

The humid evergreen monsoon forests in China and other parts of Asia contribute significantly to the global and regional atmospheric circulation and hydrological cycle. The forests are, however, changing in structure due to increasing droughts, with potential impacts on forest hydrology. Long-term monitoring of these forests has also shown strong shifts in tree size distribution and tree species composition, changes that are likely to impose shifting functional demands on wood traits, leading to modification of the wood anatomy, stem sapflow and forest stand water use, as a consequence of changing hydraulic structures. We investigated the roles of tree size, species composition, elevation and microclimate on tree water use (TWU) and stand transpiration (E_c) in two forest stands located at 20 m (Low-site) and 300 m (High-site) elevations in the Dinghushan Biosphere forest reserve in South China (23°09'21"N–23°11'30"N, 112°30'39"E–112°33'41"E). The reserve was established in 1956 to protect the natural monsoon evergreen broad-leaved forests. Sap flux density (SFD) was measured for a period of 1 year on 34 trees belonging to five different species common to the two stands. Species abundance, social position of the crown and crown size, tree diameter at breast height (DBH) and the area of the conductive sapwood (S_A) were measured in plots of 400 and 600 m², respectively. TWU was calculated from SFD and S_A , while E_c was estimated from TWU and stand S_A derived from DBH/ S_A relationship. S_A was positively and exponentially ($R^2 = 0.91$; $P < 0.001$) correlated with DBH. The mean maximum SFD from the 34 trees, belonging to the five species ranged between 3.9 ± 0.6 and 16.4 ± 1.8 g cm² h⁻¹, while the mean TWU_{max} ranged between 5 and 50 kg d⁻¹. Differences among individuals were significant ($P < 0.05$) and were attributed to social position of the crown and tree size. The average daily canopy transpiration (E_c) from trees with DBH >10 cm was 1.1 ± 0.6 and 0.9 ± 0.4 mm d⁻¹, accounting for 36–43% of the total soil water uptake at the ET and GH sites, respectively. Daily fluctuations in SFD and E_c were determined by VPD and PAR. Despite the low TWU and E_c from trees with DBH >10 cm, the total potential evapotranspiration (E_T) from the forest was estimated at 3.6 mm d⁻¹, which is within the range for most tropical forests. It is likely that the understory, with DBH <10 cm plays an important role in forest water use, an attribute of a relatively young forest stand.