Climate Indices Methodology

Last update : 6 April 2026

Abb.	Used Var.	Used data	Reference	Description
NINO12	SST	NOAA ERSST v5	Trenberth, K. E., and David P. Stepaniak , 2001: Indices of El Niño evolution. Journal of Climate., 14, 1697-1701	The Niño1+2 SST anomaly (SSTA) index is an indicator of far eastern tropical Pacific El Niño conditions, off the coasts of Peru and Chile. It is calculated with SSTs in the box 90°W - 80°W, 10°S - 0°. Climatological mean period is 1991-2020.
NINO3	SST	NOAA ERSST v5	Trenberth, Kevin E., 1997: The Definition of El Niño. Bull. Amer. Meteor. Soc., 78, 2771–2777	The Niño3 SSTA index is an indicator of eastern tropical Pacific El Niño conditions. It is calculated with SSTs in the box 150°W - 90°W, 5°S - 5°N. Climatological mean period is 1991-2020.
NINO34	SST	NOAA ERSST v5	Trenberth, Kevin E., 1997: The Definition of El Niño. Bull. Amer. Meteor. Soc., 78, 2771–2777	The Niño3.4 SSTA index is an indicator of central tropical Pacific El Niño conditions. It is calculated with SSTs in the box 170°W - 120°W, 5°S - 5°N. Climatological mean period is 1991-2020.
NINO4	SST	NOAA ERSST v5	Trenberth, K. E., and David P. Stepaniak , 2001: Indices of El Niño evolution. Journal of Climate., 14, 1697-1701	The Niño4 SSTA index is an indicator of western tropical Pacific El Niño conditions. It is calculated with SSTs in the box 160°E - 150°W, 5°S - 5°N. Climatological mean period is 1991-2020.
ONI	SST	NOAA ERSST v5	Yu, J. Y. and Kim, S. T.: Identifying the types of major El Niño events since 1870, Int. J. Climatol., 33, 2105–2112, doi:10.1002/joc.3575, 2013 http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_change.shtml	The Oceanic Nino Index (ONI) is one of the primary indices used to monitor the El Nino-Southern Oscillation (ENSO). The ONI is calculated by averaging sea surface temperature anomalies in an area of the east-central equatorial Pacific Ocean (5°S - 5°N, 170°W - 120°W), based on changing base period which consist of multiple centered 30-year base periods. Also, a 3-month time average (running mean) is calculated in order to better isolate variability closely related to the ENSO phenomenon.
TNI	SST	NOAA ERSST v5	Kevin E. Trenberth and David P. Stepaniak, 2001: Indices of El Niño Evolution. J. Climate, 14, 1697–1701.	Trans-Niño index (TNI), can be given by the difference between the normalized SST anomalies averaged in the Niño-1+2 and Niño-4 regions.
EMI	SST	NOAA ERSST v5	Ashok, K., S. K. Behera, S. A. Rao, H. Weng and T. Yamagata, 2007. El Nino Modoki and its possible teleconnection. J. Geophys. Res., 112, C11007, doi:10.1029/2006JC003798.	$EMI = [SSTA]_A - 0.5*[SSTA]_B - 0.5*[SSTA]_C$ The brackets in equation represent the area-averaged SSTA over each of the region A (165°E–140°W, 10°S–10°N), B (110°W–70°W, 15°S–5°N), and C (125°E–145°E, 10°S–20°N), respectively. Climatological mean period is 1991-2020.

DMI	SST	NOAA ERSST v5	Saji, N. H., B. N. Goswami, P. N. Vinayachandran and T. Yamagata, 1999. A Dipole Mode in the tropical Indian Ocean. Nature, 401 (23): 360363.	the Indian Ocean Dipole Mode Index (DMI) is defined as the SSTA difference between the western (50°E-70°E, 10°S-10°N) and southeastern (90°E-110°E, 10°S to equator) regions of the tropical Indian Ocean. Climatological mean period is 1991-2020.
TNA	SST	NOAA ERSST v5	Enfield, D.B., A.M. Mestas, D.A. Mayer, and L. Cid-Serrano (1999), How ubiquitous is the dipole relationship in tropical Atlantic sea surface temperatures?, JGR-O, 104, 7841-7848	The Tropical North Atlantic Index is Anomaly of the average of the monthly SST from 5.5°N-23.5°N and 15°W-57.5°W. Climatological mean period is 1991-2020.
TSA	SST	NOAA ERSST v5	Enfield, D.B., A.M. Mestas, D.A. Mayer, and L. Cid-Serrano (1999), How ubiquitous is the dipole relationship in tropical Atlantic sea surface temperatures, JGR-O, 104, 7841-7848	The Tropical South Atlantic Index is Anomaly of the average of the monthly SST from Eq-20°S and 10°E-30°W. Climatological mean period is 1991-2020.
ATLTRI	SST	NOAA ERSST v5	Deser, Clara, Michael S. Timlin, 1997: Atmosphere-Ocean Interaction on Weekly Timescales in the North Atlantic and Pacific. Journal of Climate: Vol. 10, No. 3, pp.393-408	1st EOF Timeseries of SST 10°N-70°N, 0-80°W. The base period used to analyze EOF is 1991-2020.
PNA	Z500	CORe monthly	Wallace, J. M.D. S. Gutzler, 1981: Teleconnections in the geopotential height field during the Northern Hemisphere winter, Mon. Wea., Rev., 109, 784–812.	One of the most prominent modes of low-frequency variability in the Northern Hemisphere extratropics where z* is the normalized 500 mb geopotential height anomaly, i.e., the height departure from the mean divided by the standard deviation. z* is normalized using the 1991-2020 base period monthly means and standard deviations. PNA = ¼ [z* (20°N, 160°W) -z*(45°N, 165°W) + z* (55°N, 115°W)- z*(30°N, 85°W)]
WP	Z500	CORe monthly	Barnston, A.G., and R.E. Livezey, 1987: Classification, seasonality and persistence of low - frequency atmospheric circulation patterns. Mon. Wea. Rev., 115, 1083-1126. Wallace J.M., and D.S. Gutzler, 1981: Teleconnections in the geopotential height field during the Northern hemisphere Winter. Mon. Wea. Rev., 109, 784-812.	The WP pattern is a primary mode of low-frequency variability over the North Pacific in all months, and has been previously described by both Barnston and Livezey (1987) and Wallace and Gutzler (1981). Climatological mean period is 1991-2020.
NP	SLP	CORe monthly	Trenberth, K. E. and J. W. Hurrell (1994): Decadal atmosphereocean variations in the Pacific. Clim. Dyn., 9, 303–319.	Area-weighted sea level pressure over the region 30°N-65°N, 160°E-140°W.

AO	Z1000	CORe monthly	COHEN, J., and M. Barlow, 2005, The NAO, the AO, and Global warming: How closely related?, J. Climate, 18, 4498-4513.	To identify the leading teleconnection patterns in the atmospheric circulation, Emperical Orthogonal Function (EOF) was applied to the monthly mean 1000-hPa height anomalies poleward of 20° latitude for the Northern Hemisphere. The base period used to analyze EOF is 1991-2020. The loading pattern of AO is defined as the first leading mode from the EOF analysis of monthly mean height anomalies at 1000-hPa.
AAO	Z700	CORe monthly	Abram, N, Mulvaney, R, Vimeux, F et al 2014, 'Evolution of the Southern Annular Mode during the past millennium', Nature Climate Change, vol. 4, no. 7, pp. 564-569.	To identify the leading teleconnection patterns in the atmospheric circulation, Emperical Orthogonal Function (EOF) was applied to the monthly mean 700-hPa height anomalies poleward of 20° latitude for the Southern Hemisphere. The base period used to analyze EOF is 1991-2020. The loading pattern of AAO is defined as the first leading mode from the EOF analysis of monthly mean height anomalies at 700-hPa.
NAO	SLP	CORe monthly	Hurrell, J. W., and C. Deser, 2009: North Atlantic climate variability: The role of the North Atlantic Oscillation. J. Mar. Syst., 78, No. 1, 28-41	The principal component (PC)-based indices of the North Atlantic Oscillation (NAO) are the time series of the leading Empirical Orthogonal Function (EOF) of SLP anomalies over the Atlantic sector, 20°-80°N, 90°W-40°E. The base period used to analyze EOF is 1960-2020.
SOI	SLP	CORe monthly	Trenberth, K. E., & Shea, D. J., 1987: On the evolution of the Southern Oscillation. Monthly Weather Review, 115, 3078–3096.	The development and intensity of El Niño or La Niña events in the Pacific Ocean, calculated using the pressure differences between Tahiti and Darwin SLP(Tahiti, 18S,150°W)-SLP(Darwin, 10°S,130°E) Note the anomalies are departures from the 1991-2020 base period.
QBO	U30	CORe monthly	Baldwin, M.P. et al, 2001: The Quasi-Biennial Oscillation. Reviews of Geophys., 39, 179-229	Calculated at PSD (from the zonal average of the 30mb zonal wind at the equator as computed from the NCEP/NCAR Reanalysis).
WYI	U850 U200	CORe monthly	Webster, P.J., and S.Yang, 1992: Monsoon and ENSO: Selectively interactive systems. Quart. J. Roy. Meteor. Soc., 118, 877-926.	U850 minus U200 averaged over 0-20°N, 40°E-110°E. Index data is normalized between 1991-2020.
AUSMI	U850	CORe monthly	Kajikawa, Y., B. Wang and J. Yang, 2010: A multi-time scale Australian monsoon index, Int. J. Climatol, doi: 10.1002/joc.1955.	U850 averaged over 5°S-15°S, 110°E–130°E. Index data is normalized between 1991-2020.
SAMI	V850 V200	CORe monthly	Goswami, B. N., B. Krishnamurthy, and H. Annamalai, 1999: A broad-scale circulation index for interannual variability of the Indian summer	V850 minus V200 averaged over 10-30°N, 70°E-110°E. Index data is normalized between 1991-2020.

			monsoon. Quart. J. Roy. Meteor. Soc., 125, 611-633.	
IMI	U850	CORe monthly	Wang, B., R. Wu, K.-M. Lau, 2001: Interannual variability of Asian summer monsoon: Contrast between the Indian and western North Pacific-East Asian monsoons. J. Climate, 14, 4073-4090.	U850(5°N-15°N , 40°E-80°E) minus U850(20°N-30°N , 70°E-90°E). Index data is normalized between 1991-2020.
WNPMI	U850	CORe monthly	Wang, B., R. Wu, K.-M. Lau, 2001: Interannual variability of Asian summer monsoon: Contrast between the Indian and western North Pacific-East Asian monsoons. J. Climate, 14, 4073-4090.	U850(5°N-15°N, 100°E-130°E) minus U850(20°N-30°N , 110°E-140°E). Index data is normalized between 1991-2020.