

BAB VII

KESIMPULAN DAN SARAN

VII.1. Kesimpulan

1. Erupsi dengan nilai $VEI \geq 0$, $VEI \geq 2$, $VEI = 2$, dan erupsi di Jawa bagian timur dan Jawa bagian tengah tidak memiliki tren naik atau turun dan juga tidak memiliki variasi musiman. Tidak dilakukan analisis deret waktu untuk erupsi di Jawa bagian barat karena data yang tidak ideal. Urutan wilayah yang memiliki jumlah erupsi terbanyak hingga terkecil adalah Jawa bagian timur, Jawa bagian tengah, dan Jawa bagian barat.
2. Akan terjadi 6 erupsi dengan $VEI \geq 2$ dan terjadi 4 erupsi dengan $VEI = 4$ dalam kurun waktu 5 tahun yang akan datang (2023-2027).
3. Dalam kurun waktu 5 tahun setelah terjadi erupsi, probabilitas terjadi erupsi selanjutnya adalah 0,756-0,849 untuk Gunung Raung, 0,741-0,783 untuk Gunung Bromo, 0,782-0,934 untuk Gunung Semeru, 0,708-0,741 untuk Gunung Merapi, dan 0,649-0,725 untuk Gunung Slamet.

VII.2. Saran

1. Analisis deret waktu dapat dilakukan dengan menggunakan satuan waktu yang lain, seperti dalam satuan waktu bulanan untuk menghasilkan nilai yang detail atau satuan waktu yang lebih lama dari 1 tahun untuk menghasilkan nilai yang lebih umum.
2. Analisis ketahanan dapat dilakukan dalam satuan waktu yang lebih khusus, satuan bulanan atau satuan harian, untuk mendapatkan nilai yang lebih detail.
3. Data yang digunakan dapat dikombinasikan dengan sumber selain dari Global Volcanism Program.

DAFTAR PUSTAKA

- Acquah, H. de-G., 2010, Comparison of Akaike information criterion (AIC) and Bayesian information criterion (BIC) in selection of an asymmetric price relationship: *Journal of Development and Agricultural Economics*, v. 2, p. 001–006.
- Arbad, A.P., Takeuchi, W., Aoki, Y., and Ardy, A., 2019, Vulnerability Assessment At Mt. Bromo Indonesia By Using Time-Series Land Surface Deformation and Gis: *Applied Research on Civil Engineering and Environment (ARCEE)*, v. 1, p. 24–30, doi:10.32722/arcee.v1i01.1954.
- Box, G.E.P., Jenkins, G.M., Reinsel, G.C., and Ljung, G.M., 2016, *Time Series Analysis: Forecasting and Control*: Hoboken, John Wiley & Sons, Inc., 669 p.
- BPPTKG JEJAK INSTITUSI PEMANTAUAN GUNUNGAPI INDONESIA:, <https://bpptkg.esdm.go.id/pub/page.php?idf=4> (accessed August 2022).
- Caricchi, L., Annen, C., Blundy, J., Simpson, G., and Pinel, V., 2014, Frequency and magnitude of volcanic eruptions controlled by magma injection and buoyancy: *Nature Geoscience*, v. 7, p. 126–130, doi:10.1038/ngeo2041.
- Cerqueira, V., Torgo, L., and Mozetič, I., 2020, Evaluating time series forecasting models: an empirical study on performance estimation methods: *Springer US*, v. 109, 1997–2028 p., doi:10.1007/s10994-020-05910-7.
- Clements, B., Hall, R., Smyth, H.R., and Cottam, M.A., 2009, Thrusting of a volcanic arc: A new structural model for Java: *Petroleum Geoscience*, v. 15, p. 159–174, doi:10.1144/1354-079309-831.
- Cowpertwait, P.S.P., and Metcalfe, A. V., 2009, *Introductory Time Series with R*: New York, NY, Springer New York, 254 p., doi:10.1007/978-0-387-88698-5.
- Cryer, J.D., and Chan, K.-S., 2008, *Time Series Analysis: With Applications in R*: New York, NY, Springer New York, Springer Texts in Statistics, 487 p., doi:10.1007/978-0-387-75959-3.
- Dzierma, Y., and Wehrmann, H., 2012, On the likelihood of future eruptions in the Chilean Southern Volcanic Zone: interpreting the past century's eruption record based on statistical analyses: *Andean Geology*, v. 39, p. 380–393, doi:10.5027/andgeoV39n3-a02.
- Gayatri, D., 2005, Mengenal Analisis Ketahanan (Survival Analysis): *Jurnal Keperawatan Indonesia*, v. 9, p. 36–40, doi:10.7454/jki.v9i1.158.
- Gertisser, R., Charbonnier, S.J., Keller, J., and Quidelleur, X., 2012, The geological evolution of Merapi volcano, Central Java, Indonesia: *Bulletin of Volcanology*, v. 74, p. 1213–1233, doi:10.1007/s00445-012-0591-3.
- Global Volcanism Program, 2022a, Report on Raung (Indonesia) (Bennis, K.L., and Venzke, E., eds.), <https://volcano.si.edu/showreport.cfm?doi=10.5479/si.GVP.BGVN202210-263340> (accessed January 2023).
- Global Volcanism Program, 2022b, Volcanoes of the World, v. 4.11.2 (30 Sep2022): Smithsonian Institute, <https://doi.org/10.5479/si.GVP.VOTW4-2013> (accessed June 2022).
- Groen, T.A., L'Ambert, G., Bellini, R., Chaskopoulou, A., Petric, D., Zgomba,

- M., Marrama, L., and Bicout, D.J., 2017, Ecology of West Nile virus across four European countries: Empirical modelling of the *Culex pipiens* abundance dynamics as a function of weather: *Parasites and Vectors*, v. 10, p. 1–12, doi:10.1186/s13071-017-2484-y.
- Hall, R., 2011, Australia–SE Asia collision: plate tectonics and crustal flow: Geological Society, London, Special Publications, v. 355, p. 75–109, doi:10.1144/SP355.5.
- Hall, R., 2012, Late Jurassic–Cenozoic reconstructions of the Indonesian region and the Indian Ocean: *Tectonophysics*, v. 570–571, p. 1–41, doi:10.1016/j.tecto.2012.04.021.
- Hall, R., and Sevastjanova, I., 2012, Australian crust in Indonesia: *Australian Journal of Earth Sciences*, v. 59, p. 827–844, doi:10.1080/08120099.2012.692335.
- Hariyono, E., and S, L., 2018, The Characteristics of Volcanic Eruption in Indonesia, in *Volcanoes - Geological and Geophysical Setting, Theoretical Aspects and Numerical Modeling, Applications to Industry and Their Impact on the Human Health*, InTech, p. 73–92, doi:10.5772/intechopen.71449.
- Hyndman, R.J., and Athanasopoulos, G., 2018, *Forecasting: Principles and Practice*: Melbourne, OTexts, 504 p., OTexts.com/fpp2.
- Kishore, J., Goel, M., and Khanna, P., 2010, Understanding survival analysis: Kaplan-Meier estimate: *International Journal of Ayurveda Research*, v. 1, p. 274–278, doi:10.4103/0974-7788.76794.
- Kleinbaum, D.G., and Klein, M., 2012, *Survival Analysis*: New York, NY, Springer New York, Statistics for Biology and Health, 700 p., doi:10.1007/978-1-4419-6646-9.
- Lee, E.T., and Wang, J.W., 2003, *Statistical Methods for Survival Data Analysis*: Hoboken, John Wiley & Sons, Inc., 513 p.
- Nag, A., 2021, *Survival Analysis with Python*: Boca Raton, Auerbach Publications, 83 p., doi:10.1201/9781003255499.
- Newhall, C.G., and Self, S., 1982, The volcanic explosivity index (VEI): an estimate of explosive magnitude for historical volcanism.: *Journal of Geophysical Research*, v. 87, p. 1231–1238, doi:10.1029/jc087ic02p01231.
- Pacey, A., Macpherson, C.G., and McCaffrey, K.J.W., 2013, Linear volcanic segments in the central Sunda Arc, Indonesia, identified using Hough Transform analysis: Implications for arc lithosphere control upon volcano distribution: *Earth and Planetary Science Letters*, v. 369–370, p. 24–33, doi:10.1016/j.epsl.2013.02.040.
- PVMBG Data Dasar Gunungapi Indonesia: Badan Geologi Kementerian Energi dan Sumber Daya Mineral, <https://vsi.esdm.go.id/index.php/gunungapi/data-dasar-gunungapi> (accessed June 2022).
- PVMBG, 2021, Tipe Gunung Api di Indonesia (A, B, dan C): Badan Geologi KESDM, <https://magma.esdm.go.id/v1/edukasi/tipe-gunung-api-di-indonesia-a-b-dan-c> (accessed February 2022).
- Shmueli, G., and Lichtendahl Jr., K.C., 2011, *Practical Time Series Forecasting with R: A Hands-On Guide*: Green Cove Springs, Axelrod Schnell Publishers, 202 p.

- Siebert, L., Simkin, T., and Kimberly, P., 2010, *Volcanoes of The World*: Berkeley, University of California Press, 551 p.
- Sigurdsson, H., Houghton, B., McNutt, S., Rymer, H., and Stix, J., 2015, *The Encyclopedia of Volcanoes*: New York, Academic Press, <https://www.ptonline.com/articles/how-to-get-better-mfi-results>.
- Stel, V.S., Dekker, F.W., Tripepi, G., Zoccali, C., and Jager, K.J., 2011, Survival Analysis I: The Kaplan-Meier Method: *Nephron Clinical Practice*, v. 119, p. c83–c88, doi:10.1159/000324758.
- Sudradjat, A., Syafri, I., and Paripurno, E.T., 2011, The Characteristics of Lahar in Merapi Volcano, Central Java as the Indicator of the Explosivity during Holocene: *Indonesian Journal on Geoscience*, v. 6, p. 69–74.
- Surono et al., 2012, The 2010 explosive eruption of Java's Merapi volcano—A '100-year' event: *Journal of Volcanology and Geothermal Research*, v. 241–242, p. 121–135, doi:10.1016/j.jvolgeores.2012.06.018.
- Takeuchi, S., 2015, A melt viscosity scale for preeruptive magmas: *Bulletin of Volcanology*, v. 77, doi:10.1007/s00445-015-0929-8.
- Varley, N., Johnson, J., Ruiz, M., Reyes, G., and Martin, K., 2018, Applying statistical analysis to understanding the dynamics of volcanic explosions: *Statistics in Volcanology*, p. 57–76, doi:10.1144/iavcei001.6.
- Verma, Y., 2021, Complete Guide To Dickey-Fuller Test In Time-Series Analysis: Developers Corner, <https://analyticsindiamag.com/complete-guide-to-dickey-fuller-test-in-time-series-analysis/> (accessed May 2022).
- Watson, J., 2011, *Volcanoes: Principal Types of Volcanoes*: USGS, <https://pubs.usgs.gov/gip/volc/types.html> (accessed May 2022).
- Wei, W.W.S., 2006, *Time Series Analysis: Univariate and Multivariate Methods*: Boston, Pearson, 614 p.