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The first soil moisture reconstruction in the Mediterranean Chilean Andes region developed by tree rings and satellite observations to inform climate change impacts in South America

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Soil moisture (SM) is a key variable in the earth surface dynamics; however, long-term in situ measurements at the global scale are scarce. In the Mediterranean Chilean Andes (MA; 30°-37°S), Sclerophyllous Forest tree species such as Belloto del Norte (BN; *Beilschmiedia miersii*) can grow for more than two centuries in very scarce humid lowland geographical zones. At the present work, we assess the linkages between two BN tree-ring chronologies (BML and AGU sites; 70 cores) and daily high-resolution satellite-based surface soil moisture product v201812.0 from ESA and to reconstruct past SM variations in the MA region. Our findings exhibit strong relationships between tree-growth from BML and AGU sites and the SM from 32°-34°S and 71°-73°W spatial domain, especially from February to September. We found significant r Pearson correlations of 0.85 and 0.68 during 1983-2014 (*P*-value < 0.001), respectively. Based on these results, we reconstructed the SM between 1800 - 2014 period using multiple linear regression. Our model retains 71.4% of the total variance and exhibits an unprecedented SM reduction since 2006 in the context of the past two centuries. This work constitutes the first reconstruction of surface soil moisture variability derived from remote sensing carried out in Chile, and can provide new information to understand current environmental changes related to the severe mega-drought period experienced in Chile since 2010, which has provoked water conflicts, the Sclerophyllous Forest decline and browning, and the intensification of climate extreme events such as heatwaves and wildfires in the MA.

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