SPECIAL PAPERS

THE 16 SEPTEMBER 2015 M8.3 CHILE EARTHQUAKE

Editor's note: The latest great earthquake in Chile, South America was successfully predicted by a concerted effort of world scientists. It was initially warned more than one year prior, and a short-term warning was given 21 days prior to the mainshock. It was made possible by well-established, but relatively little-appreciated, concepts and a multiparameter approach. The entire procedures taken by the group will set a new direction for the future earthquake prediction practice. Another significance of this success is that it has broken the myth that 'No one can predicted earthquakes', which has been claimed by world seismological authorities. Due to time constraint, this NCGT issue includes only some short preliminary reports and introduces precursory signals which had appeared prior to the mainshock.

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ANALYSIS OF PSYCHROMETRIC PARAMETERS ASSOCIATED WITH SEISMIC PRECURSORS IN CENTRAL CHILE: A NEW EARTHQUAKE OR THE GREAT 2010 MAULE M8.8 AFTERSHOCK?

Ariel R. CÉSPED
Principal Researcher, Chilesismos
chilesismos@gmail.com

(Author's note: The original of this paper was issued on August 26, 2015 – 21 days prior to the mainshock of the Chilean earthquake on September 16, 2015)

Abstract: This paper shows the results of the analysis on psychrometric parameters associated with earthquake precursors in the central area of Chile, during the period of July - August 2015. A comparative study found equivalences between the behavior of the current readings and that occurred in preceding days of the Maule M8.8 mega-earthquake in 2010, which allowed to infer the possibility of a significant earthquake for the period of September - October, 2015.

Keywords: *earthquake prediction, psychrometrics, atmospheric research*

LITHOSPHERE-ATMOSPHERE ELECTRO-CHEMICAL CONNECTION

State-of-the-Art studies in the field of atmospheric physics suggest that areas near active geological faults show a *seismic preparation* process in days or weeks before earthquakes, emitting chemical and electromagnetic signals such as radioactive gases (mostly Radon Rn222), ions, "p-holes", and electromagnetic pulses (Rozhnoi et. al., 2009; Freund, 2010; Pulinets, 2011). Ions and free electrons released by the Earth's crust, possibly associated with piezoelectric phenomena in the area of greater stress, or product of the induced radiolysis by the radioactive decay of Radon, saturate the sub-soil and migrate to the surface. The gradient of potential between the ground (cathode) and the ionosphere (anode) (which in standard conditions is up to 100 Volts/m) activates the relative motion of these particles through the air, and eventually collide with the airborne water molecules, breaking electrical links and triggering an "avalanche" of corpuscles (Townsend Discharge) in a large scale. Thermodynamical instability of these radicals is quickly balanced (the average reaction time is approximately 11 nanoseconds) by a mechanism of neutralization of *ion induced nucleation* (IIN), bringing together the atoms in suspension and developing aerosols of several nanometers in diameter. This process occurs with a large associated energy transfer process consisting of latent heat, which is released into the atmosphere. Inherent phase change alters the amount of water vapour in the air, thus, the relative humidity in areas close to the future epicenter spontaneously. If the phenomenon described above is sufficiently extensive, the variations could finally reach the upper levels of the

atmosphere, re-setting properties of the cloud layer (linear precursor clouds) (Zhong, 2014) and the high-speed winds in the high troposphere (jet-streams) (Wu, 2014) until they can be visible from space by satellites.

EXPERIMENTAL PROCEDURE

To identify the possible action of the mechanism described above, an analysis of some psychrometric parameters associated with seismic precursors is performed. The meteorological database is provided by the *Dirección Meteorológica de Chile* at the *Carriel Sur*, Talcahuano (36.7S, 73.0W) station. Taken Periods of studies are (1) January-February 2010 and (2) July-August, 2015.

Figure 1. Area of study (rectangle)

In order to detect a possible participation of radicals in the composition of electro-chemistry of the air and the presence of induced nucleation processes, an analysis of the *corrected chemical potential* (ΔU) (Boyarchuk et. al., 2006) is suggested, in accordance with the equation (1):

$$\Delta U = 5.8x10^{-10}(20T_S + 5463)^2 \ln(100/H_R) \quad (1)$$

Where *TS* and *HR* are the temperature in °C and relative humidity of the air respectively. Then it is necessary to check possible alterations associated with the process of stabilization of ionized particles and its interaction energy with water vapour in the air through an analysis of the *condensation latent heat L(T)* (Roger and Yau, 1989) according to the equation (2):

$$L(T) = (2500.8 - 2.36T_D + 0.0016T_D^{\,2} - 0.00006T_D^{\,3}) \quad (2)$$

Where T_D is the condensation temperature of water, considering, in this case, the *dew point* in °C. If this process reaches a level of considerable influence, the traces of latent heat around the area over the future epicenter should therefore be traceable from space via satellite. To verify this, an analysis of behavior of the *surface latent heat flux* (SHLF) is performed. The data is obtained from the database of *Surface Flux Re-analysis* webserver, managed by the *National Center of Environment Prediction* (NCEP). Finally the three parameters ΔU, *L(T)*, and *SHLF* are evaluated through the *anomaly index*, according to the following algorithm (3):

$$A_{index} = \frac{(x - \bar{x})}{\sigma} \quad (3)$$

Where x is the daily value of the sample, and x and σ average and standard deviation of the data series. A threshold was established to discriminate the anomalous values equal to $x + 2.5\sigma$. The results are tabulated and graphed for further analysis.

RESULTS

The following are the comparative results of the *ΔU*, *L(T)*, and *SHLF* analysis respectively, for the period January-February 2010 and July-August 2015 in Bío-Bío and surrounding regions.

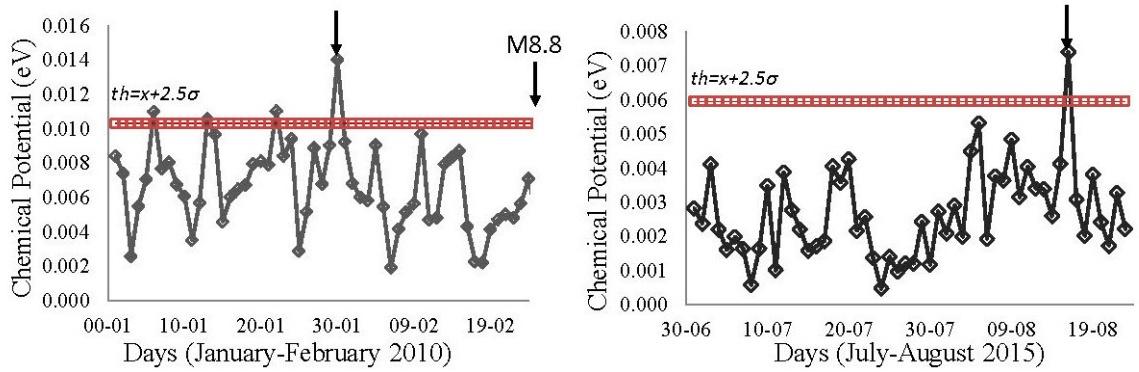

Chart No. 1 (left) shows a significant variation of *ΔU* occurred on January 30, 2010, twenty-eight days before the Maule M8.8 earthquake. Chart No. 2 (right) shows an analogue anomaly occurred on August 16, 2015.

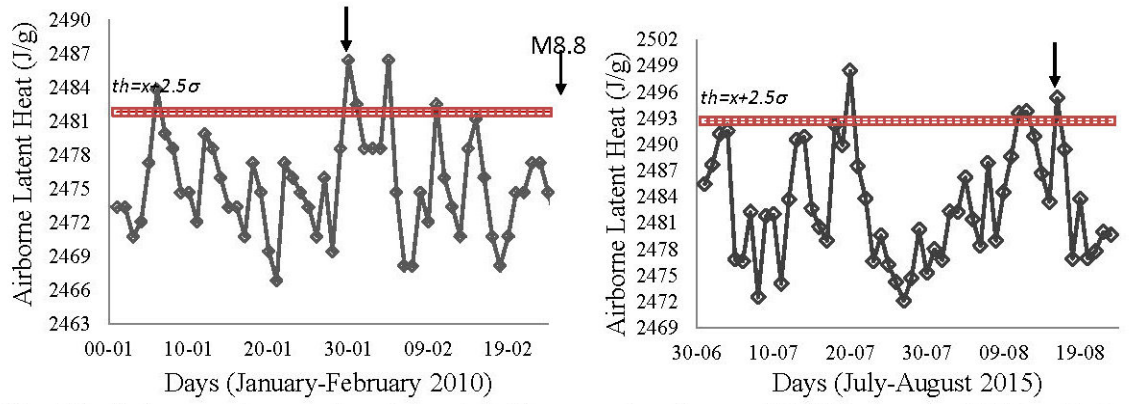

Chart No. 3 (left) shows an important variation in *L(T)* occurred on January 30, 2010, twenty-eight days before the Maule M8.8 earthquake. Chart No. 4 (right) shows an analogue anomaly occurred on August 16, 2015.

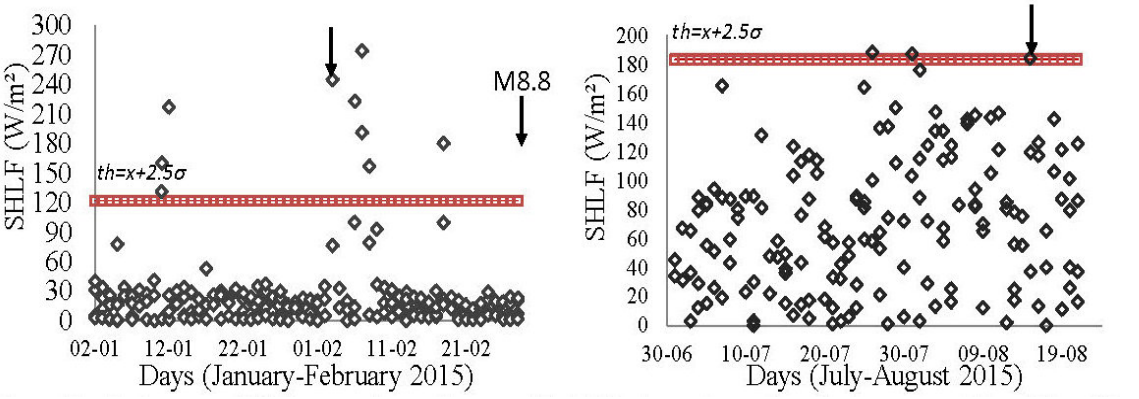

Chart No. 5 (left), shows a *SHLF* anomaly on January 02, 2010, three days after the increase of the *ΔU* and *L(T)* and twenty-six days before the Maule M8.8 earthquake. Chart No. 6 (right) shows a *SHLF* anomaly on August 16, 2015, the same day as the detection of *ΔU* and *L(T)* anomalies observed in Chart No. 2 and Chart No. 4

CONCLUSIONS

As one can see in the results, an important psychrometric variation associated with seismic precursors was observed on August 16, 2015 in the central area of Chile. Bi-monthly comparative analysis shows a disturbing similarity to the behavior in the days prior to the Maule M8.8 earthquake in 2010. If this is a new seismic preparation process, the occurrence timeframe would be around September-October, 2015. Since the observed event has major earthquake characteristics (+ M8) the classic effect of uncertainty according to the *seismic preparation areas* empiric equations (Dovobrolsky et al., 1979) cannot point clearly the final area of the future epicenter. However, the apparent geological instability after the 2010 Maule M8.8 earthquake (35-37°S), as well as the extensive seismic gap in the north-central Chile coast (30-33°S) allow to infer not only that the possibility of one major event is high, but that the seismic potential could concentrate on these areas. This assertion also fits with the results of the method "*algorithm M8"* (Kossovokov, 2015), which currently provide a seismic alert (in progress) to the Chilean coast around 30-36°S with the preliminary expiration date on January 2016. Whether this results are predicting a new earthquake or a strong aftershock of the 2010 earthquake, it is valuable that results of three different models converge towards a similar conclusion, providing an exceptional instance so that the authorities and emergency teams take the appropriate guidelines that allow to mitigate the effects of a possible catastrophe.

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POSTCRIPT: On September 16, 2015, twenty one days after issuing of this report, a powerful M8.3 earthquake hit the north-central of Chile (-31.570, -71.654°W). This shock occurred inside the two areas (30-33°S) discussed in the paper. Based on the data provided by the Chile's National Emergencies Office (ONEMI), 13 fatalities and one million people were affected by the shock and tsunami along the central Chile coast. The report was sent to ONEMI on August 28, and posted on the social networks on August 31, 2015 (https://goo.gl/I3kLLY). More than 30,000 followers witnessed this prediction, and many of them took preparedness for this event. We thank to all of the people and press that spread this warning in advance.