Age and climate sensitivity of radial growth of *Picea crassifolia* to climate in a transitional climatic zone in Northwest China

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**ABSTRACT**

Study of the radial growth response to climate factors at different tree ages is essential for predicting forest dynamics and formulating correct management policies. In this study, we analysed the growth responsiveness of *Picea crassifolia* to climate conditions, and evaluated its relationship to tree age at the individual tree scale, in the transitional zone between regions affected by the East Asian monsoon and winds blowing from the west (westerlies) in the Qilian Mountains. On three study sites, 150 cores were taken from 75 trees. Pearson correlation coefficients were calculated between the standardized tree-ring series of each core (and chronology) and climatic factors which were utilized to research the climate-growth relationships. Quadratic polynomial fitting was used to test the relationships between tree age, chronological parameters, and the radial growth response to climate. Radial growth was positively influenced by total precipitation for the previous July-September and the current May-July. Additionally, radial growth was negatively correlated with the total monthly precipitation for the current September, and the mean monthly temperature for the previous July. Trees younger than 80 years old showed a stronger response to accumulative precipitation in the previous July-September, those older than 160 years old showed a stronger response to precipitation at the end of current growing season, while those of 140–160 years old showed a weaker response to precipitation in the current May-July.

**INTRODUCTION**

Assessing the influence of climate on the radial growth of trees is essential for predicting forest dynamics and forming adaptive forest management policy (Elliott *et al.* 2015, Griesbauer and Green 2012). Dendrochronological method could research the climate-radial growth accurately and quickly (Henttonen *et al.* 2014, Zhang *et al.* 2015, Suvanto *et al.* 2016). Trees in the transitional climatic zone are highly sensitive to climate and is suitable for tree-ring research. Study at the transitional zone between southern subtropical zone to northern tropical zone in Yangchun (north China) found precipitation in autumn was the main factor that impacted radial growth of *Cinnamomum camphora* (Xing *et al.* 2004). Gonzalez-Gonzalez *et al.* (2014) compared the climatic signal in the earlywood vessels of *Quercus petraea* and *Quercus pyrenaica* in a transitional area between the Atlantic and Mediterranean regions of the Iberian Peninsula. Research in the north-eastern part of the