

Identification of Groundwater Radon Precursory Anomalies by Critical Slowing Down Theory: A Case Study in Yunnan Region, Southwest China

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Generally speaking, there are three parameters that affect the correlation calculation, one is the level of WD, the other is the window length (WL), and the third is the lag length.

The lag length is the position difference of the first digit of two calculation windows. We choose 1 step as the lag length because the AR-1 is the easiest way to indicate CSD. And we selected the level 3 to 8 to discuss the best WD level according to the past studies.

We take the time interval between a possible anomaly and the subsequent earthquake as a "total data length" to determine the WL. The empirical formula for the relationship between the occurrence time of earthquake and precursor is as follows:

$$lgRT = 0.63M \pm 0.15$$

where R (km) is the epicenter distance, T (days) is the number of days before the earthquake when the earthquake precursor appears, and M is the earthquake magnitude. According to the calculation, the maximum occurrence time of the precursor with less 500 km epicenter distance is about 73 days before the earthquake, and its 2% is 1.46 days and its 50% is 36.5 days. So we assume the Suitable WL interval as 5 to 30 days.

The Figure.S1 is the LC station's AR-1 and variances with the same level of WD and different WL before Lijiang earthquake 100 days. The Figure.S1 (a) is the result of residual and the Figure.S1 (b) is the result of low frequency data. The level of WD is 5 and the WL is 5, 10, 20, 30 days. The Figure.S2 is the LC station's residual's AR-1 and variances with the same WL (5 days) and different level of WD (level 3 to 8) before Lijiang earthquake 100 days. The Figure.S2 (a) is the result of the residual and the (b) is the result of the low frequency data.

We choose moderate parameters, level 5 of WD and 10 days of WL finally, as described in the Section 5 of main text.

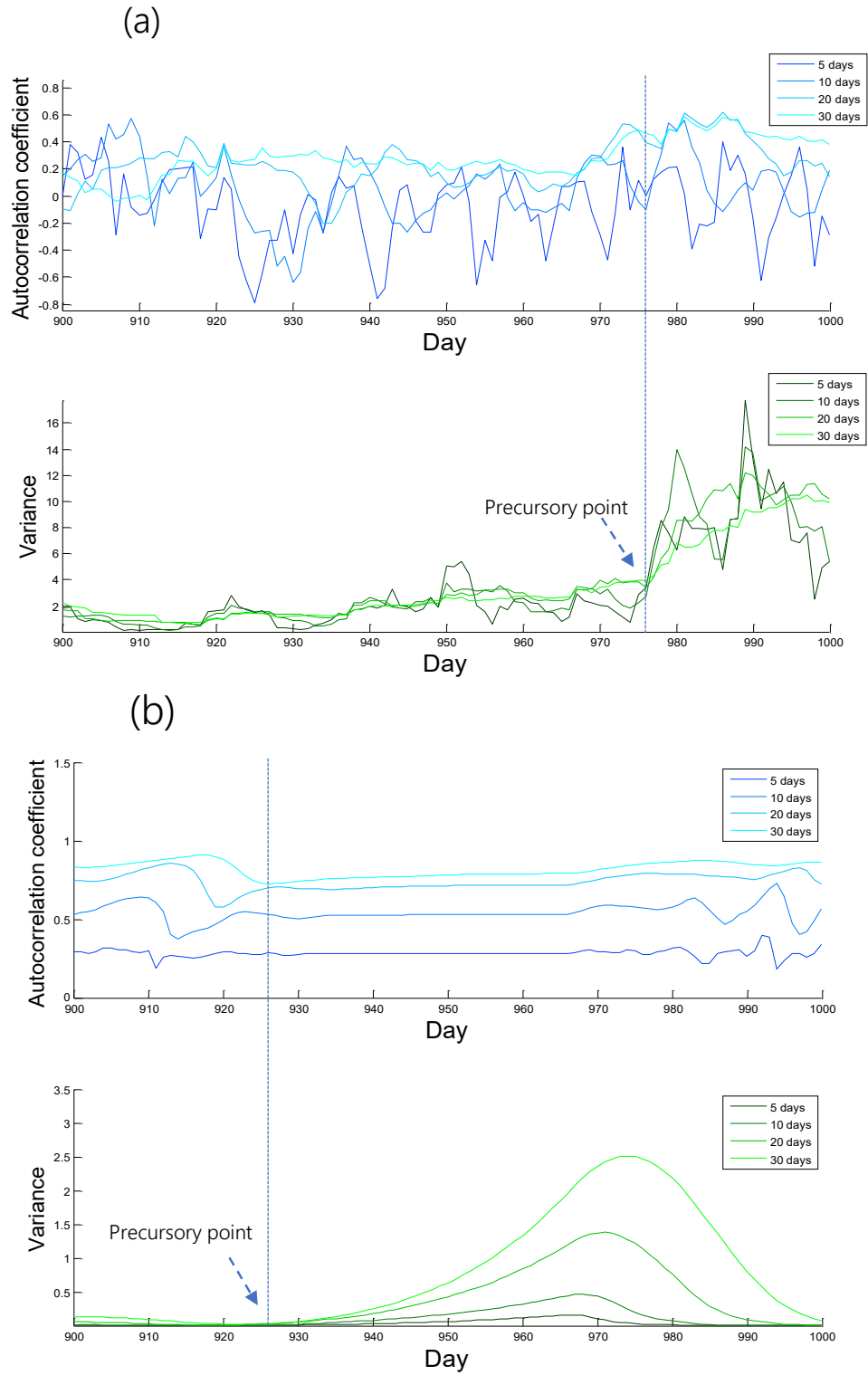


Figure.S1. Comparison of calculation results of different levels of WL with the same WD at LC station's residual (a) and low frequency (b). The level of the WD is 5, and the WL is 5, 10, 20 and 30 days respectively.

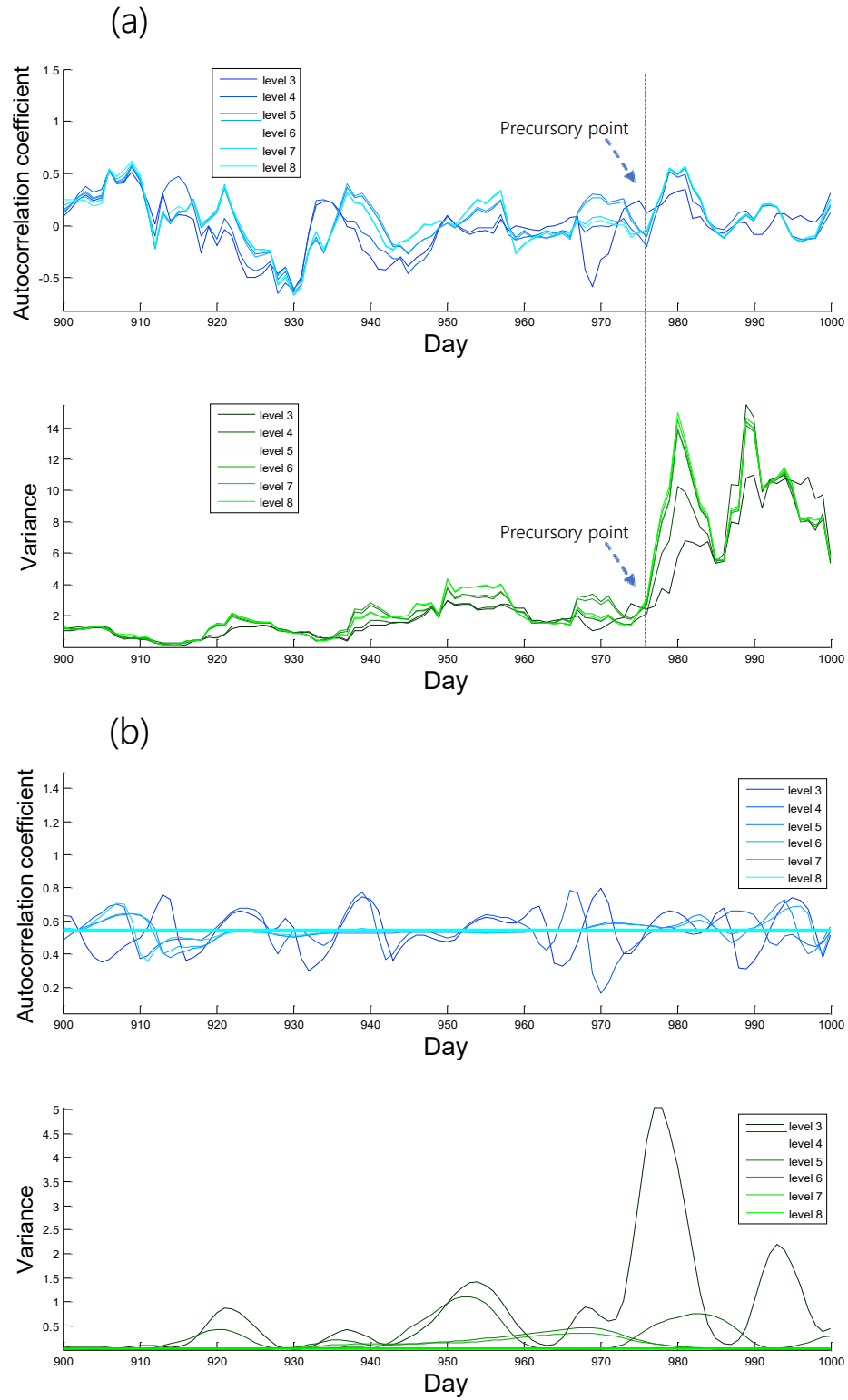


Figure.S2. Comparison of calculation results of different levels of WD with the same WL at LC station's residual (a) and low frequency (b). The level of the WL is 10 days, and the WD is level 3 to 8 respectively.