
# Data quality control of P and S wave picking of local earthquakes

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ABSTRACT

For the accurate determination of local earthquake hypocenters, it is necessary to have reliable and good quality P- and S-wave readings. Data quality control is an important step to correct or filter anomalies that can occur during phase picking. The Chatelain method (Chatelain, 1978) is first applied to facilitate VP/VS ratio calculation. This method is based on calculating the differences between P- and S-waves arrival times between all stations that record the same earthquake. The plot on the same graph of all S-phase differences vs P-phase differences between each pair of stations for all the studied earthquakes over a region in which the VP/VS ratio is supposed to be uniform is used to get the average VP/VS ratio. We then check the points that are outside the scheme, and evidence phase picking anomalies that need to be checked and provide corrections at the concerned station.

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INTRODUCTION

## Zemmouri – Boumerdes Earthquake May 21, 2003

Approximately
2,266 people died,
10,261 injured,
200,000 left homeless as a result of the earthquake.

More than 1,243 buildings were completely or partially destroyed.
Five bilions US dollaras damage resulted.

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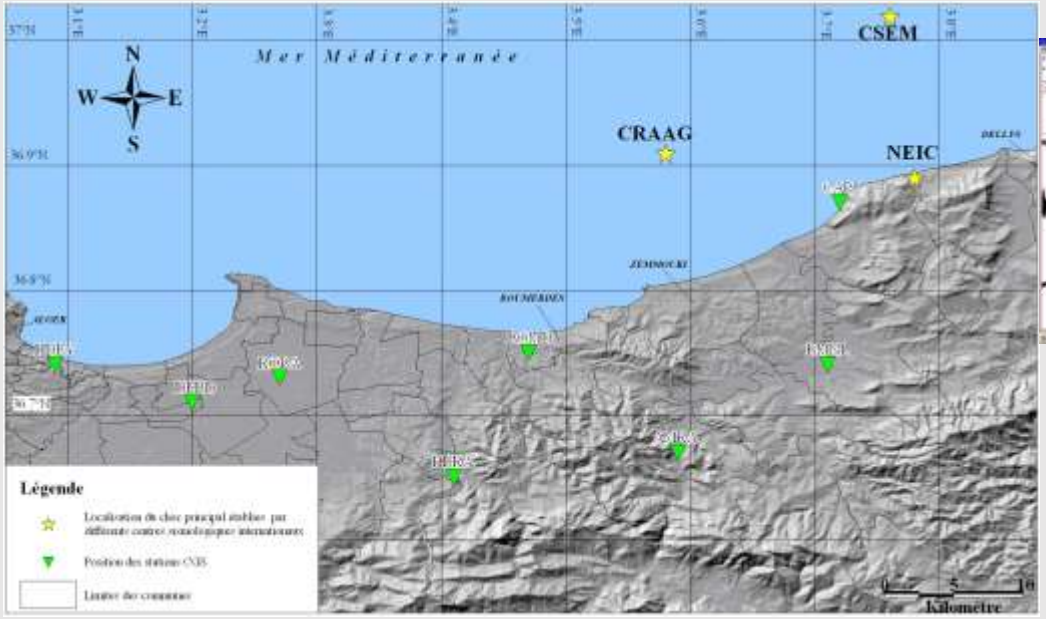
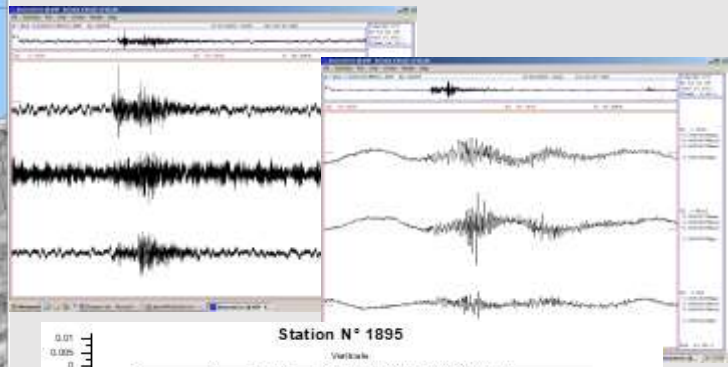
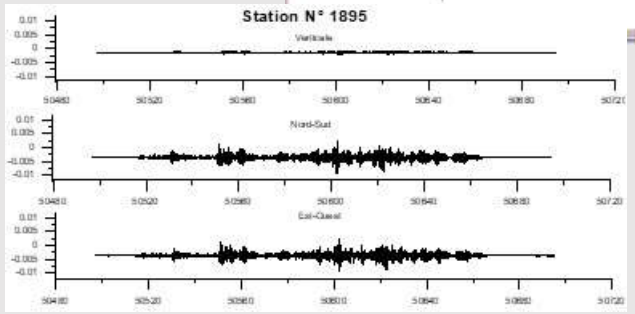
## Aftershocks monitoring after Zemmouri – Boumerdes 2003 earthquake

Array station location




Examples of recorded aftershocks





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METHODS

# Modified Wadati diagram, Chatelain (1978)

The method described by Chatelain (1978) allows the determination of $V_p/V_s$ ratio which is common to the whole set of the events.

For each earthquake, the method requires at least one pair of stations with time readings for both *P* and *S* waves.

If we consider an event that is recorded by two stations (*i,j*) at hypocentral distances $d_i$ and $d_j$, the time difference between phases $t_{Pi} - t_{Pj}$ and $t_{Sj} - t_{Si}$ can be expressed as:

$$t_{Pj} - t_{Pi} = (d_j - d_i)/V_P \text{ and } t_{Sj} - t_{Si} = (d_j - d_i)/V_S .$$

$$\text{Thus, } t_{Sj} - t_{Si} = (t_{Pj} - t_{Pi})V_P/V_S .$$

All the *S*-wave arrival time differences obtained are plotted on a diagram as a function of the *P*-wave arrival time differences. The slope of the best-fitting line yields the $V_P/V_S$ ratio.

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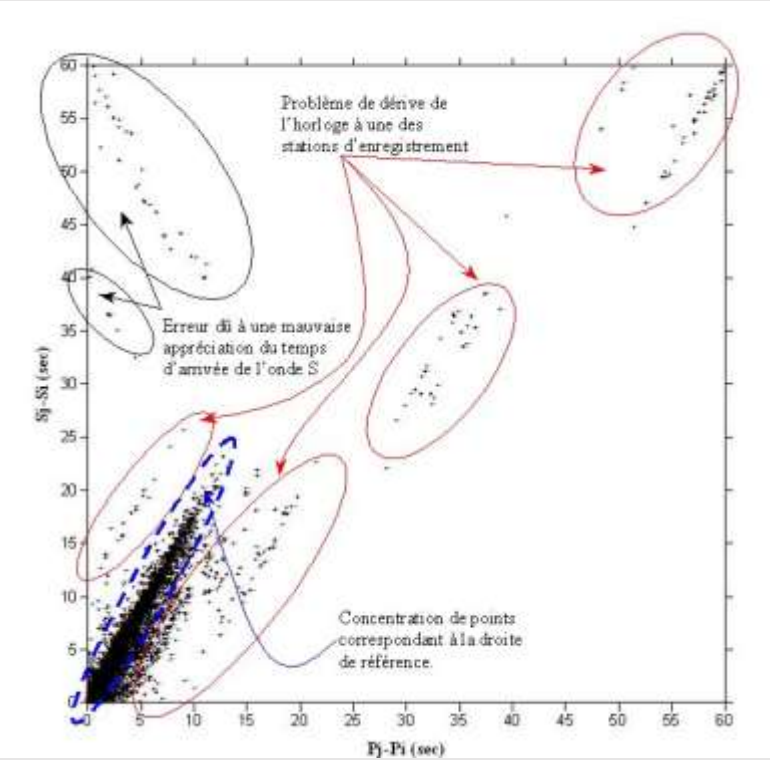
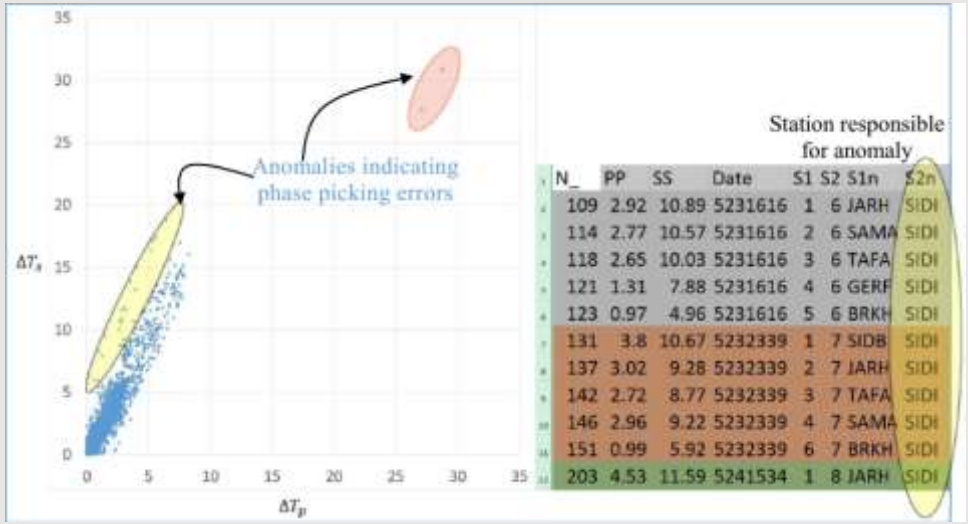
METHODS

# Example of modified Wadati diagram




| N_ | PP | SS | Date | S1 | S2 | S1n | S2n |
|---|---|---|---|---|---|---|---|
| 109 | 2.92 | 10.89 | 5231616 | 1 | 6 | JARH | SIDI |
| 114 | 2.77 | 10.57 | 5231616 | 2 | 6 | SAMA | SIDI |
| 118 | 2.65 | 10.03 | 5231616 | 3 | 6 | TAFA | SIDI |
| 121 | 1.31 | 7.88 | 5231616 | 4 | 6 | GERF | SIDI |
| 123 | 0.97 | 4.96 | 5231616 | 5 | 6 | BRKH | SIDI |
| 131 | 3.8 | 10.67 | 5232339 | 1 | 7 | SIDB | SIDI |
| 137 | 3.02 | 9.28 | 5232339 | 2 | 7 | JARH | SIDI |
| 142 | 2.72 | 8.77 | 5232339 | 3 | 7 | TAFA | SIDI |
| 146 | 2.96 | 9.22 | 5232339 | 4 | 7 | SAMA | SIDI |
| 151 | 0.99 | 5.92 | 5232339 | 6 | 7 | BRKH | SIDI |
| 203 | 4.53 | 11.59 | 5241534 | 1 | 8 | JARH | SIDI |

**BENI ILLMANE earthquake of may 14, 2010 - aftershock**

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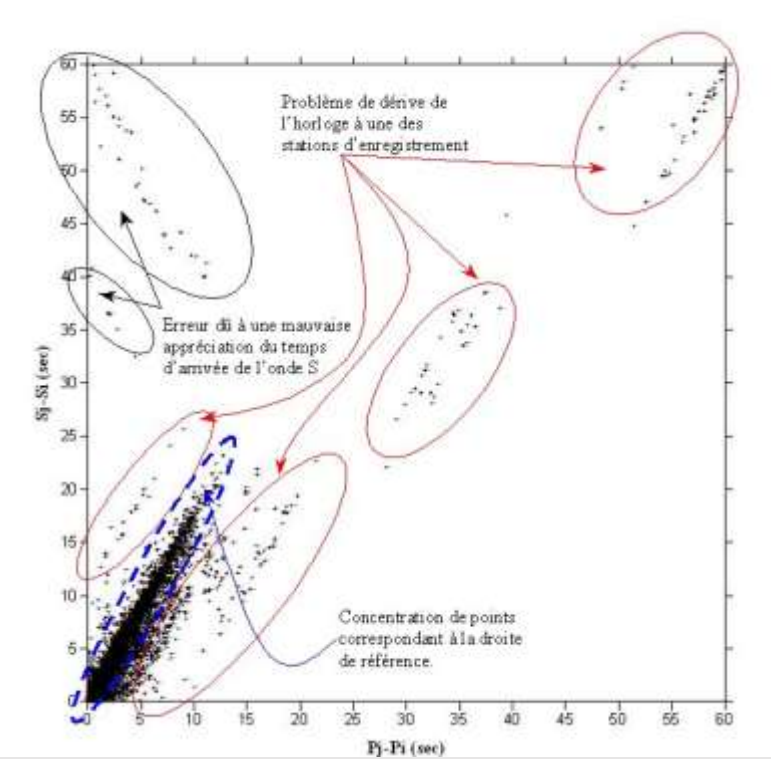
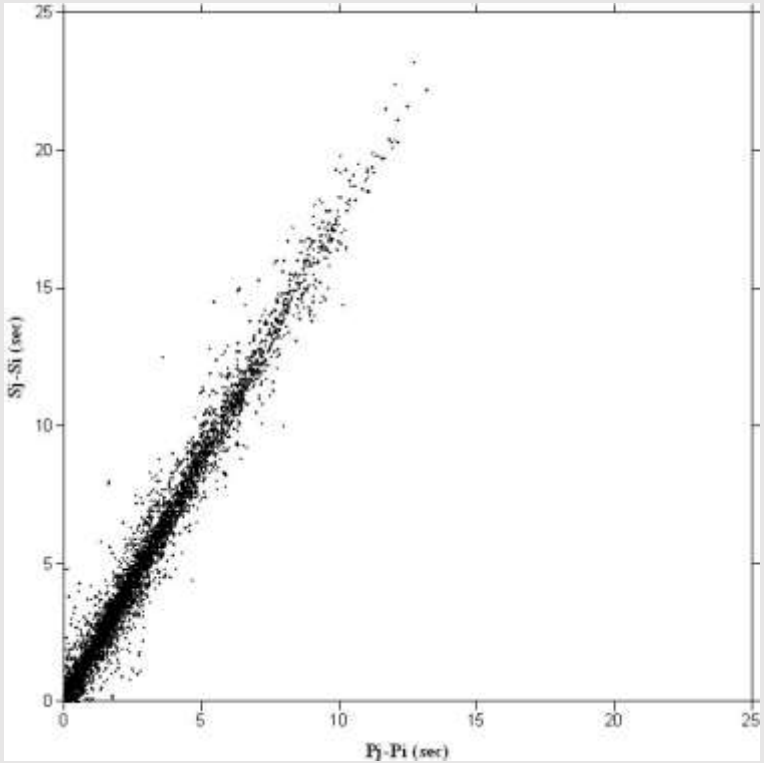
RESULTS

# Example of modified Wadati diagram




Befor correction




After correction

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