Potential Impact of Climate Changes on Spatial Distribution of Schistosomiasis in China

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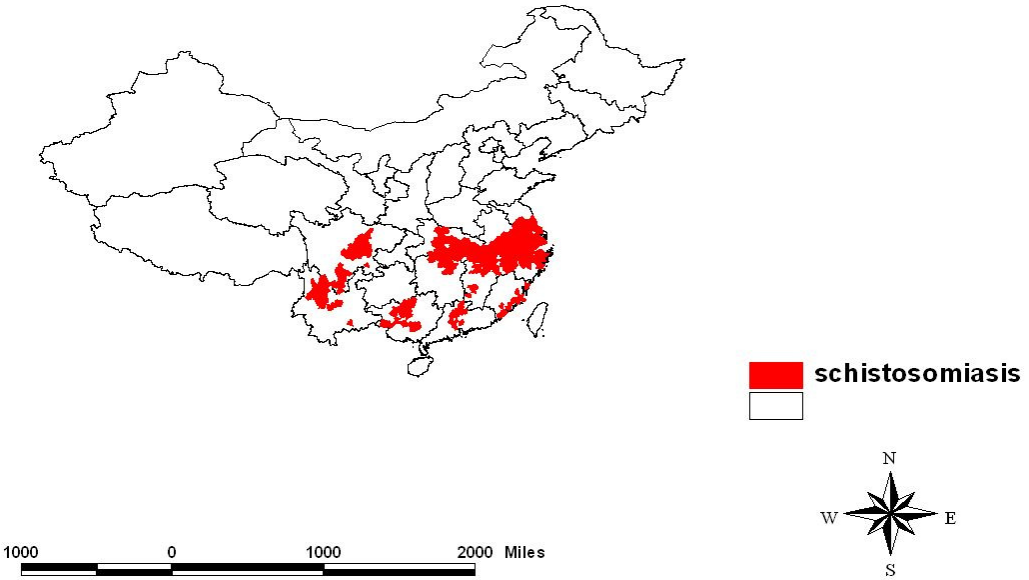
Introduction

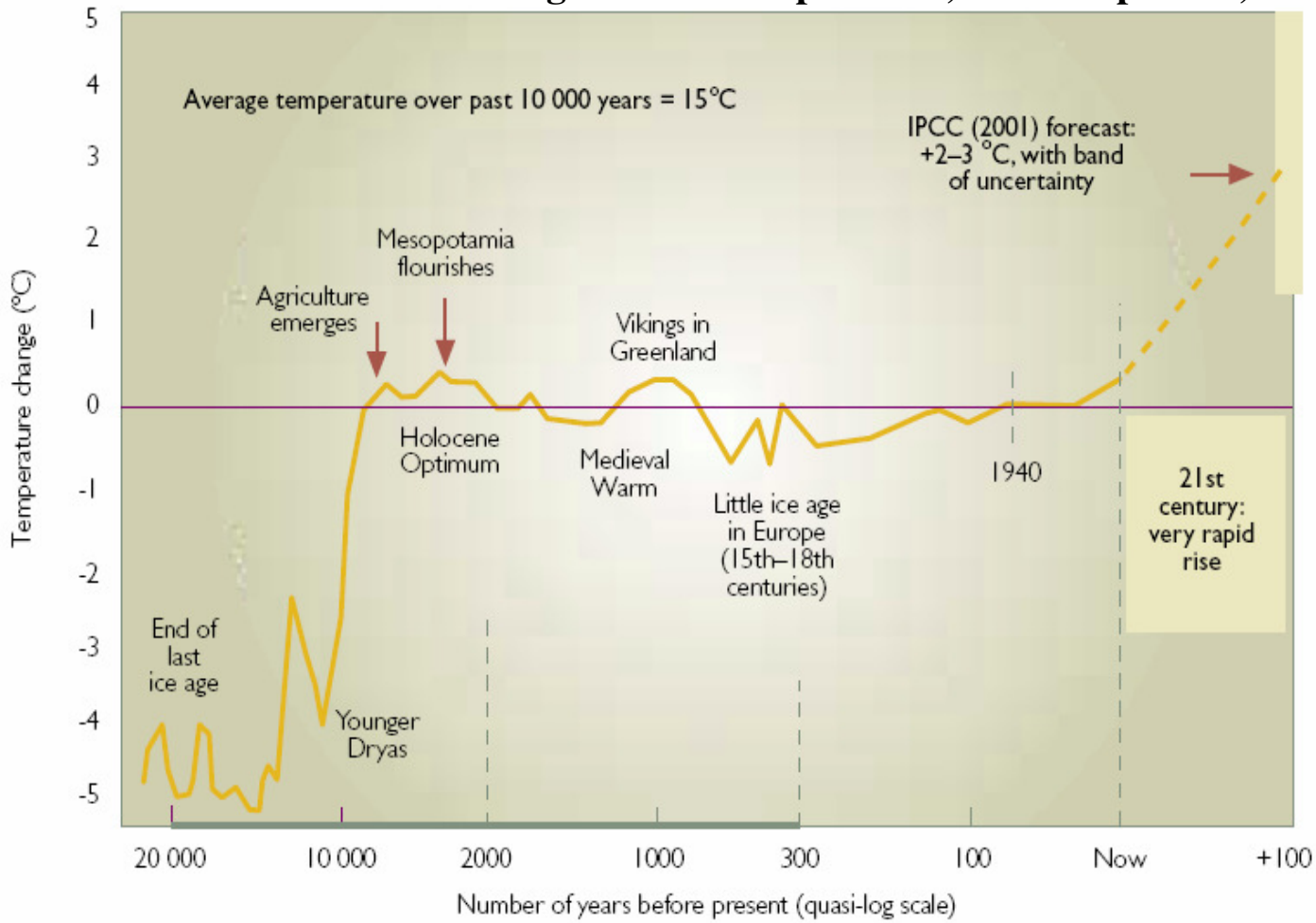
Schistosomiasis distribution in China



Schistosomiasis remains an important public health problem in China, with an estimated 843 000 people infected in 2003.The temperature is a main risk factor for schistosomiasis. In this study, Geographic Information Systems (GIS) technique was applied to understand the relationship between climate changes and schistosomiasis distribution.

➢Warming world

Variations in Earth's average surface temperature, over the past 20,000 years



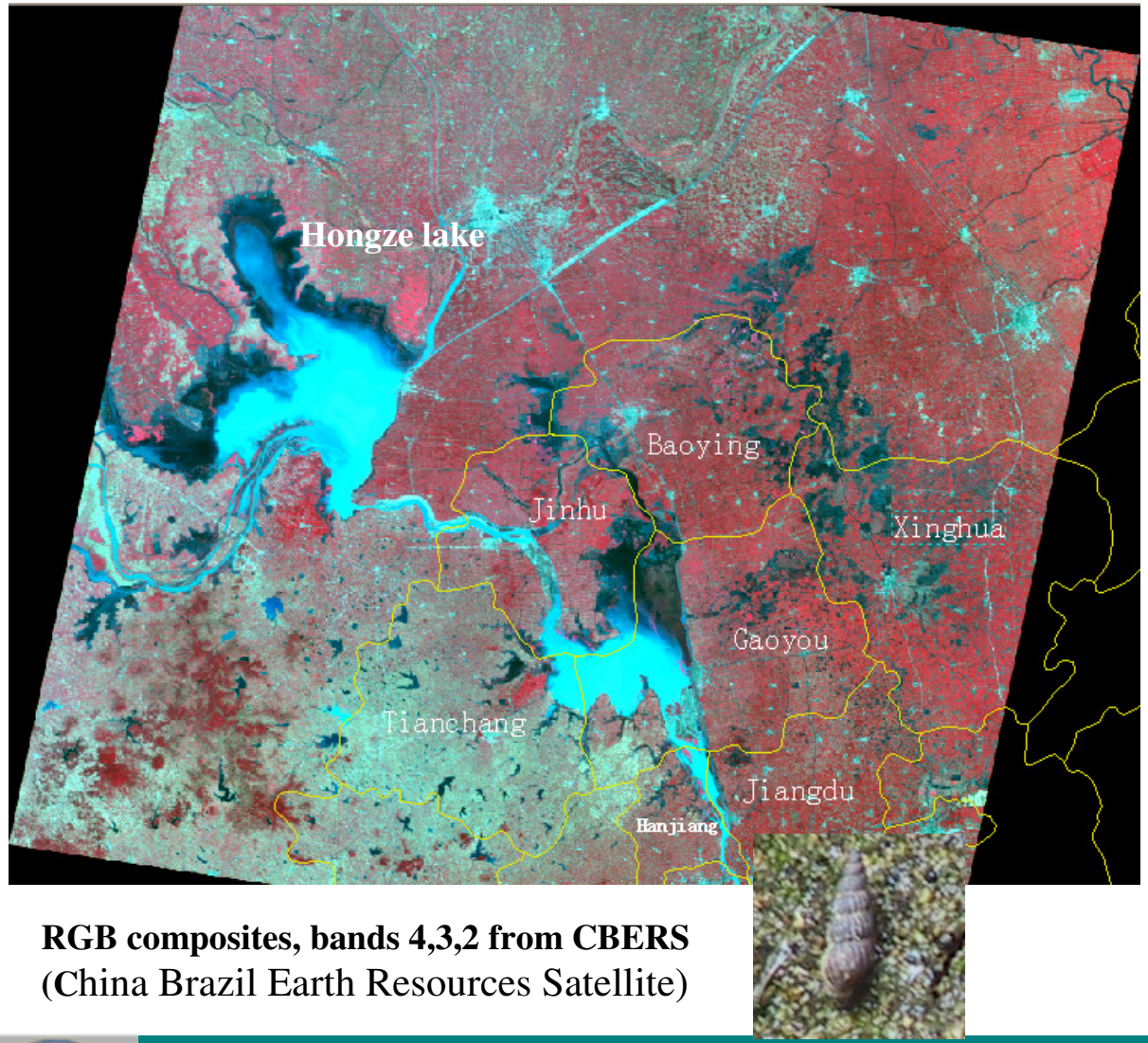
Source: WHO,2003.Climate change and human health-risk and responses. Summary
IPCC - Intergovernmental Panel on Climate Change

➢The south-to-north water diversion project in China

There are three water diversion routes planned in this project, namely the East Route, Middle Route and West Route. The three water diversion routes are designed to connect the Yangtze river with the three largest rivers in the north - the Yellow, the Huaihe and the Haihe rivers. The first and second phases of the East Route construction and the first phase of the Middle Route construction should be completed by 2010. Total cost of this work will be more than 180 billion Chinese yuan (about 25 billion U.S. dollars).

➢The south-to-north water diversion project in China

Headstream of East route



RGB composites, bands 4,3,2 from CBERS
(China Brazil Earth Resources Satellite)

The snail is distributed along the water stream

Data and methods

➢Disease Map

Epidemic counties were digitized from the Chinese schistosomiasis atlas.

➢Air temperature

The mean lowest air temperature in a year, mean lowest air temperature in January, mean air temperature in a year, mean air temperature in January and mean highest air temperature in a year during 1961 to 1990 were collected from Data-sharing Network of Earth System Science (www.geodata.cn). Air temperature of 1km^2 grid map was produced.

Data and methods

➢**Relationship between schistosomiasis and air temperature**

In Arcview GIS, 1km^2 grid air temperature in the distributional area of schistosomiasis was computed. Descriptive statistical analyses were conducted using SPSS11.5 software.

➢**Better index for predicting the distribution of schistosomiasis**

Air temperature's scope map was computed from the results of descriptive analysis and then it was overlayed with the map of schistosomiasis distribution. From the overlay map, the degree of agreement between schistosomiasis distribution and different air temperatures was investigated.

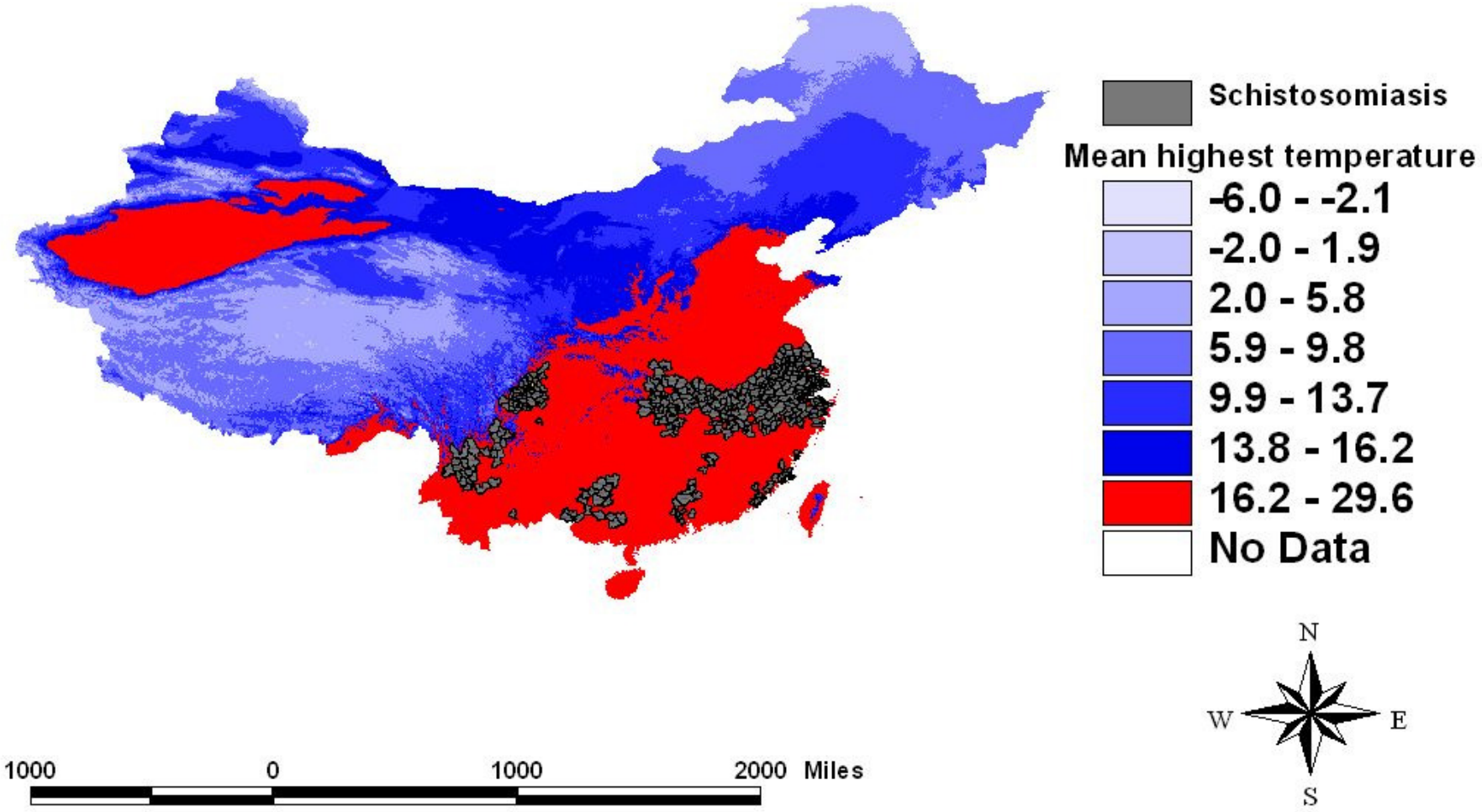
Results

Air temperature in the endemic areas of schistosomiasis

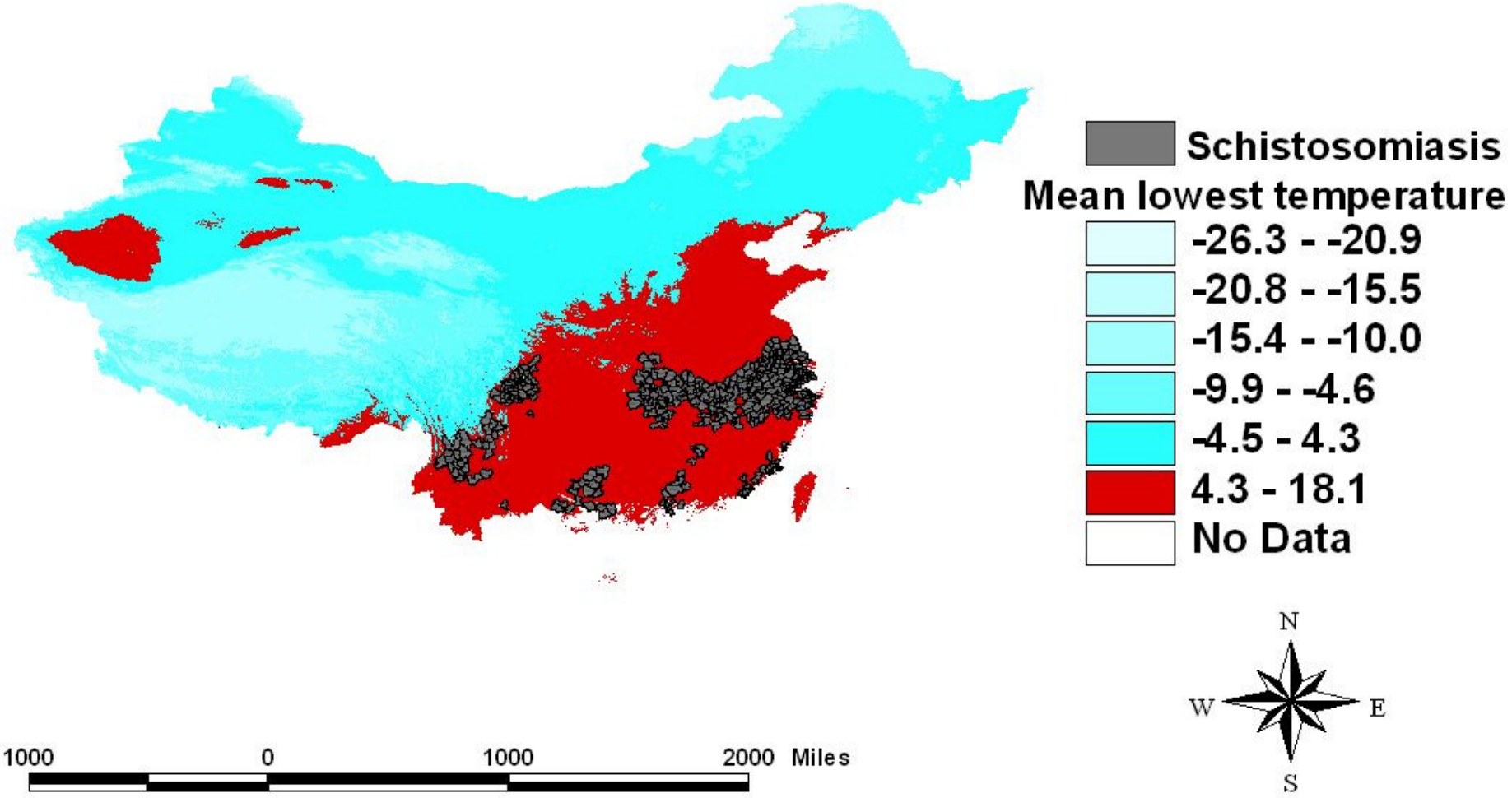
Air temperature	Mean	Median	$P_{2.5}$	$P_{97.5}$
Mean lowest air temperature in many years	12.4	12.7	4.3	18.1
Mean lowest air temperature in January of many years	1.4	0.9	-4.6	9.2
Mean air temperature in many years	16.0	16.1	9.4	21.1
Mean air temperature in January of many years	5.0	4.2	0.9	12.4
Highest air temperature in many years	20.7	20.5	16.2	25.6

$P_{2.5}$-Percentile 2.5, $P_{97.5}$- Percentile 97.5

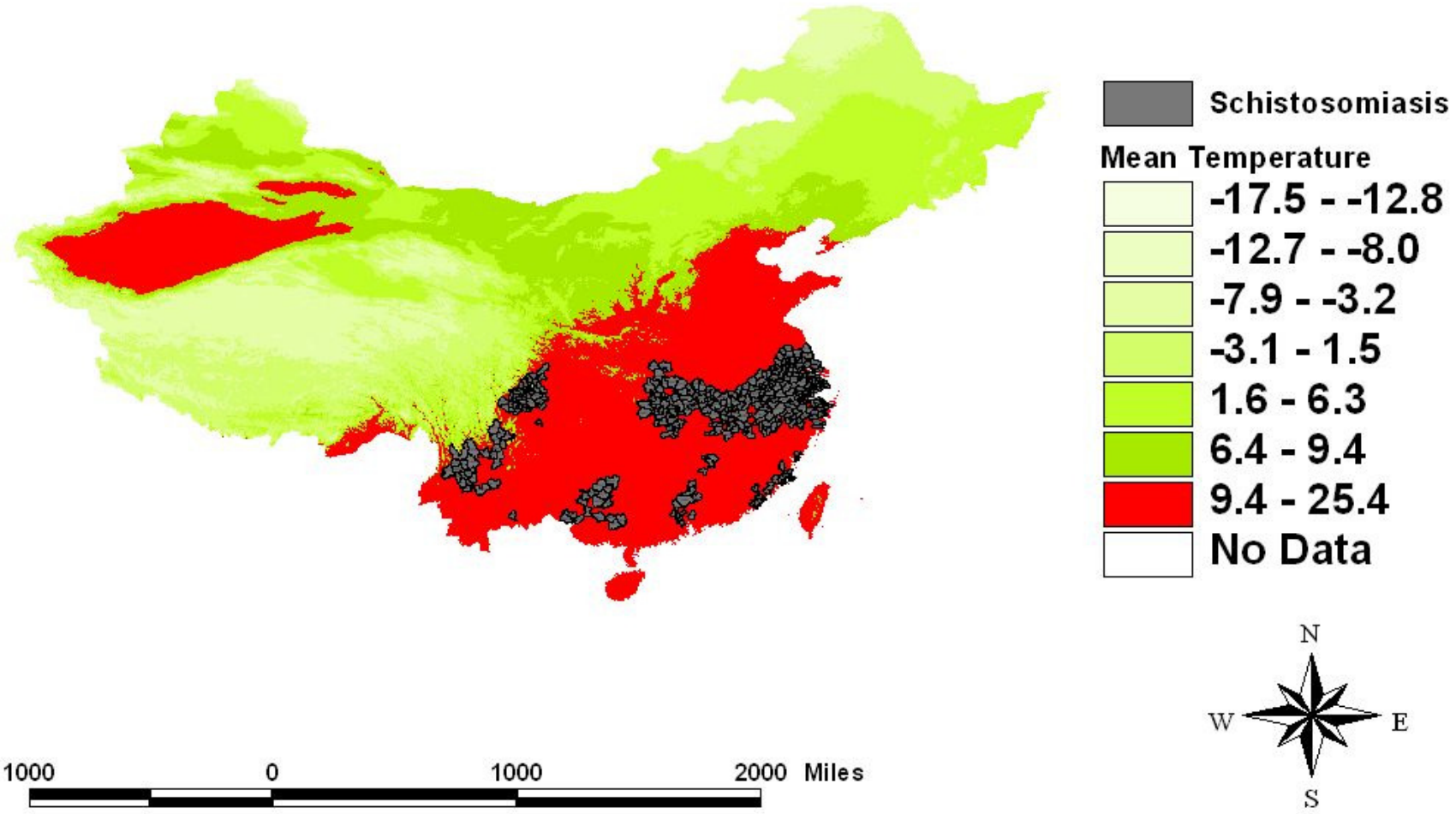
Mean highest temperature of 30 years and Schistosomiasis



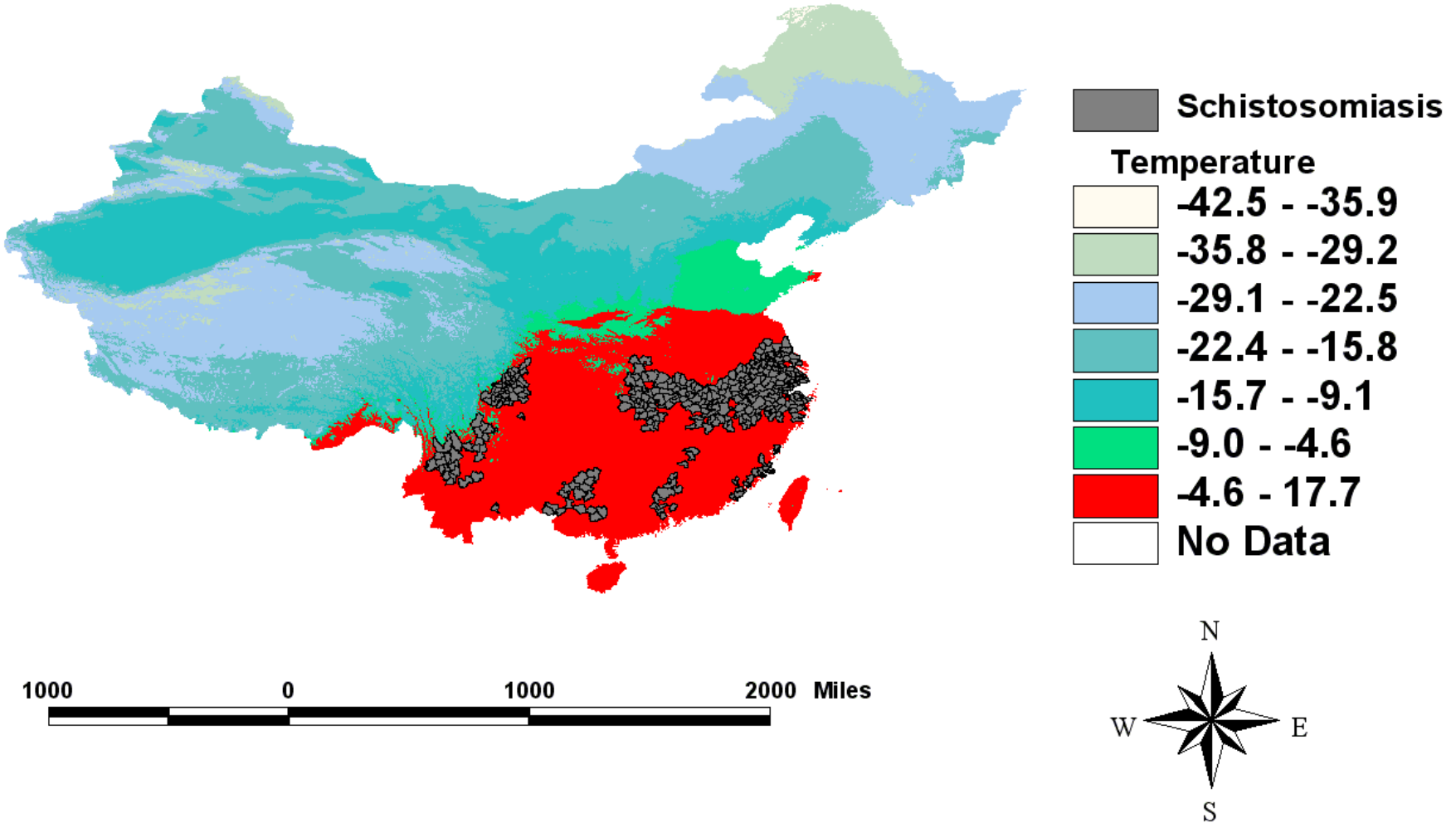
Mean lowest temperature of 30 years and Schistosomiasis



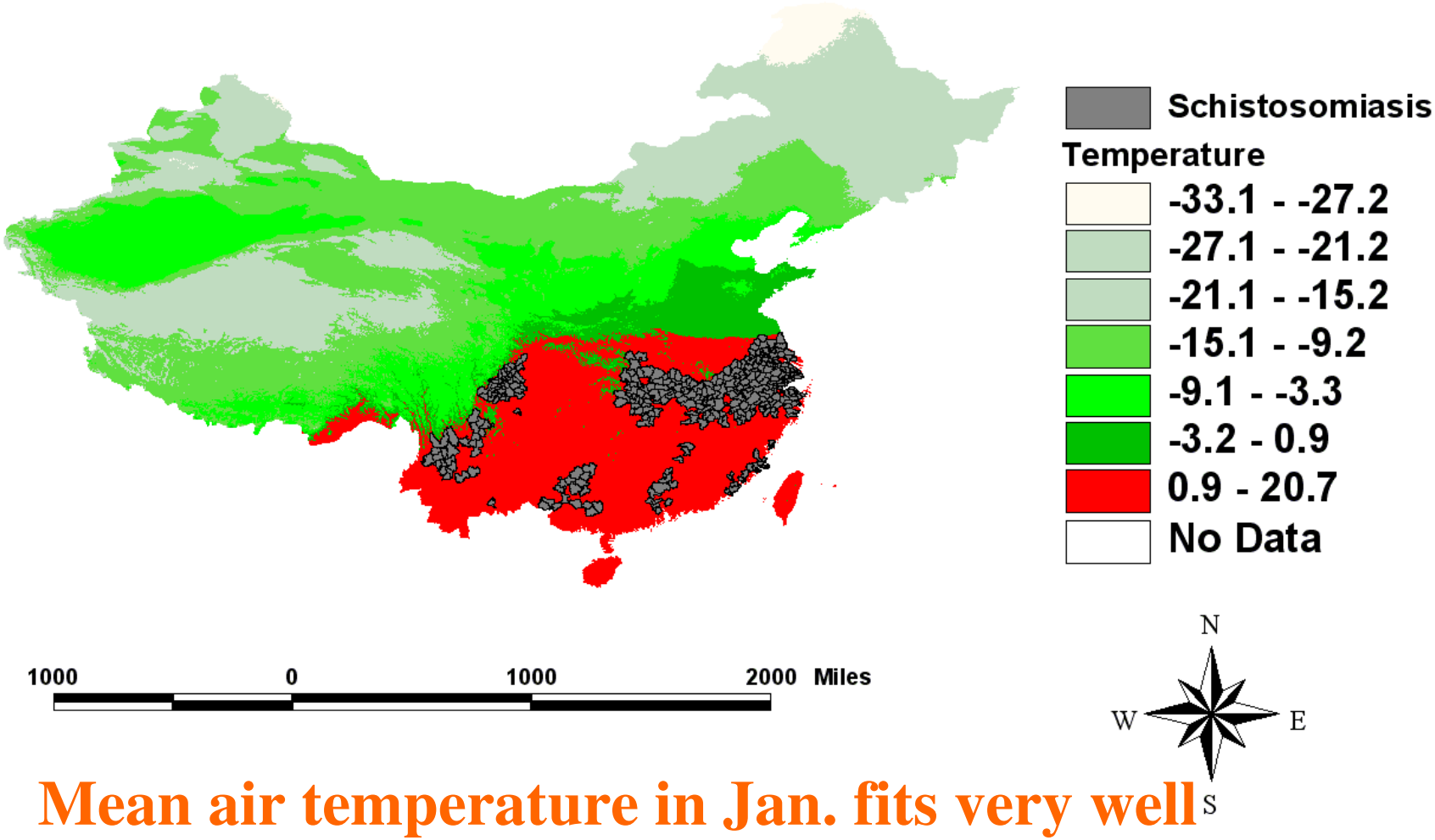
Mean Temperature of 30 years and Schistosomiasis



Mean lowest air temperature in January of 30 years and Schistosomiasis

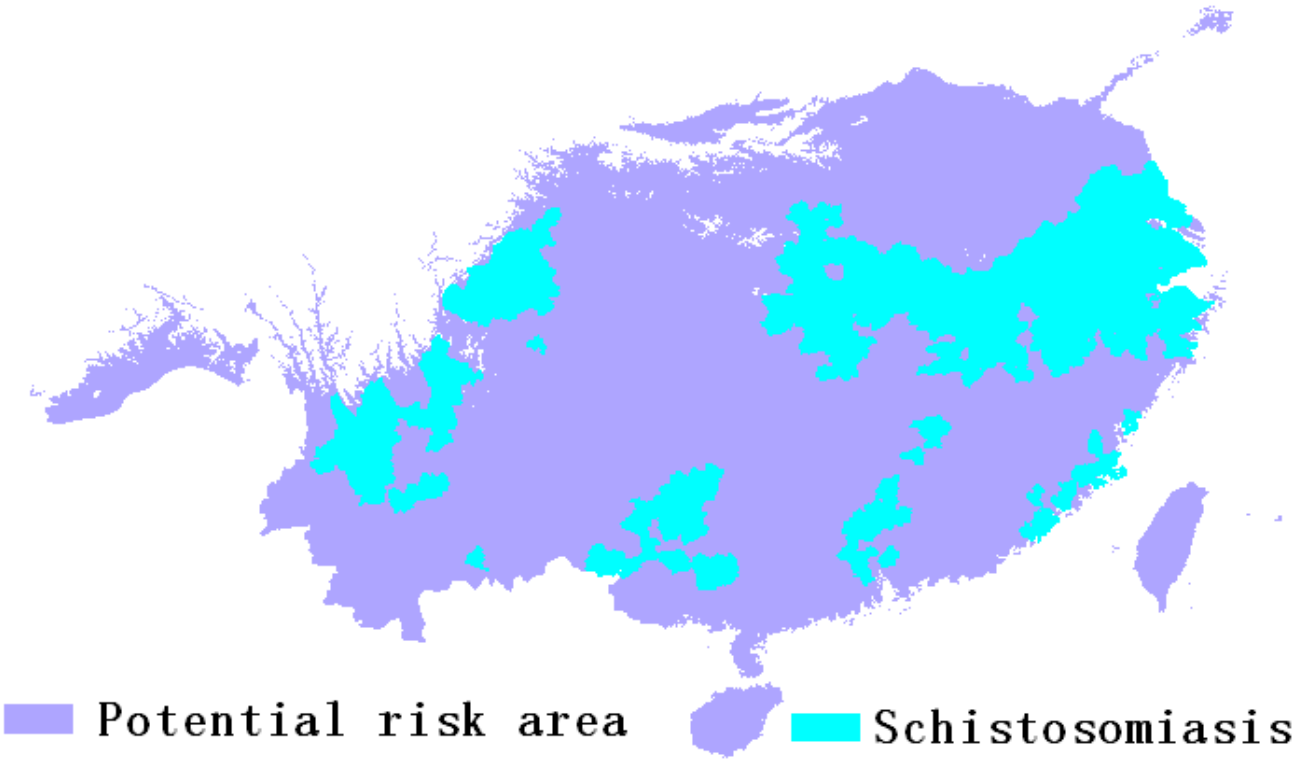


Mean air temperature in January of 30 years and Schistosomiasis



Mean air temperature in Jan. fits very well

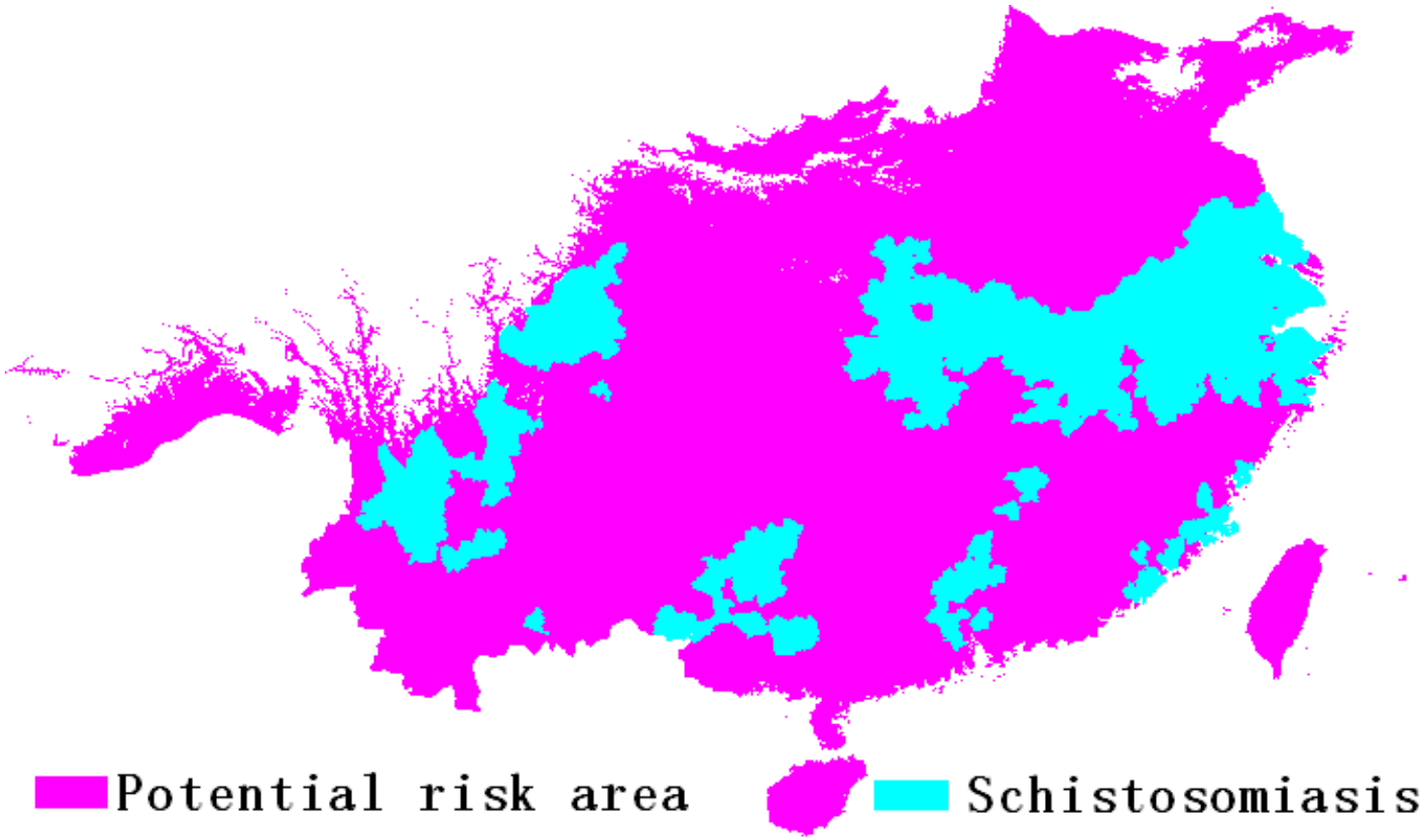
Potential risk area of schistosomiasis in 2050



Mean temperature in 2050= Mean temperature of many years +2.3

Based on recent meteorological models for the whole of China, the mean temperature will increase by 2.3-3.3℃ in 2050 and by 3.9-6.0℃ in 2100. Assume that the temperature will rise evenly, this map shows the potential risk area of schistosomiasis in 2050.

Potential risk area of schistosomiasis in 2100



Mean temperature in 2100= Mean temperature of many years +3.9

Conclusion

- **The mean air temperature in January is a better index for predicting the distribution of schistosomiasis.**
- **With the global climate warming and the carry-out of south-to-north water diversion project in China, the disease transmission will extend northward into currently non-endemic areas.**
- **Global climate warming will cause great challenges for the schistosomiasis control in the future.**

Further study

A limitation of our current approach is that it emphasizes the role of temperature, but does not take into account the role of rainfall and the potential interaction between temperature and rainfall. Recent improvements in modeling global trends in streamflow, precipitation, and water availability should become an integral part of present and future predictions of climate change and variability on infectious disease dynamics, including schistosomiasis.

Acknowledgments

This study was supported by the National Natural Science Foundation of China (#30590374),by the National High Technology Research and Development Program of China (#2006AA02Z402) and by Shanghai Leading Academic Discipline Project (no.B118)

Thanks for your attention