



EUROPEAN EXTREMELY LARGE TELESCOPE SITE SELECTION A COMPARISON BETWEEN REAL SELECTION AND MULTICRITERIA-DECISION-ANALYSIS SUGGESTIONS

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1. ABSTRACT

The European Southern Observatory carried out a site selection, for the construction of the European Extremely Large Telescope (EELT) in the southern hemisphere. Since an observatory like this involves a multi millionaire budget, the best location must be thoroughly determined by taking into account key aspects such as meteorology, atmosphere conditions, logistics and legal issues for each candidate place. The selection was in favor of Cerro Armazones - in the Antofagasta region in Chile - which not only surpass technical characterization needs, but it's country has built enormous experience in instrumentation facility construction and operation. On top of this, Armazones is near another important astronomical centre such as Cerro Paranal. In this work we compare the final decision using several multi-criteria algorithms implemented in Python (TOPSIS, Weighted-Product, Weighted-Sum and ELECTRE 1), with the final decision taken by the ESO organization, among the different locations candidates (Cerro Macón, Argentina; Aklm, Morocco; Observatorio Roque de los Muchachos, Canary, Spain; and Ventarrones, Chile) and the selected site (Armazones). The data was completely obtained in bibliographic references, and the parameters included are all of relevance not only for this site election, but for any astronomical facility. From 5 of the candidate sites, there have been favored as the best three those belonging to the Atacama desert: Ventarrones as third, following Armazones in second place, and Macon at the top. Nevertheless, ELECTRE 1 method places Macon in its kernel choices as non-defeated; being this the same as to say that there isn't a better place for EELT than Macon (within this available choices). It is observed so, that methods identify quality of sites inside Atacama desert, but it also chooses Macon ridge over Armazones. The necessity for criteria generation, representing legal aspects, logistic challenges, and experience in the organization to bring a correct site qualification.

The Full dataset and experiment are located at:

https://github.com/toros-astro/epio2017_EELT_MCDM

Keywords: MCDM – Astronomy – Site Selection

2. REFERENCES

CABRAL, J. B., LUCZYWO, N. A., Y ZANAZZI, J. L. (2016): "Scikit-Criteria:



colección de métodos de análisis multi-criterio integrado al stack científico de Python". In XIV Simposio Argentino de Investigación Operativa (SIO 2016)-JAIIO 45 (Tres de Febrero, 2016), pp. 59-66

HUANG, J. J., Y YOON, K. (2011): *Multiple attribute decision making: methods and applications*. Chapman and Hall/CRC. USA.

ROY, B. (1991): "The outranking approach and the foundations of ELECTRE methods". Theory and decision, vol. 31(1), pp. 49-73.

VERNIN, J., MUÑOZ-TUÑÓN, C., SARAZIN, M., RAMIÓ, H. V., VARELA, A. M., TRINQUET, H., DELGADO, J. M., FUENSALIDA, J.J., REYES, M., BENHIDA, A., BENKHALDOUN, Z., GARCÍA LAMBAS D., HACH, Y., LAZREK, M., LOMBARDI, G., NAVARRETE, J., RECABARREN, P., RENZI, V., SABIL, M., Y VRECH, R. (2011): "European extremely large telescope site characterization i: Overview". Publications of the Astronomical Society of the Pacific, vol. 123(909), pp. 1334.

Ramió, H. V., Vernin, J., Muñoz-Tuñón, C., Sarazin, M., Varela, A. M., Trinquet, H., ... & Benkhaldoun, Z. (2012). European Extremely Large Telescope Site Characterization. II. High Angular Resolution Parameters. Publications of the Astronomical Society of the Pacific, 124(918), pp. 868.

Varela, A. M., Ramió, H. V., Vernin, J., Muñoz-Tuñón, C., Sarazin, M., Trinquet, H., ... & Benkhaldoun, Z. (2014). European Extremely Large Telescope Site Characterization III: Ground Meteorology. Publications of the Astronomical Society of the Pacific, 126(938), pp. 412.

