Supplement of

Exposure-based risk assessment and emergency management associated with the fallout of large clasts at Mount Etna

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## Historical activity

| Date       | Crater | Plume height a (km) | Lava fountain height (m) | Duration (mins) | Reference                                                                                     |
|------------|--------|---------------------|--------------------------|-----------------|-----------------------------------------------------------------------------------------------|
| 23 May 2016| NEC    | n/a                 | n/a                      | n/a             | (INGV, n.d.)                                                                                   |
| 21 May 2016| VOR    | n/a                 | n/a                      | ~ 60            | (INGV, n.d.)                                                                                   |
| 19 May 2016| VOR    | n/a                 | n/a                      | n/a             | (INGV, n.d.)                                                                                   |
| 18 May 2016| VOR    | 3 - 3.5 av          | n/a                      | > 60            | (INGV, n.d.)                                                                                   |
| 5 Dec 2015 | VOR    | 13                  | 1120                     | ~ 120           | (Bonaccorso and Calvari, 2017; Corsaro et al., 2017; Pompilio et al., 2017; Vulpiani et al., 2016) |
| 4 Dec 2015 pm | VOR    | 13.3                | 2050                     | 65              | (Bonaccorso and Calvari, 2017; Corsaro et al., 2017; Pompilio et al., 2017; Vulpiani et al., 2016) |
| 4 Dec 2015 am | VOR    | 13.4                | 2600                     | ~ 140           | (Bonaccorso and Calvari, 2017; Corsaro et al., 2017; Pompilio et al., 2017; Vulpiani et al., 2016) |
| 3 Dec 2015 | VOR    | 15                  | >1000                    | 80              | (Bonaccorso and Calvari, 2017; Corsaro et al., 2017; INGV, n.d.; Pompilio et al., 2017; Vulpiani et al., 2016) |
| 28 Dec 2014 | NSEC  | n/a                 | n/a                      | > 120           | (Bonforte and Guglielmino, 2015; INGV, n.d.)                                                   |
| 14 Jun 2014| NSEC   | n/a                 | n/a                      | n/a             | (INGV, n.d.)                                                                                   |
| 2 Dec 2013 | NSEC   | n/a                 | n/a                      | 85              | (De Beni et al., 2015)                                                                         |
| 28 Nov 2013| NSEC   | n/a                 | n/a                      | 385             | (De Beni et al., 2015)                                                                         |
| 23 Nov 2013| NSEC   | > 6 av              | 2500                     | 40              | (Andronico et al., 2015; De Beni et al., 2015; Bonaccorso et al., 2014, 2016; Corradini et al., 2016) |
|            |        | 9 +/- 1.8           | 3500                     | 50              |                                                                                               |
|            |        | 10 - 12             | 1000                     |                 |                                                                                               |
| 17 Nov 2013| NSEC   | n/a                 | n/a                      | 225             | (De Beni et al., 2015; INGV, n.d.)                                                             |
| 11 Nov 2013| NSEC   | n/a                 | n/a                      | 420             | (De Beni et al., 2015; INGV, n.d.)                                                             |
| 26 Oct 2013| NSEC   | 7                   | 500                      | 480             | (De Beni et al., 2015; Greco et al., 2016; INGV, n.d.; Sellitto et al., 2016)                   |
| 27 Apr 2013| NSEC   | n/a                 | 300 - 500                | ~ 120           | (De Beni et al., 2015; INGV, n.d.; Viccaro et al., 2016)                                       |
|            |        |                     |                          | 130             |                                                                                               |
|            |        |                     |                          | 210             |                                                                                               |
| 20 Apr 2013| NSEC   | 7 av                | 800 - 1000               | 55              | (De Beni et al., 2015; INGV, n.d.; Viccaro et al., 2016)                                       |
|            |        |                     |                          | ~ 60            |                                                                                               |
|            |        |                     |                          | 85              |                                                                                               |
| 18 Apr 2013| NSEC   | n/a                 | n/a                      | 75              | (De Beni et al., 2015; Spampinato et al., 2015; Viccaro et al., 2016)                           |
|            |        |                     |                          | 135             |                                                                                               |
| 12 Apr 2013| NSEC   | n/a                 | n/a                      | ~ 60            | (De Beni et al., 2015; INGV, n.d.; Spampinato et al., 2015; Viccaro et al., 2016)               |
|            |        |                     |                          | 70              |                                                                                               |
|            |        |                     |                          | 480             |                                                                                               |
| 3 Apr 2013 | NSEC   | n/a                 | 80 - 100                 | 60              | (De Beni et al., 2015; INGV, n.d.; Viccaro et al., 2016)                                       |
|            |        |                     |                          | 95              |                                                                                               |
|            |        |                     |                          | 135             |                                                                                               |
| 16 Mar 2013| NSEC   | 2 av                | 600 - 800                | 25              | (De Beni et al., 2015; INGV, n.d.; Viccaro et al., 2016)                                       |
|            |        |                     |                          | 20              |                                                                                               |
| 5-6 Mar 2013| NSEC  | Several km av      | 800                      | 45              | (De Beni et al., 2015; INGV, n.d.; Viccaro et al., 2016)                                       |
|            |        |                     |                          | 50              |                                                                                               |
| Date          | Crater | Plume height a (km) | Lava fountain height (m) | Duration (mins) | Reference                                      |
|---------------|--------|---------------------|--------------------------|-----------------|-----------------------------------------------|
| 28 Feb 2013   | NSEC   | n/a                 | n/a                      | 30              | (De Beni et al., 2015; Viccaro et al., 2016) |
| 23 Feb 2013   | NSEC   | n/a                 | 800                      | 45              | (De Beni et al., 2015; INGV, n.d.; Viccaro et al., 2016) |
| 21 Feb 2013   | NSEC   | n/a                 | n/a                      | 30              | (De Beni et al., 2015; Viccaro et al., 2016) |
| 20 Feb 2013 pm| NSEC   | n/a                 | n/a                      | 45              | (De Beni et al., 2015; Spampinato et al., 2015; Viccaro et al., 2016) |
| 20 Feb 2013 am| NSEC   | n/a                 | n/a                      | 40              | (De Beni et al., 2015; Spampinato et al., 2015; Viccaro et al., 2016) |
| 19 Feb 2013   | NSEC   | n/a                 | 200                      | 45              | (De Beni et al., 2015; Viccaro et al., 2016) |
| 13 Feb 2013   | NSEC   | n/a                 | n/a                      | 57              | (De Beni et al., 2015)                        |
| 24 Apr 2012   | NSEC   | n/a                 | n/a                      | 45              | (Viccaro et al., 2016)                        |
| 12 Apr 2012   | NSEC   | 3 av                | n/a                      | 70              | (Viccaro et al., 2016)                        |
| 1 Apr 2012    | NSEC   | Few km av           | n/a                      | 90              | (Viccaro et al., 2016)                        |
| 18 Mar 2012   | NSEC   | 4 - 5 av            | 100                      | 150             | (INGV, n.d.; Viccaro et al., 2016)            |
| 4 Mar 2012    | NSEC   | Several km av       | n/a                      | 120             | (Viccaro et al., 2016)                        |
| 9 Feb 2012    | NSEC   | 6 av                | 300 - 400                | 300             | (INGV, n.d.; Viccaro et al., 2016)            |
| 5 Jan 2012    | NSEC   | 7 - 8               | 100-150                  | 95              | (INGV, n.d.; Viccaro et al., 2016)            |
| 15 Nov 2011   | SEC    | Several km av       | 300                      | 80              | (Andronico and Del Carlo, 2015; Viccaro et al., 2016) |
| 23 Oct 2011   | NSEC   | 6                   | 300                      | 155             | (Guerrieri et al., 2015; INGV, n.d.; Viccaro et al., 2016) |
| 8 Oct 2011    | NSEC   | n/a                 | n/a                      | 195             | (INGV, n.d.; Viccaro et al., 2016)            |
| 28 Sep 2011   | NSEC   | n/a                 | 600 - 800                | 35              | (INGV, n.d.; Viccaro et al., 2016)            |
| 19 Sep 2011   | NSEC   | n/a                 | n/a                      | 40              | (Viccaro et al., 2016)                        |
| 8 Sep 2011    | NSEC   | n/a                 | n/a                      | 120             | (Carbone et al., 2015; INGV, n.d.; Viccaro et al., 2016) |
| 29 Aug 2011   | NSEC   | n/a                 | 100                      | 45              | (Carbone et al., 2015; INGV, n.d.; Viccaro et al., 2016) |
| 20 Aug 2011   | NSEC   | 5 - 6 av            | n/a                      | 50              | (Carbone et al., 2015; INGV, n.d.; Viccaro et al., 2016) |
| 12 Aug 2011   | NSEC   | 3 av 7              | > 100 Several 100 m      | 115             | (Carbone et al., 2015; Guerrieri et al., 2015; Scollo et al., 2015; Viccaro et al., 2016) |
| 5 Aug 2011    | NSEC   | n/a                 | 710                      | 165             | (Carbone et al., 2015; INGV, n.d.; Viccaro et al., 2016) |
| 30 Jul 2011   | SEC    | n/a                 | 450 - 500                | 120             | (Carbone et al., 2015; INGV, n.d.; Viccaro et al., 2016) |
| 25 Jul 2011   | SEC    | n/a                 | 340 - 350                | 240             | (Carbone et al., 2015; INGV, n.d.; Viccaro et al., 2016) |
| Date       | Crater | Plume height a (km) | Lava fountain height (m) | Duration (mins) | Reference                                                                 |
|------------|--------|---------------------|--------------------------|-----------------|--------------------------------------------------------------------------|
| 19 Jul 2011 | SEC    | 1.5 - 2 av          | 200 - 250                | 150             | (Carbone et al., 2015; INGV, n.d.; Viccaro et al., 2016)                 |
| 9 Jul 2011  | SEC    | 9 av                | 540                      | 105             | (Carbone et al., 2015; Viccaro et al., 2016)                             |
| 12 May 2011 | SEC    | 2 - 3 av            | 200 - 300                | 250             | (INGV, n.d.; Viccaro et al., 2016)                                       |
| 10 Apr 2011 | SEC    | 2 av                | 300                      | 360             | (INGV, n.d.; Viccaro et al., 2016)                                       |
| 18 Feb 2011 | SEC    | n/a                 | n/a                      | 660             | (Viccaro et al., 2016)                                                   |
| 12 Jan 2011 | SEC    | 9 > 4 av > 6 av     | 800 - 300 - 500          | 65 - 100        | (Andronico et al., 2014b; Calvari et al., 2011; Donnadieu et al., 2016; INGV, n.d.; Viccaro et al., 2015) |
| 10 May 2008 | SEC    | n/a                 | n/a                      | 210             | (Bonaccorso et al., 2011)                                               |
| 23 Nov 2007 | SEC    | n/a                 | n/a                      | 300             | (Acocella et al., 2016)                                                  |
| 4 Sep 2007  | SEC    | 5                   | 350 - 400 - 400 - 600    | 600 - 640       | (Acocella et al., 2016; Andronico et al., 2008)                           |
| 7 May 2007  | SEC    | n/a                 | n/a                      | 450             | (Acocella et al., 2016)                                                  |
| 29 Apr 2007 | SEC    | Few 100 m av        | n/a                      | n/a             | (Acocella et al., 2016)                                                  |
| 11 Apr 2007 | SEC    | n/a                 | n/a                      | > 225           | (Acocella et al., 2016)                                                  |
| 29 Mar 2007 | SEC    | Several km av       | 600 - 800                | 70              | (Acocella et al., 2016)                                                  |
| 24 Nov 2006 | SEC    | 1.3 - 2 av          | 200 - 300                | n/a             | (Andronico et al., 2014a)                                                |
| 25 Nov – 4 Dec 2002 | SEC | n/a | n/a | 10 days | (Spampinato et al., 2008)                                               |
| 14 Nov 2002 | SEC    | 7 av 3.5 av         | n/a                      | n/a             | (Scollo et al., 2012)                                                   |
| 13 Jul 2001 | SEC    | n/a                 | 400 - 500                | 140             | (La Spina et al., 2015)                                                 |
| 7 Jul 2001  | SEC    | n/a                 | 300 - 400                | 45              | (La Spina et al., 2015)                                                 |
| 4 Jul 2001  | SEC    | n/a                 | 50 - 60                  | 80              | (La Spina et al., 2015)                                                 |
| 27 Jun 2001 | SEC    | n/a                 | 400 - 500                | 55              | (La Spina et al., 2015)                                                 |
| 22 Jun 2001 | SEC    | n/a                 | 300 - 400                | 15              | (La Spina et al., 2015)                                                 |
| 19 Jun 2001 | SEC    | n/a                 | 200 - 300                | 35              | (La Spina et al., 2015)                                                 |
| 17 Jun 2001 | SEC    | n/a                 | 150 - 200                | 40              | (La Spina et al., 2015)                                                 |
| 15 Jun 2001 | SEC    | n/a                 | 50 - 60                  | n/a             | (La Spina et al., 2015)                                                 |
| 13 Jun 2001 | SEC    | n/a                 | 150 - 200                | 45              | (La Spina et al., 2015)                                                 |
| 9 Jun 2001  | SEC    | n/a                 | n/a                      | n/a             | (Alparone et al., 2007)                                                 |
| 7 Jun 2001  | SEC    | n/a                 | n/a                      | n/a             | (Alparone et al., 2007)                                                 |
| 24 Jun 2000 | SEC    | 3 – 4 av            | 500                      | 440             | (Alparone et al., 2003)                                                 |
| 14 Jun 2000 | SEC    | 4.5 av              | 600                      | 250             | (Alparone et al., 2003)                                                 |
| 8 Jun 2000  | SEC    | n/a                 | n/a                      | 280             | (Alparone et al., 2003)                                                 |
| 5 Jun 2000  | SEC    | 4 av                | 500 - 600                | 145 - 35        | (Alparone et al., 2003, 2007)                                            |
| 1 Jun 2000 pm | SEC | n/a | n/a | 125 | (Alparone et al., 2003)                                               |
| 1 Jun 2000 am | SEC | 5.5 av | 800 | 500 | (Alparone et al., 2003)                                               |
| 27 May 2000 | SEC    | n/a                 | n/a                      | 195             | (Alparone et al., 2003)                                                 |
| 23 May 2000 | SEC    | n/a                 | n/a                      | 115             | (Alparone et al., 2003)                                                 |
| 19 May 2000 | SEC    | n/a                 | n/a                      | 115             | (Alparone et al., 2003)                                                 |
| 17 May 2000 | SEC    | Not visible         | 500                      | 125             | (Alparone et al., 2003)                                                 |
| 15 May 2000 pm | SEC | Not visible | 700 | 90 | (Alparone et al., 2003)                                               |
| 15 May 2000 am | SEC | n/a | n/a | 60 | (Alparone et al., 2003)                                               |
| 5 May 2000  | SEC    | 4.5 – 5 av          | 800                      | 370             | (Alparone et al., 2003)                                                 |
| 26 Apr 2000 | SEC    | 5 av                | No data                  | 80              | (Alparone et al., 2003)                                                 |
| Date       | Crater | Plume height \(^a\) (km) | Lava fountain height (m) | Duration (mins) | Reference                          |
|------------|--------|---------------------------|--------------------------|----------------|-----------------------------------|
| 16 Apr 2000| SEC    | 6 av                      | 400                      | 215            | (Alparone et al., 2003)           |
| 6 Apr 2000 | SEC    | n/a                       | n/a                      | 105            | (Alparone et al., 2003)           |
| 3 Apr 2000 | SEC    | n/a                       | n/a                      | 165            | (Alparone et al., 2003)           |
| 1 Apr 2000 | SEC    | 3 av                      | Fog                      | 180            | (Alparone et al., 2003)           |
| 29 Mar 2000| SEC    | n/a                       | n/a                      | 115            | (Alparone et al., 2003)           |
| 24 Mar 2000| SEC    | n/a                       | n/a                      | 95             | (Alparone et al., 2003)           |
| 22 Mar 2000| SEC    | Not visible               | 300 - 350                | 125            | (Alparone et al., 2003)           |
| 19 Mar 2000| SEC    | n/a                       | n/a                      | 115            | (Alparone et al., 2003)           |
| 14 Mar 2000| SEC    | Not visible               | 200 - 250                | 125            | (Alparone et al., 2003)           |
| 12 Mar 2000| SEC    | Not visible               | 80                       | 130            | (Alparone et al., 2003)           |
| 8 Mar 2000 | SEC    | 3 av                      | 300                      | 145            | (Alparone et al., 2003)           |
| 4 Mar 2000 | SEC    | n/a                       | n/a                      | 120            | (Alparone et al., 2003)           |
| 28 Feb 2000| SEC    | n/a                       | n/a                      | 100            | (Alparone et al., 2003)           |
| 27 Feb 2000| SEC    | n/a                       | n/a                      | 165            | (Alparone et al., 2003)           |
| 23 Feb 2000| SEC    | n/a                       | n/a                      | 105            | (Alparone et al., 2003)           |
| 20 Feb 2000 pm | SEC   | n/a                       | n/a                      | 90             | (Alparone et al., 2003)           |
| 20 Feb 2000 am | SEC  | n/a                       | n/a                      | 45             | (Alparone et al., 2003)           |
| 19 Feb 2000| SEC    | n/a                       | n/a                      | 45             | (Alparone et al., 2003)           |
| 18 Feb 2000 pm | SEC  | n/a                       | n/a                      | 20             | (Alparone et al., 2003)           |
| 18 Feb 2000 am | SEC | n/a                       | n/a                      | 20             | (Alparone et al., 2003)           |
| 17 Feb 2000 pm | SEC  | n/a                       | n/a                      | 25             | (Alparone et al., 2003)           |
| 17 Feb 2000 am | SEC | n/a                       | n/a                      | 25             | (Alparone et al., 2003)           |
| 16 Feb 2000 pm | SEC | > 3 av                    | 300 - 350                | 20             | (Alparone et al., 2003)           |
| 16 Feb 2000 am | SEC | n/a                       | n/a                      | 25             | (Alparone et al., 2003)           |
| 15 Feb 2000| SEC    | Not visible               | >500                     | 40             | (Alparone et al., 2003)           |
| 14 Feb 2000 pm | SEC  | 4 av                      | 350 - 400                | 30             | (Alparone et al., 2003)           |
| 14 Feb 2000 am | SEC | n/a                       | n/a                      | 60             | (Alparone et al., 2003)           |
| 13 Feb 2000| SEC    | n/a                       | n/a                      | 25             | (Alparone et al., 2003)           |
| 12 Feb 2000 pm | SEC  | n/a                       | n/a                      | 55             | (Alparone et al., 2003)           |
| 12 Feb 2000 am | SEC | n/a                       | n/a                      | 75             | (Alparone et al., 2003)           |
| 12 Feb 2000 am | SEC | Not visible               | 350 - 400                | 70             | (Alparone et al., 2003)           |
| 11 Feb 2000 pm | SEC | Not visible               | 250 - 300                | 60             | (Alparone et al., 2003)           |
| 11 Feb 2000 am | SEC | n/a                       | n/a                      | 55             | (Alparone et al., 2003)           |
| 10 Feb 2000| SEC    | n/a                       | n/a                      | 55             | (Alparone et al., 2003)           |
| 9 Feb 2000 pm | SEC  | n/a                       | n/a                      | 35             | (Alparone et al., 2003)           |
| 9 Feb 2000 am | SEC  | n/a                       | n/a                      | 65             | (Alparone et al., 2003)           |
| 8 Feb 2000 pm | SEC  | n/a                       | n/a                      | 70             | (Alparone et al., 2003)           |
| 8 Feb 2000 am | SEC  | n/a                       | n/a                      | 75             | (Alparone et al., 2003)           |
| 7 Feb 2000 | SEC    | 3.2 av                    | 200                      | 75             | (Alparone et al., 2003)           |
| 6 Feb 2000 am | SEC  | n/a                       | n/a                      | 65             | (Alparone et al., 2003)           |
| 6 Feb 2000 pm | SEC  | n/a                       | n/a                      | 50             | (Alparone et al., 2003)           |
| 5 Feb 2000 | SEC    | n/a                       | n/a                      | 85             | (Alparone et al., 2003)           |
| 4 Feb 2000 am | SEC  | n/a                       | n/a                      | 70             | (Alparone et al., 2003)           |
| 4 Feb 2000 pm | SEC  | n/a                       | n/a                      | 50             | (Alparone et al., 2003)           |
| 3 Feb 2000 | SEC    | n/a                       | n/a                      | 85             | (Alparone et al., 2003)           |
| 2 Feb 2000 | SEC    | n/a                       | n/a                      | 65             | (Alparone et al., 2003)           |
| 1 Feb 2000 | SEC    | n/a                       | n/a                      | 100            | (Alparone et al., 2003)           |
| 29 Jan 2000| SEC    | n/a                       | n/a                      | 95             | (Alparone et al., 2003)           |
| 26 Jan 2000| SEC    | n/a                       | n/a                      | 565            | (Alparone et al., 2003)           |
| 4 Nov 1999 | BN     | n/a                       | n/a                      | 190            | (Cannata et al., 2008)            |
| 27 Oct 1999| BN     | n/a                       | n/a                      | 415            | (Cannata et al., 2008)            |
| Date       | Crater | Plume height a (km) | Lava fountain height (m) | Duration (mins) | Reference                          |
|------------|--------|---------------------|--------------------------|-----------------|------------------------------------|
| 21 Oct 1999 | BN     | n/a                 | n/a                      | 110             | (Cannata et al., 2008)            |
| 16 Oct 1999 | BN     | n/a                 | n/a                      | n/a             | (Cannata et al., 2008)            |
| 14 Oct 1999 | BN     | n/a                 | n/a                      | n/a             | (Cannata et al., 2008)            |
| 12 Oct 1999 | BN     | n/a                 | n/a                      | n/a             | (Cannata et al., 2008)            |
| 20 Sep 1999 | BN     | n/a                 | n/a                      | 130             | (Cannata et al., 2008)            |
| 4 Sep 1999  | SEC    | n/a                 | n/a                      | 10              | (Cannata et al., 2008)            |
| 4 Sep 1999  | SEC    | n/a                 | 1500                     | 65              | (Cannata et al., 2008; La Delfa et al., 2001) |
| 4 Feb 1999  | SEC    | 9                   | n/a                      | 90              | (Cannata et al., 2008; La Delfa et al., 2001) |
| 23 Jan 1999 | SEC    | n/a                 | n/a                      | 45              | (Cannata et al., 2008)            |
| 20 Jan 1999 | SEC    | n/a                 | n/a                      | 35              | (Cannata et al., 2008)            |
| 18 Jan 1999 | SEC    | n/a                 | n/a                      | 30              | (Cannata et al., 2008)            |
| 16 Jan 1999 | SEC    | n/a                 | n/a                      | 25              | (Cannata et al., 2008)            |
| 13 Jan 1999 | SEC    | n/a                 | n/a                      | 50              | (Cannata et al., 2008)            |
| 10 Jan 1999 | SEC    | n/a                 | n/a                      | 40              | (Cannata et al., 2008)            |
| 5 Jan 1999  | SEC    | n/a                 | n/a                      | 60              | (Cannata et al., 2008)            |
| 11 Oct 1998 | SEC    | >10                 | Few 100 m                | 60              | (Dubosclard et al., 1999)         |
| 15 Sep 1998 | SEC    | n/a                 | n/a                      | n/a             | (Corsaro and Pompilio, 2004)       |
| 6 Aug 1998  | VOR    | n/a                 | n/a                      | n/a             | (Corsaro and Pompilio, 2004)       |
| 22 Jul 1998 | VOR    | >10                 | n/a                      | 6               | (Andronico et al., 2015; Corsaro and Pompilio, 2004; La Delfa et al., 2001) |
| 27 Mar 1998 | NEC    | n/a                 | n/a                      | 120             | (Corsaro and Pompilio, 2004; La Delfa et al., 2001) |

Table S1 Lava fountains at Mount Etna. Craters: BN (Bocca Nuova); NEC (Northeast Crater); NSEC (New Southeast Crater); SEC (Southeast Crater); VOR (Voragine). n/a = not available. a Plume height is above sea level, except av = above vent.
Fig. S1 Median wind speed and direction profiles, showing 25th and 75th percentile (error bars), for 2013 for summer (April to September), winter (October to March) and the whole period, produced from TephraProb (Biass et al., 2016; NOAA, 2017). Wind direction is the direction towards which the wind blows, measured in degrees from north.
Fig. S2 Median wind roses for 2013 for summer (April to September), winter (October to March) and the whole period, produced from TephraProb (Biass et al., 2016; NOAA, 2017). Wind direction is the direction towards which the wind blows.
Fig. S3 Median wind speed and direction profiles, showing 25th and 75th percentile (error bars), for 2006 to 2015 for summer (April to September), winter (October to March) and the whole period, produced from TephraProb (Biass et al., 2016; NOAA, 2017). Wind direction is the direction towards which the wind blows, measured in degrees from north.
Fig. S4 Wind roses for 2006 to 2015 for summer (April to September), winter (October to March) and the whole period, produced from TephraProb (Blass et al., 2016; NOAA, 2017). Wind direction is the direction towards which the wind blows.
Fig. S5 Median wind speed and direction profiles, showing 25\textsuperscript{th} and 75\textsuperscript{th} percentile (error bars), for 1997 to 2015 for summer (April to September), winter (October to March) and the whole period, produced from TephraProb (Biass et al., 2016; NOAA, 2017). Wind direction is the direction towards which the wind blows, measured in degrees from north.
Fig. S6 Wind roses for 1997 to 2015 for summer (April to September), winter (October to March) and the whole period, produced from TephraProb (Biass et al., 2016; NOAA, 2017). Wind direction is the direction towards which the wind blows.
Sensitivity analysis

Fig. S7 For contours showing the furthest extent of sedimentation of 5 cm particles, impact of varying a) the number of particles used in each simulation, b) the particle density. NSEC = New Southeast Crater.

Fig. S8 Cumulative hazard zone, showing area where probability of impact from a 5 cm clast is > 40 %, 30 – 40 %, 20 – 30 %, 10 – 20 %, 1 – 10 % and < 1 %, for 1000, 2000, 4000 and 8000 simulations.
Fig. S9 Modelled probability of impact of a 5 cm clast. a) 1000 simulations, b) 2000 simulations, c) 4000 simulations, d) 8000 simulations, e) overlap of maps for 1000, 2000, 4000 and 8000 simulations.

Probability of impact:
- Red: > 40 %
- Orange: 30 - 40 %
- Yellow: 20 - 30 %
- Green: 10 - 20 %
- Light green: 1 - 10 %
- Blue: < 1 %
Modelled contours (vent and clast size)

- Bocca Nuova 4.5 cm
- NSEC 4.5 cm
- Voragine 4.5 cm
- Bocca Nuova 7 cm
- NSEC 7 cm
- Voragine 7 cm
- NEC 4.5 cm
- SEC 4.5 cm
- NEC 7 cm
- SEC 7 cm

Fig. S10 Modelled 4.5 and 7 cm clast size isopleths for 23 November 2013 lava fountain from each of the five summit craters. NEC = Northeast Crater, NSEC = New Southeast Crater, SEC = Southeast Crater.
Fig. S11 Probability map showing exposure of infrastructure to impact from a 5 cm clast for the One Eruption Scenario – high mass eruption rate from Voragine. Ski areas: ET-N = Etna Nord, ET-S = Etna Sud. BG = Baita delle Guide, CCN = Top station of the Funivia dell’Etna cable car, PDO = INGV Pizzi Deneri Observatory, RC = Rifugio Citelli.
Fig. S12 Evacuation times to reach the safe zone (for One Eruption Scenario – high mass eruption rate from NSEC) based on walking speed of 3.3 km h\(^{-1}\), assuming people start a maximum of 500 m from any path with a) no shelters, b) one shelter and c) two shelters. Hazard zone is the area with probability of impact from 5 cm clast ≥ 1 %. Safe zone includes area with probability of impact < 1 %. NSEC = New Southeast Crater. Ski areas: ET-N = Etna Nord, ET-S = Etna Sud. BG = Baita delle Guide, CCN = Top station of the Funivia dell’Etna cable car, PDO = INGV Pizzi Deneri Observatory, RC = Rifugio Citelli.
Fig. S13 Evacuation times to reach the safe zone (for One Eruption Scenario – high mass eruption rate from NSEC) based on walking speed of 3.3 km h\(^{-1}\), assuming people start a maximum of 300 m from any path, with a) one shelter and b) two shelters. Hazard zone is the area with probability of impact from 5 cm clast ≥ 1%. Safe zone includes area with probability of impact < 1%. NSEC = New Southeast Crater. Ski areas: ET-N = Etna Nord, ET-S = Etna Sud. BG = Baita delle Guide, CCN = Top station of the Funivia dell’Etna cable car, PDO = INGV Pizzi Deneri Observatory, RC = Rifugio Citelli.
Evacuation times to reach the safe zone (for One Eruption Scenario – low mass eruption rate) based on walking speed of 3.3 km h\(^{-1}\), with a) no shelter and b) one shelter. Hazard zone is the area with probability of impact from 5cm clast ≥ 1 %. Safe zone includes area with probability of impact < 1 %. NSEC = New Southeast Crater. BG = Baita delle Guide, CCN = Top station of the Funivia dell’Etna cable car, PDO = INGV Pizzi Deneri Observatory.

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