Resume

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Education:

1961 Ph.D,, Physical-mathematical Sciences, Institute of Applied Geophysics, USSR Academy of Science, Moscow

1956 BA: Physics, Department of Physics, Peking University

Professional Positions:

1966-present: Professor (1978-present), research scientist (1966-1978).
Director of the institute (1984-1993),
Chairman of academic committee (2000-present)
Institute of Atmospheric Physics, Chinese Academy of Sciences.

2005-present: Vice-president, China Branch, International Euro-Asian Academy of Sciences

2001-present: Executive Director. CAS-TWAS-WMO Forum on Climate Problems.

1995-present: Director (1995-2003), founder director (2003-present), International Center for Climate and Environment Sciences, Chinese Academy of Sciences.

1998-present: President (1998-2002), Honorary President (2002-present), China Meteorological Society.

1996-2006: Vice-president, China Association of Science and Technology.

1995-present: President (1995-2000), consultant (2000-present), China Society of Industrial and Applied Mathematics.

1996-present: Vice president (1996-2001), Honorary President (2001-present), China Oceanography Society.

1990-2002: Chairman, Chinese Committee for WCRP.

1985-2001: Director (1985-1993), Chairman of Academic Committee (1993-2001), State Key Lab. of Atmos. Sciences and Geophysical Fluid Dynamics， Chinese Academy of Sciences.

1993-1996: Member, Joint Scientific Committee for WCRP/ICSU-WMO-IOC.

1980, 12-1982, 3: Visiting senior research scientist, Geophysical Fluid Dynamics Lab, Princeton University/NOAA, Princeton.

1961-1966, Feb.: Research scientist, Institute of Geophysics and Meteorology, Chinese Academy of Sciences.

Honors and Awards:

1996 Member, International Academy for Europe and Asia

1995 Fellow, the Academy of Sciences for the Developing World (TWAS)

1994 Foreign Member, Russian Academy of Sciences

1980 Academician, Chinese Academy of Sciences

1989 National Pioneer Scientist (in China)

1979 National Pioneer Scientist (in China)

2005 Award of National Natural Sciences, second class (in China). Title: Climate system model and prediction theory. (Zeng Q.C. , H.J. Wang, and Z.H. Lin)

1987 Award of National Natural Sciences, second class (in China). Title: Theory on geostrophic and rotational adjustments of atmospheric motions. (Zeng Q.C., D.Z. Ye, and M.C. Li)

1987 Award of National Natural Sciences, third class (in China). Title: remote sensing of atmosphere and satellite meteorology. (Tao S.Y, Zeng Q.C., et al)

2011 Outstanding Science and Technology Achievement Prize of the Chinese Academy of Sciences, Principle Contributor, Title: Formation and development Mechanism of Dust Storm and its Monitoring, Forecast and Disaster Assessments.

2001 Award of Natural Sciences (first class), Chinese Academy of Sciences, Title: Nonlinear instability of atmospheric motions. (Mu M., Q.C. Zeng et al.)

1998 Award of Natural Sciences (first class), Chinese Academy of Sciences, Title: Climate dynamic model, modeling and prediction. (Zeng Q.C. et al.)

1995 Award of Scientific and Technological Progress, Ho Leung Ho Lee Foundation

1991 Award of Natural Sciences (first class), Chinese Academy of Sciences, Title: IAP AGCM and the numerical modeling of major climatological characteristics. (Zeng Q.C. et al.)

1989 Award of Natural Sciences (first class), Chinese Academy of Sciences, Title: Computational geophysical fluid dynamics. (Zeng Q.C. et al.)

1988 Award of Natural Sciences (first class), Chinese Academy of Sciences, Title: The evolutionary process of atmospheric disturbances and their interactions with basic current. (Zeng Q.C., P.S. Lu, et al.)

2014 Elected Honorary Member of the American Meteorological Society

2016 Award of 61st International Meteorological Prize (IMO)

2019 Award of China's top science award

Prof. Qing-Cun Zeng's Contributions to Meteorological science, education and service.

Professor Qing-Cun Zeng, as an outstanding scientist, for more than fifty years, has been studying meteorology, atmospheric sciences, geophysical fluid dynamics, and global change of climate and environment. He has made outstanding achievements and great contributions to the following fields:

(1) Theoretical investigation of Numerical weather prediction, climate system model and Earth system model;

(2) Atmospheric dynamics and Geophysical fluid dynamics;

(3) General atmospheric circulations and Monsoon systems, and their dynamics;

(4) Models and methods in dynamic short-term climate prediction and the study on Global climate and environment changes;

(5) Disastrous weather systems, especially the dust storms in East Asia, their formation and development mechanism, monitoring, prediction, disaster assessment, and the relevant characteristics of boundary layer, soil erossion and dust entrainment mechanism;

(6) Theory of atmospheric remote sensing and satellite meteorology;

(7) Investigation of artificial weather modification and development of natural cybernetics.

He has published 7 books and more than hundred papers, and edited several monographs.

Prof. Zeng is also a great educator. A large numbers of graduate and undergraduate students were grown up under his guidance and teaching, including some experts from the developing countries. He was a very good teacher in many national and international training courses too.

Prof. Zeng made important contributions to running the Institute of Atmospheric Physics, Chinese Academy of Sciences. This institute is one famous research institution of atmospheric and meteorological sciences in the world and a best one in developing countries, and he was the director (1984-1993) of the Institute. His outstanding contributions were also extended to the China Meteorological Society (president, 1998-2002, honorary president, 2002-) and China committee for WCRP (chairman, 1990-2000). His valuable advice and guidance in the practice of meteorological services in China were highly recognized, such as the setting up and routine service of satellite meteorology, the sub-routine dynamical climate prediction, the routine operation of dust storm monitoring and prediction system, and the advanced programme of artificial weather modification.

Professor Zeng also has been and still is actively involved in the affairs organized by WMO. He deeply involved in the WCRP and the IPCC programs, and was the WCRP JSC member (1993-1996) and one of the principle authors of the climate model chapter both in the first and the second IPCC Scientific Assessment. He is the executive director of CAS-TWAS-WMO Forum on Climate Problems. This forum holds symposium once per year since 2001, and is appreciated by the climate scientists, especially the young scientists from developing countries.

Professor Qing-Cun Zeng's Achievements in Scientific Research

(1)Theoretical research of Numerical weather prediction, Climate system model and Earth system model

In 1961 professor Qing-Cun Zeng developed a semi-implicit method [1] for numerically integrating the baroclinic primitive equations. By the help of this method he first successfully made the short term prediction of weather situation using the observed wind, geopotential and temperate fields as the initial conditions. This method and scheme had been applied to the routine 24 hrs weather prediction in the Moscow World Meteorological Centre since 1963. In 1965, professor Zeng developed another method—the quadratic conservation scheme for integrating the global model. Later on the scheme has been widely applied to the design of Chinese Climate System Model (the IAP-AGCM, IAP-OGCM, IAP94-LSM and their coupling) [2-9]. Since 2007 his group picks out the design of Earth System Model. These models have been applied to the short term climate prediction in China and joined in the WCRP, IPCC and global change studies. Besides, the semi- implicit method and quadratic conservation scheme are also widely applied to other branches of atmospheric sciences and the computational fluid mechanics.

(2)Atmospheric dynamics and Geophysical fluid dynamics

Professor Zeng, after Rossby and Yeh, developed solid systematic theory on the adaptation of atmospheric motion and the motions on rotating planet, from the local to the planetary scales, and applied these results to the weather analysis and numerical prediction. Next, in 1979 he published a book "The physical-mathematical bases of numerical weather prediction, Vol.1"[14] .This book together with his other following work, such as [15], systematically investigated some basic problems, such as the well posedness of the problem consisting of governing equations and boundary-initial conditions. The book [14] was very soon reviewed and introduced to the foreign scientists by Japanese, Russian and English speaking experts, and attracted attention of very famous mathematician to the atmospheric problems (Lions et al. Nonlinearity, Vol. 5,237-288). The wavepacket and continuous spectrum were also deeply investigated by Prof. Zeng. His theory gave very strict and sound explanation of the evolutionary characteristics of developing /decaying wave packets of long wave and their interactions with the basic flow. These theoretical results very clearly displayed the picture of the issues, and hence were convenient to the weather forecasting experts.

(3)General atmospheric circulation, monsoon systems and their dynamics

Based on the investigation of dynamics of seasonal variation of general circulation, professor

Zeng suggested some indice to divide the seasons and determine their abrupt changes, and proposed mathematically more strict and more objective indices to define the monsoon region, monsoon strength and the date of their onset and retreat. There methods and indices are universal. He indicated that the global monsoon systems consist of tropic monsoon region, subtropical monsoon region and temperate-frigid monsoon region. They are driven by the seasonal variation of solar declination and so related interactions of motions of Northern and Southern Hemisphere, seasonal variation of thermal contrast between continents and oceans, and the seasonal variation of axis of westerlies respectively. The monsoon systems possess significant baroclinic vertical structure. These results have been applied to the climate analysis and prediction [21-25].

(4)Theoretical methods for short term climate prediction and the study of global climate change

By using the climate model developed by him and his group an extra seasonal (from the autumn to the summer of the next year) prediction of summer precipitation anomaly was first carried out in 1990. After that a dynamic climate prediction system for subroutine has been developed in 1994 and improved as the IAP DCP-Ⅱ in 2002. The system consists of ensemble integration, bias and error correction and the final prediction (mathematic expectance, standard deviation and probability) [26-31]. The scheme was first reported twice in the International Conference on Monsoon variability and Prediction (Trieste,1994) and the International Conference on TOGA Program (Melbourne,1995) as invited presentation—the only presentation of dynamical climate prediction[28-29].

Besides professor Zeng was also actively involved in the global climate change studies. In 1992, he had made one of the first simulations of climate change induced by $2\times CO_2$[32], and he was one of the principle authors in the climate model chapter both in the1st and 2nd IPCC Scientific Assessment [33,34].

(5)Disastrous weather, dust storm in East Asia and the research on windy atmospheric boundary layer

Professor Zeng paid special attention to the research of disastrous weathers such as heavy rain and heat wave in summer and the dust storms in East Asia. By his suggestion and guidance the climate background and the mechanism of dust storm formation and evaluation were systematically investigated, and a routine system of dust storm monitoring, predicting, warning and the disaster assessment has been set up and widely used by the central and province meteorological offices [35] (Outstanding Science and Technology Achievement Prize of the Chinese Academy of Sciences, 2011). Together with the dust storm research he made careful investigation of the characteristics and dynamics of windy boundary layer. He explored that, the high frequency turbulent fluctuations are nearly isotropic and random but the gusty wind disturbance (period is several min.) are high anisotropic and coherent. They play different role, the turbulence makes diffusion of the particles, and the coherent gusty wind disturbance like small scale advection-convection makes the entrainment of particles into the upper levels of the boundary layer [36-40].

(6)The theoretical research of the atmospheric remote sensing and satellite meteorology

Involving the practical affairs of atmospheric remote sensing and satellite meteorology,

professor Zeng published a book “Principles of infrared remote sensing of the atmosphere [41] in 1974. In this book and some following papers [42], the theoretical problems of remote sensing methods (such as multi-frequency channels and angular scanning) were deeply investigated, including the possibilities and limitations, and the optimal channels. He especially indicated the essential difference of the remote sensing of material constituent vertical profile from the temperature, and that by the use of satellite alone remote sensing of water vapor in the lowest levels of the atmosphere is unreliable, even impossible. These have considered in the design of meteorological satellite in China.

(7)Research in the artificial weather modification and development of natural cybernetics

Based on the practices and experiences professor Zeng developed a general theory “natural cybernetics”, investigating the self-controlling and artificial controlling of natural environment [43-46], and applied this theory to give advice for the weather modification, the regulation of atmospheric quality, controlling of air pollution, controlling of silt sedimentation, and the risk assessment and management of disastrous event. This theory is also suitable to be applied to wide fields and high evaluated by the scientists as “natural extension and further development of the cybernetics” (Yang J.C., 1996: The Development of Cybernetics and the Natural Cybernetics, in System Research, Part I, p15-20).

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