

Información resumida solicitada por la RESeT

Research Group: Cyclostratigraphy and Earth Sciences Time Series Analysis (CESTAS)

Involved Institutions: Universidad de Granada, IGME, Centro Andaluz de Ciencias de la Tierra (CSIC-UGR)

Contact Person: Eulogio Pardo-Igúzquiza, e.pardo@igme.es

Director of Research: Francisco Javier Rodríguez-Tovar, fjrtovar@ugr.es

Number of Researchers: 15

Qualitative description of the research in relation with RESeT: The main task of the reserach group is the development of theorethical and computational improvements in the spectral analysis of time series in Earth Sciences. In particular, we are interested in the problem of uneven time series, compositional time series, soft computing methodologies (permutation algorithm, bootsrap, geostatistics, artificial neural networks, genetic algorithms, and simulated annealing) and real applications (stratigraphical, mineralogical, paleontological and geochemical data).

Collaboration with other groups in relation with RESeT: We could collaborate with groups that develop innovative methodologies in spectral analysis in time series and with groups that have the problema of analysing real data.

Bussinesses that can have a benefit collaborating with us in relation with RESeT: In general any bussissness of enviromental sciences or engineering that needs to analyse the spectral content of the data that they collect in their monitoring.

Most Relevant References

Methodological Development

Pardo-Igúzquiza, E., and Rodríguez-Tovar, F.J., 2000. The permutation test as a non-parametric method for testing the statistical significance of power spectrum stimation in cyclostratigraphic research. *Earth and Planetary Science Letters* 181, 175-189.

Rodríguez-Tovar, F.J. and Pardo-Igúzquiza, E., 2003. Strong evidence of high-frequency (sub-Milankovitch) orbital forcing by amplitude modulation of Milankovitch signals. *Earth and Planetary Science Letters* 210, 179-189.

Pardo-Igúzquiza, E., and Rodríguez-Tovar, F.J., 2006. Maximum entropy spectral analysis of climatic time series revisited: Assessing the statistical significance of estimated spectral peaks. *Journal of Geophysical Research* 111, D10102, doi: 10.1029/2005JD006293.

Pardo-Igúzquiza, E., and Rodríguez-Tovar, F.J., 2011. Implemented Lomb-Scargle periodogram: a valuable tool for improving cyclostratigraphic research on unevenly sampled deep-sea stratigraphic sequences. *Geo-Marine Letters*, 31, 537-545.

Public Domain Software Development

Pardo-Igúzquiza, E., Chica-Olmo, M. and Rodríguez-Tovar, F.J. 1994. CYSTRATI: a computer program for spectral analysis of stratigraphic successions. *Computers & Geosciences* 20, 511-584.

Pardo-Igúzquiza, E., Schwarzacher, W. and Rodríguez-Tovar, F., 2000. A library of computer program for assisting teaching and research in cyclostratigraphic analysis. *Computers & Geosciences* 26, 723-740.

Pardo-Igúzquiza, E., and Rodríguez-Tovar, F.J., 2004. POWGRAF2: a program for graphical spectral analysis in cyclostratigraphy. *Computers & Geosciences* 30, 533-542.

Pardo-Igúzquiza, E., and Rodríguez-Tovar, F.J., 2005. MAXENPER: a program for maximum entropy spectral estimation with assessment of statistical significance by the permutation test. *Computers & Geosciences* 31, 555-567.

Pardo-Igúzquiza, E., and Rodríguez-Tovar, F.J., 2011. Spectral and cross-spectral analysis of uneven time series with the smoothen Lomb-Scargle periodogram and Monte Carlo evaluation of statistical significance. *Computers & Geosciences* 49, 207-216.

Applications in Earth Sciences

Olóriz, F., Rodríguez-Tovar, F.J., Chica-Olmo, M. and Pardo-Igúzquiza, E. 1992. The marl-limestone rhythmites from the lower Kimmeridgian (Platynota Zone) of the central Prebetic and their relationship with variations in orbital parameters. *Earth and Planetary Sciences Letters* 11, 407-424.

Bádenas, B., Aurell, M., Rodríguez-Tovar, F.J. and Pardo-Igúzquiza, E., 2003. Sequence stratigraphy and bedding rhythms of fan outer ramp limestone succession (Late Kimmeridgian, Northeast Spain). *Sedimentary Geology* 161, 153-174.

Jiménez-Moreno, G., Rodríguez-Tovar, F.J., Pardo-Igúzquiza, E., Fauquette, S., Suc, J.-P. and Müller, P., 2005. High-resolution palynological analysis in late early-middle Miocene core from the Pannonian Basin, Hungary: climatic changes, astronomical forcing and eustatic fluctuations in the Central Paratethys. *Palaeogeography, Palaeoclimatology, Palaeoecology* 212, 181-197.

Jiménez-Moreno, G., Aziz, H.A., Rodríguez-Tovar, F.J., Pardo-Igúzquiza, E., and Suc, J.P., 2007. Palynological evidence for astronomical forcing in Early Miocene lacustrine deposits from Rubielos de Mora Basin (NE Spain). *Palaeogeography, Palaeoclimatology, Palaeoecology* 252: 601-616.

Rodríguez-Tovar, F.J., Reolid, M., and Pardo-Igúzquiza, E., 2010. Planktonic versus benthic foraminifera response to Milankovitch forcing (Late Jurassic, Betic Cordillera): Testing methods for cyclostratigraphic analysis. *Facies* 56: 459-470.

Rodríguez-Tovar, F.J., Löwemark, L. and Pardo-Igúzquiza, E., 2011. Zoophycos cyclicity during the last 425 ka in the northeastern South China Sea: evidence for monsoon fluctuation at the Milankovitch scale. *Palaeogeography, Palaeoclimatology, Palaeoecology* 256: 256-263.

- Pardo-Igúzquiza**, E., Lebreiro, S.M., and Rodríguez-Tovar, F.J. (Guest Editors), 2013. Cyclicity in the Geological Record. *Boletín Geológico y Minero*, Madrid, 124, 135-343.
- Rodríguez-Tovar**, F.J., Sánchez-Almazo, I., **Pardo-Igúzquiza**, E., Braga, J.C., and Martín, J.M., 2013. Incidence of obliquity and precession-forced Milankovitch cycles in the western Mediterranean: Early Messinian sedimentation in the Sorbas Basin (Almería, southern Spain). *International Journal of Earth Sciences*, 102, 1735-1755.
- Rodrigo-Gámiz, M., Martínez-Ruiz, F., **Rodríguez-Tovar**, F.J., Jiménez-Espejo, F. and **Pardo-Igúzquiza**, E. 2014. Millennial- to centennial-scale climate periodicities and forcing mechanisms in the westernmost Mediterranean for the past 20,000 years. *Quaternary Research* 81, 78-93.
- Jiménez-Espejo, F.J., García-Alix, A., Jiménez-Moreno, G., Rodrigo-Gámiz, M., Anderson, R.S., **Rodríguez-Tovar**, F.J., Martínez-Ruiz, F., Giralt, S., Delgado Huertas, A., and **Pardo-Igúzquiza**, E., 2014. Saharan Aeolian input and effective humidity variations over western Europe during the Holocene from a high altitude record. *Chemical Geology* 374-375, 1-12.