THE 4TH UPI INTERNATIONAL GEOGRAPHY SEMINAR 2020

GEOGRAPHY'S CONTRIBUTION TO THE SUSTAINABLE DEVELOPMENT GOALS: GLOBAL CHALLENGES AND OPPORTUNITIES

BOOK OF PROGRAM

IGEOS 2020

IOP Conference Series
Earth and Environmental Science

Scopus

WELCOMING REMARKS

It is a great honor for me to welcome all of you to the 4th International Geography Seminar (IGEOS) 2020. On behalf of the steering committees, I would like to express my sincere gratitude for your presence at this seminar. The theme of this seminar "**GEOGRAPHY'S CONTRIBUTION TO THE SUSTAINABLE DEVELOPMENT GOALS: GLOBAL CHALLENGES AND OPPORTUNITIES"**.

Geography plays a crucial role in understanding our world. It makes a vital contribution to our knowledge of the rapidly changing environmental and social challenges facing us and how we should tackle them.

Geography is a field of science dedicated to the study of the lands, the features, the inhabitants, and the phenomena of the Earth. Learning geography will create citizens who are able to understand and do something about some of the major issues and problems including climate change, energy dependence, war and regional conflicts, globalization and international terrorism. Geography provokes and answers questions about the natural and human worlds, using different scales of enquiry to view them from different perspectives. It develops knowledge of places and environments throughout the world, an understanding of maps, and a range of investigative and problem-solving skills both inside and outside the classroom. As such, it prepares pupils for adult life and employment.

Geography is a focus within the curriculum for understanding and resolving issues about the environment and sustainable development. It is also an important link between the natural and social sciences. As pupils study geography, they encounter different societies and cultures. This helps them realize how nations rely on each other. It can inspire them to think about their own place in the world, their values, and their rights and responsibilities to other people and the environment. It includes historical and political geography, cultural geography, economic and physical geography, regional science, cartographic methods, remote sensing, spatial analysis, and applications to areas such as land-use planning, development studies, and analyses of specific countries, regions, and resources.

The Sustainable Development Goals were adopted by the United Nations in 2015 as a call-to-action for people worldwide to address five critical areas of importance by 2030: people, planet, prosperity, peace, and partnership.

The 4th IGEOS 2020 provides the scope for opportunities to learn progressed by international scientists and academicians. International Geography Seminar offers excessive quality content to suit the diverse professional development of science and technologies. It is a perfect platform to discuss the current discoveries and developments in the field of Geography.

In closing, I encourage delegates to participate actively in the interesting discussions over the day. I wish everyone a successful and fruitful conference and keep in healthy during this pandemic covid19.

Thank you and warm regards,

Dr.rer.nat. Nandi, S.Pd., M.T., M.Sc.

Chairman IGEOS

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PROGRAM SCHEDULE
4th INTERNATIONAL GEOGRAPHY SEMINAR (IGEOS)
UNIVERSITAS PENDIDIKAN INDONESIA, SEPTEMBER 30, 2020

NO	TIME	ACTIVITY	VENUE
1	07.00 – 08.00 WIB (Western Time of Indonesia)	Registration **(Tia Kartika Septiyanti and Jalu Rafli)**	Main Meeting room
2	08.00 – 08.40	Opening Ceremony: 1. **Dr.rer.nat Nandi, S.Pd., M.T., M.Sc.** (Chairman IGEOS) 2. **Dr. Agus Mulyana, M.Hum**. (Dean Faculty of Social Sciences Eduation) 3. **Prof. Dr. M. Solehuddin, M.Pd., MA**. (Rector of Universitas Pendidikan Indonesia)	Main Meeting room & Numan Sumantri Building room 103
3	08.40 – 09.00	Break	
4	09.00 – 10.30	Plenary Session 1 Keynote Speaker: 1. **Prof. Dr. Mohammad Ali** Universitas Pendidikan Indonesia, Bandung - Indonesia 2. **Prof. Dr. M. Baiquni** Universitas Gadjah Mada, Yogyakarta – Indonesia 3. **Prof. Jon C. Lovett** University of Leeds, Leeds - UK Chair Session: **Annisa Joviani Astari, M.IL, M.Sc. Ph.D**	Main Meeting room
5	10.30 – 11.00	Question and answer	Main Meeting room
6	11.00 – 12.15	Plenary Session 2 Speaker: Prof. Dr. Darsiharjo (UPI) Prof. Dr. Eva Banowati (UNNES) Prof. Madya Dr. Mohd Hairy Ibrahim (UPSI Assoc. Prof. Dr. Mamat Ruhimat (UPI) Prof. Madya Dr. Nor Kalsum Mohd Isa (UPSI) Dr. Salfarina Samsudin (UTM) Chair Session: **Dr. Eng. Beta Paramita**	Main Meeting room
7	12.15 – 12.25	IGEOS announcements	Main Meeting room
8	12.25 – 13.00	break	
9	13.00 – 15.00	Parallel session 1	Break out room
10	15.00 – 15.30	break	
11	15.30 – 17.00	Parallel session 2	Break out room
12	17.00 – 17.30	Closing ceremony and IGEOS announcements	Main Meeting room

PARALLEL SESSION

BREAK OUT ROOM	SESSION CHAIR:
Break out room 1: Physical Geography and Environment management	Arif Ismail, M.Si.
Break out room 2: GIS and Remote Sensing	Shafira Himayah, M.Sc.
Break out room 3: Humankind and Environment	Muhammad Ihsan, M.T.
Break out room 4: Humankind and Environment	Asri Ria Affriani, M, Eng
Break out room 5: Hazard, Risk, Land Degradation and Disaster	Hendro Murtianto, M.Sc.
Break out room 6: Land Use and Land Cover Change	Riki Ridwana, M.Sc.
Break out room 7: Gender, Religiuos, Politics and Environment	Silmi Afina Aliyan, M.T
Break out room 8: Health Environment and Sustainable development Goals (SDGs)	Alnidi Safarach Bratanegara, M.Si
Break out room 9: Urban and Rural Environmental Geography	Haikal Ihsan, M.Sc.
Break out room 10: Geography Education	Totok Doyo Pamungkas. M. Eng

PRESENTATION SCHEDULE

Breakout room 1: Physical Geography and Environment management

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20015	Deasy Arisanty, Karunia Puji Hastuti, Aswin Nur Saputra, Muhammad Muhaimin, Faisal Arif Setiawan	Characteristic of Mass Movement in Riam Kanan Watershed, Indonesia
2	13.10 - 13.20	ABS-IGEOS-20041	Syahrizal Koem, Rakhmat Jaya Lahay, Salmun K. Nasib	The Sensitivity of Meteorological Drought Index Towards El Nino-Southern Oscillation
3	13.20 - 13.30	ABS-IGEOS-20042	Winda Dwi Octavia, Supriatna, Ratna Saraswati	Estuary Boundary of Cimandiri and Cisadane Based on Water Surface Salinity
4	13.30 - 13.40	ABS-IGEOS-20043	Aswin Nur Saputra, Deasy Arisanty, Muhammad Muhaimin, Sidharta Adyatma	Empirical Modeling of the Distribution of Chlorophyll-a in Riam Kanan Reservoir
5	13.40 - 13.50	ABS-IGEOS-20093	Haura Ikrimah, Supriatna, Iqbal Putut Ash Shidiq	Spatial Distribution Analysis of Lift Net Fishing Device Based on Oceanographic Features in Palabuhanratu Bay
6	13.50 - 14.00	ABS-IGEOS-20104	Safira Nur Aisyah, Supriatna, Andry Rustanto	A spatial Study of Landscape Patterns in Landslide-Prone Areas at Cikakak Sub-District, West Java
7	14.00 - 14.10	ABS-IGEOS-20102	Intan Manyoe, Ronal Hutagalung	The extraction and analysis of lineament density from digital elevation model (DEM) in Libungo geothermal area, Gorontalo
8	14.10 - 14.20	ABS-IGEOS-20165	Djati Mardiatno, Mukhamad Ngainul Malawani, Marindah Yulia Iswari, Kharisma Nur Hafizah, Noviyanti Listyaningrum	Study on Morpho-arrangement of Anthropogenic Landforms to Identify the Potential Exposures to Tsunami Hazard in Parangtritis, Yogyakarta
9	14.20 - 14.30	ABS-IGEOS-20162	Muhamad Danial Suma, Rini Rahmatia S, Intan Noviantari Manyoe, Tessy Choirunnisa Kobandaha, Mohammad Rizki Aditya Kandouw, Dewi Darmayanti Tolodo	Mass wasting mechanism of Gorontalo Outer Ring Road (GORR) in Padengo, Gorontalo
10	14.30 - 14.40	ABS-IGEOS-20216	Aliza Sanad, Eko Kusratmoko, Adi Wibowo	Urban Heat Islands Phenomenon In Majalengka Regency
11	14.40 - 14.50	ABS-IGEOS-20196	Siti Hamidah, Maulia D. Kembara, Dina Siti Logayah	Simulation Of Landslide Disaster In Reducing Disaster Risk
12	14.50 - 15.00	ABS-IGEOS-20140	Alfi Wira Wijaya, Eko Haryono	Study of Carbon dioxide (CO2) Concentration Distribution in The Soil on Mixed Vegetation Area Landcover at Specific Sites of Jonggrangan Karst Zone
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20206	Ambar Kusumandari, Dwi Prasetya Ananta	The effectiveness of agroforestry in reducing the erosion rate compared to the eucalyptus plantation in Wanagama I Educational Forest
14	15.40 - 15.50	ABS-IGEOS-20215	Dinda Shafira Dwi Arlan, Eko Kusratmoko, Revi Hernina	The Identification Of Soil Moisture As A Factor Of Drought In Cilutung Watershed During Indian Ocean Dipole Year
15	15.50 - 16.00	ABS-IGEOS-20228	Riyatmoko Aji, Tjaturahono Budi Sanjoto, Juhadi	Impact of the Rob Flood Disaster in North Pekalongan
16	16.00-16.10	ABS-IGEOS-20146	Muhamad Ervin, Muh. Alfin Anafi, As'ak Arif, Herlina Restu Ayu Puspita, Arifima Nurlaila Dewi, Arif Ashari	Hydrogeomorphology of Spring at the Junction of Sumbing-Sindoro Twin Stratovolcanoes, Central Java

No	Time	Code	Author	Tittle
17	16.10 – 16.20	ABS-IGEOS-20106	Listyo Yudha Irawan, Sumarmi, Damar Panoto, Irfan Helmi Pradana, Rahmad Faizal, Melinda Meganagatha Rosbella Devy, Dimas Bayu Perdana Putra	The Identification of Flood Susceptibility And Its Contributing Factors in Kabupaten Sampang

Breakout room 2: GIS and Remote Sensing

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20006	Ketut Prasetyo	Application Of Remote Sensing And Gis To Identify The Vulnerability Of Ground-W A Ter Pollution In Topographic Karts
2	13.10 - 13.20	ABS-IGEOS-20013	Triana Devi Pratiwi, Iqbal Putut Ash Shidiq, Supriatna	Cimandiri Estuary Zonation Based on Sea Surface Salinity from Sentinel-2 Imagery and its Relation with the Catching Spots Distribution of Anguilla spp. Larvae
3	13.20 - 13.30	ABS-IGEOS-20019	A Sediyo Adi Nugraha, I Putu Ananda Citra	Application of Split-Windows Algorithm (SWA) Method in Forest Canopy Density (FCD) Model on Landsat 8 OLI/TIRS
4	13.30 - 13.40	ABS-IGEOS-20025	Alphi kemal hisyam, Supriatna, Iqbal Putut Ash Shidiq	Using NDVI, ARVI, MSAVI Algorithm For Paddy Growth Phase and Estimation of Rice Productivity in Cikakak Sub- District, Sukabumi Regency
5	13.40 - 13.50	ABS-IGEOS-20039	Budi Setiawan, Sukamdi, Umi Listyaningsih	Probabilistic Projections of Total Fertility Rates for Indonesia and its Regions using the Bayesian Hierarchical Model
6	13.50 - 14.00	ABS-IGEOS-20049	Sofia Utari Ramadhani, Rokhmatuloh, Adi Wibowo	The rice production of paddy field and relationship with elevation using Sentinel-1A SAR in Subang Regency
7	14.00 - 14.10	ABS-IGEOS-20053	Ahmad Nurhuda, Adi Wibowo, Kustiyo	Spatial-temporal of the growth phase and rice varieties using Sentinel-1A radar imagery in Ciasem District, Subang Regency
8	14.10 - 14.20	ABS-IGEOS-20078	Muhammad Muhaimin, Dini Fitriani, Sidharta Adyatma , Deasy Arisanty	Mapping Build-Up Area Density Using Normalized Difference Built-Up Index (NDBI) and Urban Index (UI) Wetland In The City Banjarmasin
9	14.20 - 14.30	ABS-IGEOS-20077	Bowo Susilo, Ari Cahyono	Utilization of Online Geospatial Data Sources for Oikonym Study: Mapping and Analysis of Housing Name in Capital Area of Kulon Progo Regency
10	14.30 - 14.40	ABS-IGEOS-20073	Andry Rustanto, Nurul Sri Rahatiningtyas, Martijn J Booij	An integrated method to develop high temporal Landsat images using free and open-source (FOSS) GIS application
11	14.40 - 14.50	ABS-IGEOS-20091	Riko arrasyid, Ervika Putri Wulandari, Lisma Dian Sukmawati, Nandia Putri, Vira Islami Nurawaliyah	Applied Geographic Information System for disaster based on smong's local wisdom
12	14.50 - 15.00	ABS-IGEOS-20105	Karunia Pasya Kusumawardani, Iswari Nur Hidayati	Analysis of Urban Heat Island and Urban Ecological Quality Based on Remote Sensing Imagery Transformation in Semarang City

No	Time	Code	Author	Tittle
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20103	Budi Setiawan, Sukamdi, Umi Listyaningsih	Probabilistic Projections of Life Expectancy for Indonesia and its Region using the Joint Probabilistic Projection Model
14	15.40 - 15.50	ABS-IGEOS-20144	Risma Sari Septianingrum, Eko Haryono	Morphometric Analysis Using Geographical Information System Techniques in Serpeng and Sumurup Watersheds
15	15.50 - 16.00	ABS-IGEOS-20178	Mohamad Fikri Maulana, Tjiong Giok Pin, Adi Wibowo	Spatial Pattern of Propagation Digital Terrestrial Television System in East Jakarta City
16	16.00 - 16.10	ABS-IGEOS-20171	Rahma Kurnia Sri Utami, Nurul Khakim, Retnadi Heru Jatmiko, Andri Kurniawan, Listumbinang Halengkara	GIS Network Analysis to Optimize Zoning System Implementation for Public Junior High Shools in Yogyakarta City
17	16.10 - 16.20	ABS-IGEOS-20183	Siti Hamidah, Lili Somantri, Arif Ismail, Riki Ridwana, Regina M. Hitoyo	Cartography Training: Thematic Mapping Related to the Covid-19 Outbreak for Government Staff
18	16.20 - 16.30	ABS-IGEOS-20203	Shafira Himayah, Riki Ridwana	Vegetation Spectral Characteristics Based on Altitude Zone in Galunggung Volcano

Breakout room 3: Humankind and Environment

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20021	Ilma Indriasri Pratiwi, Endah Fitriyani, Andreas Suwandi	Model for Culinary Destination Planning and Management on Tourism Village in Coastal Area: Case Study of Gebang Mekar Tourism Village in Cirebon West Java
2	13.10 - 13.20	ABS-IGEOS-20020	Nuri Novianti Afidah, Siti Hamidah, Risris Hari Nugraha, Mochamad Whilky Rizkyanfi, Ahmad Fuadin, Welsi Damayanti	The Kadu Lexicon Local Wisdom of Geographic's Toponymic at Pandeglang Regency, Banten Province
3	13.20 - 13.30	ABS-IGEOS-20055	Dadi Mulyadi Nugraha, Vini Agustiani Hadian, Nurti Budiyanti, Daris Hadianto	Environmental Efforts Through 'lembur Kaulinan Lebaksiuh'
4	13.30 - 13.40	ABS-IGEOS-20085	Sukamdi, Ratih Fitria Putri, Muhammad Arif Fahrudin Alfana, Seri Aryati, Ratri Purnama Dewi, Bagas Aditya, Lucia Sandra Budiman, Sri Kumala Ningrum	Demographic issues in local area: insight from Kretek Sub District, Regency of Bantul, Yogyakarta Special Region, Indonesia
5	13.40 - 13.50	ABS-IGEOS-20097	Andi Putranto	Landscape Archaeology As A Key Concept For Cultural Resources Management In Indonesia
6	13.50 - 14.00	ABS-IGEOS-20094	Dadi Mulyadi Nugraha, Pipi Karmila, Febriana Ruspendi, Iwan Kurniawan , Kikki Ayu Kirana	Contructing the values of Environment Care Characters through Duduk Ngelmu program as an effort to increase civic Disposition
7	14.00 - 14.10	ABS-IGEOS-20124	Muslihin ahmad, Enok Maryani, Ahmad Yani	Pawang Uteun Local Wisdom Values in Managing Aceh Forest
8	14.10 - 14.20	ABS-IGEOS-20122	Ahmad Yani, Asep Mulyadi, Rosita	Tour Guide Level of Understanding on Geodiversity, Biodiversity; and Culture Diversity - Study at Ciletuh Pelabuhanratu Global Geopark

No	Time	Code	Author	Tittle
9	14.20 - 14.30	ABS-IGEOS-20101	Muhammad Aliman, Sumarmi, Yurni Suasti, Dahri Hi Halek, Rozana Eka Putri	Rimbo Larangan Revitalization of Minangkabau Community to Foster High School Students Environmental Awareness
10	14.30 - 14.40	ABS-IGEOS-20152	Aang Supriatna, Ratna Fitria, Kama Abdul Hakam, Siti Nurbayani, Warlim	Indigenous Knowledge in "Sundanese Land" Kawih to Introduce Geographical Conditions to Elementary School Students
11	14.40 - 14.50	ABS-IGEOS-20148	Nurdiani Fathiraini, Wawan Darmawan, Tarunasena Ma'mur, Wildan Insan Fauzi	The Vantage Point of Geopolitics: Capturing Indonesia's Maritime Axis Policy
12	14.50 - 15.00	ABS-IGEOS-20142	Angga Kurniawansyah, Tjiong Giok Pin, Nurul Sri Rahatiningtyas	The Suitability of Mangrove Tourism In The District of Cilamaya Wetan, Karawang Regency, West Java Province
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20133	Wildan Insan Fauzi, Ayi Budi Santosa, Tarunasena, Iing Yulianti	The Demographic Dynamics of Bandung City 1907-1996 in Haryoto Kunto's View
14	15.40 - 15.50	ABS-IGEOS-20176	Nabila Cahya Sakina, Tuty Handayani , Dewi Susiloningtyas	Coastal Communities Mobility Pattern Around Mangrove Ecotourism Sukakerta Village, Cilamaya Wetan, Karawang Regency.
15	15.50 - 16.00	ABS-IGEOS-20172	dinie anggraeni dewi, Dasim Budimansyah, Ace Suryadi, Dadang Sundawa	Ecological Citizenship : Environmental Care Program For Young Citizen In Digital Era
16	16.00 - 16.10	ABS-IGEOS-20107	Labibatussolihah, Agus Mulyana, Yani Kusmarni, Yeni Kurniawati	Geographical Information: Walking Tour Opportunities in The Karst Area
17	16.10 - 16.20	ABS-IGEOS-20153	Dina Siti Logayah Dina Siti Logayah, Acep Supriadi, Retno Ayu Hardiyanti	Genius Loci: Heritage Tourism as a Special Interest Social Space
18	16.20 – 16.30	ABS-IGEOS-20130	Endah fitriyani	New Normal in the Hotel Industry: How to apply cleanliness, health, safety, and environmental sustainability standards of Hotel in Bandung.
19	16.30 – 16.40	ABS-IGEOS-20065	Ridwan Effendi, Vidi Sukmayadi, Seniwati, Triyanto, Muhaimin Zulhair Achsin	Media Coverage and People's Perspective: Non-Muslims Perception of Human Rights

Breakout room 4: Humankind and Environment

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20114	Ahmad Zubair, Widyawati Sumadio, Anggie Renaisance Zulkarnain Putri	Passengers Deviant Behavior Mapping In Duri Train Station
2	13.10 - 13.20	ABS-IGEOS-20168	Sakinah Ralea Lestari	Relationship Between Fishermen Wife'S Characteristics And Decision Making In Household And Social Communities At Depok Beach
3	13.20 - 13.30	ABS-IGEOS-20217	Siti Nurbayani	Correlation Of Sosio-Regional Characteristics And Women's And Children's Violence Distribution In Indonesia
4	13.30 - 13.40	ABS-IGEOS-20227	Bigharta Bekti Susetyo, Bayu Wijayanto, Widia Sutriani, Feri Ferdian	Construction of Spatial & Tourism Perspective for Wali Nagari, Customs Leader and Community Figure in Nagari Batuhampar, Limapuluh Kota
5	13.40 - 13.50	ABS-IGEOS-20226	Siti Nurzulaika Binti Roslan, Zuriatunfadzliah Binti Sahdan	Mapping Force Migration From survivor of Domestic Violence in Refuge WAO

No	Time	Code	Author	Tittle
6	13.50 - 14.00	ABS-IGEOS-20233	Devita Rahmadani, Hafid Setiadi, Triarko Nurlambang	Political Contestation of Public Space on Local Community
7	14.00 - 14.10	ABS-IGEOS-20230	Adhit Setiadi, Nurrokhmah Rizqihandari, Hafid Setiadi	The Impact Of Tourism Development On The Changes Of Households Economy In Ciwidey Tourism Area, Bandung Regency, West Java
8	14.10 - 14.20	ABS-IGEOS-20247	Slamet Nopharipaldi Rohman, Enok Maryani, Ahmad Yani	Local Wisdom of the Indigenous Society of Kampung Kuta in Maintaining Leuweung Gede as a Form of Environmental Conservation Efforts
9	14.20 - 14.30	ABS-IGEOS-20072	Aprillia Christianawati, Dyah Rahmawati Hizbaron	Physical Vulnerability Analysis of Cultural Heritage for Strong Winds in the City of Yogyakarta, Indonesia
10	14.30 - 14.40	ABS-IGEOS-20027	asep mulyadi, moh. Dede, Bayu Iqbal Anshari, Millary Agung Widiawaty	Toponyms And Flood Disaster In The Capital Region Of Jakarta, Indonesia
11	14.40 - 14.50	ABS-IGEOS-20081	Ahmad Yani, Mamat Ruhimat, Asep Mulyadi	Geography Teacher's Innovativeness on TPACK Framework Based Learning Technology
12	14.50 - 15.00	ABS-IGEOS-20092	Suhendro , Dede Sugandi, Mamat Ruhimat	Geography Teachers Skills: Higher Order Thinking Skills (HOTS) Oriented Assessment Instrument
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20120	Amelia Zahara, Enok Maryani, Ahmad Yani	The Effect of Media Literacy on Geography Skills in Geography Education Students
14	15.40 - 15.50	ABS-IGEOS-20118	Akhmad Munaya Rahman, Faisal Arif Setiawan, Bambang Subiyakto, Hasymi Syarif	The Effectiveness of Video Usage as Learning Resource for Students
15	15.50 - 16.00	ABS-IGEOS-20209	Nandi	Rural and Urban Education: Challenges for Future Geography Education
16	16.00-16.10	ABS-IGEOS-20137	Tresa Tri Susilawati, Enok Maryani, Ahmad Yani	Implications of Inquiry Approach Against Understanding Geography Concept Material By Utilizing Customary Environments in Kampung Naga
17	16.10 - 16.20	ABS-IGEOS-20254	Nurul Rochmah Pramadika	Tourists' Motivation Towards The Sustainable Tourism Attraction
18	16.10 - 16.20	ABS-IGEOS-20011	Dian Equanti, Galuh, Agus	Local Aspiration About Tourism. How People Thought About Their Living Space and How Far Do They Want to Participate in Tourism Sector. A Study of Community Based Tourism at Batu Burung Beach, Singkawang City of West Kalimantan.

Breakout room 5: Hazard, Risk, Land Degradation and Disaster

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20029	I Putu Ananda Citra, I Putu Ari Purwanto	Variation of Coastal Resource Potential in Tejakula District
2	13.10 - 13.20	ABS-IGEOS-20040	Nur Risma Tirani, Supriatna, Adi Wibowo	Impact of the Climate on Fishing Locations of Fish Larvae in Palabuhanratu Bay
3	13.20 - 13.30	ABS-IGEOS-20099	Mu'alim Nur, Wiwandari Handayani	Water-Related Disasters in Pemali-Comal River Basin - Indonesia: Typology and Policy Support

No	Time	Code	Author	Tittle
4	13.30 - 13.40	ABS-IGEOS-20157	Dewi Tolodo, Intan Noviantari Manyoe, Yayu Indriati Arifin	Geochemistry Characteristics of The Hungayono geothermal Area for The Development of Clean Energy in Gorontalo Province
5	13.40 - 13.50	ABS-IGEOS-20237	Galuh Yuliani, Fira Nandatamadini, Denni Widhiyatna, Mamun Mollah, Siska Mutiara, Agus Setiabudi	Adsorption Of Ammonium Ions In Aqueous Solution Using Raw And Acid Washed Peat Soil
6	13.50 - 14.00	ABS-IGEOS-20253	Syiva Fauzia Lestari, Suratman	The susceptibility of landslide zone using weight of evidence method in nagari tanjung sani and nagari sungai batang, west sumatera.
7	14.00 - 14.10	ABS-IGEOS-20026	M.H. Dewi Susilowati	Priority Regions of Mitigation For Drought and Food Insecurity in Lebak Regency, Banten Province
8	14.10 - 14.20	ABS-IGEOS-20034	Naya Cinantya Drestalita, Nurrohman Wijaya, Naufal Muhammad Iqbal	Spatial assessment of socio-economic vulnerability to climate-related disasters at the local level: Study of coastal villages in Indramayu, Indonesia
9	14.20 - 14.30	ABS-IGEOS-20145	Sani Afifah, Dyah Rahmawati Hizbaron, Muh Aris Marfai	Tidal Flood Hazard Modelling Using The National DEM (DEMNAS) and SPOT 6 Imagery in Part of Sayung District, Demak Regency
10	14.30 - 14.40	ABS-IGEOS-20014	Aldila Rahma, Djati Mardiatno, Dyah Rahmawati Hizbaron	Factor Analysis and Consensus Contributing to Undergraduate Students' Ecoliteracy on Disaster Risk Reduction
11	14.40 - 14.50	ABS-IGEOS-20113	Rafika Hasanah, Ernawati, Muhammad Aliman	Content Analysis in Geography Texbooks of Natural Disaster Mitigation using Beck and McKeown Model
12	14.50 - 15.00	ABS-IGEOS-20166	Sitti Raisa, Enok Maryani, Epon Ningrum	Contribution of Critical Thinking in Disaster Preparedness of Geographic Students
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20158	Vini Agustiani Hadian, Kama A. Hakam, Siti Nurbayani, Ratna Fitria	Role Playing: Disaster Mitigation Literacy Strategies in Primary School Students
14	15.40 - 15.50	ABS-IGEOS-20195	Warlim , Ratna Fitria, Kama A. Hakam, Siti Nurbayani, Aang Supriatna	Disaster Mitigation Through Comic Moral Dilemmas for Elementary School Students
15	15.50 - 16.00	ABS-IGEOS-20246	Mustolikh Mustolikh, Dasim BudimansyahDarsiharjo, Encep Syarief Nurdin	Religious Constructivism Approach in Disaster Mitigation Learning for Environmentally Caring Character Development

Breakout room 6: Land Use and Land Cover Change

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20037	Dhandy Septian Wiratama, Supriatna, Tjiong Giok Pin	Oceanographic Factors and Land Cover Change in Cimandiri Watershed Against Phytoplankton Distribution in Cimandiri Estuary, West Java with Sentinel-2A Imagery
2	13.10 - 13.20	ABS-IGEOS-20051	Ahmat Rifai	Spatial Dynamics Model for Land Carrying Capacity Prediction in Ambon City

No	Time	Code	Author	Tittle
3	13.20 - 13.30	ABS-IGEOS-20062	Hana Yazid, Adi Wibowo, Kustiyo	Spatial Distribution of Rice Planting Pattern using Sentinel-1A SAR in Pabuaran District, Subang Regency
4	13.30 - 13.40	ABS-IGEOS-20116	Riki Ridwana, Fitra Saleh, Shafira Himayah, Riko Arrasyid, Totok Doyo Pamungkas, Azhari Al Kautsar	Spatiotemporal Analysis of Rice Crops in the Covid-19 Pandemic Period for Local Food Security Using Sentinel 2B Imagery Case Study: Tasikmalaya City
5	13.40 - 13.50	ABS-IGEOS-20164	Kartika Kusuma Wardani, Supriatna, Andry Rustanto	Sustainable Agricultural Landscape as a Food Security Effort in Cisolok Sub-district, Sukabumi Regency, West Java, Indonesia
6	13.50 - 14.00	ABS-IGEOS-20163	Brian Pradana, Ade Pugara, Deny Aditya Puspasari	The effect of tollroad development on land-use change in exit tollroad, Batang District
7	14.00 - 14.10	ABS-IGEOS-20155	Nofa Martina Ariani, Bagus Nuari Priambudi, Muhammad Indra Hadi Wijaya	Land Use Change As An Indicators To Formulate The Gentrification Phase At The Diponegoro University Semarang
8	14.10 - 14.20	ABS-IGEOS-20173	Wahdini Safira, Astrid Damayanti, Tito Latif Indra, Muhammad Dimyati	Model Cellular Automata-Markov Chain For Prediction of Development and Land Carrying Capacity of Settlement in Balikpapan City, East Kalimantan Province
9	14.20 - 14.30	ABS-IGEOS-20234	Sofy Wardhani, Triarko Nurlambang, Nurrokmah Rizqihandari, Hafid Setiadi	Spatial Segregation at Large-Scale Planned Residential Bintaro Jaya
10	14.30 - 14.40	ABS-IGEOS-20232	Ghillman Fikri, Hafid Setiadi, Ratri Candra Restuti, Satria Indratmoko	The Influences of Farmer Group Institution on Agricultural Land Use Change in Ciwidey Agropolitan Area, Bandung Regency, West Java
11	14.40 - 14.50	ABS-IGEOS-20046	Sukamdi	Population Impact Analysis : Consequences of Population Policy on Demographic Variables in Yogyakarta Special Region
12	14.50 - 15.00	ABS-IGEOS-20207	Widyawati Sumadio, Ahmad Zubair, Kintan Maulidina, M. Khairul Rosyid, Fariz Zulkarnain	Community characteristic as a foundation in planting hilly areas, a case study
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20229	Aurora Febrianti Naser, Hafid Setiadi, Nurrokhmah Rizqihandari, Satria Indratmoko	The Spatial Relationship between The Horticultural Farming and Household Welfare at Rancabali District, Bandung, West Java
14	15.40 - 15.50	ABS-IGEOS-20063	Elvanya Rosaline Dewi Andini, Widyawati Sumadio	Tea Smallholder Livelihood Development
15	15.50 - 16.00	ABS-IGEOS-20170	Virgi Citra Nabila, Astrid Damayanti, Muhammad Dimyati	Suitability of Seaweed Cultivation Areas on Serangan Island, Denpasar City, Bali Province.

Breakout room 7 : Gender, Religiuos, Politics and Environment

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20005	Ratna Fitria, Bunyamin Maftuh, Elly Malihah, Aang Supriatna, Warlim, Kama Abdulhakam, Siti Nurbayani	Voting Behavior of West Javanese Women in Terms of Geographical Location and Cultural
2	13.10 - 13.20	ABS-IGEOS-20245	Mirna Nur Alia Abdullah, Oca Ginting	Diffusion : Dowry Change in Maba Belu Selambar Culture (a Case Study on Marriage between Karo and Kupang Tribes in Indonesia)

No	Time	Code	Author	Tittle
3	13.20 - 13.30	ABS-IGEOS-20012	Nurti Budiyanti, M Rindu Fajar Islamy, Muhamad Parhan, Risris Hari Nugraha, Ganjar Eka Subakti, Ahmad Fuadin	Internalizing Islamic Values In Building Green Education
4	13.30 - 13.40	ABS-IGEOS-20016	Vidi Sukmayadi, Muhammad Fasha Rouf, Azizul Halim Yahya	Indigenous Concepts of Gender, Communication and their Link to Spatial Processes: A Case Study in Kasepuhan Ciptagelar, Indonesia
5	13.40 - 13.50	ABS-IGEOS-20056	Suka Prayanta Pandia, Ermawati Girsang, Shania Taras Perangin-angin, Shirley Natasha	Perceptions of Racism Based on Regional Indigenous
6	13.50 - 14.00	ABS-IGEOS-20033	Karunia Puji Hastuti, Deasy Arisanty, Akhmad Munaya Rahman, Parida Angriani	Exploring indigenous knowledge values of bahuma as a preservation of the national culture of Indonesia
7	14.00 - 14.10	ABS-IGEOS-20038	Rama Wijaya, Maulia Depriya Kembara, Muhamad Parhan, Nurti Budiyanti, Vini Agustiani Hadian	Pemali as a Defense of Ecovillage Values in the Kampung Kasepuhan Babakan Lama
8	14.10 - 14.20	ABS-IGEOS-20045	Dadi Mulyadi Nugraha, Wina Nurhayati Praja, Abdul Azis, Abih Gumelar, Pandu Hyangsewu	Internalization of Green Moral community of Kuta Village Ciamis Regency
9	14.20 - 14.30	ABS-IGEOS-20047	Edi Suresman	Religion as a Solution to Behavioral Problems Faced by Street Children: A Case Study in Indonesia
10	14.30 - 14.40	ABS-IGEOS-20052	Suka Prayanta Pandia, Audia Fara Pencawan, Ermawati Girsang, Dina Wati Veronika Napitupulu	Effectiveness of Peacecamp in Eastern Indonesia
11	14.40 - 14.50	ABS-IGEOS-20061	Munawar Rahmat, Endis Firdaus, Wildan Yahya	Sunni-Shiite Harmony and Conflict in Jepara (Central Java) and Sampang (Madura)
12	14.50 - 15.00	ABS-IGEOS-20058	Sidharta Adyatma, Muhammad Muhaimin, Muhammad Anshori, Aswin Nur Saputra	Takmir's (mosque administrator) response to the suitability of the mosque's qibla direction in Banjarmasin
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20030	heni zaenudin, Kokom Siti Komariah	A Media-Based Campaign to Protect Watershed of Citarum River, West Java Province, Indonesia
14	15.40 - 15.50	ABS-IGEOS-20079	Nur Alliya Yasmin Noor Azlan, Zuriatunfadzliah Bt Sahdan	Perceptions of Influential Transgender in Malaysia: A Social Media Analysis
15	15.50 - 16.00	ABS-IGEOS-20243	Endis Firdaus, Munawar Rahmat, Raniri Munawar	Emotional Geography of eternity: A case study of spiritual tolerance of religion in the family of a widow whose husband dies of a different religion

Breakout room 8 : Health Environment and Sustainable Development Goals (SDGs)

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20188	Amrullah Fathurrahman, Supriatna	Challenges and Opportunities of Biodiversity Park as a Togong-Tanga Indigenous Peoples Conservation Area in Banggai Kepulauan, Central Sulawesi
2	13.10 - 13.20	ABS-IGEOS-20182	Anggita Winda Sari, Dewi Liesnoor Setyowati	The Local Wisdom of Communities in Maintaining the Sustainability of Telaga Mangunan in Tlogohendro Village, Petungkriyono District, Pekalongan Regency
3	13.20 - 13.30	ABS-IGEOS-20008	Endang Puji Astuti, Joni Hendri, Mara Ipa, Mega Tyas Prihatin, Andri Ruliansyah, Triwibowo Ambar Garjito	Identification of Wuchereria bancrofti in Culex quinquefasciatus Post-Mass

No	Time	Code	Author	Tittle
				Drug Administration (MDA) Lymphatic Filariasis in Bekasi District, Indonesia
4	13.30 - 13.40	ABS-IGEOS-20023	Heni zaenudin, Ahmad Fachrul Muchtar affandi, Ridwan Effendi	Health Campaign of COVID-19 Prevention through New Media in an Urban Area
5	13.40 - 13.50	ABS-IGEOS-20032	Pandji Dhewantara, Muhammad Umar Riandi, Tri Wahono	Effect of climate change on the geographical distribution of leptospirosis risk in Western Java, Indonesia
6	13.50 - 14.00	ABS-IGEOS-20057	Ferry Fathoni, Jon C Lovett, Annisa Joviani Astari, Hery Haerudin	Sustainability of the Indonesian energy for the transportation sector: Impact of the global agenda and national environmental policies on institutional development
7	14.00 - 14.10	ABS-IGEOS-20070	Annisa Joviani Astari, Lili Somantri, Alnidi Safarach Bratanegara, Haikal Muhammad Ihsan, Silmi Afina Aliyan	Ecological Criteria for Sustainability in Global, National, and Local Scales: A Review of the Literature and Case Study in the Indonesian Palm Oil Sector
8	14.10 - 14.20	ABS-IGEOS-20076	Muhammad Alfana, Sukamdi	Covid-19 Implications for Demographic Parameters and Demographic Bonus Achievements in Indonesia
9	14.20 - 14.30	ABS-IGEOS-20084	Alwan husni ramdani, Haikal Muhammad Ihsan, Aly Mecca	Government Instagram Study In An Urban Area In Pandemic Covid-19
10	14.30 - 14.40	ABS-IGEOS-20082	Alnidi Safarach Bratanegara, Lili Somantri, Annisa Joviani Astari, Silmi Afina Aliyan, Haikal Muhammad Ihsan	the importance of environmental awareness and industrial hygiene for workers
11	14.40 - 14.50	ABS-IGEOS-20080	Nur Wita Fadillah, Chatarina Muryani, Pipit Wijayanti	An Analysis of Sustainable Tourism Development Planning of Geopark in Nglanggeran Region, Patuk District, Gunungkidul Regency, Special Region of Yogyakarta
12	14.50 - 15.00	ABS-IGEOS-20096	Trisnaningsih Trisnaningsih, Buchori Asyik	Child Marriage in Urban Areas: Gender Quality Perspectives in Sustainable Development Goals (SDGs) Programs
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20090	Wanjat Kastolani, Darsiharjo, Iwan Setiawan, Upi Supriatna	Integrated Waste Processing In Pangandaran Beach Tourism Area
14	15.40 - 15.50	ABS-IGEOS-20117	Sukmaniar	Level of Community Vulnerability in the Slums of Palembang City
15	15.50 - 16.00	ABS-IGEOS-20108	Novanda Nurul Aini Puspitasari, Pramono Hadi	Effects of Land Use on The Number of Coliform Bacteria in Boyong River, Sleman
16	16.00 – 16.10	ABS-IGEOS-20251	Jalu Rafli Ismail, Arif Ismail, Nandi	Spatial Analysis on Influence of Elevation Toward Infection Fatality Ratio of Coronavirus Disease 2019 in Bandung Regency and Bandung City
17	16.10 - 16.20	ABS-IGEOS-20242	Nandi, Lili Somantri, Arif Ismail	Mapping of the level of vulnerability of the region to the pandemic Covid-19: Case study of Bandung Municipality
18	16.20-16.30	ABS-IGEOS-20174	Agung Satriyo Nugroho, Muhammad Galang Ramadhan Al Tumus, and Khadijatusalma	Mapping Threat of Crisis Due to Covid 19 Towards the Management of the Indonesian Border By: Agung Satriyo Nugroho, Muhammad Galang Ramadhan Al Tumus, and Khadijatusalma

Breakout room 9 : Urban and Rural Environmental Geography

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20001	Dias Oktri Raka Setiadi, Muhammad Baiquni	Household Livelihood Strategies of Inhabitant Traditional Javanese House in Brayut Tourist Village
2	13.10 - 13.20	ABS-IGEOS-20004	Nurti Budiyanti, Maulia D Kembara, Rama Wijaya A. Rozak, Pandu Hyangsewu, Daris Hadianto	The Role Of Local Culture "masagi" In Developing Indonesian Education Spirituality Becomes Insan Kamil
3	13.20 - 13.30	ABS-IGEOS-20024	Moh. Dede, Chay Asdak, Iwan Setiawan	Spatial-Ecological Approach in Cirebon's Peri-Urban Regionalization
4	13.30 - 13.40	ABS-IGEOS-20064	Dio Armansyah, Widyawati Sumadio	Social Capital Role in Enhancing the Middle Eastern Investment in Warung Kaleng Area
5	13.40 - 13.50	ABS-IGEOS-20075	Dedy Miswar	Spatial Analysis of Uninhabitable Houses (RTLH) Tanggamus Regency, Lampung Province
6	13.50 - 14.00	ABS-IGEOS-20074	Arry retnowati, Genta Darma Maulya, Khusnul Intan Dwi Fajar	Sustainable development from the view of Village Development Index Implementation at Landslide Prone Area in Kulon Progo
7	14.00 - 14.10	ABS-IGEOS-20088	Ikhsan Maulana Mulya, M.H. Dewi Susilowati, Ratri Candra Restuti	Locations and Tourist Characteristics of Culinary Tourism in West Bandung Regency, West Java Province
8	14.10 - 14.20	ABS-IGEOS-20086	Rena Mukti Sari, Ahmad, Moh. Gamal Rindarjono	An analysis of Settlement Areas Development in the 2010-2020 Period in Blambangan Umpu, Way Kanan Regency, Lampung Province
9	14.20 - 14.30	ABS-IGEOS-20159	Ade Pugara, Brian Pradana, Deny Aditya Puspasari	The Efficiency of Semarang Pekalongan Toll Road in Goods Transportation
10	14.30 - 14.40	ABS-IGEOS-20156	Deny aditya puspasari, Ade Pugara, Brian Pradana	Tourism and Housing Transformation Process
11	14.40 - 14.50	ABS-IGEOS-20151	Monica Pratiwi	Livelihood sustainability of small-scale fishermen on Depok Beach, Special Region of Yogyakarta
12	14.50 - 15.00	ABS-IGEOS-20149	Ade Pugara, Fahrul Hidayat, Rizal Aprianto, Izzan Arif Hutomo	The Influence of Mudik Tradition on The Corona Case Escalation In Central Java
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20147	Firyadi	CO2 Emissions and Sequestration with Land Use and Land Cover Changes According to the Spatial Plan in Banyuasin Regency, South Sumatra
14	15.40 - 15.50	ABS-IGEOS-20139	Riris Rinonce Hapsari, Hapsari Proboningrum, Muhamad Rosyid Pamungkas	Overtourism Threat In Kuta District, Badung Regency, Bali Province
15	15.50 - 16.00	ABS-IGEOS-20212	Iwan Hermawan, Octaviadi Abrianto, Revi Mainaki	The Spatial Structure Of Cirebon City In 1918 Based On Archeological Heritage Of Sugar Industry And Railroad Transportation
16	16.00 - 16.10	ABS-IGEOS-20223	Paramita Rahayu, Erma Fitria Rini, Jayanti Kusuma Wardhani	Urban water governance: Lesson learned from urban water problems in Surakarta
17	16.10 - 16.20	ABS-IGEOS-20231	Wafa Fauzia, Hafid Setiadi, Nurrokhmah Rizqihandari	Transformation of Public Space Utilization by Online Ojek
18	16.20 - 16.30	ABS-IGEOS-20095	Murdiyah Winarti, Wawan Darmawan, Erlina Wiyanarti, Iing Yulianti	Cultural Heritage and History-Based Tourism Potentials in Bandung City
19	16.30 - 16.40	ABS-IGEOS-20210	Fauziah Che Leh	Geography of Fear: Tourists and their experiences in Kuala Lumpur Urban Tourist Spot

No	Time	Code	Author	Tittle
20	16.40 - 16.50	ABS-IGEOS-20126	Siti Rahmah Husnul Khotimah, Wawan Gunawan, Angga Dwiartama	Effectiveness of ginger supply chains in rural communities as a form of farming sustainability (study case in Cianjur district)

Breakout room 10 : Geography Education

No	Time	Code	Author	Tittle
1	13.00 - 13.10	ABS-IGEOS-20238	Rafzan	Dimension of critical thinking students on Project Citizen Learning to Build Awareness In Natural Resource Utilization
2	13.10 - 13.20	ABS-IGEOS-20035	Daris Hadianto , Vismaia S. Damaianti, Yeti Mulyati, Muhamad Parhan, Nurti Budiyanti	Geographical Position And Society Literacy Skill : Implementation Of Literacy Model Based On Local Culture, Life Ability, And Independent Business In The Underdeveloped Regions
3	13.20 - 13.30	ABS-IGEOS-20048	Suhendro , Slamet N. Rohman, Avi Valentri, Ottovianus Diliano Nery, Nurul Komariah, Ismail Akbar	The Urgency of Technological Pedagogical and Content Knowledge (TPACK) in Integrating Geography Learning
4	13.30 - 13.40	ABS-IGEOS-20068	Nur Wahyuni	The Contribution Eco-Literacy in Environmental Care Behavior Students of State High School in The City of Medan
5	13.40 - 13.50	ABS-IGEOS-20115	Ahmad Yani, Enok Maryani, Epon Ningrum	Scientific Learning Implementation during the Covid-19 Pandemic in Geography Subject
6	13.50 - 14.00	ABS-IGEOS-20112	Sugeng Widodo, Sugeng Utaya, Sumarmi, Syamsul Bachri	The Development of Creative Thinking Oriented Instructional Material of Geography Subject
7	14.00 - 14.10	ABS-IGEOS-20111	Totok Doyo Pamungkas	Student Perception of E-Learning in Geographical Perspective
8	14.10 - 14.20	ABS-IGEOS-20161	Pardo wandra, Iwan Setiawan, Ahmad Yani	The Effect of Problem Based Learning Model on Students' Spatial Thinking (Quasi-Experimental Study, In Class XI IIS SMAN 1 Lunang, Kab. Pesisir Selatan).
9	14.20 - 14.30	ABS-IGEOS-20150	Dian Puspita Anggreni, Sumarmi, Dwiyono Hari Utomo, Muhammad Aliman	The Influence of Guided Inquiry Learning with Geo-Literacy and Scheme on Spatial Thinking Ability
10	14.30 - 14.40	ABS-IGEOS-20135	Saiful Amin, Budi Handoyo, Sumarmi, Syamsul Bachri, Singgih Susilo, Cipta Estri Sekarrini	The development of a conceptual model of environment-problem-based geography instructional materials
11	14.40 - 14.50	ABS-IGEOS-20134	Ruli As'ari, Dede Rohmat, Epon Ningrum, Ahmad Yani	Exploring the Potential of Galunggung Volcano Region to Develop Geographic Education Field Laboratory
12	14.50 - 15.00	ABS-IGEOS-20131	Siti Fadjarajani	Integration of Spatial Intelligence-Based Learning with Utilization of the Ecovillage Program in the Citanduy Watershed, West Java, Indonesia
	15.00 - 15.30		Break	
13	15.30 - 15.40	ABS-IGEOS-20198	Alvi Yasin Martindo	Need Analysis to Identify Hypermedia Lite Droid for Spatial Thinking
14	15.40 - 15.50	ABS-IGEOS-20208	Rasi Yeni Mustika, Enok Maryani, Wanjat Kastolani, Rasi Yeni Mustika, Enok Maryani, Wanjat Kastolani	The Role of Geographic Learning on Breakdown Behaviour In Pandeglang High School

No	Time	Code	Author	Tittle
15	15.50 - 16.00	ABS-IGEOS-20202	Dede Sugandi, Ramadhan Pascawijaya	Cognitive Assessment of Students in Geographic Learning at The Senior Hight School At Bandung City
16	16.00 - 16.10	ABS-IGEOS-20211	Epon Ningrum	Utilization of Microteaching to Develop Teaching Skills of Students at the Geography Education Study Program, Universitas Pendidikan Indonesia
17	16.10 - 16.20	ABS-IGEOS-20244	Robiyati, Ahmad Yani, Iwan Setiawan	The Effect of the Availability of Non-Textbooks in Geography Learning on Student's Reading Interest in Geographic Literacy
18	16.20 – 16.30	ABS-IGEOS-20017	Aris Munandar	Differences in Learning Activities by Using Merdeka Lesson Plans for Elementary School Teachers in Jakarta
19	16.30 - 16.40	ABS-IGEOS-20098	Yeni Kurniawati, Wawan Darmawan, Murdiyah Winarti, Tarunasena	Geography Trajectory in the High School History Textbook's Historiography Based on the 2013 Curriculum
20	16.40 - 16.50	ABS-IGEOS-20255	Ade Rika Siti Fauziyah, Mamat Ruhimat, Dede Sugandi	The Role of Disaster Knowledge in the Preparedness of Students in West Bandung Regency

CONTENT

PHYSICAL GEOGRAPHY AND ENVIRONMENT MANAGEMENT

ABS-IGEOS-20015

Characteristic of Mass Movement in Riam Kanan Watershed, Indonesia

Deasy Arisanty, Karunia Puji Hastuti, Aswin Nur Saputra, Muhammad Muhaimin, Faisal Arif Setiawan
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Mass movement occurred in upstream in Riam Kanan watershed due to this area is part of Meratus Mountain. The objective of study is to analyse the vulnerability class of mass movement in the upstream of Riam Kanan Watershed and to analyse the characteristics of the mass movement in the upstream of Riam Kanan Watershed based aspects of morphology and morphogenesis. This study used the survey method, to determine the vulnerability class mass movement using slope maps and vegetation density map. Aspects of morphology and morphogenesis are used to determine the characteristics of mass movement. Aspects of morphology are slope of hill. Aspects of morphogenesis includes soil depth and rock weathering. The research area is dominated by medium and high vulnerability classes i.e. 54804.47 Ha and 36546.04 Ha. The mass movement type in the landform of weak eroded of denudation hills, metamorphic rock material (D1) is rotational landslides and rock fall. Rotational landslide has the characteristic of slope > 250, the soil thickness ranges from 1-2 m and occurring of rock weathering. Rock fall has the characteristic of slope > 450, about 30 cm of soil thickness, low vegetation density, further weathering.

Keywords : mass movement, landform, morphology, morphogenesis

ABS-IGEOS-20041

The Sensitivity of Meteorological Drought Index Towards El Nino-Southern Oscillation

Syahrizal Koem, Rakhmat Jaya Lahay, Salmun K. Nasib
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s.koem@ung.ac.id, rjlahay@gmail.com, salmun@ung.ac.id El Nino-Southern Oscillation (ENSO) contributes to the regional climates, such as precipitation and droughts. The objectives of the present work were to: (1) identify the severity index; (2) analyze the correlation of Standardized Precipitation Index (SPI) and Reconnaissance Drought Index (RDI), and; (3) identify the response of SPI and RDI towards ENSO. SPI and RDI were calculated for time scales (3, 6, and 12 months), and these represented the seasonal and annual drought. The identification of the responses of the drought severity index, based on ENSO, consisted of several thresholds, namely weak, moderate, and strong. In this research, the correlational value and RMSE only represented the performance of SPI and RDI on different time scales. The areas with similar climate conditions demanded a test on the performance of SPI and RDI in different height variations. According to the results, the drought severity index would decline along with an increase in the time scales. The strong El Nino phase could be significant to the seasonal and annual drought. In other words, ENSO was impactful on the precipitation and dynamics of drought. Drought periods were due to the moderate and strong El Nino phase, while the weak phase led to a normal condition. For this reason, ENSO could be functioned as an indicator to predict drought.

Keywords : rainfall, the severity of drought, SPI, RDI

The Sensitivity of Meteorological Drought Index Towards El Nino-Southern Oscillation

S Koem[1], **R J Lahay**[1] **and S K Nasib**[2]

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Abstract. El Nino-Southern Oscillation (ENSO) contributes to the regional climates, such as precipitation and droughts. The objectives of the present work were to: (1) identify the severity index; (2) analyze the correlation of Standardized Precipitation Index (SPI) and Reconnaissance Drought Index (RDI), and; (3) identify the response of SPI and RDI towards ENSO. SPI and RDI were calculated for time scales (3, 6, and 12 months), and these represented the seasonal and annual drought. The identification of the responses of the drought severity index, based on ENSO, consisted of several thresholds, namely weak, moderate, and strong. In this research, the correlational value and RMSE only represented the performance of SPI and RDI on different time scales. The areas with similar climate conditions demanded a test on the performance of SPI and RDI in different height variations. According to the results, the drought severity index would decline along with an increase in the time scales. The strong El Nino phase could be significant to the seasonal and annual drought. In other words, ENSO was impactful on the precipitation and dynamics of drought. Drought periods were due to the moderate and strong El Nino phase, while the weak phase led to a normal condition. For this reason, ENSO could be functioned as an indicator to predict drought.

1. Introduction

Researchers have continued to assess the severity of drought in the context of a climate change phenomenon, El-Nino Southern Oscillations (henceforth, ENSO). Some studies report that severity is, by nature, a complex phenomenon, by which it might be a difficult task for one to examine and predict such a phenomenon [1–4]. For this reason, many have endeavored to develop a method for predicting drought that takes into account the variables of hydroclimatic, such as precipitation, soil moisture, streams, snows, groundwater, evapotranspiration, and vegetation [5]. Among the methods are a Standardized Precipitation Index (henceforth, SPI) [6] and Reconnaissance Drought Index (henceforth, RDI) [3]. Both of these two methods require monthly precipitation data. The only difference is that RDI needs other variables, i.e., temperature and potential evapotranspiration (henceforth, PET). Further, the methods function to estimate the severity index on different time scales, thus helping the assessment of seasonal and annual drought.

Examining the correlation pattern of ENSO and drought is deemed essential, given the impact of ENSO on the regional climates, such as precipitation and droughts. Compared to La Nina, El Nino is impactful on the hydrologic condition, and it leads to a rise in the rain days (with precipitation less than 1 mm) during drought seasons [7]. The condition marks the significance of ENSO in determining the precipitation. Despite the impact of ENSO on the decline of precipitation, especially during El-

Nino, one cannot justify that ENSO affects the level of drought totally. Nevertheless, assessing the drought severity index is essential, since this is central to the condition of society, economy, and environment [8]. The assessment can also serve as a reference for preparing measures required for adaptation and mitigation of the effects of drought due to ever-changing climates in the future [9].

The present work discusses the drought of severity index resulted from the SPI and RDI, and the correlation of both methods in Gorontalo regency. Furthermore, the study also explores the responses of SPI and RDI towards ENSO.

2. Methods

2.1. Research site

Gorontalo regency is located in the northern part of Sulawesi Island. In the province of Gorontalo, this 2125 km^2 regency is one of the major producers of rice and maize. The climate of Gorontalo regency is equatorial, where the peak of the rain season, before reaching its lowest from August to October, from April to June and November to January (see Fig. 1). The average minimum and maximum temperature there is 23ºC and 32ºC, respectively. In the northern and southern parts of the regency, the majority of the area is highland.

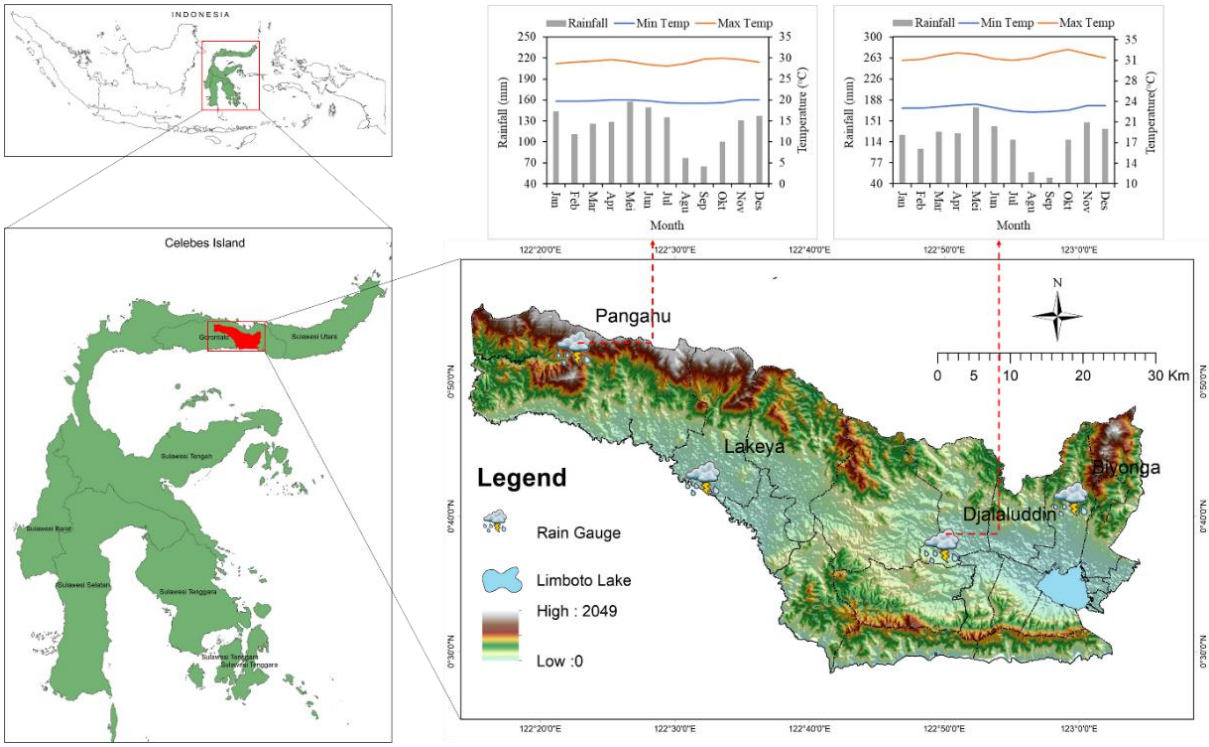

Figure 1. Location map of the study area

2.2. Climate data

The data of this present work were the precipitation and temperature data of 35 years (from 1982 to 2016); the reason is to meet the prerequisite in performing a severity index analysis [10]. All of the data were retrieved from the River Basin Organization, Sulawesi (or Balai Wilayah Sungai, henceforth, BWS II), Meteorology, Climatology, and Geophysical Agency (henceforth, BMKG), and from the website http://sacad.database.bmkg.go.id/grid/web/ as well as iridl.ldeo.columbia.edu/SOURCES/NOAA/. Data normalization was performed using inverse distance weighting interpolator, i.e., an interpolator used to complete missing data; this was based on the previous study by Koem and Rusiyah [9,11].

2.3. Calculating meteorological drought index

The SPI and RDI were calculated using software called DrinC. SPI is a method widely used in identifying meteorological drought index; this method was introduced by McKee et al. [6]. The data of precipitation from 1982 to 2016 in each station were processed using the probability density function of the gamma distribution (equation 1) to produce SPI on different time scales.

$$g(x) = \frac{1}{\beta^{\alpha}\Gamma(\alpha)} x^{\alpha-1} e^{-x/\beta}, \text{ for } x > 0 \quad (1)$$

where α and β represented the parameter of shape and parameter of scale, x represented the precipitation rate, and $\Gamma(\alpha)$ represented gamma function.

RDI index was introduced by Tsarikis et al. [3]. This index applied the PET, in addition to the precipitation, as the key variable in determining the drought severity index [12]. Further, RDI was stated in three forms, namely: initial value (α_k), normalized RDI (RDI_n), and standardized RDI (RDI_{st}). The initial value (α_k) was presented in the form of aggregate on a monthly basis; still, the value was estimable on seasonal or annual basis [13]. The calculation of the initial value (α_k) was performed using the following equation:

$$a_k^{(i)} = \frac{\sum_{j=1}^{k} P_{ij}}{\sum_{j=1}^{k} PET_{ij}}, \text{i} = 1 \text{ to N} \quad (2)$$

where P_{ij} and PET_{ij} represented the precipitation and evapotranspiration in month-j and year-i, N represented the number of years in the available data. Normalized RDI (RDI_n) was calculated using equation 3, where, the parameter $\overline{a}_k$ refers to the average of the arithmetic of a_k calculated for the year N.

$$RDI_n^{(i)} = \frac{a_k^{(i)}}{\overline{a}_k} - 1 \quad (3)$$

Standardized RDI (RDI_{st}), was calculated using a procedure similar to the one used in estimating SPI; the formula is as follows:

$$RDI_{st(k)}^{(i)} = \frac{y_k^{(i)} - \overline{y}_k}{\hat{\sigma}_{yk}} \quad (4)$$

where y_i referred to ln $a_k^{(i)}$; $\overline{y}_k$ referred to mean of arithmetic; $\hat{\sigma}_{yk}$ represented the standard deviation. By that, RDI was applicable in the distribution of gamma, by adjusting the probability density function to the given frequency distribution $a_k^{(i)}$[14]. Since SPI and RDI estimated and interpreted the drought severity index in a similar fashion, thereby, the classification and the threshold were the same (see Table 1).

Table 1. Classification of drought according to the SPI and RDI values

SPI and RDI range	Drought classes
2 or more	Extremely wet
1.5 to 1.99	Very wet
1 to 1.49	Moderately wet
-0.99 to 0.99	Normal
-1 to -1.49	Moderately dry
-1.5 to -1.99	Severely dry
-2 and less	Extremely dry

A Pearson correlation was used to identify the correlation between SPI and RDI on different time scales, while the SPI and RDI performance was examined using Root Mean Squared Error (henceforth, RMSE). RMSE was examined using equation 5, where N represented the height of each time scale of SPI or RDI [13]. Within the last section of this paper was discussed the responses of SPI

and RDI towards ENSO, i.e., the identification of the severity index on different time scales based on three categories of ENSO: weak, moderate, and strong. The ENSO from 1982 to 2016 was determined according to the parameter of the Oceanic Nino Index (henceforth, ONI).

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N}(RDI_i - SPI_i)^2}{N}} \quad (5)$$

3. Results and Discussion

3.1. Comparison between SPI and RDI

The temporal characteristics between SPI and RDI at Lakeya and Biyonga station, in general, indicates a similar pattern. In other words, there are no differences in the index value of the two methods at the same time. Based on Fig. 2, the drought severity index was below normal in SPI-3 detected in 1982, 1983, 1987, 1991, 1992, 1997, 1998, 2002, 2012, 2015, and 2016. In SPI-6, the dry was detected simultaneously in SPI and RDI in 1982, 1992, 1997, 1998, 2002, 2015, and 2016. The dry, in SPI-12, was detected in 1982, 1992, 2002, and 2015. The situation revealed that the high time scale led to a decline in the events of drought. Moreover, the years where drought was identified correlated with the El-Nino event, despite changes in the time scale.

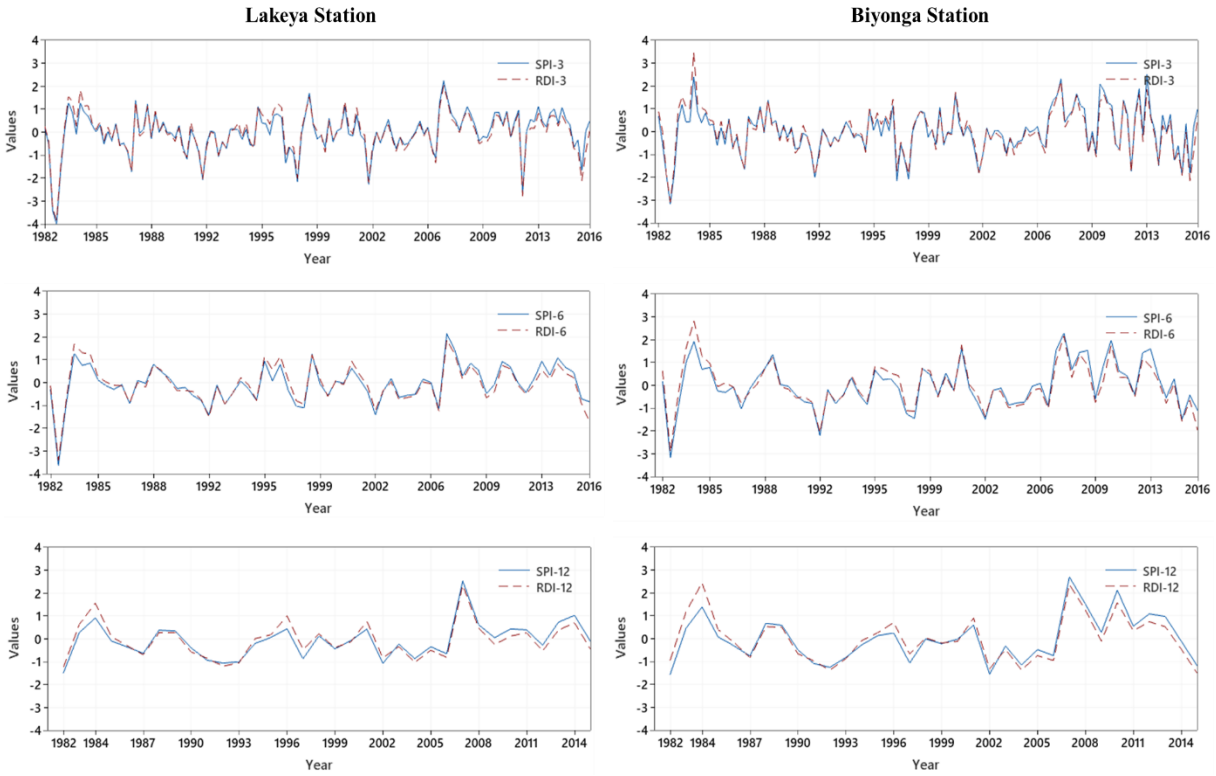

Figure 2. SPI and RDI time series from 1982 to 2016 on different time scales

The application of time scales (3 and 6 months) was capable of detecting the level of precipitation and seasonal drought [9]. The dry season in 1982 was consistently in scale 3 and 6 months, where the severity index was categorized extreme (below -2). The drought event during the La Nina phase indicated no index value below normal (≤-1). During the La Nina phase, the tendency was the wet season (index value above normal, ≥1) since the phase could trigger rain in the observed station. This condition corresponds to the previous study, where the dry event rarely correlates with La Nina, while the El Nino event could lead to extreme drought [15]. Nevertheless, both El Nino and La Nina result in different responses to the dry and wet season in the research sites.

3.2. Analysis of correlation and performance of SPI and RDI

The Pearson correlation between SPI and RDI showed linear correlation in different time scales (Fig. 3). The correlation value of SPI-3 in stations of Pangahu, Lakeya, Djalaluddin, and Biyonga was at 0.95, 0.97, 0.95, and 0.96 in consecutive order. Moreover, the correlation value of SPI-6 in the stations was at 0.94, 0.96, 0.95, and 0.95 respectively, while that of the SPI-12 was at 0.94, 0.95, 0.92, and 0.94 respectively (Table 2). The numbers signify a strong correlation between the SPI and the RDI. The correlation value was acquired at the p-value of < 0.05 for all stations on different time scales (Fig.3). The p-value of <0.05 illustrates that there is a difference between SPI and RDI value due to the different input of climate variables between both indexes. The SPI only refers to the input of rainfall data, where the RDI estimates the drought index by referring to the variables of rainfall and PET.

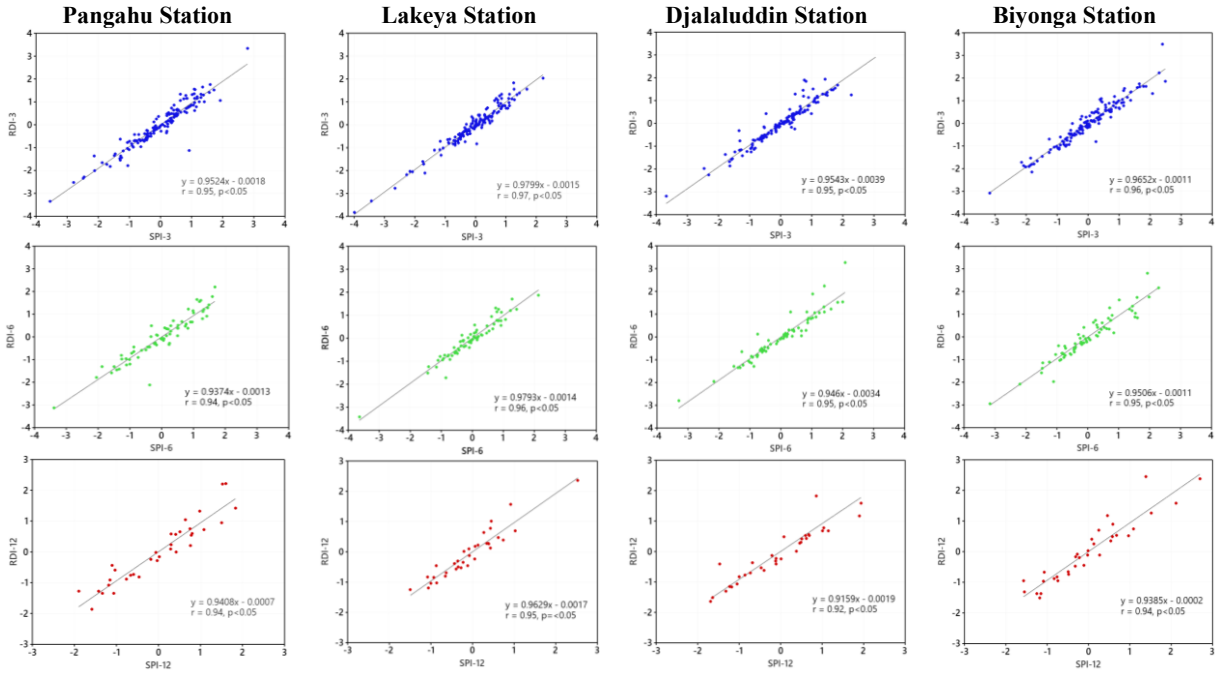

Figure 3. The correlation between SPI and RDI on different timescales

Table 2. Correlation coefficient (r) of SPI and RDI on different time scales

Station	Time scales		
	3	6	12
Pangahu	0.95	0.94	0.94
Lakeya	0.97	0.96	0.95
Djalaluddin	0.95	0.95	0.92
Biyonga	0.96	0.95	0.94

Table 3. The RMSE of the SPI and RDI on different time scales

Station	Time scales		
	3	6	12
Pangahu	0.31	0.35	0.34
Lakeya	0.21	0.23	0.25
Djalaluddin	0.30	0.33	0.41
Biyonga	0.26	0.31	0.35

As observed on the correlation value, the study generates a propensity of correlation value decrease along with the increase in time scale. Similar finding was discovered by a previous study, in which it is stated that the correlation coefficient value between SPI and RDI tended to decrease as the time

scale increased [13]. Table 3 displays the RMSE value of SPI and RDI in different time scales at stations of Pangahu, Lakeya, Djalaluddin, and Biyonga. The RMSE value of SPI-3 and SPI-6 at Pangahu station was the highest (0.31 and 0.35, respectively), while the highest RMSE value in SPI-12 was at Djalaluddin station (0.41). In general, the RMSE value tends to increase along with an increase in time scale; therefore, it is generated that the duration of time scale influences the SPI and RDI index value [13]. The generated correlation and RMSE values only describe the performance of SPI and RDI on a different time scale. That said, in areas with similar climate condition, the test of SPI and RDI performance must be conducted at different altitude level; such tests requires station data that represents the altitude level of the tested area.

3.3. The response of SPI and RDI on ENSO events

Association between drought severity index and ENSO event provides information on the role of ENSO event during a drought period [16]. The ENSO influences the intensity of the seasonal, annual, and potential rainfall at equatorial area [17,18]. The ENSO event consists of two phases, viz. El Nino and La Nina. The phases are monitored through the ONI indicator of the sea surface temperature (SST) anomaly in the Pacific Ocean. Based on the ONI indicator of the magnitude of the SST anomaly, the El Nino and La Nina events are classified into three thresholds, namely weak, moderate, and strong. That being mentioned, the drought severity index of SPI and RDI is continuously observed in each phase of ENSO events from 1982 to 2016 to acquire a descriptive data of ENSO events towards the drought dynamics.

Table 4. ENSO events and drought conditions based on SPI and RDI 3

ONI[b]	Year	Pangahu		Lakeya		Djalaluddin		Biyonga	
		SPI-3	RDI-3	SPI-3	RDI-3	SPI-3	RDI-3	SPI-3	RDI-3
SE	1982[a]/83	-3.55	-3.35	-3.99	-3.83	-3.68	-3.18	-3.17	-3.09
WL	1984[a]/85	2.80	3.34	1.26	1.82	3.06	4.17	2.40	3.48
ME	1986/87[a]	-1.72	-1.74	-1.71	-1.72	-1.58	-1.58	-1.64	-1.66
SL	1988[a]/89	1.30	1.19	1.20	1.13	1.08	1.03	1.10	1.04
ME	1991/92[a]	-2.11	-2.00	-2.07	-2.06	-2.31	-2.26	-2.01	-1.92
WE	1994[a]/95	0.21	0.47	0.13	0.38	0.17	0.06	-0.12	0.02
WL	1995[a]/96	0.26	0.54	0.40	0.75	0.63	0.74	0.06	0.33
SE	1997[a]/98	-2.79	-2.51	-2.16	-2.03	-1.64	-1.67	-2.08	-1.87
ML	1998[a]/99	1.72	1.53	1.70	1.55	1.49	1.37	0.91	0.88
WL	2000[a]	0.89	0.77	0.58	0.51	1.09	1.01	1.08	0.91
ME	2002[a]/03	-2.47	-2.34	-2.26	-2.18	-1.55	-1.54	-1.82	-1.81
WE	2004[a]/05	-0.52	-0.72	-0.55	-0.79	-0.81	-1.08	-0.72	-1.02
WE	2006[a]/07	-1.30	-1.47	-1.14	-1.34	-0.29	-0.44	-0.70	-0.95
ML	2007/08[a]	1.25	1.00	0.52	0.38	1.68	1.47	0.40	0.20
ME	2009[a]/10	-0.31	-0.49	-0.18	-0.40	-0.96	-1.10	0.00	-0.18
ML	2010[a]/11	1.58	1.42	0.87	0.76	1.75	1.55	1.79	1.63
SE	2015[a]/16	-1.01	-1.08	-0.66	-0.73	-1.58	-1.58	-1.90	-1.90

[a]The year of ENSO peak

[b]Strong La Nina (SL), Moderate La Nina (ML), Weak La Nina (WL), Strong El Nino (SE), Moderate El Nino (ME), Weak El Nino (WE). Highlight red color shows dry period (below normal), highlight turquoise color shows wet period (above normal)

From 1982 to 2016, the observation detected three weak El Nino events, four moderate events, and three strong events. During the time frame, the strong La Nina phase occurred once, while the weak and moderate phase occurred three times each. Table 4 displays the ENSO events and the SPI-3 and RDI-3 drought in the observed stations. The weak El Nino phase in 1994/95 and 2004/05 showed normal condition, while in 2006/07, the SPI-3 and RDI-3 in Pangahu and Lakeya station were moderately dry category. In the meantime, instead of indicating a dry period, the weak La Nina phase in 1984/85, 1995/96, and 2000 in SPI-3 and RDI-3 indicated normal and wet periods. In 1984/85, all stations indicated wet period with extremely wet category (see Table 4).

During the moderate El Nino phases in 1986/87, 1991/92, and 2002/03, all observed stations displayed dry period in severely dry and extremely dry category. In spite of that, the moderate El Nino phase in 2009/10 (with its peak in December 2009) displayed normal conditions. During this phase, the dry period occurred in early 2010 (between January-March) with moderately dry category; however, the event only occurred in some stations. In the moderate La Nina phases in 1998/99, 2007/08, and 2010/11, all observed stations did not indicate a dry period; rather, the stations displayed relatively varied normal and wet conditions. During the strong El Nino phases in 1982/83 and 1997/98, all observed stations displayed extreme drought period at severely dry up to extremely dry category. In 2015/16, the SPI-3 and RDI-3 index tended to indicate a dry period with variation of normal up to severely dry category (Table 4). In all stations, the strong La Nina phase only occurred in 1988/89. The phase indicated a moderately wet period.

Table 5. ENSO events and drought conditions based on SPI and RDI 6

ONI[b]	Year	Pangahu		Lakeya		Djalaluddin		Biyonga	
		SPI-6	RDI-6	SPI-6	RDI-6	SPI-6	RDI-6	SPI-6	RDI-6
SE	1982[a]/83	-3.39	-3.12	-3.63	-3.42	-3.29	-2.79	-3.16	-2.94
WL	1984[a]/85	1.68	2.20	0.76	1.31	2.08	3.28	1.92	2.82
ME	1986/87[a]	-1.12	-0.95	-0.93	-0.90	-1.51	-1.29	-1.04	-0.78
SL	1988[a]/89	0.52	0.51	0.80	0.78	0.90	0.83	0.73	0.73
ME	1991/92[a]	-2.04	-1.78	-1.43	-1.52	-2.16	-1.95	-2.20	-2.08
WE	1994[a]/95	-0.13	0.07	-0.28	-0.10	-0.33	-0.31	-0.41	-0.29
WL	1995[a]/96	0.99	1.17	0.94	1.13	1.10	1.06	0.66	0.83
SE	1997[a]/98	-0.94	-0.72	-1.03	-0.80	-1.22	-1.22	-1.25	-1.11
ML	1998[a]/99	1.50	1.42	1.23	1.21	1.03	0.85	0.74	0.74
WL	2000[a]	0.29	0.26	0.06	0.07	0.86	0.62	0.53	0.42
ME	2002[a]/03	-1.49	-1.31	-1.41	-1.23	-1.38	-1.35	-1.48	-1.38
WE	2004[a]/05	-0.49	-0.57	-0.56	-0.65	-0.78	-0.81	-0.77	-0.90
WE	2006[a]/07	-1.33	-1.41	-1.15	-1.25	-0.54	-0.58	-0.90	-1.03
ML	2007/08[a]	1.29	0.80	0.30	0.15	1.63	1.23	0.69	0.35
ME	2009[a]/10	-0.74	-0.90	-0.48	-0.67	-1.00	-1.10	-0.57	-0.74
ML	2010[a]/11	1.45	1.28	0.92	0.75	1.84	1.52	1.98	1.77
SE	2015[a]/16	-1.10	-1.23	0.46	0.22	-1.05	-1.05	-1.49	-1.58

[a]The year of ENSO peak
[b]Strong La Nina (SL), Moderate La Nina (ML), Weak La Nina (WL), Strong El Nino (SE), Moderate El Nino (ME), Weak El Nino (WE). Highlight red color shows dry period (below normal), highlight turquoise color shows wet period (above normal)

The SPI-6 and RDI-6 index in the weak El Nino phase in 1994/95 and 2004/05 showed normal condition, while in 2006/07, both indexes simultaneously indicated a dry condition in Pangahu and Lakeya stations with moderately dry category (Table 5). In the meantime, the weak La Nina phase in 1984/85, 1995/96, and 2000 indicated normal and wet periods. On top of that, the moderate El Nino phase in 1991/92 displayed severe drought period with severely dry and extremely dry category, while in 2002/03, all observed stations indicated moderately dry category. In general, the events in 1986/87 and 2009/10 displayed normal and moderately dry category (see Table 5). The SPI-6 and RDI-6 index in the moderate and strong La Nina phase displayed normal and dry condition in all stations. The SPI-6 and RDI-6 index in the strong El Nino phase in 1982/83 showed severe drought (index value <-2) as displayed in SPI-3 and RDI-3; while in 1997/98 and 2015/16, the SPI-6 and RDI-6 indexes showed normal and moderately dry condition (Table 5). The ENSO phenomenon that occurred from 1982 to 2016 suggested that the frequency of dry period was higher than wet period in the scale of 3 and 6. The drought's frequency and severity increased after 1980/81; in most cases, the drought coincided with the El Nino event [19].

The identification on the weak El Nino phase indicated that SPI-12 and RDI-12 generally showed an identical condition (as displayed in the 3 and 6 index scale); all observed stations displayed normal condition (Table 6). The moderate El Nino phase in 1991/92 and 2002/03 showed moderate drought

that occurred evenly in all observed stations; however, the phase in 1986/87 and 2009/10 displayed normal condition (Table 6). The strong El Nino phase in 1982/83, 1997/98, and 2015/16 consistently showed dry condition, albeit the indication of normal condition displayed by SPI-12 and RDI-12 in the stations. On top of that, all scales of La Nina phases from 1982 to 2016 did not indicate a dry period at the stations (Table 6). The results showed that an increase in time scale causes the drought severity to decrease, from severe to normal. As based on the data acquired from the observed stations, a strong El Nino phase can be impactful to the seasonal and annual drought period in Gorontalo regency. In addition to that, there is a shift of ±1-3 months between the peak of the El Nino phase and the dry period in SPI-3 and RDI-3.

Table 6. ENSO events and drought conditions based on SPI and RDI 12

ONI[b]	Year	Pangahu		Lakeya		Djalaluddin		Biyonga	
		SPI-12	RDI-12	SPI-12	RDI-12	SPI-12	RDI-12	SPI-12	RDI-12
SE	1982[a]/83	-1.89	-1.27	-1.49	-1.25	-1.47	-0.41	-1.57	-0.96
WL	1984[a]/85	1.52	2.20	0.92	1.56	1.85	3.16	1.39	2.44
ME	1986/87[a]	-0.66	-0.75	-0.63	-0.69	-1.32	-1.31	-0.76	-0.82
SL	1988[a]/89	0.78	0.54	0.38	0.27	0.69	0.52	0.67	0.53
ME	1991/92[a]	-1.33	-1.35	-1.06	-1.19	-1.18	-1.17	-1.25	-1.37
WE	1994[a]/95	0.30	0.58	-0.20	0.01	-0.21	-0.13	-0.27	-0.09
WL	1995[a]/96	0.51	0.65	0.06	0.18	0.60	0.52	0.13	0.26
SE	1997[a]/98	-1.10	-0.44	-0.87	-0.46	-0.85	-0.78	-1.06	-0.67
ML	1998[a]/99	0.76	0.75	0.14	0.22	0.38	0.01	-0.01	0.03
WL	2000[a]	-0.18	-0.25	-0.07	-0.13	0.49	0.31	-0.02	-0.12
ME	2002[a]/03	-1.03	-0.59	-1.07	-0.83	-1.63	-1.52	-1.55	-1.31
WE	2004[a]/05	-0.76	-0.88	-0.86	-1.03	-1.05	-1.06	-1.15	-1.37
WE	2006[a]/07	-0.59	-0.74	-0.65	-0.81	-0.47	-0.54	-0.74	-0.95
ML	2007/08[a]	1.83	1.42	0.62	0.47	1.93	1.59	1.51	1.26
ME	2009[a]/10	-0.46	-0.82	0.05	-0.24	-0.40	-0.62	0.27	-0.11
ML	2010[a]/11	1.51	0.95	0.43	0.12	1.89	1.17	2.12	1.58
SE	2015[a]/16	-1.59	-1.87	-0.11	-0.45	-1.68	-1.64	-1.18	-1.51

[a]The year of ENSO peak
[b]Strong La Nina (SL), Moderate La Nina (ML), Weak La Nina (WL), Strong El Nino (SE), Moderate El Nino (ME), Weak El Nino (WE). Highlight red color shows dry period (below normal), highlight turquoise color shows wet period (above normal)

Table 7. The average value of the index on ENSO events

Oceanic Nino Index	Time Scales					
	SPI-3	SPI-6	SPI-12	RDI-3	RDI-6	RDI-12
Weak El Nino	-0.47	-0.64	-0.55	-0.57	-0.65	-0.58
Moderate El Nino	-1.54	-1.31	-0.88	-1.56	-1.25	-0.92
Strong El Nino	-2.35	-1.76	-1.24	-2.24	-1.65	-0.98
Weak La Nina	1.21	0.99	0.60	1.53	1.26	0.90
Moderate La Nina	1.31	1.22	1.09	1.15	1.01	0.80
Strong La Nina	1.17	0.74	0.63	1.10	0.71	0.47

Based on the average index value at the ENSO events, the RDI estimates lower index value compared to SPI in weak and moderate El Nino phases; on the other hand, the RDI estimates higher index value than SPI in strong El Nino phases. Both indexes tend to produce similar results in estimating the wet period in the weak, moderate, and strong La Nina phases. The SPI and RDI in scale of 3, 6, and 12 displayed negative value; therefore, the El Nino is regarded to signal a dry event, particularly at the moderate and strong scale (Table 7). In addition, the La Nina events only signaled wet period. This is reflected in the positive value in SPI and RDI index in the scales of 3, 6, and 12 (Table 7). Such results indicate that the ENSO affects the rainfall and drought dynamics in Gorontalo

regency. Therefore, the prediction requires focusing on the local drought to discover the main reason for local rainfall variation aside from ENSO [20].

4. Conclusion

From 1982 to 2016, drought occurred more frequently in the time scale of 3 and 6 compared to the scale of 12. Overall, the ENSO yields varied impacts on drought. Dry period can occur in moderate and strong El Nino phases, while weak El Nino phases tend to show normal conditions in general. That being mentioned, the ENSO is considered as a valid indicator in predicting drought events in Gorontalo regency. In addition, it is also applicable as an instrument in a drought early warning system to predict drought events and drought management in the research area [19]. Estimation of drought index that uses climate data such as rainfall and temperature is applicable in observing meteorological drought, agricultural drought, as well as hydrological drought; such conducts are essential to the effective planning and management of water resources in every area [16].

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