

Update Note 21th May 2019

SplitRacer 2.0 contains many new features and fixes to older routines. This is why I have decided to change it's version code to 2.0, as this marks a completely new version. Here I list the changes in the order in which they appear in the code.

I want to take this opportunity to thank a number of people whose codes / ideas have improved SplitRacer. Many thanks to: Sebastien Chevrot, Neala Creasy and Frederik Link.

If you encounter problems, find bugs or want to be part of the SplitRacer email list for updates, please contact me at reiss@geophysik.uni-frankfurt.de

Data download:

- 1) Once a data center and network are chosen, station names appear together with the location code(s) of the station. This is relevant for permanent stations which may have more than one seismometer. Please consult the `available_stations.txt` file in your working directory to find out which seismometer you want to use. For stations without location codes (mostly temporary deployments and permanent stations with only one seismometer) only the station name will appear. The `data_request_` file per station lists the used location code now directly before the name of the `mseed` file.

The format of the `data_request_` file per station is now:

YYYY	MM	DD	HH	MM	SS.SS	lat	lon	dist	baz	depth	m	loc	files
2012	01	01	05	27	55.98	31.46	138.1	90.85	40.1	365.3	6.8	-	/mseed_files/AIGLE_CH/ file1.mseed

If the location code is empty, a '-' will occur, otherwise it will list the used location code, i.e. '00', '10', '30', ...

- 2) For each station, a `channel_info.txt` is written during the download and stored in each station's `mseed` folder. This lists all meta data for the chosen station and location code. A new event list starting magnitude 5.8 from 1980 onwards is placed in the `defaults` folder.

Pre-Processing:

During the initial pre-processing routine, the `channel_info.txt` file is used to correct sensor misalignment if a misalignment value is given by the meta data. If you realize later that this value is incorrect, you can manually adjust the values in the `channel_info.txt` file before the analysis. Please beware of the different time intervals a station is / was active for and that you need to change the azimuth values for both, North and East components. SplitRacer's own misalignment routine which is based on the long-period particle motion is still in place and will find the remaining sensor misalignment.

Splitting Analysis:

- 1) In the splitting GUI, there are now three options for using misalignment corrections:
 - 1) a mean value calculated by the SplitRacer misalignment routine based on the long-

period particle motion of all phases, 2) a per event misalignment value as determined from each phase, 3) a value chosen entirely by the user. This last option might be useful if a station has very few events and the misalignment routine does not provide a realistic correction.

- 2) SplitRacer now includes splitting intensity measurements after Chevrot (2000). The code for measuring the splitting intensity as implemented in SplitRacer was originally written by Neala Creasy. Sebastien Chevrot provided help in implementing the calculation of the fast axis, delay time and errors from splitting intensity measurements. If you use SplitRacer to report splitting intensity measurements, please cite:

Chevrot, S. (2000). Multichannel analysis of shear wave splitting. *Journal of Geophysical Research*, 105, 21579–21590. <https://doi.org/10.1029/2000JB900199>

and

Deng, J., Long, M. D., Creasy, N., Wagner, L. S., Beck, S. L., Tavera, H. (2016). Lowermost mantle anisotropy near the eastern edge of the Pacific Large Low Shear Velocity Province: Constraints from SKS-SKKS splitting intensity discrepancies. *Geophysical. Journal International*, 210, 774-786. <https://doi:10.1093/gji/ggx190>.

Please give credit where it is due!

- 3) There seems to have been a bug in the calculation of the numbers of degrees of freedom as adopted from SplitLab (Wüstefeld et al. 2008). After fixing this bug, errors given by the 95% confidence level are now significantly larger. This does not affect very good measurements; however, ‘fair’ measurements or those where it is not entirely clear whether it’s a split or noise or nearly null have large confidence levels. It is useful to compare the results of the energy minimization method to the splitting intensity measurement – a true null should also have a very small splitting intensity value.
- 4) When displaying single phase splitting results, the phi interval for the energy grid and confidence level changes automatically now from -90/90° to 0/180° if the fast axis is within 30° of the grid boundary.
- 5) The results file per station now includes much more information than before:
Event date, event time, event latitude, event longitude, event depth, event magnitude, station-event distance, backazimuth, misalignment correction, phase, phi, dt, error phi (min. and max.), error dt (min. and max.), confidence level, splitting intensity, error splitting intensity (min. and max.), category
- 6) Once you click on the ‘overview’ button in the splitting GUI, the splitting vector which calculates phi and dt from splitting intensity measurements will appear in a separate window. The results of this analysis are also stored in the *graphics_output* folder for each station’s single splitting analysis.

General remarks:

Please make sure you remove old SplitRacer versions from your Matlab search path.

The Linux and Mac versions now work without ‘wget’ and use the ‘curl’ command instead to download data.

Several other small bugs and misspellings have been fixed.