensland Police Service Media Unit (QPS Media) reported a tenfold increase in the

number of followers on its Facebook page (from 17,000 to 165,000) over the 24 hours following the 10 January 2011 Toowoomba flash floods (Charlton, 2011).

Two key issues arise with the use of social media in times of crisis. The first concerns the issues of *authority and trust* including the capacity of authorities to deliver timely and accurate information to as broad a section of the affected population as possible, as well as the trustworthiness of information that is sourced from or distributed by the ordinary users of social media platforms, and the extent to which improved social media practices might mitigate the spreading of misinformation (Mendoza *et. al.*, 2010). The second key problem area is *coordination*, including the coordination, rather than duplication, of efforts among emergency response and media agencies; and the coordination of data and information flows within and across the media ecology.

These questions need to be approached from dual perspectives: on the one hand, via the large-scale, detailed forensic analysis of the actual patterns of use of social media in disasters; and on the other, via a deeper understanding of the principles, policies and practices that govern social media use in both the population at large, and in emergency response and media organisations.

This project builds on and extends the novel and powerful methodologies for the large-scale, quantitative and qualitative study of social media use, using tools such as *Twapperkeeper.com*, *Gawk* and *Gephi*. Such high-powered data storage, data processing and data visualization tools have enabled the project team to comprehensively track public user participation in social media spaces around

specific themes and topics, for example by capturing the content created and shared by Twitter communities gathered around key hashtags like #qldfloods (for the January 2011 Queensland floods), #eqnz (for the 2010 and 2011 Christchurch earthquakes), or #tsunami (for the March 2011 earthquake and tsunami off north-eastern Japan).

During unfolding disaster events themselves, it is important to be able to track and visualize patterns of activity in near real-time, in order to assess the effectiveness of their current emergency media strategies and, where necessary, to advise on how to change them. After the immediate emergency has passed, further quantitative and qualitative analysis of data gathered on public online activity can be complemented by additional qualitative research involving interviews and focus groups with key emergency media staff, and other emergency and media organisations, as well as volunteer community organisers who played significant roles in responding to the emergency.

In summary, the key innovations of this project have been to:

1. Apply data mining and analysis techniques to an investigation of the uses of social media in crisis communication;
2. Combine computer-aided quantitative techniques with in-depth qualitative analysis to examine communicative and community practices in *ad hoc* online publics formed around the shared experience of a natural disaster;
3. Develop the tools for a near real-time tracking, analysis, and visualisation of public communication about unfolding disaster events in social media spaces;

4. Establish detailed comparative metrics to provide a clear understanding of social media uses in different emergency contexts;
5. Work with emergency management organisations to develop, implement, and evaluate, through an iterative process, advanced strategies for the use of social media by emergency and media organisations during natural disasters.

Insights arising from application of the project methodology will now be applied to two case studies: the 2011 Brisbane/South-East Queensland floods in Australia, and the response of the Queensland Police Service (QPS) media unit in their uses of social media, and the 2011 Christchurch earthquake in New Zealand.

The 2011 Brisbane and South-East Queensland Floods

The Australian state of Queensland received an unprecedented amount of rainfall during December 2010 and January 2011, resulting in widespread flooding across large areas – a flood emergency was declared for half of the Queensland territory, with an area the size of France and Germany combined estimated to be under water. While early flooding occurred in the relatively sparsely populated west of the state, later floods affected larger regional population centres like Rockhampton, on the central Queensland coast, and further heavy rain finally caused widespread flooding in the state's south east corner, where the major regional cities Toowoomba and Ipswich, and finally the state capital Brisbane were severely affected. Arguably, the flood peak in Brisbane, in the early hours of 13 January 2011, also marks the peak of the overall flood crisis in Queensland in terms of its direct effects on residents; in Brisbane alone, some 30,000 properties were partially inundated by floodwaters.

As a major environmental crisis, the floods were covered extensively by the Australian and international mainstream media. As they began to affect major population centres, social media platforms such as Facebook and Twitter, as well as content sharing sites Flickr and YouTube began to play an important role, as locals used them to distribute first-hand footage of the situation in their local areas. In this, the South East Queensland flood events must be considered separately from the wider inundation of other parts of the state, as events here developed a somewhat more urgent dynamic. A number of South East Queensland towns, starting with the regional centre of Toowoomba, experienced rapid and devastating flash flooding which caused small creeks to swell to raging torrents within minutes, carrying off cars and other heavy items without warning. Here, following a pattern established in other unforeseen disaster events, social media played an important role in capturing and disseminating first-hand footage of the flash floods, in effect operating as an unofficial, distributed early warning system; later, social media users also shared further links to mainstream news reports and footage of the destruction caused by the same torrent in the Lockyer Valley below Toowoomba. Along with further heavy rainfalls and water releases from Wivenhoe Dam, the floodwaters washing through the area made their way to the downstream cities of Ipswich and Brisbane over the following 48 hours.

As these initial reports of devastation heightened fears of flooding in Ipswich and Brisbane, social media became an increasingly important element of the flood mobilisation efforts. On Twitter, the #qldfloods hashtag rapidly emerged as a central mechanism for coordinating discussion and information exchange related to the

floods. Notably, too, the Twitter accounts of several official sources quickly adopted the #qldfloods hashtag for their own tweets. Indeed, the social media use of several of these organisations underwent a rapid development process as the emergency unfolded; this is best illustrated using the example of the official Facebook and Twitter accounts of the Queensland Police Service (QPS).

The comparatively simple network structure of the Twitter platform, where accounts are either 'public' (visible to all, and even to non-registered visitors) or 'private' (visible only to followers approved by the author) means that topically relevant tweets from public accounts can be found and shared very widely. For the purposes of crisis communication, this compares favorably for example with the communicative structures of Facebook, where more complex visibility permissions mean that messages will not normally travel far beyond a user's immediate circle of friends, or friends of friends.

As a platform, Twitter provides exceptionally flat and flexible communicative structures. The openness of the system allows users to 'listen in' (Crawford, 2009) to a wide range of accounts – institutions, news agencies and individuals – and gain a multifaceted understanding of how an event is being experienced and reported. It also allows institutions, emergency services and journalists to listen in to the experiences of locals in the midst of the crisis. For researchers, publicly visible *Twitter* messages have been published to the Internet at large, at least technically, and archiving them in the course of research activities is therefore substantially less problematic, especially where hashtagged conversations about major public events are concerned.

Overall, more than 35,000 tweets containing the #qldfloods hashtag were captured by the study during the period of 10-16 January (Figure 1). A sharp, early spike in activities occurred in the afternoon of 10 January, as first reports of the Toowoomba flash flooding and subsequent 'inland tsunami' in the Lockyer Valley were shared on Twitter. Overall activity levels peaked around midday on 11 January, however – at around 1100 tweets per hour between 12 and 2 p.m., as the Brisbane River began to burst its banks in Brisbane itself. Given the larger population size of the area then affected, combined with sociodemographic factors which may result in a higher percentage of Twitter users amongst the urban population in Brisbane, this high level of activity is unsurprising. Hourly activity patterns also indicate a marked diurnal pattern, with significant drops in Twitter activity during the early hours of each day; notably, however, Twitter volumes remain comparatively high (at close to 100 tweets per hour) during the early mornings of 12 and 13 January, as flood rescue and relief operations continue through the night.

Insert Figure 1

Cumulative figures for each day also highlight 11 and 12 January as the most active days of the flood crisis in South East Queensland, pointing to 12 January (the height of the Brisbane flooding) as the day most notable for Twitter use (Figure 2); we recorded over 11,600 #qldfloods tweets on this day. Additionally, these days also saw the largest number of unique Twitter users participating in exchanging #qldfloods-tagged tweets; 12 January saw nearly 7,000 Twitter users post (or retweet) at least one #qldfloods tweet. Such volume may be explained at least in part also by the greater national and international attention to the disaster event: as news coverage of the

floods reached audiences outside of the immediately affected area, many users also expressed their support and condolences through social media, some using the #qldfloods hashtag as they did so.

Insert Figure 2

Figure 3 indicates the relative presence of these types of tweets, and of tweets containing URLs, in #qldfloods during 10-16 January 2011. There is a particularly high level of retweets during the early days of the crisis, which is unsurprising: during this time, Twitter would have been used especially to share the breaking news first of the Toowoomba and Lockyer Valley floods, and then of the latest flooding reports in Brisbane. With mainstream media coverage increasing, however, such retweeting – at least of basic information which could now be expected to be widely available through other media – could be allowed to decline somewhat; the fact that retweets consistently accounted for more than half of all #qldfloods tweets indicates that the hashtag continued to play an important role in the dissemination of information, however. It must be noted in this context that such retweeted messages would also have been visible well beyond the hashtag community itself, of course: for example to those followers of retweeting users who did not themselves follow the hashtag, or even to non-registered visitors to the Twitter Website who searched for specific users or keywords. Retweeting, in other words, amplifies information well beyond any hashtags which may already be present in a message.

Insert Figure 3

In line with these observations is the fact that some 30-40% of all #qldfloods messages contained links to further online information (ranging from official Websites through news reports to eyewitness photos and videos of the floods); this further points to the importance of Twitter for disseminating information and furthering the flow of news and other material across multiple media platforms. Here, a gradual increase can be observed over the course of the week; this is due mainly to the fact that towards the latter part of the week, the total number of messages (and participating users) declines, leaving only those with a relatively direct relation to the floods events and most involved in sharing further information about the floods and their aftermath. What remains at the end of the period are likely to be largely local users, beginning the process of recovery and rebuilding and sharing information about how best to do so.

Mere activity is an insufficient indicator of visibility and impact, however: any *Twitter* account may post updates at very high volume, but this does not mean that these messages reach an audience. A better measure of visibility is whether such messages are replied to and/or retweeted by other users: from this, a clear group of important influencers emerges. In the first place, we again see a pronounced 'long tail' distribution even amongst the 25 most visible accounts: the Queensland Police Service's @QPSMedia account, as well as the Australian Broadcasting Corporation's @abcnews and Brisbane-based metropolitan newspaper @couriermail are notable leaders. Almost all of these most replied-to accounts in #qldfloods mainly received retweets, rather than genuine @replies; however, Figure 4 shows only hashtagged replies, and a significant number of further @replies, without hashtags, may also have been received by these accounts. The single major exception is @TheQldPremier, the

account of Queensland State Premier Anna Bligh; it received comparatively few retweets (which is not surprising, given that only one of its tweets contained a #qldfloods hashtag), but some 200 @replies. It is also notable that a significant majority of the most visible Twitter accounts in #qldfloods are 'official' accounts representing emergency services, media organisations, and their employees.

Insert Figure 4

Retweeting, then, is an especially important factor in amplifying the visibility of messages sent by 'official' media and emergency authority accounts. The Queensland Police account @QPSMedia sent some 72 hashtagged messages during the days examined here, for example, but received over 1800 retweets for these messages (an average of 25 retweets per message); this enabled its tweets to be seen well beyond the reach which they would have had from the @QPSMedia account or the #qldfloods hashtag alone.

This points to important lessons for emergency and media services informing the public during natural disasters and other crises: their network of followers, and the followers of the hashtags which are used in individual tweets, constitute important partners in disseminating information more widely than is possible for these services alone. Further, to maximise the possibility of retweeting, messages should be designed to be passed along easily (e.g. by leaving space in the tweet for adding 'RT @username'), and should contain hashtags relevant to the topic.

Taken together, these observations clearly document that the information posted on Twitter by the Queensland Police Service, as well as by other authoritative sources, was able to 'cut through' effectively: to reach its immediate audience as well as be passed along and thus amplified many times over, with the help of other Twitter users acting as further information disseminators especially at the height of the crisis. Even more notably, tweets containing situational information and advice, pointers to news media stories and multimedia updates, but also notably advice on how to help or donate funds, were particularly "resonant"; while @QPSmedia itself did not provide much information related to help and fundraising, many other Twitter users provided and shared such information in their stead.

These data also confirm that the tweets posted by @QPSMedia, in particular, were as useful and authoritative as the crisis situation urgently required; they provided timely and important information and advice for flood victims and other information-seekers. At the same time, given that the Queensland Police Service's approaches to using Twitter during the flood crisis were developed ad hoc and with little prior planning, these successes also suggest that there is significant scope for official agencies to play an even greater role in providing up-to-date information and coordinating relief and volunteer efforts through social media, alongside their more established emergency management procedures.

QPS Media and the Brisbane Floods

From our overall analysis of the #qldfloods data, the Queensland Police Service Media Unit's Twitter account, @QPSMedia, clearly emerged as the most visible

participant in #qldfloods; it became a major source of information for Queenslanders and others following the unfolding floods crisis on Twitter, and introduced innovations such as the #Mythbuster series of tweets, which aimed to intervene in the spread of rumour and disinformation. The evident success of the QPS Media Unit's use of Facebook as well as its Twitter account @QPSMedia has been widely noted in the media, with team members making regular public appearances to discuss the social media strategies of the organisation in the context of crisis communication.

To further examine the specific role played by @QPSMedia in the context of overall #qldfloods activities, we undertook a detailed content analysis both of tweets in the overall #qldfloods hashtag, as well as of tweets which form part of the conversation with @QPSMedia (that is, tweets from and to the @QPSMedia account). We coded these tweets for the presence of a number of content categories, outlined below. For our analysis of #qldfloods, we worked with a representative sample drawn from the total dataset, coding every twentieth of all tweets. For our analysis of @QPSMedia, we coded all tweets containing the term "@QPSMedia", and/or sent by the @QPSMedia account.

Our coding categories were first developed for the @QPSmedia sample, and then adjusted to be relevant to the overall #qldfloods sample. All tweets in both samples were then coded using this coding system, and cross-checked for consistency. Our coding scheme includes five major categories – Information, Media Sharing, Help and Fundraising, Direct Experience, and Discussion and Reaction – which in turn divide into several distinct sub-categories.

Information

A – Advice: Tweets that provide information about what to do (e.g. during evacuations), safety tips, and how best to act to streamline the relief and recovery process. Includes tweets that contain information about services to contact for assistance or information.

S – Situational Information: Tweets that provide information about the location of floods, road closures, areas to avoid, and other risks. Includes maps and other visualisations, as well as specific, tailored information for locals. Includes information about rescue, response and recovery from a service-oriented angle, and reports on this process from official sources. Pertains to information from official sources.

RI – Requests for Information: Where individuals ask questions about the current situation or about specifics, such as looking for particular individuals, postings about lost dogs, etc. Includes requests from MSM for content or interviews.

Media Sharing

NM – News Media: Media updates, news reports, press releases and press conferences. Includes both links to other sources and headline-like tweets from official and media sources that contain statistics and provide news information independently of links.

MM – Multimedia: Links to photo galleries, videos and images of the flooding.

Help and Fundraising

H – Help: Tips for how to help as well as requests for help, volunteers, etc. from both official sources or individuals.

FR – Fundraising: Requests for donations, invitations to fundraising events, deals with help to raise money for the floods, announcements of donations.

Direct Experience

PNE – Personal Narrative and Eyewitness Reports: Includes tweets about direct, personal experience of the floods and eyewitness reports on the ground of events as they happen.

Reactions and Discussion

AD – Adjunctive Discussion: Use of the event in question to spark off other discussions about e.g. environmental politics or the performance of the federal government.

PR – Personal Reaction: Expression of reaction to the events as they unfold. Pertains to people who are responding to information about the event.

T – Thanks: Expressions of thanks and appreciation to particular actors for their role during the flood crisis. Includes referrals and recommendations to Twitter users to follow particular official users.

SP – Support: Expressions of support toward those affected by the event.

META – Meta-Discussion: Discussions on Twitter and in the media about the significance of social media and its role in crisis response.

Overall Patterns

Overall tweet patterns in #qldfloods over the key days of the crisis (Figure 5) are generally consistent with the patterns of activity identified in Figure 2 above: 11-13 January constitute the most active days for #qldfloods, coinciding with the height of the flood crisis in Brisbane.

Insert Figure 5

There are, however, notable differences in the trends which can be identified for the five major categories: **Discussion and Reaction** and **Information** already become prominent by 11 January, while **Media Sharing** and **Help and Fundraising** still grow substantially on the following day, as a greater range of media coverage emerges and the relief effort swings into action. The latter category, in particular, remains strong on 13 January, too – showing the gradual shift from emergency information to relief and recovery over the course of the week. By contrast, **Direct**

Experience – the most minor category overall – is comparatively strong mainly on 11 January, as Brisbane floodwaters rise and several affected locals use *Twitter* to report on the current situation, resulting in widespread retweets of their messages.

Clearly, then, general uses of #qldfloods and specific conversations around the @QPSMedia account differ quite considerably. Whereas activity in the hashtag #qldfloods shows a fairly even distribution of tweet types, activities around @QPSmedia overwhelmingly consisted of Information tweets, complemented by a much smaller number of Media Sharing tweets. The third category of any note, Discussion and Reaction, mainly captured meta-discussion tweets acknowledging how well @QPSMedia performed during the floods crisis.

These findings clearly indicate that @QPSMedia was successful in reaching its target audience, and that the members of that audience treated the account with considerable care and respect. @QPSMedia tweets themselves were appropriate to the task at hand, containing timely and relevant information, and as a result were also widely retweeted, as we have already shown. Responses to @QPSMedia, in turn, remained consistently constructive and on-topic, as well as expressing support and gratitude to the Queensland Police Service staff operating the account.

The Christchurch Earthquake and the #eqnz hashtag

On February 22, 2011, an earthquake destroyed significant parts of the New Zealand city of Christchurch. The February earthquake followed a previous earthquake on 4 September 2010, which had already substantially weakened building structures in the

area. As a result, the February earthquake and its aftershocks exacerbated that damage and caused a large number of Christchurch buildings to collapse. The February 2011 quake caused nearly 200 fatalities, affected a substantial percentage of the local population, and has been estimated to have generated NZ$15 billion in reconstruction costs (Rotherham, 2011).

Twitter coverage of the earthquake spiked within the first hours of the event, at about 7500 tweets/hour (or just over two tweets/second) – this is the phase when locals and more distant onlookers alike are likely to be tweeting and retweeting the first reports emerging from the disaster area, in order to alert their own *Twitter* followers. Within two or three days of the initial disaster event itself, however, use of the hashtag has declined markedly, showing, perhaps, that the hashtag as a coordinating mechanism is no longer valuable for anyone but directly affected local users.

Because of the earlier quake, in 2011, there was general agreement to use the hashtag #eqnz that had been established in that earlier crisis. It therefore remained accessible to local residents and authorities as part of their available repertoires for crisis communication, and could now be activated again. The initial spike would provide a very clear illustration of what Alfred Hermida has described as *Twitter*'s role as a medium for 'ambient journalism' (Hermida, 2010): the platform may lie dormant for most of the time, used instead for largely non-journalistic purposes, but it is ready to spring into action as a major tool for news dissemination and discussion at a moment's notice.

The sudden increase in reports about an earthquake in New Zealand (expressed for

example by the appearance of relevant hashtags and keywords in *Twitter*'s 'trending topics') acts as mechanism to draw the attention of more and more *Twitter* users to the event – even if they are not directly affected by it –, and also leads some of them to participate in the #eqnz hashtag itself (if perhaps only by sharing and retweeting other users' tweets), at least for some time; as the full situation becomes widely known, however, and as genuinely *new* news updates become less frequent, this activity is no longer as necessary as before, and their activities slow down.

This is also evident in the types of tweets being tagged with the #eqnz hashtag: as Figure 6 shows, some 60 per cent of all #eqnz tweets during the first few days of the crisis are (manual) retweets of existing messages – that is, take the form 'RT @sender [original message]', possibly with further comments added by the retweeting user.1 This percentage declines markedly over the following days, to around 40 per cent by early March, indicating an emphasis on sharing original information rather than passing along only a handful of key messages. Figure 6 also indicates that over the course of the two weeks, the percentage of tweets containing genuine @replies (not counting retweets, which constitute a special kind of @reply) remains relatively steady, if at a relatively low average of 13 per cent of all tweets.

Insert Figure 6

Taken together, these statistics on tweets, retweets, and @replies also enable us to identify the most active and most visible participants in the #eqnz hashtag community, then. The most active single account contributing to #eqnz was that of @CEQgovtnz, the official *Twitter* account of the New Zealand government's

Canterbury Earthquake Authority which was established after the first major earthquake in September 2010 (the agency has since been renamed as Canterbury Earthquake Recovery Authority, and now tweets as @CERAgovtnz); this account alone was responsible for nearly 2500 tweets during the first fortnight after the 2011 tremor, as Figure 7 indicates (amounting to nearly 180 tweets per day, on average). Other highly active accounts – if nowhere near as active as @CEQgovtnz – represent a diverse group of *Twitter* users, from government (such as the Christchurch City Council, @ChristchurchCC) to news organisations (radio station @NewstalkZB, newspaper @NZHerald) and volunteer efforts for gathering information about the areas affected by the earthquake (including @eqnz_live, which operated a crowdsourced map of the Christchurch area) and providing advice to survivors (like @operationSAFE, which offered guidelines for parents of traumatised children). A large number of the accounts represented here, however, are run by individuals pitching in to help disseminate information – from major and minor celebrities like *New Zealand's Next Top Model* TV show judge Colin Mathura-Jeffree (@NZTopModelColin) and New Zealand ocean racing blogger @sailracewin to private accounts.

Insert Figure 7

Activity patterns for these accounts are necessarily varying widely, depending on their ability to provide first-hand information. While leading account @CEQgovtnz is a major source of original information, for example (some 80 per cent of its tweets are non-retweets), all but eight of the second-placed @sailracewin's 910 tweets during the first fortnight were (apparently verbatim) retweets, and the same is true for a great

number of the other leading accounts. They act, in other words, as amplifiers of #eqnz-tagged messages, connecting this dedicated space for sharing information related to the disaster with their more amorphous, person-centred networks; in doing so, they serve as a discovery mechanism alerting their own networks of followers to the breaking news story and to the existence of dedicated hashtag coordinating the further dissemination and discussion of news about the event. This retweeting activity is precisely the point at which news shared on *Twitter* no longer remains an ambient commodity, passing by most users without being recognised, and instead turns active, recommended for greater attention by one or more of the users in one's personal network of *Twitter* connections.

Such patterns are broadly comparable with what we have observed in the context of the January 2011 Queensland floods (Bruns *et al*., 2012), with the exception of the predominance of the @NZHerald account. In Queensland, the *Twitter* account of the Queensland Police Service (@QPSmedia), rather than a media organisation, led the field. The prominence of the *New Zealand Herald* account in this case may point to a greater level of interest and concern by *Twitter* users further afield – for example, by the large New Zealander diaspora in Australia –, who may be expected to search for (and retweet) media reports more than advisories from local authorities; additionally, the online coverage by the *New Zealand Herald* (and its own use of *Twitter* to disseminate this information) also lent itself well to generating such further amplification.

These changes point to a fundamental, if gradual, shift in how #eqnz is used: during the first few days, largely as a space for sharing and commenting on the news from

Christchurch, and involving a greater number of users and, presumably, a larger percentage of users from further afield. The lack of verifiable geolocation information for partipating users on *Twitter* prevents us from assessing this assumption more thoroughly, but it is also notable that (as Figure 8 shows) the total number of unique users participating in #eqnz drops considerably after the first few days, from some 20,000 on 22 February 2011 to a base level of 2,500 or less from 26 February onwards (with a brief spike above that level again on 1 March).

Insert Figure 8

In combination with the reduced number of overall users, this may be understood as a gradual disappearance of more casual onlookers who were mainly sharing the news at the start of the crisis, but have limited interest in tracking recovery efforts in similar detail; what is left as they retreat from the conversation is a smaller 'hard core' of users who continue to use *Twitter* and #eqnz as an effective channel for sharing information that may be of relevance only to directly affected locals.

Conclusion

This paper has demonstrated the value for disaster and emergency management authorities of making active use of social media such as Twitter as tools for communication with the wider population during periods of crisis. It has demonstrated this through two case studies: the January 2011 floods that hit Brisbane and South-East Queensland in Australia, and the February 2011 earthquake in Christchurch, New Zealand.

Where social media mark a major advance on traditional modes of communication is in the two-way, interactive nature of the medium. This enables information to be received, and messages to be communicated, throughout the community, and provides authorities with on-the-ground intelligence that can be shared quickly in rapidly changing situations. It is a complement to more traditional communications channels, such as broadcast media, but is one where the emergency services divisions can themselves become media communicators, as with the case of QPS Media.

The two key issues that arise with social media in crisis communication events are: (1) authority and trust – what is accurate information, and how to avoid the harmful effects of misinformation; and (2) coordination – how to achieve the most effective response without duplicating efforts. These studies indicate that both the emergency management authorities and media organisations have complementary roles as trusted information sources with a wide community reach in times of crisis. It also indicates that the key to effective social media use is active engagement of the public itself as co-creators of relevant media and informational content.

References

Bruns, A. (2011). *Tracking Crises on Twitter: Analysing #qldfloods and #eqnz*. Plenary paper at Australia and New Zealand Disaster and Emergency Management Conference, Canberra, Australia, April 12, 2011.

Bruns, A., Burgess, J., Crawford, K., and Shaw, F. (2012). *#qldfloods and @QPSMedia: Crisis Communication on Twitter in the 2011 South East Queensland Floods*. Research Report, Brisbane: ARC Centre of Excellence for Creative Industries and Innovation, January 10, 2012. ARetrieved from http://cci.edu.au/floodsreport.pdf, accessed on April 23, 2013.

Bruns, A. and Burgess, J. (2012). *Local and Global Responses to Disaster: #eqnz and the Christchurch Earthquake*. Paper presented at Earth, Fire & Rain: Australian & New Zealand Disaster and Emergency Management Conference, Brisbane April 16-18, 2012.

Charlton, K. (2011). *@QPSMedia and the Brisbane Floods*. Paper presented at the Eidos symposium Social Media in Times of Crisis, Brisbane, Australia, April 4, 2011.

Crawford, K. (2009). Following You: Disciplines of Listening in Social Media. *Continuum: Journal of Media and Cultural Studies,* 23(4), 525-535.

Australian Government Information Management Office. (2009). *Engage: Getting on with Government 2.0.* Report of the Government 2.0 Task Force. Canberra, Australia: Department of Finance and Deregulation. Retrieved from http://www.finance.gov.au/publications/gov20taskforcereport/doc/Government20TaskforceReport.pdf, accessed on April 23, 2013.

Hermida, A. (2010, May) 'From TV to Twitter: How Ambient News Became Ambient Journalism', *M/C Journal*, 13(2). Retrieved from http://journal.media-culture.org.au/index.php/mcjournal/article/view/220 , accessed on April 23, 2013.

International Association for Emergency Management (IAEM). (2010). *Issues Paper on IAEM and Social Media on November 22, 2010*. Retrieved from http://www.iaem.com/documents/SocialMedia20101122.pdf, accessed on April 22, 2013.

Mendoza, M., Poblete, B. and Castillo. C. (2010). *Twitter under Crisis: Can We Trust What We RT?*. Paper at 1st Workshop on Social Media Analytics (SOMA '10), Washington, D.C., July 25, 2010. Retrieved from http://snap.stanford.edu/soma2010/papers/soma2010_11.pdf, accessed on April 22, 2013.

Noveck, B. (2009). *Wiki Government: How Technology Can Make Government Better, Democracy Stronger, and Citizens More Powerful*. Washington, D.C.: Brookings Institution Press.

Shaw, F., Burgess, J., Crawford, K., and Bruns, A. (2012) 'Sharing News, Making Sense, Saying Thanks: Patterns of Talk on Twitter during the Queensland Floods', *Australian Journal of Communication*, 40(1): 23-40.

Shi, P.J., Li, N., Ye, Q., Dong, W.J., Han, G.Y., Fang, W.H. (2010). Research on Integrated Disaster Risk Governance in the Context of Global Environmental Change. *International Journal of Disaster Risk Science* 1(1), 17-23.

Figure 1

#qldfloods tweets per hour 10-16 January, 2011

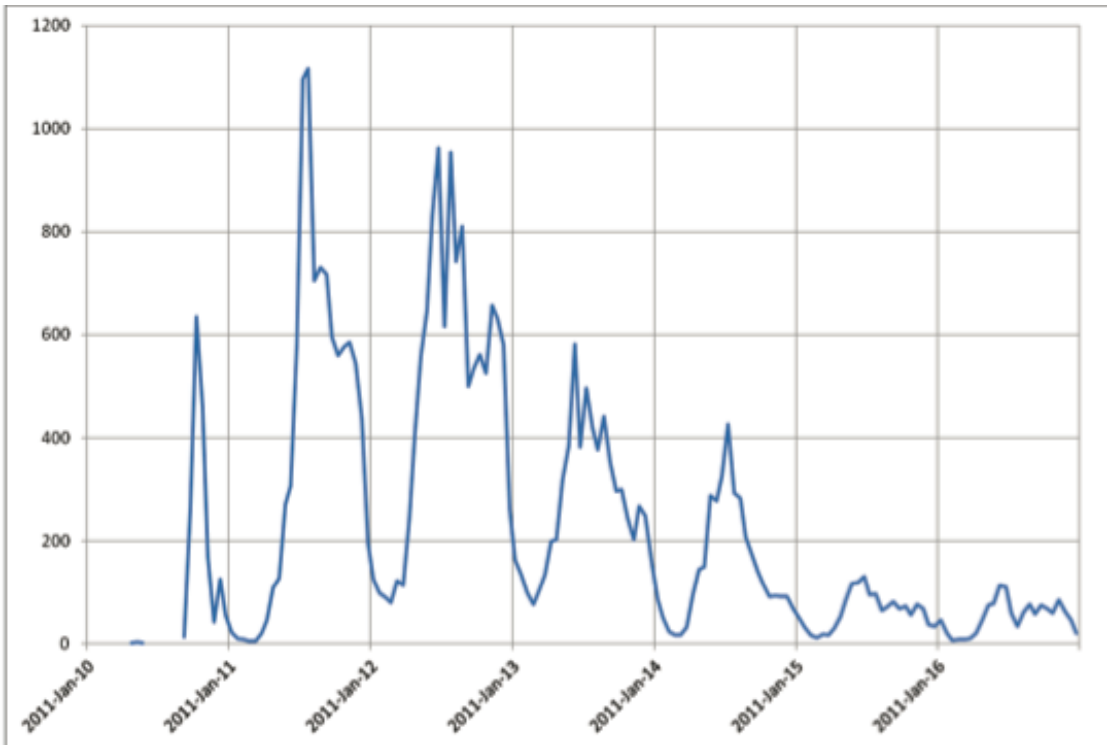

Figure 2

#qldfloods tweets and unique users per day, 10-16 January 2011

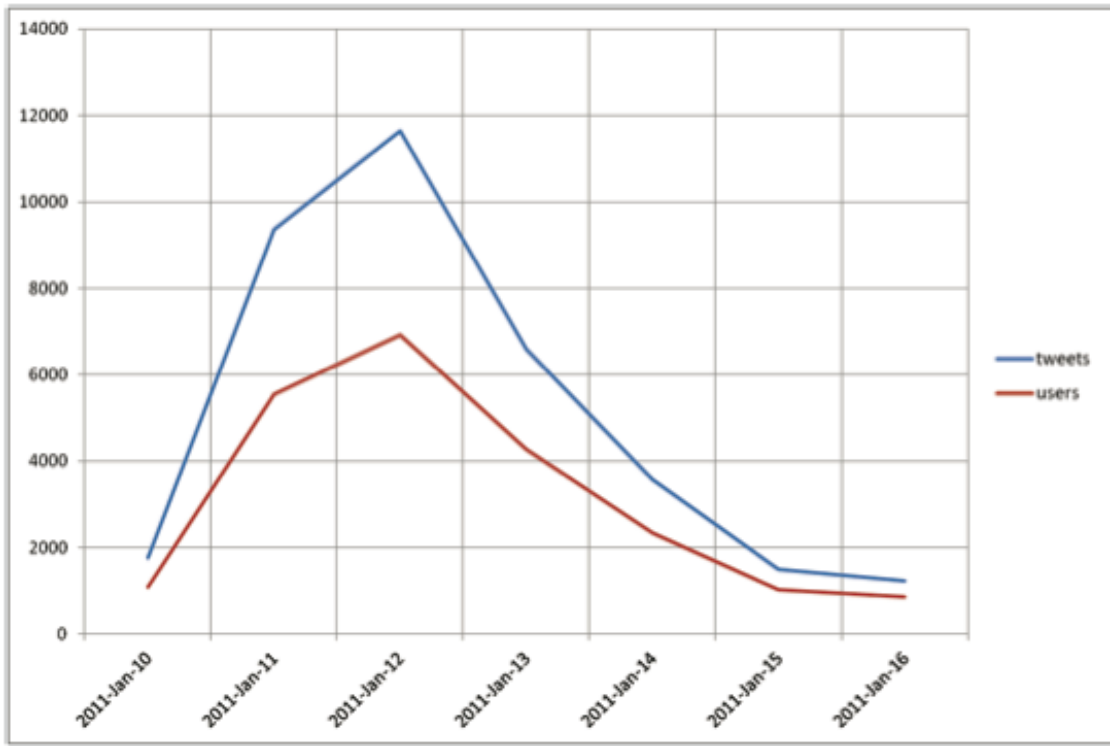

Figure 3

#qldfloods Tweet Types, 10-16 January, 2011

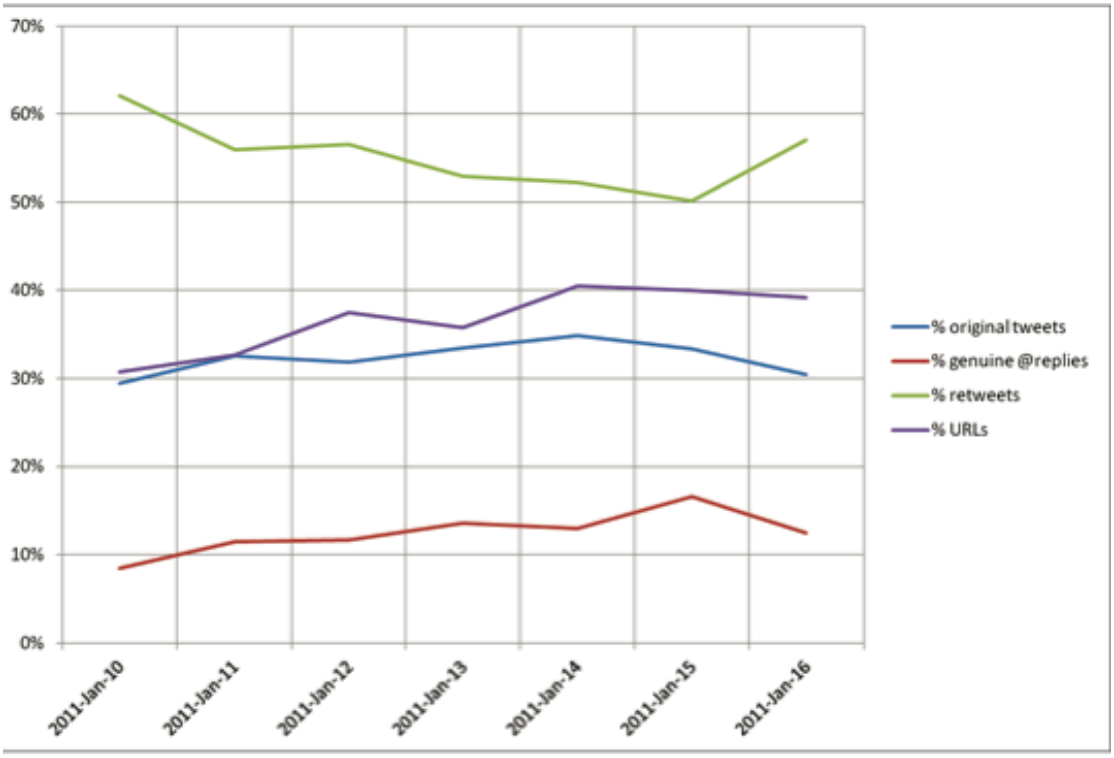

Figure 4

Most visible contributors to #qldfloods, 10-16 January, 2011

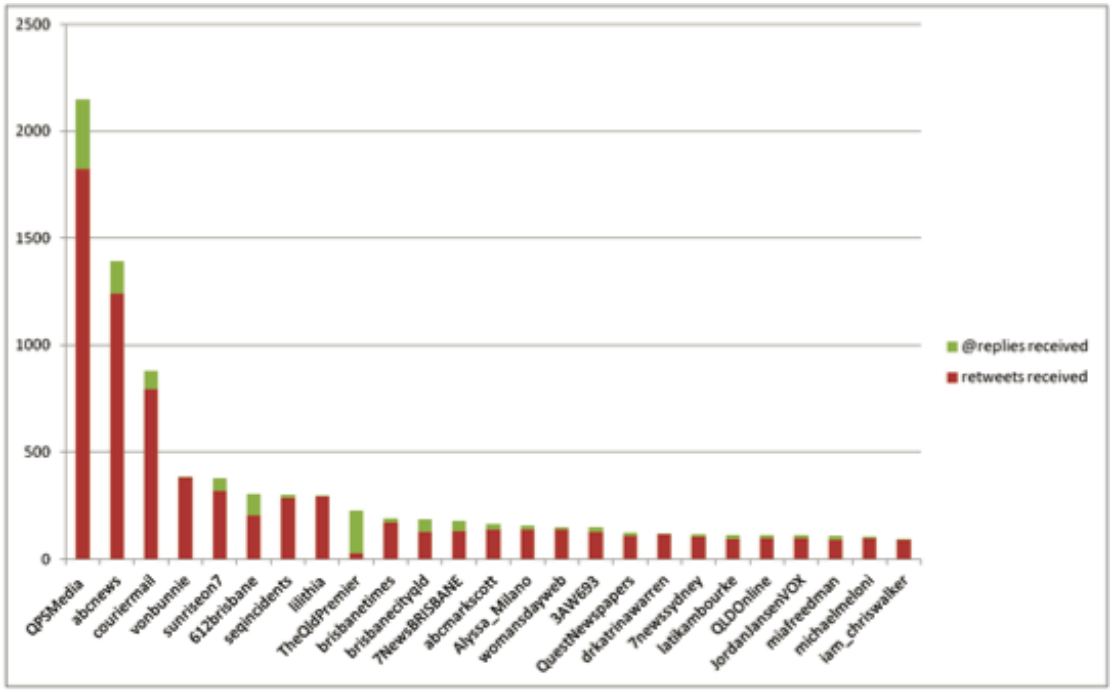

Figure 5

#qldfloods tweet types over time, 9-17 January, 2011

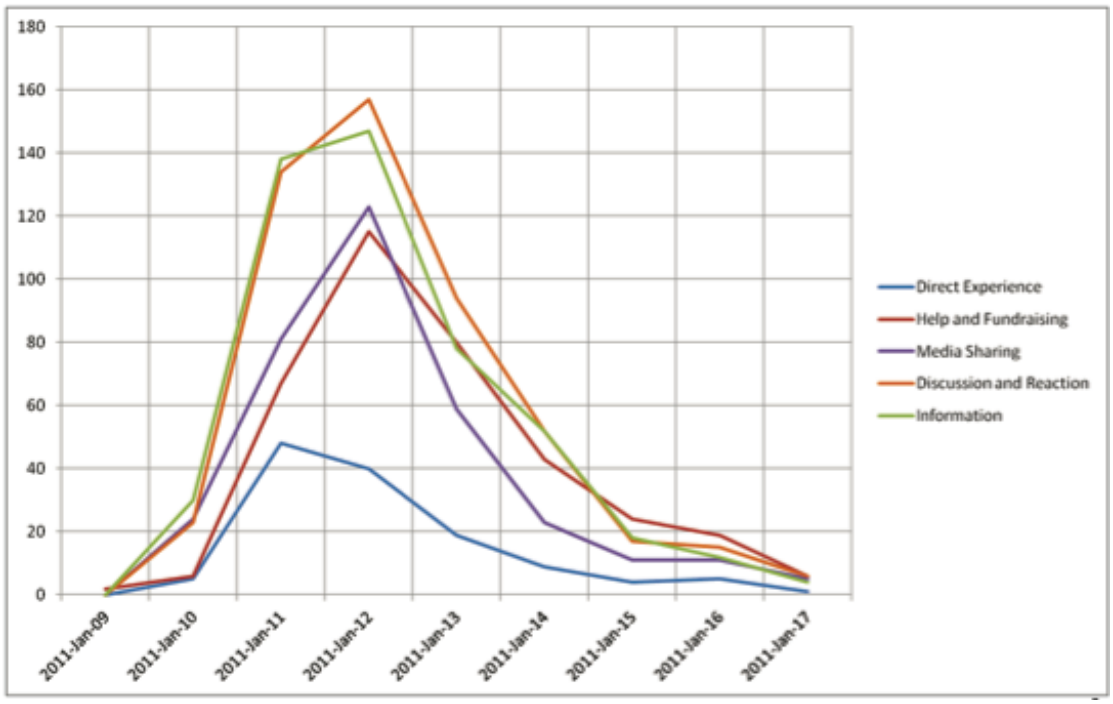

Figure 6

Percentage of #eqnz tweets containing URLs, (manual) retweets, and @replies, against total volume, 22 Feb-7 March 2011

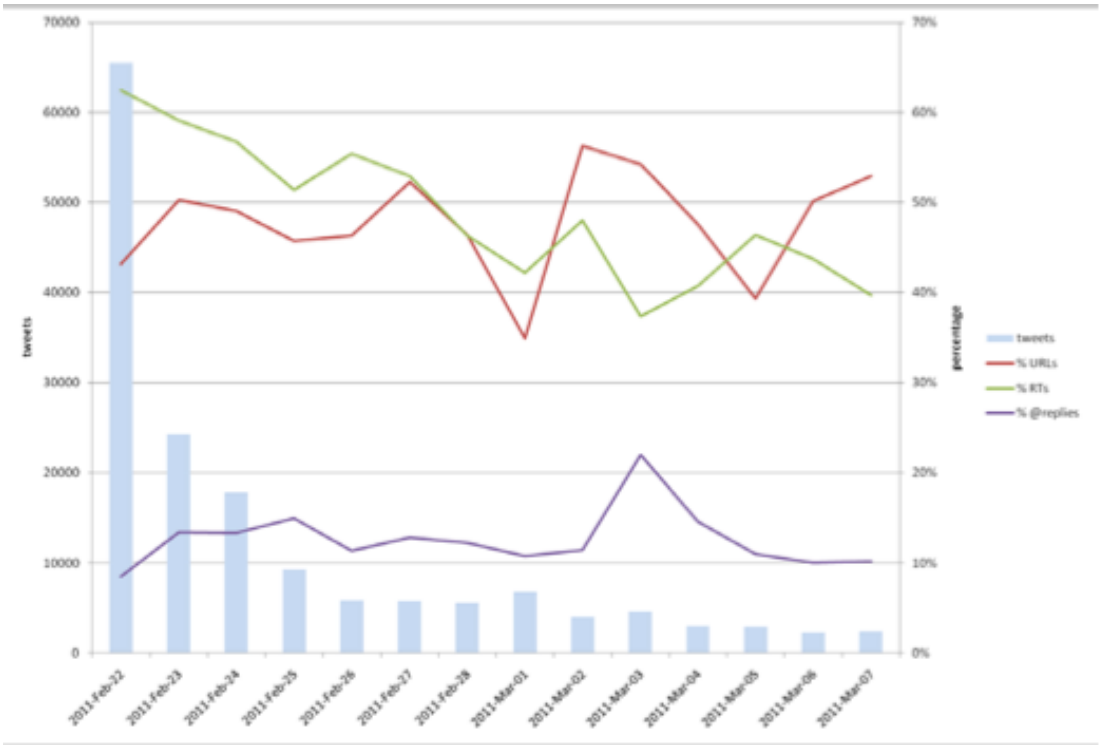

Figure 7

25 most active accounts participating in #eqnz, 22 Feb-7 March 2011

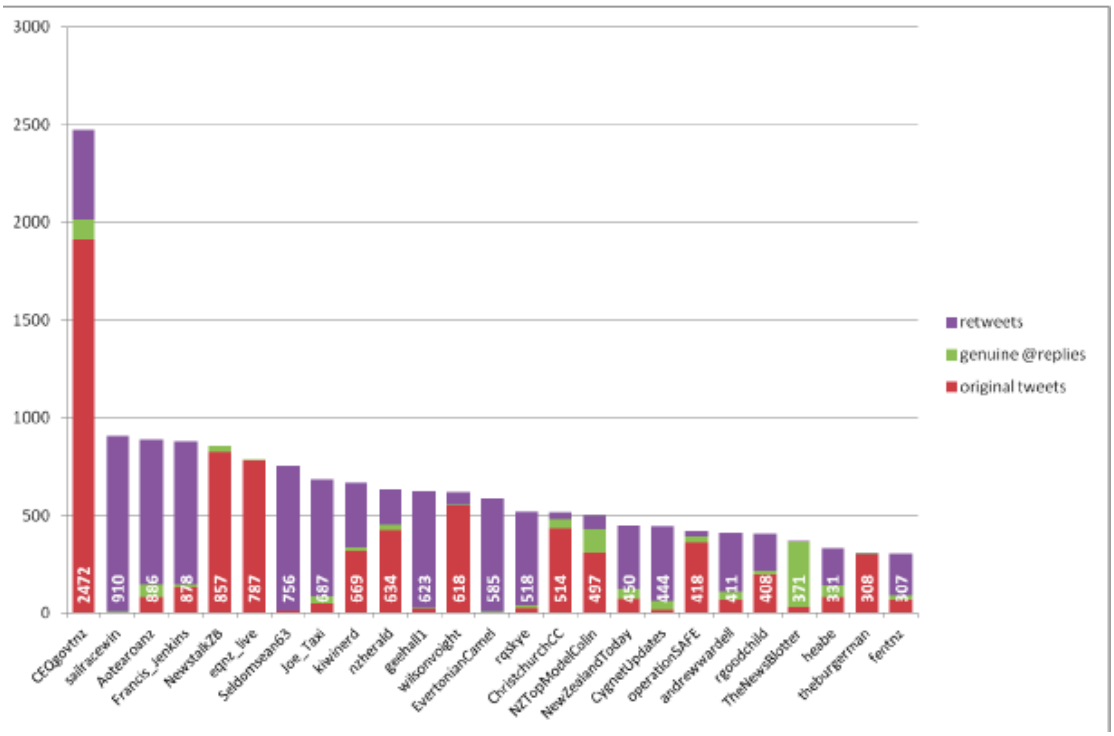

Figure 8

Numbers of tweets and unique users in #eqnz during 22 Feb.-7 March 2011 - breakdown of tweeting activity into percentiles of more and less active users