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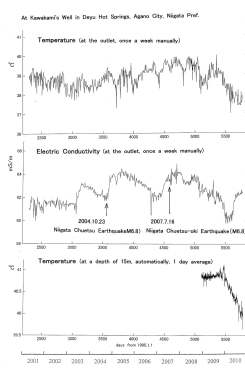
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Recent anomalous changes in temperature and electric conductivity of groundwater at Deyu Hot Springs, Niigata Prefecture

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Electric conductivity changes of groundwater, representing the changes on ion concentration, are partly induced by the intrusion of water from deep underground, which is responsible to the crustal stress conditions. Since April, 2001, Mr. Sadao Kawakami has been manually measuring temperature and electric conductivity of groundwater at Deyu Hot Springs, Agano City, in the northern Niigata Prefecture. The measurement is conducted at an interval of one week for the water pumped up from the well. Furthermore, we have temperature data measured automatically since December 7, 2008. The conductivity was almost constant at a level of 60-62mS/m until around June, 2003, when the conductivity initiated to rise. The peak value of 63mS/m is recorded around the period between August and November, 2003. While decreasing after the peak period, the conductivity turned to rise responding to the 2004 Niigata-ken Chuetsu Earthquake of M6.8 with the maximum at 64mS/m in around January, 2005 and decreased gradually. Around March, 2007 it tended to rise again followed by the 2007 Niigata-ken Chuetsu-oki earthquake of M6.8 on Sep.16, 2007. The above phenomena suggests stress concentrations taking place in the crust before large earthquakes, which may generate highly compressed fluids within cracks in the rocks. Those fluids tend to migrate upwards through crack system in the crust. Among them, the intrusion of water with high concentration of ions into a shallow water reservoir results in an increase in the conductivity of the water. Rise of conductivity is accompanied by temperature rise for the above cases. Around the end of 2009 the conductivity started to decrease with clearly decreasing temperature, indicating stress relaxation underground. However, the recent rise of the conductivity since the end of May, 2010 is not with increase of temperature. The origin of the water of decreasing temperature tended to be different from that of increasing conductivity. Anyway, newly activated stress changes are going on in the Niigata area.



Keywords: groundwater, groundwater temperature, electric conductivity, earthquake prediction