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Change in strong Eastern Pacific El Niño events dynamics in the warming climate

Carréric, A.; Dewitte, B.; Cai, W.; Capotondi, A.; Takahashi, Ken; Yeh, Sang-Wook; Wang, Guojian; Guémas, V. (2019) Change in strong Eastern Pacific El Niño events dynamics in the warming climate. *Climate Dynamic* 54**:** 901–918. Doi: 10.1007/s00382-019-05036-0

Abstract

While there is evidence that ENSO activity will increase in association with the increased vertical stratification due to global warming, the underlying mechanisms remain unclear. Here we investigate this issue using the simulations of the NCAR Community Earth System Model Large Ensemble (CESM-LE) Project focusing on strong El Niño events of the Eastern Pacific (EP) that can be associated to flooding in Northern and Central Peru. It is shown that, in the warmer climate, the duration of strong EP El Niño events peaking in boreal winter is extended by two months, which results in significantly more events peaking in February–March–April (FMA), the season when the climatological Inter-Tropical Convergence Zone is at its southernmost location. This larger persistence of strong EP events is interpreted as resulting from both a stronger recharge process and a more effective thermocline feedback in the eastern equatorial Pacific due to increased mean vertical stratification. A heat budget analysis reveals in particular that the reduction in seasonal upwelling rate is compensated by the increase in anomalous vertical temperature gradient within the surface layer, yielding an overall increase in the effectiveness of the thermocline feedback. In CESM-LE, the appearance of strong EP El Niño events peaking in FMA accounts for one-quarter of the increase in frequency of occurrence of ENSO-induced extreme precipitation events, while one-third results from weak-to-moderate El Niño events that triggers extreme precipitation events because of the warmer mean SST becoming closer to the convective threshold. In CESM-LE, both the increase in mean EP SST and the change in ENSO processes thus contribute to the increase in extreme precipitation events in the warmer climate.

Evaluation of GPM-era Global Satellite Precipitation Products over Multiple Complex Terrain Regions

Derin, Y.; Anagnostou, E.; Berne, A., Borga, M.; Boudevillain, B.; Buytaert, W.; Chang, C.-H.; …. Yilmaz, K.K (2019) Evaluation of GPM-era Global Satellite Precipitation Products over Multiple Complex Terrain Regions. Remote Sens. 11 (24): 2936. doi: **10.3390/rs11242936**

Open Access

Abstract

The great success of the Tropical Rainfall Measuring Mission (TRMM) and its successor Global Precipitation Measurement (GPM) has accelerated the development of global high-resolution satellite-based precipitation products (SPP). However, the quantitative accuracy of SPPs has to be evaluated before using these datasets in water resource applications. This study evaluates the following GPM-era and TRMM-era SPPs based on two years (2014–2015) of reference daily precipitation data from rain gauge networks in ten mountainous regions: Integrated Multi-Satellite Retrievals for GPM (IMERG, version 05B and version 06B), National Oceanic and Atmospheric Administration (NOAA)/Climate Prediction Center Morphing Method (CMORPH), Global Satellite Mapping of Precipitation (GSMaP), and Multi-Source Weighted-Ensemble Precipitation (MSWEP), which represents a global precipitation data-blending product. The evaluation is performed at daily and annual temporal scales, and at 0.1 deg grid resolution. It is shown that GSMaPV07 surpass the performance of IMERGV06B Final for almost all regions in terms of systematic and random error metrics. The new orographic rainfall classification in the GSMaPV07 algorithm is able to improve the detection of orographic rainfall, the rainfall amounts, and error metrics. Moreover, IMERGV05B showed significantly better performance, capturing the lighter and heavier precipitation values compared to IMERGV06B for almost all regions due to changes conducted to the morphing, where motion vectors are derived using total column water vapor for IMERGV06B.

Summertime precipitation deficits in the southern Peruvian highlands since 1964

Imfeld, N.; Barreto Schuler, C.; Correa Marrou, K.M.; Jacques-Copes, M; Sedlmeier, K.; Gubler, S.; Huerta, A.; Brönnimann, S. (2019). International Journal of Climatology, 39 (11): 4497-4513. Doi: **10.1002/joc.6087**

Open Access

Abstract

Precipitation deficits remain a concern to the rural population in the southern Peruvian highlands and knowledge about their occurrence is lacking because of scarce data availability. For mountainous regions with sparse station networks, reanalyses can provide valuable information; however, known limitations in reproducing precipitation are aggravated due to unresolved topographical effects. In this study, we assess in a first step the representation of precipitation during the rainy season (January–February–March) in seven reanalysis data sets in comparison to a newly generated gridded precipitation data set for Peru. In a second step, we assess summer precipitation deficits in Peru during the second half of the 20th century.

In the reanalyses data sets, we find biases strongly influenced by the topography of the models and low correlations for the rainy season. Thus, reanalyses do not solve the problem of data scarcity for this region either. Furthermore, we confirm that El Niño is not a sufficient stratification criterion for precipitation deficits during the rainy season (JFM) in the southern Peruvian highlands. Based on observational records and reanalyses, a considerable fraction of inter-annual variability of precipitation can be explained through upper-tropospheric zonal wind anomalies. Westerly wind anomalies, often related to the warming of the troposphere during an El Niño event, lead to dry conditions, but not all El Niño events produce these westerly wind anomalies. Atmospheric simulations indicate differences between precipitation deficits in central Pacific and eastern Pacific El Niño flavours, which cannot be addressed in observations due to reduced record length: Droughts in the southern Peruvian Andes during eastern Pacific El Niño events seem to be related to a stronger warming in the troposphere above the central Pacific ocean, whereas this is not the case for droughts during central Pacific El Niño events. These results, however, need to be further corroborated by model studies and palaeoclimatological research.

Heavy snowfalls in the peruvian andes: the wettest winter of the last 19 years

Ramos, I.; Aliaga, V.; Castro A.Y. (2019) Heavy snowfalls in the peruvian andes: the wettest winter of the last 19 years. State of the climate in 2018. America Meteorological Society, 100 (9): 203 – 221. doi: **10.1175/2019BAMSStateoftheClimate.1**

Open Access

Reseña

Esta investigación permitió conocer la frecuencia de nevadas en el Perú durante los últimos 19 años utilizando imágenes de satélite, asimismo permitió determinar los años y meses en los cuales ocurrieron los eventos más intensos, así como la circulación atmosférica asociada a estos.

Ocean climate observing requirements in support of Climate Research and Climate Information.

Stammer, D.; Bracco, A.; AchutaRao, K.; Beal, L.; Bindoff, Nathaniel; Braconnot, Pascale; Cai, Wenju; …. Vialard, J. (2019) Ocean climate observing requirements in support of Climate Research and Climate Information. Frontiers in Marine Science, 6:444. **doi: 10.3389/fmars.2019.00444**

Abstract
Natural variability and change of the Earth's climate have significant global societal impacts. With its large heat and carbon capacity and relatively slow dynamics, the ocean plays an integral role in climate, and provides an important source of predictability at seasonal and longer timescales. In addition, the ocean provides the slowly evolving lower boundary to the atmosphere, driving, and modifying atmospheric weather. Understanding and monitoring ocean climate variability and change, to constrain and initialize models as well as identify model biases for improved climate hindcasting and prediction, requires a scale-sensitive, and long-term observing system. A climate observing system has requirements that significantly differ from, and sometimes are orthogonal to, those of other applications. In general terms, they can be summarized by the simultaneous need for both large spatial and long temporal coverage, and by the accuracy and stability required for detecting the local climate signals. This paper reviews the requirements of a climate observing system in terms of space and time scales, and revisits the question of which parameters such a system should encompass to meet future strategic goals of the World Climate Research Program (WCRP), with emphasis on ocean and sea-ice covered areas. It considers global as well as regional aspects that should be accounted for in designing observing systems in individual basins. Furthermore, the paper discusses which data-driven products are required to meet WCRP research and modeling needs, and ways to obtain them through data synthesis and assimilation approaches. Finally, it addresses the need for scientific capacity building and international collaboration in support of the collection of high-quality measurements over the large spatial scales and long time-scales required for climate research, bridging the scientific rational to the required resources for implementation.

Determining payments for watershed services by hydro-economic modeling for optimal water allocation between agricultural and municipal water use.

Havisto, R.; Santos, D.; Perrels, A. (2019). Determining payments for watershed services by hydro-economic modeling for optimal water allocation between agricultural and municipal water use. Water Resources and Economics 26 (100127). doi: 10.1016/j.wre.2018.08.003

Reseña

La creciente demanda de agua agrícola y poblacional (municipal), así como el creciente estrés sobre los cuerpos de agua, anhelan una gestión eficiente y sostenible del agua. Es así, que es importante explorar instrumentos de política basados en evidencia que logren el uso sostenible del agua de una manera que sea óptima tanto para los habitantes como para los agricultores al mismo tiempo. Una forma es la determinación de tasas de pagos por servicios de cuenca, obtenido a traves de un modelo hidroeconómico.

Highly structured slow solar wind emerging from an equatorial coronal hole

Bale, SD, Badman, ST, Bonnell, JW *et al.* (2019). Viento solar lento altamente estructurado que emerge de un agujero coronal ecuatorial. Nature 576 (7786): 237–242. doi: 10.1038/s41586-019-1818-7

Abstract

During the solar minimum, when the Sun is at its least active, the solar wind[1,2] is observed at high latitudes as a predominantly fast (more than 500 kilometres per second), highly Alfvénic rarefied stream of plasma originating from deep within coronal holes. Closer to the ecliptic plane, the solar wind is interspersed with a more variable slow wind[3] of less than 500 kilometres per second. The precise origins of the slow wind streams are less certain[4]; theories and observations suggest that they may originate at the tips of helmet streamers[5,6], from interchange reconnection near coronal hole boundaries[7,8], or within coronal holes with highly diverging magnetic fields[9,10]. The heating mechanism required to drive the solar wind is also unresolved, although candidate mechanisms include Alfvén-wave turbulence[11,12], heating by reconnection in nanoflares[13], ion cyclotron wave heating[14] and acceleration by thermal gradients[1]. At a distance of one astronomical unit, the wind is mixed and evolved, and therefore much of the diagnostic structure of these sources and processes has been lost. Here we present observations from the Parker Solar Probe[15] at 36 to 54 solar radii that show evidence of slow Alfvénic solar wind emerging from a small equatorial coronal hole. The measured magnetic field exhibits patches of large, intermittent reversals that are associated with jets of plasma and enhanced Poynting flux and that are interspersed in a smoother and less turbulent flow with a near-radial magnetic field. Furthermore, plasma-wave measurements suggest the existence of electron and ion velocity-space micro-instabilities[10,16] that are associated with plasma heating and thermalization processes. Our measurements suggest that there is an impulsive mechanism associated with solar-wind energization and that micro-instabilities play a part in heating, and we provide evidence that low-latitude coronal holes are a key source of the slow solar wind.

A step closer to the Sun's secrets

Verscharen, D. (2019) A step closer to the Sun's secrets. Nature 576 (7786): 219-220. doi: 10.1038/d41586-019-03665-3

Abstract

Although the Sun is quite near to us compared with other stars, it has always kept intriguing and fundamental scientific secrets from us. For instance, we still don't know how the solar corona — the Sun's outermost atmosphere — maintains temperatures in excess of one million kelvin, whereas the visible surface has temperatures of just below 6,000 K[1]. The corona produces the solar wind, an outflow of plasma particles (free ions and electrons) that expands into the space between the planets. In 2018, NASA launched the Parker Solar Probe[2] (PSP) with the aim of identifying the mechanisms behind the heating of the corona and the acceleration of the solar wind. Four papers in *Nature*[3–6] report the first results from the PSP.

The measurements from the PSP were taken when the spacecraft was as close as 24 million kilometres to the Sun (for comparison, the average distance between Mercury and the Sun is about 58 million kilometres). They show that the solar wind near the Sun is much more structured and dynamic than it is at Earth (Fig. 1). Bale *et al.*[3] present measurements of the direction and strength of the Sun's magnetic field, which is dragged out into space by the solar wind. The authors find rapid reversals in the direction of the field that last for only minutes. Although some similar magnetic structures have been seen before[7], the large amplitude and the high occurrence rate of these reversals are surprising. In fact, the nature of these structures remains unknown.

Alfvénic velocity spikes and rotational flows in the near-sun solar wind

Kasper, J. C.; Bale, S. D.; Schwadron, N. A. (2019) Alfvénic velocity spikes and rotational flows in the near-sun solar wind. Nature 576 (7786): 228–231https://www.nature.com/articles/s41586-019-1813-z

Abstract

The prediction of a supersonic solar wind1 was first confirmed by spacecraft near Earth2,3 and later by spacecraft at heliocentric distances as small as 62 solar radii4. These missions showed that plasma accelerates as it emerges from the corona, aided by unidentified processes that transport energy outwards from the Sun before depositing it in the wind. Alfvénic fluctuations are a promising candidate for such a process because they are seen in the corona and solar wind and contain considerable energy5,6,7. Magnetic tension forces the corona to co-rotate with the Sun, but any residual rotation far from the Sun reported until now has been much smaller than the amplitude of waves and deflections from interacting wind streams8. Here we report observations of solar-wind plasma at heliocentric distances of about 35 solar radii9,10,11, well within the distance at which stream interactions become important. We find that Alfvén waves organize into structured velocity spikes with duration of up to minutes, which are associated with propagating S-like bends in the magnetic-field lines. We detect an increasing rotational component to the flow velocity of the solar wind around the Sun, peaking at 35 to 50 kilometres per second—considerably above the amplitude of the waves. These flows exceed classical velocity predictions of a few kilometres per second, challenging models of circulation in the corona and calling into question our understanding of how stars lose angular momentum and spin down as they age12,13,14

Near-Sun observations of an F-corona decrease and K-corona fine structure

Howard, R.A., Vourlidas, A., Bothmer, V. *et al.* Near-Sun observations of an F-corona decrease and K-corona fine structure. *Nature* **576,** 232–236 (2019). https://doi.org/10.1038/s41586-019-1807-x

Abstract

Remote observations of the solar photospheric light scattered by electrons (the K-corona) and dust (the F-corona or zodiacal light) have been made from the ground during eclipses1 and from space at distances as small as 0.3 astronomical units2,3,4,5 to the Sun. Previous observations6,7,8 of dust scattering have not confirmed the existence of the theoretically predicted dust-free zone near the Sun9,10,11. The transient nature of the corona has been well characterized for large events, but questions still remain (for example, about the initiation of the corona12 and the production of solar energetic particles13) and for small events even its structure is uncertain14. Here we report imaging of the solar corona15 during the first two perihelion passes (0.16–0.25 astronomical units) of the Parker Solar Probe spacecraft13, each lasting ten days. The view from these distances is qualitatively similar to the historical views from ground and space, but there are some notable differences. At short elongations, we observe a decrease in the intensity of the F-coronal intensity, which is suggestive of the long-sought dust free zone9,10,11. We also resolve the fine-scale plasma structure of very small eruptions, which are frequently ejected from the Sun. These take two forms: the frequently observed magnetic flux ropes12,16 and the predicted, but not yet observed, magnetic islands17,18 arising from the tearing-mode instability in the current sheet. Our observations of the coronal streamer evolution confirm the large-scale topology of the solar corona, but also reveal that, as recently predicted19, streamers are composed of yet smaller substreamers channelling continual density fluctuations at all visible scales.

Data-driven design of metal–organic frameworks for wet flue gas CO2 capture

Boyd, P.G., Chidambaram, A., García-Díez, E. Ireland, Christopher P.; Daff, T.; Bounds, R.; … Smit, B. (2019). Data-driven design of metal–organic frameworks for wet flue gas CO2 capture. Nature 576, 253–256. https://doi.org/10.1038/s41586-019-1798-7

Abstract

Limiting the increase of CO_2 in the atmosphere is one of the largest challenges of our generation1. Because carbon capture and storage is one of the few viable technologies that can mitigate current CO_2 emissions2, much effort is focused on developing solid adsorbents that can efficiently capture CO_2 from flue gases emitted from anthropogenic sources3. One class of materials that has attracted considerable interest in this context is metal–organic frameworks (MOFs), in which the careful combination of organic ligands with metal-ion nodes can, in principle, give rise to innumerable structurally and chemically distinct nanoporous MOFs. However, many MOFs that are optimized for the separation of CO_2 from nitrogen4,5,6,7 do not perform well when using realistic flue gas that contains water, because water competes with CO_2 for the same adsorption sites and thereby causes the materials to lose their selectivity. Although flue gases can be dried, this renders the capture process prohibitively expensive8,9. Here we show that data mining of a computational screening library of over 300,000 MOFs can identify different classes of strong CO_2-binding sites—which we term 'adsorbaphores'—that endow MOFs with CO_2/N_2 selectivity that persists in wet flue gases. We subsequently synthesized two water-stable MOFs containing the most hydrophobic adsorbaphore, and found that their carbon-capture performance is not affected by water and outperforms that of some commercial materials. Testing the performance of these MOFs in an industrial setting and consideration of the full capture process—including the targeted CO_2 sink, such as geological storage or serving as a carbon source for the chemical industry—will be necessary to identify the optimal separation material.

Accretion of a giant planet onto a white dwarf star

Gänsicke, B.T., Schreiber, M.R., Toloza, O.; Gentile, N. ; Koester, D.; Manser, C. *(2019)* Accretion of a giant planet onto a white dwarf star. *Nature* **576,** 61–64 (2019). https://doi.org/10.1038/s41586-019-1789-8

Abstract

The detection1 of a dust disk around the white dwarf star G29-38 and transits from debris orbiting the white dwarf WD 1145+017 (ref. 2) confirmed that the photospheric trace metals found in many white dwarfs3 arise from the accretion of tidally disrupted planetesimals4. The composition of these planetesimals is similar to that of rocky bodies in the inner Solar System5. Gravitational scattering of planetesimals towards the white dwarf requires the presence of more massive bodies6, yet no planet has so far been detected at a white dwarf. Here we report optical spectroscopy of a hot (about 27,750 kelvin) white dwarf, WD J091405.30+191412.25, that is accreting from a circumstellar gaseous disk composed of hydrogen, oxygen and sulfur at a rate of about 3.3×10^9 grams per second. The composition of this disk is unlike all other known planetary debris around white dwarfs7, but resembles predictions for the makeup of deeper atmospheric layers of icy giant planets, with H_2O and H_2S being major constituents. A giant planet orbiting a hot white dwarf with a semi-major axis of around 15 solar radii will undergo substantial evaporation with expected mass loss rates comparable to the accretion rate that we observe onto the white dwarf. The orbit of the planet is most probably the result of gravitational interactions, indicating the presence of additional planets in the system. We infer an occurrence rate of approximately 1 in 10,000 for spectroscopically detectable giant planets in close orbits around white dwarfs.

Mesoscale convective systems over the Amazon basin: The GoAmazon2014/5 program

Rehbein A.; Ambrizzi, T; Mechoso, C.; Espinosa S.; Myers, T. (2019) Mesoscale convective systems over the Amazon basin: The GoAmazon2014/5 program. International Journal of Climatology, 39 (15): 5599-5618. Doi: 10.1002/joc.6173

Abstract
The Green Ocean Amazon (GoAmazon2014/5) scientific program focused on the influence of aerosols and surface fluxes on tropical cloud formation. This major research effort gathered high-quality environmental data over the central Amazon basin during 2014 and 2015. The present work is a contribution to the GoAmazon2014/5 investigations with an emphasis on the behaviour of the most important mechanism of precipitation over the tropics: mesoscale convective systems (MCSs). To provide a background, MCSs' tracks obtained from infrared satellite images over the entire Amazon basin in 2014–2015 are compared with climatological values. The number of MCSs and precipitation in the basin is about 50% lower than compared to the climatology for 2000–2013. We argue that the below average occurrence of MCSs during the GoAmazon2014/5 program can be explained, at least in part, by the effects of positive anomalies in sea surface temperature over the equatorial Pacific Ocean, negative moisture transport toward the Amazon basin, and by the anticyclonic phase of the mode of interannual and intraseasonal variability over South America. Special attention is given to the 99 MCSs that occurred over the GoAmazon2014/5 site. The impact of MCSs on the meteorological variables over the GoAmazon2014/5 sites is examined, and the contribution of MCSs to rainfall over that region is estimated to be about 70% of the total. Finally, the synoptic and thermodynamic conditions related to the MCSs' genesis and dissipation are discussed. It is suggested that in days with reduced MCS genesis over the GoAmazon2014/5 region, the ventilation over the continent by easterly winds from the relative cold South Atlantic Ocean favours convection at locations near the ocean as compared to those inland.

Texto en Biblioteca

The robustness of the skewness as an early warning signal for abrupt climate change

Xie, Xiao-Qiang; He, Wen-Ping; Gu, Bin; Mei, Ying; Wang, Jinsong. International Journal of Climatology, 39 (15): 5672-5687. doi: 10.1002/joc.6179

Abstract
As a dynamical system approaches its critical threshold, the probability density distribution of the system will change significantly. Therefore, it is possible to present an early warning signal based on the changing skewness before reaching the critical threshold. Based on a zero-dimensional climate model and several typical fold models, this paper systematically studies the influence of noise and missing data on the performance of the skewness coefficient as an early warning signal of an abrupt climate change. The results in three types of fold models show that the skewness coefficient has anti-noise ability to some extent, but strong noise will significantly reduce the magnitude of the skewness coefficient and the time for early warning will also be shortened. In some cases, strong noise even will lead to the result that the skewness does not work in warning an impending abrupt change. However, the influence of strong noise on skewness is insignificant in the zero-dimensional climate model. Therefore, the influence of strong noise needs to be considered in the practical application of the skewness coefficient as an early warning signal of an abrupt change. In addition, the results of all the models also indicate that different degrees of the missing data have no statistically significant effect on the warning performance of the skewness coefficient, even when the length of the missing data is up to 20% of the total sample size used in the present paper.

Predictability of East Asian summer monsoon in seasonal climate forecast models

Yunyun Liu; Zongjian Ke; Yihui Ding. Predictability of East Asian summer monsoon in seasonal climate forecast models. International Journal of Climatology, 39 (15): 5688-5701. doi: 10.1002/joc.6180

Abstract

The prediction skill and source of the predictability of the East Asian summer monsoon (EASM) system are examined in this work based on four state-of-the-art seasonal climate forecast models including BCC_CSM1.1, ECMWF_SYS4, NCEP_CFS2 and TCC_CPS2. The prediction of the climatology and interannual EASM pattern and the impact on the prediction are further investigated. It is noted that the four models have some skill in predicting summer rainfall in the East Asia, however, the skill is low on average and also largely regional dependence. The interannual variation of EASM measured by monsoon circulation index is well reproduced, implying that the broad-scale feature/pattern of EASM has higher predictability than the detailed spatial variation of EASM rainfall. The possible sources of predictability of the interannual variability of EASM are associated with the El Niño-Southern Oscillation (ENSO) and the north Indian Ocean (NIO) sea surface temperature (SST) anomalies. The correlation pattern of rainfall with the NIO SST is characterized by a tripole pattern from south to north of East Asia, which is different from the correlation distribution of the southern-northern dipole with ENSO, suggesting that NIO SST may exert influence on the EASM independently. The major biases in climatology of EASM in the models are the northward shift of the western Pacific subtropical high (WPSH) and weak monsoonal southerly over the coast of East Asia, which leads to the prediction bias of the Meiyu/Baiu/Changma (MBC) rainfall belt. The prediction of the interannual EASM pattern presents two deficiencies: too weak rainfall variability and northward shift of the dipole rainfall pattern (opposite variation between MBC and the northwestern Pacific), that may be caused by the biases of WPSH in the models.

Climate change impact on a wine-producing region using a dynamical downscaling approach: Climate parameters, bioclimatic indices and extreme indices

Blanco-Ward, D. ; Monteiro, A. ; Lopes, M ; Borrego, C. ; Silveira, C.; Viceto, C.; Rocha, A.; Ribeiro, A.; Andrade, J. ; Feliciano, M … Miranda, A.: (2019). International Journal of Climatology, 39 (15): 5741-5760. doi: 10.1002/joc.6185

Abstract

Climate change is of major relevance to wine production as most of the wine-growing regions of the world are located within relatively narrow latitudinal bands with average growing-season temperatures (GSTs) limited to 13–21°C. This study focuses on the incidence of climate variables and indices that are relevant both for climate change assessment and for grape production, with emphasis on grapevine bioclimatic indices and extreme events (e.g., cold waves, storms, heatwaves). Dynamical downscaling of European Reanalysis-Interim and Max Planck Institute Earth System low-resolution global simulations forced with a Representative Concentration Pathway 8.5 (RCP8.5) greenhouse gas emission scenario was performed with the Weather Research and Forecast (WRF) model to a regional scale including the Douro Valley of Portugal for recent-past (1986–2005) and future periods (2046–2065, 2081–2100). The number, duration and intensity of events were superimposed over critical phenological phases estimated by using a specific local grapevine varietal phenological model in order to assess their positive or negative implications for wine production in the region. An assessment of the relevance of climate parameters and indices and their progression in recent-past and future climate scenarios with regard to the potential impact on wine production was performed. Results indicate a positive relation between higher growing-season heat accumulations and greater vintage yields. A moderate incidence of very hot days (daily maximum temperature above 35°C) and drought from pre-*véraison* phenological conditions have a positive association with vintage ratings. However, the mid- and long-term WRF-MPI RCP8.5 future climate scenarios reveal shifts to warmer and drier conditions, with the mean GST not remaining within range for quality wine production in the long-term future climate scenario. These results indicate potential impacts that suggest a range of strategies to maintain wine production and quality in the region.

The key role of decadal modulated oscillation in recent cold phase

Luo, Wen; Guan, Xiaodan; Xie, Yogkun; Lu, Jingchen; Zhou, Yubin; Zhang, Beidou. (2019). The key role of decadal modulated oscillation in recent cold phase. International Journal of Climatology. 39 (15) : 5761 – 5770. doi: 10.1002/joc.6186

Abstract

Global temperature change is strongly affected by internal climate variability (ICV). The temporal change of the ICV on the decadal to multi-decadal scales is referred as the decadal modulated oscillation (DMO) that plays a dominated role in the occurrence of enhanced warming and warming hiatus. However, investigation on the DMO in modern historical period has received limited attention. In this study, the ensemble empirical mode decomposition (EEMD) method was applied to the surface air temperature (SAT) during the boreal cold season to extract the DMO signal in the past century. Two most sensitive areas of DMO trend over northern Eurasia and northwestern North America were identified and used to build a time series of regionally enhanced DMO. It showed an obvious decadal periodic oscillation at 11–23 years and exhibited increasing amplitude. In addition, regression analysis using Niño3.4, Pacific Decadal Oscillation (PDO), Atlantic Multi-decadal Oscillation (AMO), and Arctic Oscillation (AO) revealed a major role of the AO in DMO over the mid-to-high latitudes in the Northern Hemisphere (NH). However, such strong oscillation signal has not been detected in most of the Coupled Model Intercomparison Project Phase 5 (CMIP5) models, and the extracted regionally enhanced DMO are capable of improving the predictability of SAT over the mid-to-high latitudes in the NH.

Changes in the sensitivity of tropical rainfall response to local sea surface temperature anomalies under global warming

Ying, Yun; Tao Lian; Lian, Tao. Changes in the sensitivity of tropical rainfall response to local sea surface temperature anomalies under global warming (2019). International Journal of Climatology, 39 (15): 5801-5814.doi: 10.1002/joc.6303

Abstract

Changes in tropical rainfall variability under global warming are crucial to rainfall changes induced by tropical sea surface temperature (SST) variability modes, which exerts severe influences on human society and the natural environment. As the main factor influencing tropical rainfall variability, changes in the sensitivity of tropical rainfall response to local SST anomalies under global warming remain unclear. This study reveals its two dominant spatial features based on the multi-model ensemble mean result from phase 5 of the Coupled Model Intercomparison Project. The sensitivity of tropical rainfall response to SST anomalies is enhanced in the equatorial central–eastern Pacific, and exhibits a positive Indian Ocean dipole-like pattern in the Indian Ocean. A simplified moisture budget decomposition shows that such change is composed of the thermodynamic effect induced by the increase in mean-state moisture and the dynamic effect induced by the changes in the sensitivity of atmospheric circulation response to SST anomalies. When the thermodynamic effect, displaying a 'wet-get-wetter' paradigm, is basically offset with a part of the dynamic effect by the general weakening of atmospheric circulation response to SST anomalies under global warming, changes in the sensitivity of rainfall response to SST anomalies is dominated by a residual dynamic effect that reflects the roles of two factors: the spatially non-uniform SST warming and the climatological SST. As a result, the 'warmer-get-wetter' paradigm is more important to changes in the sensitivity of rainfall rasponse to SST anomalies than to climatological rainfall changes. Moreover, the non-uniform SST warming pattern and the climatological SST are also important sources of intermodel uncertainty in the changes of sensitivity of rainfall rasponse to SST anomalies.

Robust opposite-changing tendency between the thermal advection damping by mean current and thermo-dynamical damping of ENSO Feedback in a changing climate

An, Soon-II; Heo, Eun Sook (2019) Robust opposite-changing tendency between the thermal advection damping by mean current and thermo-dynamical damping of ENSO Feedback in a changing climate. International Journal of Climatology, 39 (15); 5822-5829. doi: 10.1002/joc.6176

Abstract

The tropical Pacific climate state response to both the 21st-century greenhouse gas forcing and orbital forcing on a glacial–interglacial timescale tends to resemble either an El Niño- or La Niña-like pattern. This study reveals that so long as an El Niño- or La Niña-like change in the tropical climate state occurs, changes in two important negative feedback components of the El Niño-Southern Oscillation (ENSO) system, dynamical damping by mean thermal advection (MA) and thermo-dynamical damping (TD), largely offset each other. For example, under the El Niño-like condition, weaker trade winds due to a relaxed zonal sea surface temperature (SST) gradient reduce the mean zonal and meridional currents in the equatorial Pacific oceanic mixed layer, causing a reduction in MA, while wider expansion and enhanced activity of climatological convective clouds due to a warmer ocean surface intensifies negative SST-cloud-shortwave feedback. As a result, a change in ENSO activity in changing climate is mainly ruled out not by the change in negative feedback effect, but by the change in positive feedback effect.

Can disaster events reporting be used to drive remote sensing applications? A Latin America weather index insurance case study

Brahm, M.; Vila, D.; Martinez, S. Osgood, D (2019) Can disaster events reporting be used to drive remote sensing applications? A Latin America weather index insurance case study. Meteorological Apllications, 26 (4); 632-641. Doi: 10.1002/met.1790

Open Access

Abstract

A new data set was commissioned over Latin America with the goal of supporting decision-making in various socioeconomic activities and, in particular, for climate insurance products. The *Historical Database for Gridded Daily Precipitation Dataset over Latin America* (*LatAmPrec*), based on the combined scheme approach developed at the Centro de Previsão de Tempo e Estudos Climáticos, Instituto Nacional de Pesquisas Espaciais (CPTEC/INPE), provides a new high-resolution, low-latency, gauge–satellite-based analysis of daily precipitation over Latin America for the period March 2000–July 2017. In order to understand the strengths and limitations of the new data set for use in weather index insurance, the present study applies two different validation methodologies.

Temperature changes in the Heihe River Basin based on high accuracy surface modelling

Liu, Y.; Yue, T.; Jiao, Y.; Zhao, N. Zhao, M. (2019) Temperature changes in the Heihe River Basin based on high accuracy surface modelling. Meteorological Applications, 26 (4); 720-732. Doi: 10.1002/met.1803

Open Access

Abstract

In the context of global warming, significant differences in temperature changes occur in different regions. Obtaining a more accurate temperature distribution is important for studying regional climate change. A high accuracy surface modeling (HASM) was introduced using the air temperature output from the weather research and forecasting (WRF) model as the driving field, and observation data from meteorological stations as the accuracy control conditions to obtain 30 years of high accuracy temperature fields in the Heihe River Basin. Verified by ground-based observations, the WRF model has a limited ability to simulate temperature conditions and performs worse in low altitude areas and in winter.

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