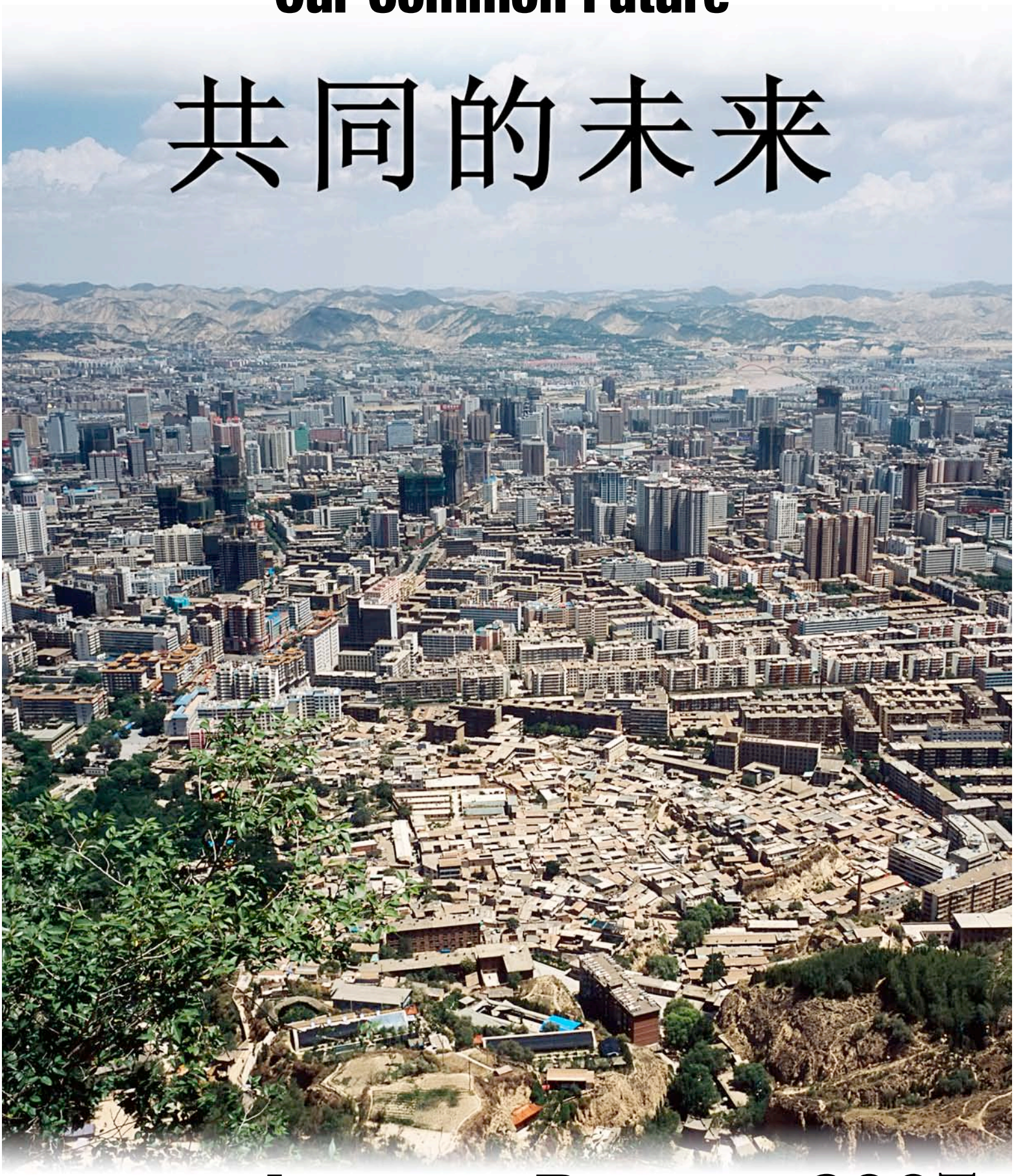
Our Common Future

共同的未来



Annual Report 2007

Nansen-Zhu International Research Centre, Beijing, China

REPORT FROM THE BOARD

VISION

The overarching goal of the Nansen-Zhu International Research Center (*NZC*) is to become an internationally acknowledged climate research and training centre with emphasis on tropical and high-latitude regions, and the interactions between these regions, for past, present and future climate.

ORGANIZATION

The *Nansen-Zhu Centre* is a non-profit joint venture located at the Institute of Atmospheric Physics under the Chinese Academy of Sciences (IAP/CAS) in Beijing, China.

NZC has five founders: IAP/CAS; the Nansen Environmental and Remote Sensing Center (NERSC), Bergen, Norway; the University of Bergen (UoB), Bergen, Norway; the Bjerknes Centre for Climate Research (BCCR), Bergen, Norway; and the Peking University (PKU), Beijing, China.

HISTORY

Representatives from the Chinese and Norwegian authorities formally opened the *Nansen-Zhu Centre* on 4 November 2003. The Center is based on an *Agreement of Understanding* between IAP/CAS, NERSC and UoB of 7 August 2001, and a *Memorandum of understanding* between IAP/CAS, NERSC, UoB and PKU of 5 November 2002.

BACKGROUND

NZC is set up based on the desire to establish and run an attractive and focussed cutting edge climate research network bridging scientists from China, Norway and abroad.

Particularly, *NZC* aims to:

- Exchange scientists and graduate students between the founding partners
- Initiate and develop joint research projects between the founding partners
- Co-ordinate and facilitate joint research proposals to be submitted to national and international funding bodies
- Stimulate and support joint publications in international peer-reviewed journals
- Develop co-operation in education and research programs.

RESEARCH ACTIVITIES

NZC's strategy is to integrate field observations, remote sensing products, theory and numerical modelling to develop cutting-edge research within four prioritised topics:

- Construction of past climate and climate variability based on low-and-high latitude paleoenvironmental reconstructions from tree rings, marine and lake sediments, and by use of modelling.
- Development and evaluation of seasonal, inter-annual and decadal time scale climate predictability systems, and identification of low-and-high latitude teleconnection patterns and mechanisms.
- Model and assess long-term climate effects of regional to global scale atmospheric events like dust storms and pollution emissions.
- Assess sources and sinks of carbon dioxide on seasonal to interdecadal time scales based on integrated use of observations and modelling.
- Model and analyse the ocean circulation and biogeochemistry by means of advanced data assimilation methods

STAFF

At the end of 2007, *NZC* employed a total staff of 58 persons, of which 13 persons are affiliated members.

The staff consists of 10 full-time research scientists, 1 jointly research scientist, 4 part-time research scientist, 8 associated research scientists, 1 administration staff, 1 Post doc, 22 PhD students and 11 master students. The total number of 33 Master and PhD students, includes 6 so-called jointly educated students.

PUBLICATIONS

During 2007, the *NZC* staff published 34 papers in international referee journals. Of these papers, 25 were published in Scientific Citation Index (SCI) journals, 4 in SCI-Extended journals, and 5 in other journals.

DOCTORAL DISSERTATIONS

Two PhD-students defended their theses at IAP/CAS in 2007:

- *Jingping Han – The interdecadal variability of the East Asian summer monsoon*
- *Lei Yu – The Transient Response of the Atlantic Meridional Overturning Circulation under the freshening of Northern High latitudes and the role of the diapycnal mixing in the response.*

FOUNDING PARTNERS

- *Institute of Atmospheric Physics/Chinese Academy of Sciences* (IAP/CAS), Beijing, China
- *Nansen Environmental and Remote Sensing Center* (NERSC), Bergen, Norway
- *University of Bergen* (UoB), Bergen, Norway
- *Peking University* (PKU), Beijing, China
- *Bjerknes Centre for Climate Research* (BCCR), Bergen, Norway

LEADER TEAM

- Director Professor Huijun Wang, IAP/CAS
- Co-Director Professor Helge Drange, NERSC/BCCR/UoB
- Deputy Director Professor Zifa Wang, IAP/CAS
- Co-Deputy Director Dr. Yongqi Gao, NERSC/IAP/BCCR

THE BOARD

- Professor Ola M. Johannessen, Director NERSC, Co-chairman NZC
- Professor Huijun Wang, Director IAP/CAS, Co-chairman NZC
- Professor Kari Tove Elvebakken, Director General UoB
- Professor Benkui Tan, Dep. Director PKU
- Professor Eystein Jansen, Director BCCR
- Professor Helge Drange, Co-director NZC

SCIENTIFIC ADVISORY BOARD

- Founding partners
- Professor Dengyi Gao, IAP/CAS
- Professor Lennart Bengtsson, Max-Plank-Institute for Meteorology, Germany

http://nzc.iap.ac.cn

AWARDS

Six awards have been received in 2007:

- Zifa Wang: Youth Prize for Science and Technology
- Dabang Jiang: Second class of the Xie-Yi-Bing Award for young meteorologist
- Ke Fan: One Hundred Excellent Doctoral Dissertations of China, 2007
- Botao Zhou: Xue Du Feng Zheng Award by the IAP/CAS, 2007
- Mingfeng Su: Liu Yongling Prize by CAS, 2007
- Weiwei Fu: Fifty Excellent Doctoral Dissertations by CAS, 2007

INTERNATIONAL COLLABORATION

Extensive collaboration has taken place with, in particular, the Frontier Research Center for Global Change (FRCGC), the Japan Agency for Marine-Earth Science and Technology and the Hokkaido University on observation in Mangshan.

INTERNATIONAL VISITS

NZC has close collaboration and frequent project-dependent exchange with students and researchers from NERSC, BCCR and UoB. The following visits took place in 2005 and 2006:

- *Chinese visitors to Norway*

Benkuai Tan	3-15 July, 2007
Linling Chen	2 April-27 June, 2007
Ying Zhang	2 April-27 June, 2007
Zhongshi Zhang	From 7 August, 2007
Linling Chen	2 Nov, 2007-Jan 31, 2008
Ying Zhang	2 Nov, 2007-Jan 31, 2008

- *Norwegian visitors to China*

Kjersti Fløttum	24-27 Oct 2007
Ola M. Johannessen	23-27 Oct 2007
Eystein Jansen	23-27 Oct 2007
Helge Drange	21-30 Oct 2007
Mats Bentsen	21 Oct-2 Nov 2007
Tore Furevik	25 March-13 April 2007
Atle Nesje	23-27 Oct 2007
Birgit Falch	23-27 Oct 2007
Dag Johan Steinskog	24-31 Aug 2007

NZC has also frequent exchanges of students and researchers from Japanese institutes.

ECONOMY 2007

NZC received 4050,000 RMB (400,000 EURO) in 2007, partly from the Chinese and Norwegian partners, and partly from national and international funding agencies.

CAS PROJECTS:

- "Attribution on the recent decadal trend of East Asian monsoon" (2006-2008), total budget: 0.7 M RMB
- "East Asia Climate Response to the Blue Arctic" (2007.01.01-2009.12.31), total budget: 2.0 M RMB
- "Earth System Modeling: Ocean Modeling" (2007.05.01-2010.04.30), budget: 0.35 M RMB
- "Deposition and evolution mechanisms of mix aerosol and its climate influence" (2007.01.01-2009.12.31, 2.6 M RMB)

MOST PROJECTS:

- "Aerosol and its impacts on climate"(2007-2011), total budget: 0.4 M RMB (project 973)
- "Development of multi-model ensemble system on regional atmospheric multiplex pollution" (2007.01.01-2010.06.30, 2.9 M RMB) (project 863)

NSFC PROJECTS:

- "Last Glacial Maximum: Climate-vegetation interaction and East Asian climate modeling with a regional climate model" (2005-2007), total budget: 0.35 M RMB
- "Multi-model results of the Last Glacial Maximum climate over China" (2008-2010), total budget: 0.4 M RMB
- Key Project "Polar Atmospheric Modes and their Impacts on the tropical Climate" (2007-2010), total budget: 1.25 M RMB
- International Cooperative Project "Interaction between the North Atlantic Climate and the East Asian Climate" (2007-2009), total budget: 0.87 M RMB
- "The impacts of circulations at high latitude on the activities of typhoon over Western Pacific and the prediction model for the typhoon activities" (2008-2010), total budget: 0.4 M RMB
- "Study on the impact of the tropical ocean warming upon the southern annular mode trend and the underlying mechanism" (2008-2010), total budget: 0.39 M RMB.
- "Integrated study on the interdecadal variations of East Asian Summer Monsoon during the 20th century" (2008-2011), total budget: 1.8 M RMB.

EC PROJECTS:

- Dragoness "Dragon in support of harmonizing European and Chinese marine monitoring for Environment and Security System (2007.10.01-2010.09.30)", budget: 0.67 M RMB
- DYNAMITE "Dynamics of the coupled climate system", FP6 STREP (2005.03.01-2008.02.28)

PROSPECTS 2008-2009

The Board expects an expansion of the number of staff and the research activities in 2008 and 2009. This increase is mainly because of research grants and funding possibilities from the European Commission (EC), the National Sciences Foundation of China (NSFC), the Research Council of Norway (RCN), the Ministry of Science and Technology (MOST), the European Space Agency (ESA), and the Chinese Academy of Sciences (CAS).

Beijing, 24 November 2007,
Ola M. Johannessen (Co-chairman)
Huijun Wang (Co-chairman)
Kari Tove Elvebakken
Benkui Tan
Eystein Jansen
Helge Drange

STAFF MEMBERS

By the end of 2007, the different employee categories are:

Full-time (11 persons)
Huijun Wang (Dir.)
Zifa Wang (Dep. Dir.)
Shuanglin Li
Xiquan Wang
Dabang Jiang
Huili Huang (admin.)
Jianqi Sun
Ke Fan
Fuying Xie
Lei Yu
Zhongshi Zhang

Jointly (1)
Yongqi Gao (Co-dep. Dir.)

Part-time (4)
Xianmei Lang; Lixia Ju; Weiwei Fu; Jie Li

Associated (8)
Helge Drange (Co-dir.); Haijun Yang; Jiang Zhu; Tore Furevik; Odd Helge Otterå; Mats Bentsen; Tianjun Zhou; Ingo Bethke

Post doc (1)
Yele Sun

PhD students (19)
Chao Gao; Chengming Pang; Gan Luo; Fengyun Wang; Jianjian Fu; Limin Tsai; Linling Chen; Meijing Lin; Mingfeng Su; Qizhong Wu; Wenyuan Chang; Xiaole Pan; Xu Yue; Yali Zh; Yanming Wang; Ying Zhang; Yingjie Cui; Youjiang He; Yuhong Guo

Jointly educated PhD stud. (3)
Dong Guo; Yan Zhang; Alex Gbaguidi

Master students (8)
Huopo Chen; Jun Wang; Lina Li; Minghong Zhang; Pingzhong Yan; Tao Wang; Wei Wang; Zhuolei Qian

Jointly educated master stud. (3)
Xichen Li; Jianping Huang; Weiling Xiang; Xichen Li

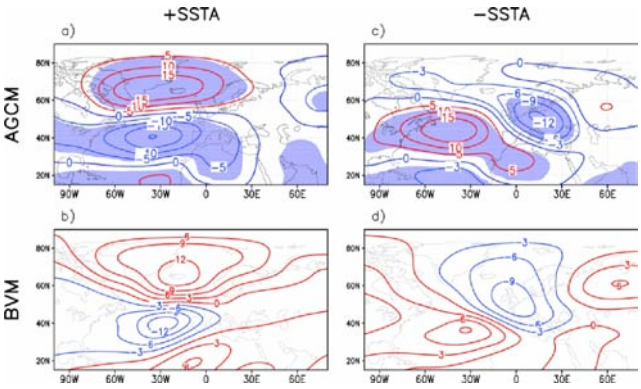
SCIENTIFIC HIGHLIGHTS

Dynamics of the extratropical response to a tropical Atlantic SST anomaly

S. L. Li et al. (2007) Journal of Climate

Previous atmospheric general circulation model (AGCM) experiments revealed that atmospheric responses to a tropical Atlantic sea surface temperature anomaly (SSTA) were asymmetric with respect to the sign of the SSTA. A positive SSTA produced a south–north dipole in geopotential heights, much like the North Atlantic Oscillation (NAO), while a negative SSTA yielded an eastward-propagating wave train, with the northern lobe of the NAO absent.

Here these height responses are decomposed into components that are symmetric or antisymmetric with respect to the sign of the SSTA. The symmetric, or notionally linear, component is a nearly south–north dipole projecting on the NAO, while the antisymmetric, or notionally nonlinear, component is a different dipole. Experiments with a diagnostic linear baroclinic model (LBM) suggest that both components are maintained primarily by transient-eddy forcing. Dynamical mechanisms for the formation of the two components are explored using the LBM and a nonlinear barotropic vorticity equation model (BVM). Transient-eddy feedback is sufficient to explain the linear response. The NAO-like linear response occurs when the initial heating induces transient-eddy forcing in the exit of the Atlantic jet. The structure of the background absolute vorticity in this region is such that this transient-eddy forcing induces a nearly north–south dipole in anomalous geopotential heights. When the nonlinear self-interaction of this transient-induced low-frequency perturbation is included in the BVM, the dipole axis tilts to the east or west, resulting in a response that is nonlinear about the sign of the forcing.

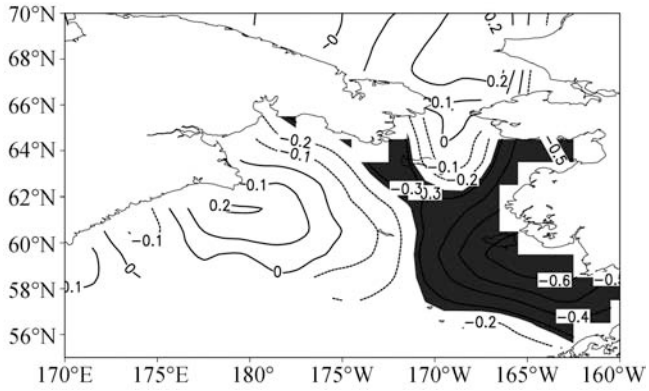


Comparison of the AGCM simulated atmospheric responses to a positive tropical Atlantic SST anomaly (a) with the BVM (Barotropical Vorticity equation Model) simulated responses to a positive transient eddy vorticity forcing located at the exit of the upper jet (b). (c) and (d), as (a) and (b), but for a sign-reversed forcing.

Relationship between Hadley circulation and sea ice extent in the Bering Sea

B. T. Zhou and H. J. Wang (in press) Chinese Science Bulletin

The linkage between Hadley circulation (HC) and sea ice extent in the Bering Sea during March-April is investigated through an analysis of observed data in this research. It is found that HC is negatively correlated to the sea ice extent in the Bering Sea, namely, strong (weak) HC is corresponding to less (more) sea ice in the Bering Sea. The present study also addresses the large-scale atmospheric general circulation changes underlying the relationship between HC and sea ice in the Bering Sea. It follows that a positive phase of HC corresponds to westward located Aleutian low, anomalous southerlies over the eastern North Pacific and higher temperature in the Bering Sea, providing unfavourable atmospheric and thermal conditions for the sea ice forming, and thus sea ice extent in the Bering Sea is decreased, and vice versa. In addition, it is further identified that East Asian-North Pacific-North America teleconnection may play an important role in linking HC and changes of atmospheric circulations as well as sea ice in the Bering Sea.



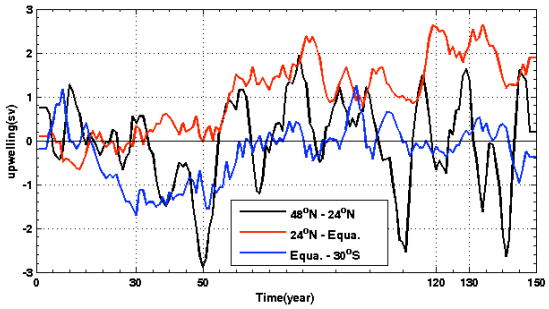
Correlations between HC and sea ice in Mar-Apr. Regions above 95% significance level are shaded.

Transient Response of the Vertical Stratification to the Enhanced Freshwater Forcing at High Latitudes in Bergen Climate Model

L.Y. Yu et al. (in press) Advances in Atmospheric Sciences

Coupled Bergen Climate Model (BCM) is used to examine the transient response of the ocean vertical density stratification to the enhanced freshwater forcing at the high northern latitudes. The results presented here are based on the model outputs of previous freshwater experiment: a 300-year control integration (CTRL), a freshwater integration (FW1) which started after 100 years running of CTRL, with an artificially and continuously threefold increase in the freshwater flux to the Nordic Seas and the Arctic Ocean throughout the following 150-year simulation. During the first 50-year integration in FW1, the Sea Surface Salinity (SSS) and density drop down rapidly leading to decreased winter convective mixing in the Nordic Seas and the North Atlantic sub-polar gyre. As a result, the rate of the North Atlantic Deep Water (NADW) formation decreases initially. However, the formation of the NADW in the Labrador and Irminger Seas gradually recover after the first 50-year integration in FW1. The Possible feedback mechanism for these responses is proposed as follows: Firstly, the freshening of the high latitude ocean decreases the sea surface density, leading to more stabilized vertical stratification in upper ocean in the Nordic Seas and the North Atlantic sub-polar gyre and the stabilized stratification suppress the NADW formation. Secondly, the reduced formation of the NADW weakens the vertical water stratification at the low-and mid-latitudes, leading to the increased basin-scale vertical water mass transformation. Consequently, the northward return branch of Atlantic

Meridional Overturning Circulation gradually increases with increased volume and salt transport to the high northern Atlantic, leading to the recovery of SSS, at the same time to reduce the vertical water stratification at the high northern North Atlantic and finally to the recovery of NADW formation.

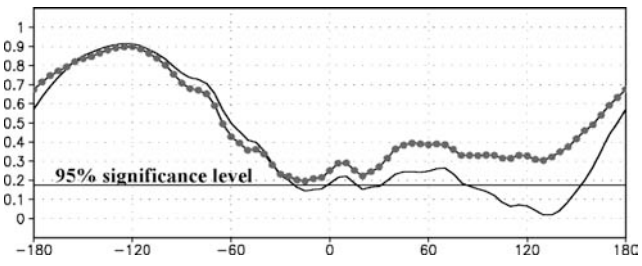


The time series of anomalies of the water mass transformation.

Zonal asymmetry of the Antarctic Oscillation

K. Fan (2007) Geophysical Research Letters

In this research, the zonal asymmetry of the southern annular mode, or the Antarctic Oscillation (AAO), is studied. It is indicated that apparent zonal asymmetry exists in the normalized sea level pressure differences between the middle and high latitudes during the boreal summer, among different longitudes, especially between the Western and Eastern Hemispheres. Results show that the Southern Oscillation (SO) is responsible for part of the zonal asymmetry in AAO. The Western Hemisphere and the Eastern Hemisphere parts of AAO are correlated at 0.23 and 0.52 respectively for the period of 1959–1998 before and after the linear regressions on the Southern Oscillation Index (SOI) have been removed from the time series. The paper also discusses the relationship between the precipitation in the East Asia and the AAO before and after removing the linear regressions on SO index (SOI), indicating the stable relationship between the East Asian precipitation and the zonal symmetric component of AAO.



The correlation coefficients between AAOWH and the normalized SLP differences between 40°S and 60°S in different longitudes for JJAS in 1871-1998. The solid line and the dotted solid line respectively represent the results before and after the linear regressions on the SOI have been removed from the time series. The abscissa are the longitude, with negative values denote the Western Hemisphere.

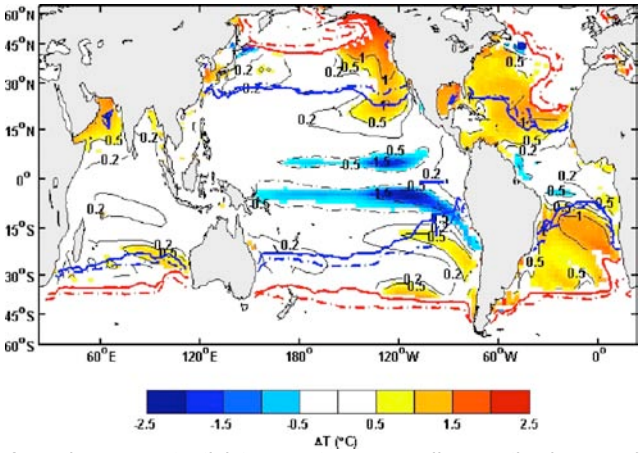
Role of the atmospheric and oceanic meridional circulation in the tropical SST changes

J. Z. Su et al. (in press) Journal of Climate

A coupled climate model is used to explore the response of the tropical sea surface temperature (SST) to positive SST anomalies in the global extratropics. The main model results here are consistent with the previous numerical studies. In response of prescribed SST anomalies in the extratropics, the tropical SSTs rise rapidly and reach a quasi-equilibrium state within several years, and the tropical subsurface temperatures show a slow response. The annual mean Hadley cell, as well as the surface trades, is weakened. The weakened trades reduce the poleward Ekman transports in the tropical ocean, and furthermore lead to anomalous positive convergences of heat transport, which is the main mechanism for maintaining the tropical Pacific SST warming.

The process of extratropical influence on the tropics is related with both the atmospheric and oceanic circulation. The Intertropical Convergence Zone (ITCZ) moves southward and eastward in the Pacific, corresponding to a reduction of the Hadley circulation and Walker circulation. At the same time, convective precipitation anomalies are formed on the boundary of climatological ITCZ, while the climatological mean convections are suppressed.

The largely delayed response of tropical subsurface temperature cannot be explained only by the strength change of the Subtropical Cells (STCs), but can be traced back to the slow changing of subsurface temperature in the extratropics. In the extratropical oceans, warming and freshening reduce the surface water density, and the outcropping lines of certain isopycnal layers are moved poleward. This poleward movement of outcropping lines can weaken the positive temperature anomalies, or even lead to negative anomalies, on given isopycnal layer. Displayed on time-dependent isopycnal layers, positive subsurface temperature anomalies present only on the first half way after subduction, and are subsequently replaced by negative temperature anomalies in the deep-tropics regions. The noticeable features of density compensation of temperature and salinity indicate that diapycnal processes play an important role in the equatorward transport of the temperature and salinity anomalies from the midlatitude.



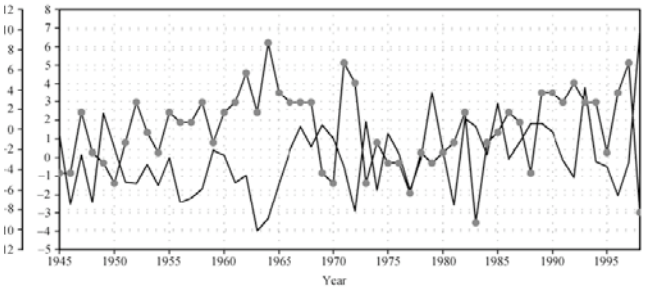
Annual mean potential temperature anomalies on the isopycnal layers σ_0 = 24.12 – 26.18, averaged over years 51-100. Unit is °C. The heavy solid (dashed) lines indicate the outcropping lines of the isopycnal layer σ_0 = 24.12 in winter (blue) and summer (red) for each hemisphere from $ABOT_{CTRL}$ (ABOT).

Relationship between the Antarctic Oscillation and the western North Pacific typhoon frequency

H. J. Wang and K. Fan (2007) Chinese Science Bulletin

Relationship between the Antarctic oscillation (AAO) and the western North Pacific typhoon number (WNPTN) in the inter-annual variability is examined in this research. The WNPTN is correlated with the AAO in June-July-August-September (JJAS) in 1949-1998 at -0.48 for the detrended time series, statistically significant at 99% level. The tropical atmospheric circulation as well as the sea surface

temperature variability over the western Pacific associated with AAO has been analyzed. It follows that a positive phase of JJAS AAO corresponds to the larger magnitude of the vertical zonal wind shear, the anomalous low-lever anti-cyclonic circulation and anomalous high-level cyclonic circulation, and lower sea surface temperature in the major typhoon genesis region in the western North Pacific, thus providing unfavourable environment for the typhoon genesis, and vice versa.

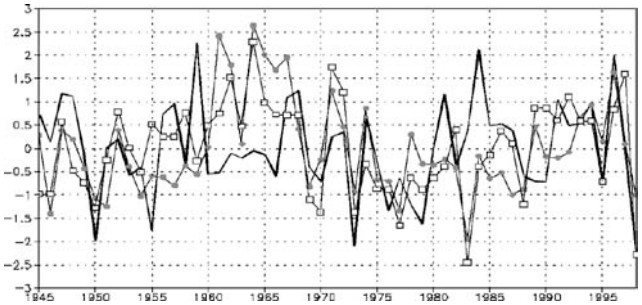


The inter-annual variation for AAO (solid line) and WNPTN (solid line with dots) in JJAS in 1945-1998. The units for y-coordinate are hPa (right) and number (left) respectively for AAO and WNPTN.

Relationships between the North Pacific Oscillation and the typhoon/hurricane frequencies

H. J. Wang, J. Q. Sun and K. Fan (2007) Science in China

Relationships between the North Pacific Oscillation (NPO) and the typhoon as well as hurricane frequencies are documented. The correlation between NPO index in June–July–August–September and the annual typhoon number in the western North Pacific is 0.37 for the period of 1949–1998. The NPO is correlated with the annual hurricane number in the tropical Atlantic at -0.28 for the same period. The variability of NPO is found to be concurrent with the changes of the magnitude of vertical zonal wind shear, sea-level pressure patterns, as well as the sea surface temperature, which are physically associated with the typhoons and hurricanes genesis. The NPO associated atmospheric circulation variability is analyzed to explain how NPO is linked with variability of the tropical atmospheric circulation in the western Pacific and the tropical Atlantic, via the atmospheric teleconnection.

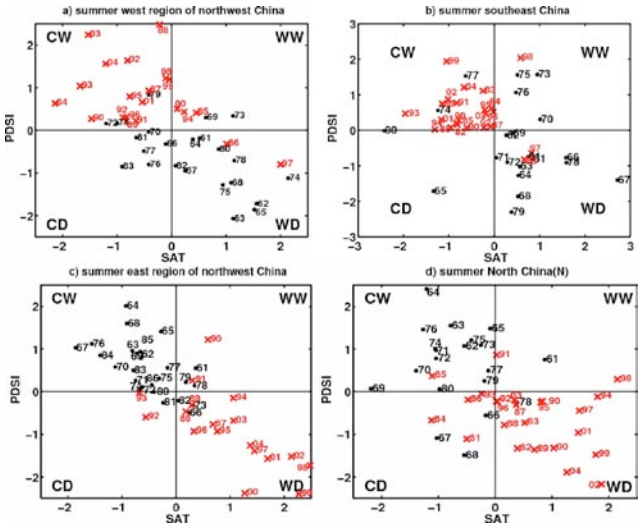


The inter-annual variation for the North Pacific oscillation (NPO) in JJAS (solid line), SNWP (solid line with dots) and TNWP (solid line with boxes) for 1945-1998. All the series have been normalized before plotting.

Decadal co-variability of the summer surface air temperature and soil moisture in China under global warming

M.F. Su and H. J. Wang (2007) Chinese Science Bulletin

The self-calibrating Palmer Drought Severity Index (PDSI) is calculated using newly updated ground observations of monthly surface air temperature (SAT) and precipitation in China. The co-variabilities of PDSI and SAT are examined for summer for the period 1961-2004. The results show that there exist a decadal climate co-variability and strong nonlinear interactions between SAT and soil moisture in many regions of China. Some of the co-variabilities can be linked to global warming. In summer, significant decadal co-variabilities from cool-wet to warm-dry conditions are found in the east region of Northwest China, North China, and Northeast China. An important finding is that in the west region of Northwest China and Southeast China, pronounced decadal co-variabilities take place from warm-dry to cool-wet conditions. Because significant warming was observed over most areas of the global land surface during the past 20-30 years, the shift to cool-wet conditions is a unique phenomenon which may deserve much scientific attention. The nonlinear interactions between SAT and soil moisture may partly account for the observed decadal co-variabilities. It is shown that anomalies of SAT will greatly affect the climatic co-variabilities, and changes of SAT may bring notable influence on the PDSI in China. These results provide observational evidence for increasing risks of decadal drought and wetness as anthropogenic global warming progresses.



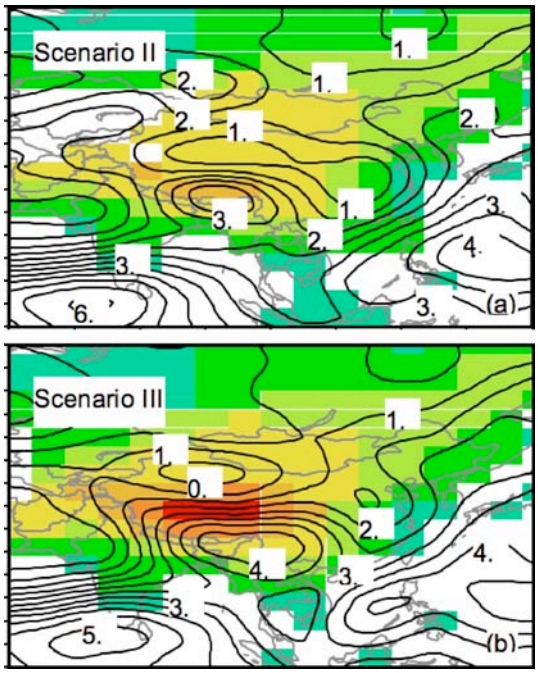
Co-variability of summer SAT and the PDSI anomaly during 1961-2004 in four regions in China: (a) west region of Northwest China, (b) Southeast China, (c) east region of Northwest China, and (d) North China. Symbols ●, × are for period 1 (from about 1961 to the mid-1980s) and period 2 (from about the mid-1980s to 2004), respectively. The digital labels beside the scatter symbols indicate the corresponding year, for example, the number 88 represents the year of 1988. Letters of CW, CD, WW, and WD represent cool-wet, cool-dry, warm-wet, and warm-dry climate combinative modes, respectively.

Impacts of tectonic changes on the reorganization of the Cenozoic paleoclimatic patterns in China

Z. S. Zhang et al. (2007) Earth and Planetary Science Letters

Geologic studies have illustrated that the planetary-wind-dominant climate in the Paleogene is changed into the monsoon dominant one near the Oligocene/Miocene boundary in China. The evolution is marked by the changes of regional aridity/humidity contrasts. The contrasts occur between the south and the north part of China in the Eocene, and then between East China and Central Asia near the Oligocene/Miocene boundary, indicating the onset of monsoon-dominant climate in China. The impacts of the Himalaya–Tibetan plateau uplift and/or the Paratethys Sea retreat on the Asian monsoon have

been well demonstrated. However, whether or not other factors have affected the above reorganization of paleoclimatic patterns remains a question to be addressed. Additional factors that should be addressed at least include the Indian Peninsular drift, the South China Sea expansion and the East China Sea transgression. Here we use the IAP-AGCM to explore their roles in the above paleoclimatic evolution. Our experiments demonstrate that the South China Sea expansion is another major forcing, in addition to the important roles of the Paratethys retreat and the Himalaya–Tibetan plateau uplift. On the contrary the impacts of the Indian Peninsular drift and the East China Sea transgression are relatively subordinate. The Himalaya–Tibetan plateau uplift plays a crucial role in the magnification of the aridity/humidity contrasts between the south and the north part of China. The Paratethys retreat, the Himalaya–Tibetan plateau uplift and the South China Sea expansion lead to the formation of the aridity/humidity contrasts between East China and Central Asia. The retreat and the uplift favour the dynamic condition, and the expansion provides the water vapour condition for the monsoon-dominant climate in China.

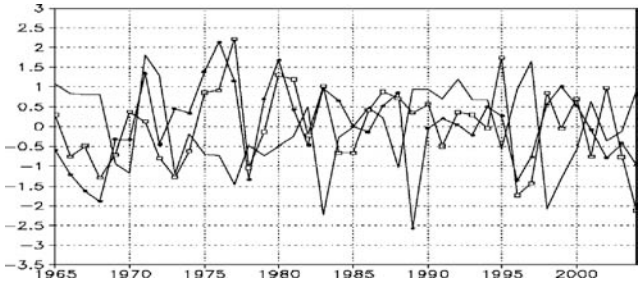


The precipitation fields simulated with the reconstructed geological land-sea distribution and topography agree well with the geological evidence.

North Pacific Sea Ice Cover, a predictor for the Western North Pacific Typhoon Frequency?

K. Fan (2007) Science in China

The relationship between the sea ice cover in the North Pacific and the typhoon frequency has been studied in this paper. It follows that the index for the sea ice cover in the North Pacific (ISA) both in December-January-February (DJF) and in March-April-May (MAM) is negatively correlated with annual typhoon number over the western North Pacific (TNWNP) during 1965-2004, with correlation coefficients of -0.42 and -0.49 respectively (above 99% significant level).



The inter-annual variation of ISA in MAM (solid line with dots), ISA in DJF (solid line with boxes) and TNWNP (solid line) during 1965-2004. All these time series have been normalized and detrended.

Large sea ice cover in the North Pacific tends to decrease TNWNP. Positive ISA (MAM) is associated with the tropical circulation and SST anomalies in the North Pacific, which may lead to unfavourable dynamic and thermal conditions for typhoon genesis over WNP from June to October (JJASO). The variability of the atmospheric circulation over the North Pacific, associated with the ISA anomaly in MAM is connected to the tropical atmospheric circulation variability in MAM via the teleconnection wave train. Besides, as the tropical circulation has strong seasonal persistency from the MAM to JJASO, thus, the ISA in MAM-related variability of the tropical atmospheric circulation as well as the SST can affect the typhoon activity over the western North Pacific.

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