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# Responses of aboveground biomass and soil organic carbon to projected future climate change in Inner Mongolian grasslands

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**SUPPLEMENTARY MATERIAL**

**Data sources for model validation**

*Aboveground biomass*

The model was validated using data for aboveground biomass from eleven sites. Data sources are detailed in Table A1. Eight of the sites were ecological observation stations of the China Meteorological Administration and the Inner Mongolia Meteorological Bureau. Data sets from these stations comprised dry weight of aboveground biomass measured from three 1 $m^2$ quadrats once per month during the growing season (Li *et al*. 2014). Six of these stations had biomass data from 1995 to 2005 for green-up (May), flowering (July) and senescence (September). Two others had such data from 1995 to 2008. Biomass data for three other ecological observation stations (Zhenglanqi, Baiyinxile and Siziwanqi) were obtained from publications, listed in Table A1, and had been collected between 1981 and 2001 using the same methods as the other ecological observation stations.

*Soil organic carbon*

Data for soil organic carbon in 0-20 cm soil layers were obtained from literature for eight sites (Table A1). Soil organic carbon was measured in August (peak period of aboveground biomass) for all sites. The soil samples had been collected from the 0-10 and 10-20 cm top soil layers, air-dried and sieved. Soil organic carbon was then measured by the $K_2Cr_2O_7$–$H_2SO_4$ oxidation method of Walkey and Black (Nelson and Sommers, 1982).

**Table A1. Data sources for aboveground biomass (g $m^{-2}$) and soil organic carbon (Kg C $m^{-2}$) at sixteen sites in Inner Mongolia, as used in model validation**

| Sites | Steppe type | Time series of aboveground biomass datasets | Time series of soil organic carbon datasets | References |
|---|---|---|---|---|
| Erguna | Meadow | 1995-2005 | — | Ecological observation station |
| Hulunbeir | Meadow | 1995-2008 | 2006, 2009 | Ecological observation station, Chen 2008; Zhang *et al*. 2009; Wendu 2011 |
| Ewenki | Meadow | — | 2004, 2005, 2008 | Han *et al*. 2008; Wang *et al*. 2007, 2010; Fan *et al*. 2010 |
| Taipsiqi | Typical | — | 2007, 2008, 2010 | Ao *et al*. 2011; Shan *et al*. 2009, 2012 |
| Zhenglanqi | Typical | 1984-1995 | — | Bai and Xu 1997 |
| Baiyinxile | Typical | 1981-2001 | 1989-1993, 1998, 2000, 2004-2006, 2010 | Guan *et al*. 1999; Geng *et al*. 2001; Cui *et al*. 2005; Duan 2006; Yan *et al*. 2008; Wu *et al*. 2008; Xu *et al*. 2009; Liu *et al*. 2012 |
| Xilinhot | Typical | 1995-2005 | — | Ecological observation station |
| Bayartuhu | Meadow | 1995-2005 | — | Ecological observation station |
| Siziwangqi | Desert | 1982-1995 | 2002, 2004-2007, 2009-2010 | Anonymous 2001; Zhao *et al*. 2006; Li *et al*. 2008; Wu *et al*. 2010; Zhou *et al*. 2011; Liu *et al*. 2012 |
| Xianghuang | Typical | 1995-2005 | — | Ecological observation station |
| Chayouhou | Typical | 1995-2005 | — | Ecological observation station |
| Sunityouqi | Typical | — | 2004, 2006 | Wei *et al*. 2005; Liu 2007; Yan 2008 |
| Wushenzhao | Desert | 1995-2008 | — | Ecological observation station, Chang *et al*. 2010 |
| Horiqin | Desert | — | 2004, 2006, 2010 | Li *et al*. 2006; He *et al*. 2009; Chen *et al*. 2012 |
| Alaxzuoqi | Desert | — | 1998, 2001 | Fu *et al*. 2003 |
| Luanjingtan | Desert | 1995-2005 | — | Ecological observation station |

**Temperature and precipitation at three exemplar sites**

Projections for temperature and precipitation change under RCP4.5 and RCP 8.5 for three exemplar sites are shown in Fig. A1 (Ewenki, meadow steppe), Fig.A2 (Xilinhot, typical steppe) and Fig. A3 (Alxazuoqi, desert steppe).

**Fig. A1.** Temperature and precipitation (1986-2100) under two climate scenarios of RCP4.5 and RCP8.5 for the meadow steppe site of Ewenki (*a*) annual mean maximum temperature; (*b*) annual mean minimum temperature; (*c*) annual mean temperature; and (*d*) annual precipitation. ** indicates significant difference at $P<0.01$ and *** at $P<0.001$.

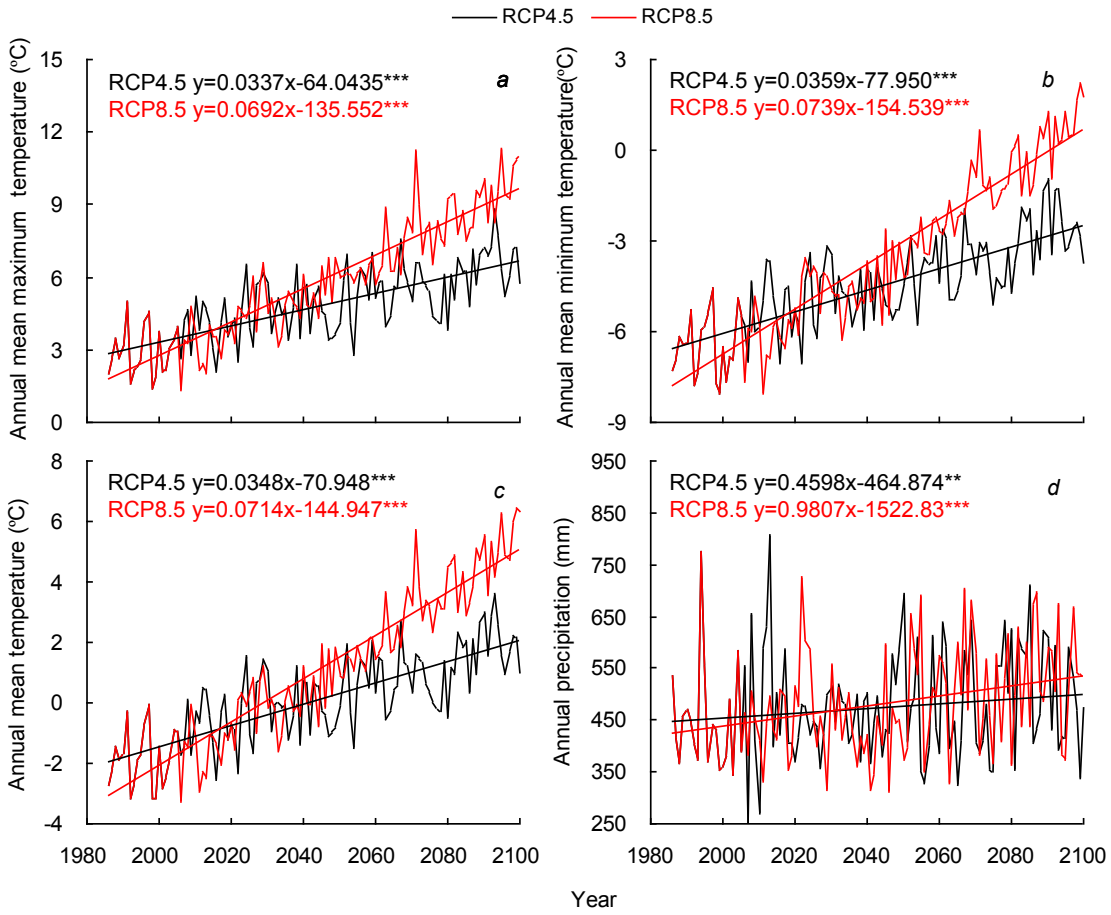


**Fig. A2.** Temperature and precipitation (1986-2100) under two climate scenarios of RCP4.5 and RCP8.5 for the typical steppe site of Xilinhot (*a*) annual mean maximum temperature; (*b*) annual mean minimum temperature; (*c*) annual mean temperature; and (*d*) annual precipitation. ** indicates significant difference at $P<0.01$ and *** at $P<0.001$.

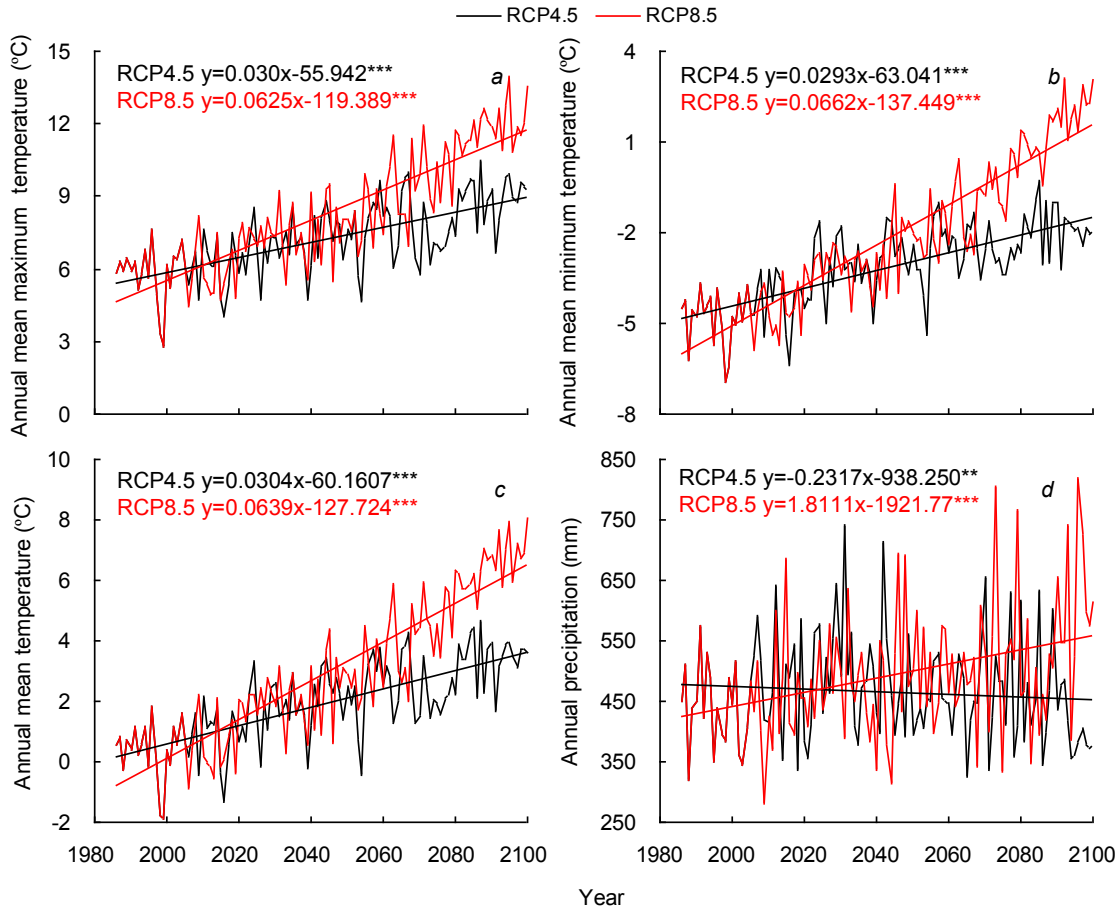
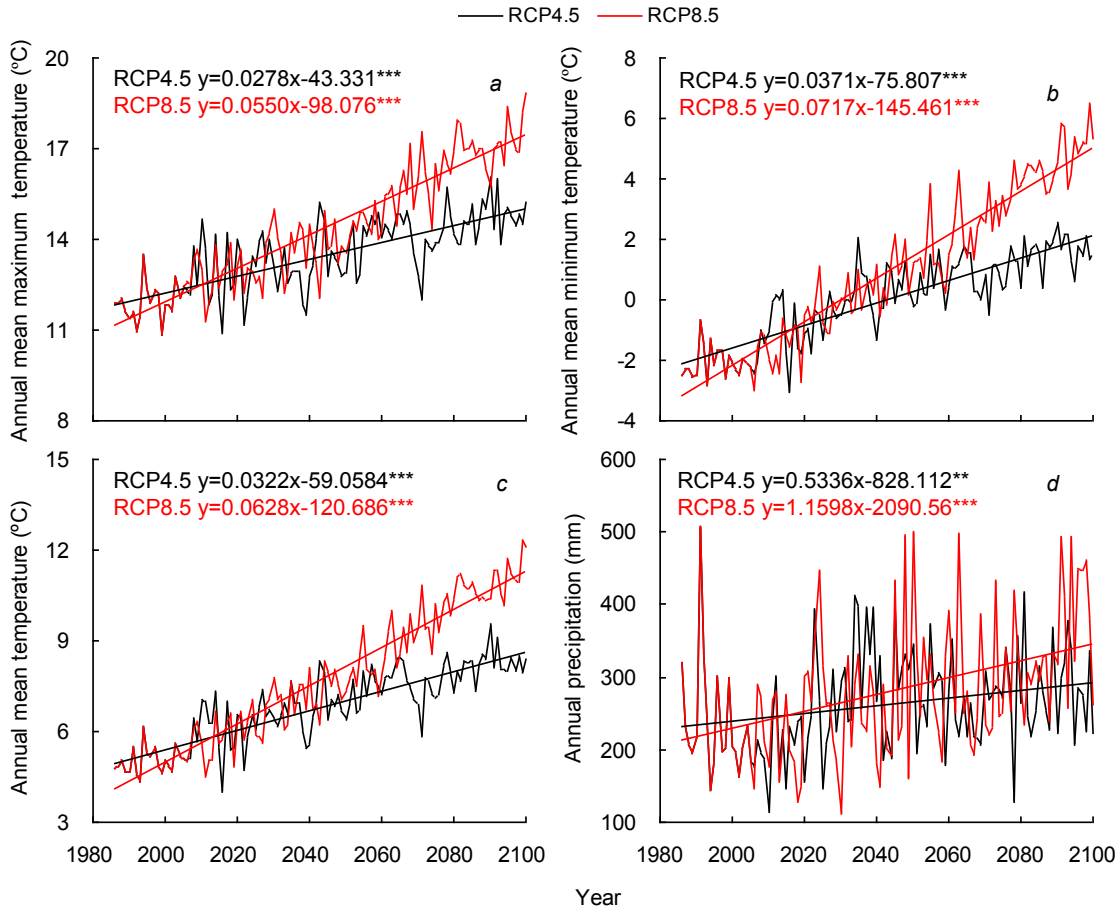


**Fig. A3.** Temperature and precipitation (1986-2100) under two climate scenarios of RCP4.5 and RCP8.5 for the desert steppe site of Alxazuoqi (*a*) annual mean maximum temperature; (*b*) annual mean minimum temperature; (*c*) annual mean temperature; and (*d*) annual mean precipitation. ** indicates significant difference at $P<0.01$ and *** at $P<0.001$.



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