[PS]FischerLab: An Interactive Program for Generating Dynamic Fischer Plots From Wireline Logs and Stratigraphic Data*

Adewale Amosu[1] and Yuefeng Sun[1]

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[1]Geology and Geophysics, Texas A&M University, College Station, Texas, United States (adewale@tamu.edu)

Abstract

Fischer plots are a technique used to graph changes in accommodation in cyclic carbonate successions. They typically depict the cumulative departure from average cycle thickness as a function of cycle number or stratigraphic depth. Many applications of Fischer plots focus on its construction from exposed cyclic carbonate successions but there are no published programs that allow a direct construction of Fischer plots from digital wireline well logs or that allow a stepwise presentation of Fischer plots. In addition to accepting interpreted stratigraphic data input, FischerLab facilitates the interpretation of digital wireline logs for generating Fischer plots in cycle and depth domains as well as in a dynamic evolving cycle and relative depth domain. The dynamic construction facilitates correlating specific stratigraphic packages to parts of the accommodation cycle while simultaneously tracking the locus of the mean subsidence vector. We demonstrate the usage of FischerLab on data derived from interpreted carbonate successions as well as from wireline log data. We also demonstrate the application of FischerLab to tidal rhythmic deposits, which generally satisfy the assumptions of Fischer plots. Fischer plots applied to tidal rhythmites may be give insight to the lunar orbital periods associated with the tidal rhythmites deposits.

References Cited

Amosu, A., and Y. Sun, 2017, FischerLab: An interactive program for generating Fischer plots and stepwise Fischer plots from wireline logs and stratigraphic data: SoftwareX (Under Review).

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Amosu, A., and M. Wehner, 2015, An angular unconformity between the Woodbine and Eagle Ford formations in Delta, Hunt, and Hopkins counties of the Eastern Texas Basin: GCAGS Transactions, v. 65, p. 781-797.

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FischerLab: An Interactive Program for Generating Dynamic Fischer Plots From Wireline Logs and Stratigraphic Data

Adewale Amosu, Yuefeng Sun; Department of Geology and Geophysics, Texas A&M University

Introduction and Objective

- *Fischer plots are a technique used to graph changes in accommodation in cyclic carbonate successions. They typically depict the cumulative departure from average cycle thickness as a function of cycle number or stratigraphic depth.*
- *FischerLab facilitates the interpretation of digital wireline logs for generating Fischer plots in cycle and depth domains as well as in a stepwise evolving cycle and relative depth domain. The dynamic construction facilitates correlating specific stratigraphic packages to parts of the accommodation cycle while simultaneously tracking the locus of the mean subsidence vector.*
- *We demonstrate the usage of FischerLab on data derived from interpreted carbonate successions as well as from wireline log data. We also demonstrate the application of FischerLab to tidal rhythmic deposits, which generally satisfy the assumptions of Fischer plots. Fischer plots applied to tidal rhythmites may give insight to the lunar orbital periods associated with the tidal rhythmites deposits.*

Fischer Plots Description and Usage

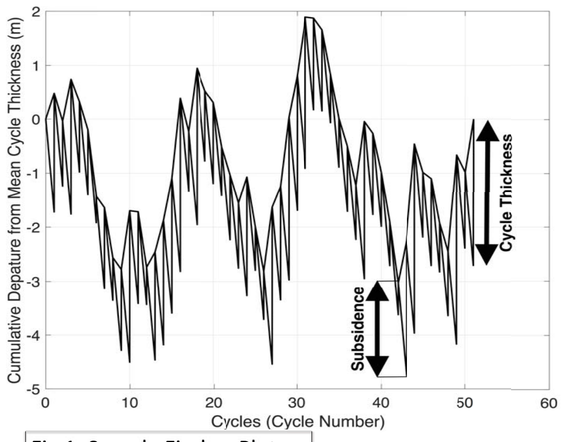


Fig 1: Sample Fischer Plot.

- *Fischer plots are constructed from stacked cyclic stratigraphic sections by representing the thickness of each cycle as a vertical line. The next cycle is shifted to the right and down by a single cycle unit and the average thickness respectively. The shift to the right represents the cycle duration while the shift down represents subsidence (it could also include corrections for compaction or isostasy). The line connecting the top of the cycles forms a wave train that starts at zero and ends at zero*
- *In the depth domain the duration of each Fischer plot cycle corresponds to the exact stratigraphic cycle duration. The cumulative departure from mean thickness (CDMT) is the difference between the actual depth and the depth that the cycle top would have occurred if all cycles were of the same thickness (Day (1997).*

$$CDMT_i = (D_0 - \frac{i}{N}T) - D_i \quad i = 1..N$$

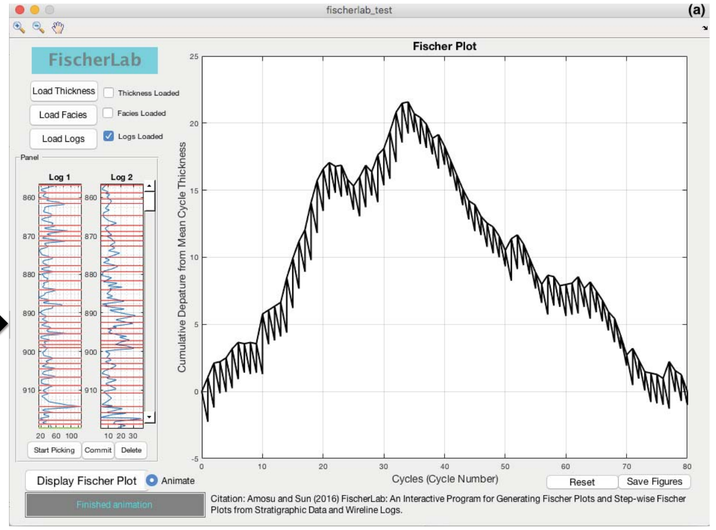
- *i is the cycle number ranging from 1 to N, D_i is the depth at the top of the ith cycle, D_0 is the depth at the base of the first cycle and T is the total thickness.*

Code Usage and Description

- *FischerLab is written in MATLAB and can be deployed as a MATLAB graphical user interface (GUI) application.*
- *The program permits inputting data in different formats. Three buttons are used to load data: the "Load Thickness", "Load Facies" and "Load Logs" buttons in CSV, XSLX, ASCII and LAS formats.*
- *The data is arranged with the youngest stratigraphic layer's thickness as the first data entry in the file and the oldest layer's thickness as the last entry of the file. The "Load logs" button is reserved for loading wireline well logs in Log ASCII Standard (LAS), CSV or XSLX formats. The LAS format is the standard well log information file format in the oil and gas and water well industries.*
- *When data is loaded as cycle thicknesses the program prompts the user for the absolute depth value at the top of the section (if known); the absolute depth values of other layers are then calculated from the thickness values. When data is loaded as logs the absolute depth value is usually included in the input file on the first column. The program then allows the user to specify the column locations of two logs that the user may wish to use for interpretation.*
- *The two logs most commonly used are the gamma ray and resistivity logs. The data can be inputted in any unit; the user may modify the axes of the output plots later (some of which are in modifiable MATLAB FIG format) to specify the unit used.*

Applications

Fig. 2 *FischerLab sample run using Wireline log input. The inset Fischer plot in (a) is derived from gamma ray and resistivity wireline logs from ODP Leg 166 in the Bahamas. The flooding surfaces are interactively interpreted and picked using FischerLab. See demonstration video for process.*



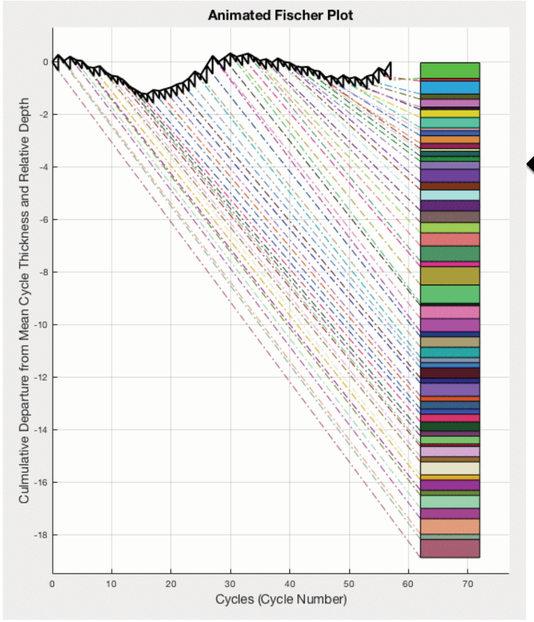
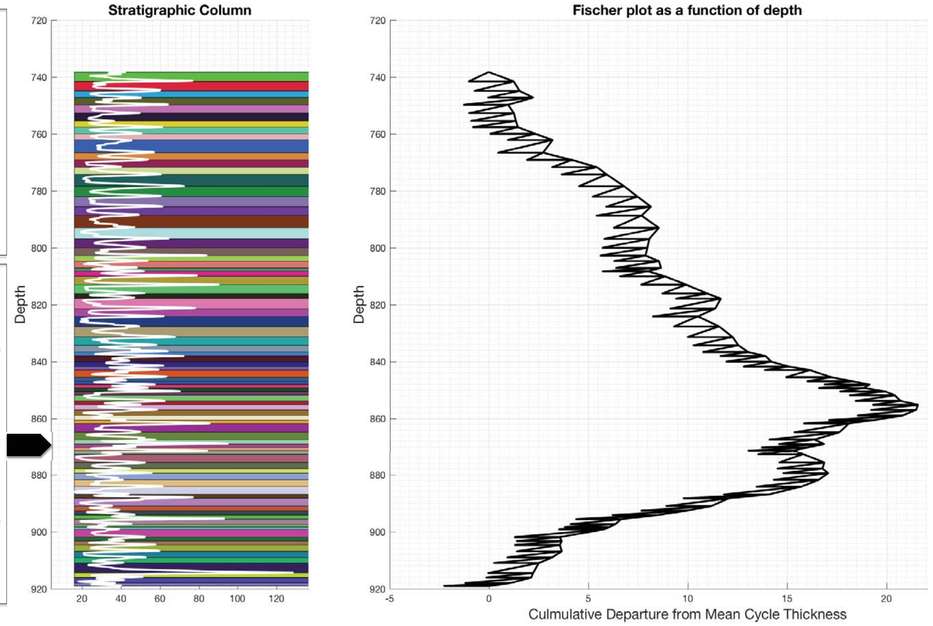


Fig. 3: Final image of the dynamic Fischer plot derived from Tidal rhythmites in Chaibasa, India, as interpreted by Mazumder and Arima (2003). *Tidal rhythmites preserve a record of astronomically induced tidal periods and are geologically instantaneous.*

Fig. 4. Fischer plot in the depth domain derived from gamma ray and resistivity wireline log data from ODP Leg 166, Site 1003D located in the Bahamas. 4a: Shows the interpreted stratigraphic column, the white line is the gamma ray wireline log (gAPI) for the given depth range. 4b: the Fischer plot. Each cycle thickness is equal to the actual thickness of the corresponding stratigraphic layer in 4a.



Conclusion

- *The developed program gives geologists and geophysicists the flexibility to construct Fischer plots directly from wireline logs as well as from interpreted stratigraphic data.*
- *We introduce the concept of dynamic Fischer plots and demonstrate that Fischer plot can be used to reconstruct the periods of lunar orbital cycles associated with tidal rhythmites deposits.*
- *Controversies have surrounded the use of Fischer plots regarding the subjective nature of cycle picks, however, the algorithm and methods of constructing Fischer plot themselves are objective and reproducible, require no information about age and subsidence and can be used to identify stacking patterns in any facies succession.*

DOWNLOAD LINK: https://goo.gl/LT91AG QR CODE: **USAGE QUESTIONS: adewale@tamu.edu**

References:

1) **Amosu, A., & Sun, Y. (2017), FischerLab: An interactive program for generating Fischer plots and stepwise Fischer plots from wireline logs and stratigraphic data, *SoftwareX* (Under Review).**

2) Amosu, A., & Sun, Y. (2017), WheelerLab: An interactive program for sequence stratigraphic analysis of seismic sections, outcrops and well sections and the generation of chronostratigraphic sections and dynamic chronostratigraphic sections, *SoftwareX*, *6*, 19-24.

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