



## Holocene biome shifts in the East Asian monsoon margin region

Anne Dallmeyer (1), Martin Claussen (1,2), Jian Ni (3), Yongbo Wang (4,5), Xianyong Cao (4,5), Ulrike Herzschuh (4,5)

(1) Max Planck Institute f. Meteorology, Hamburg, Germany, (2) Meteorological Institute, University of Hamburg, Hamburg, Germany, (3) Institute of Biochemistry and Biology, University of Potsdam, Potsdam, Germany, (4) Institute of Earth and Environmental Science, University of Potsdam, Potsdam, Germany, (5) Alfred Wegener Institute for Polar and Marine Research, Potsdam, Germany

East Asia is affected by three major atmospheric circulation systems determining the regional climate and vegetation distribution: The moisture advected by the Indian and East Asian monsoon support the growing of forest in large parts of Eastern China. The influence of the monsoon gets weaker further on the continent yielding a transition of forest to steppe and of steppe to desert in Central East Asia (e.g. Inner Mongolia) where the dry westerly winds prevail. Particularly in these transition zones, vegetation is supposed to be very sensitive to climate change and strong feedbacks are expected in case of climate and vegetation shifts due to large environmental changes (Feng et al., 2006).

During mid-Holocene, cyclic variations in the Earth's orbit around the sun led to an enhancement of the Asian monsoon system probably causing strong shifts in the biome distribution. According to reconstructions, the steppe-forest margin moved to the northwest by about 500km (Yu et al., 2000) and the desert area in China and Inner Mongolia was substantially reduced compared to today (Feng et al., 2006). However, in the complex environment of Asia, the locally limited reconstructions may not portray the general vegetation change.

To get a systematic overview on the spatial pattern of biome shifts in the Asian monsoon – westerly wind transition zone since mid-Holocene, we use the diagnostic vegetation model BIOME4 and force this model with climate anomalies from different transient Holocene climate simulations performed in coupled atmosphere-ocean-vegetation models. The main aims of this study are to a) get a consistent ensemble of possible changes in biome distribution since the mid-Holocene b) test the robustness of the simulated vegetation changes and quantify the differences between the models, and c) allow for a better comparison of simulated and reconstructed vegetation changes.

Preliminary results confirm the general trend seen in the reconstructions. The simulations reveal an expansion of forest for most models and a substantially reduced desert fraction in the transition zone during mid-Holocene. However, the amplitude of the signal and the trend varies for the different climate models. At mid-Holocene, the desert-steppe margin is located further west by approx. 6° in the ensemble mean ranging from 1° to 10° in the different simulations. The forest biomes extend further north-westward by approx. 2° in the ensemble mean ranging from 0° to 4°. In some simulations, the biome distribution shows a strong variability during the last 6000 years and a strong increase of desert starting 500 years before present. In other simulations the biome distribution stays relatively constant until 4500 years before present, afterwards the desert border gradually moves eastward to its present-day position.

### References:

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