

## Was the 1906 great Ecuador-Colombia earthquake ( $M_w$ 8.8) a multiple rupture event of three segments ?

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Since the 2011 off the Pacific coast of Tohoku Earthquake, a multiple segment rupture event is a more important problem in seismology than ever. A suspected example of this type is a great earthquake involving Tokai, Tonankai, and Nankai segments. The 1906 earthquake in the Ecuador-Colombia region is considered to belong to events of multiple segment rupture. Kanamori and McNally (1982) indicated that the rupture zone of the earthquake ( $M_w = 8.8$ ) included aftershock zones of three medium-sized earthquakes in 1942 ( $M_s = 7.9$ ), 1958 ( $M_s = 7.8$ ), and 1979 ( $M_s = 7.7$ ), judging from this aftershock data. It is, however, difficult to determine the aftershock region in the 1906 event when poor seismological observations were available. Kanamori and McNally (1982) recognized the uncertainty of the aftershock area of this earthquake, although they estimated its seismic moment from the extent of aftershock areas and derived  $M_w$  value of the earthquake. The value of  $M_w$  is close to Abe's (1979) tsunami magnitude  $M_t$ , that is, 8.8.

Abe (1979) estimate  $M_t$  of the 1906 earthquake by using far-field tsunami data in Japan and Hawaii. In his calculation the record in Hilo was adopted to be 3.6 m. In this study, we re-examined this value, finding it rather problematic, from the following reasons.

1. The information source of the value comes from an article of a local newspaper, where no numerical observations were presented.
2. According to the article, the tsunami in Hilo covered only streets and railroad tracks, but no substantial damages were reported.

We estimate the scale of the 1906 earthquake based on modern record of the 1979 earthquake. According to Kanamori and McNally (1982),  $M_w$  of the 1979 earthquake is 8.2 and  $M_t$  is 8.1. We calculate the ratio of the tsunamis amplitude of the 1979 earthquake to that of 1906, estimated from the difference in  $M_t$  of two earthquakes with tidal gauge data in Japan.  $M_t$  of 1906 earthquake must be about 8.4 to 8.5 at most. Since the 1906 earthquake was not a tsunami earthquake,  $M_w$  also must be similar, about 8.5, the value by 0.3 less than  $M_w$  by Kanamori and McNally (1982). In this study, the seismic moment of the 1906 earthquake is only about 2.8 times larger than the 1979 earthquake.

If  $M_w$  of 1906 earthquake is 8.8 as Kanamori and McNally (1982), the length of the earthquake fault is twice of the 1979 earthquake. The estimated scale is as large as the rupture zones of the three earthquakes. If  $M_w$  of 1906 earthquake is 8.5, as suggested in this study the fault length of the earthquake is only 1.4 times of the 1979 earthquake.

In conclusion, we propose that the 1906 earthquake was a multiple rupture event of three segments. The seismic moment of this earthquake seems to be not much larger than but comparable with the other three earthquakes.

### Refences

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