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Transit time of water discharges from catchments in coastal mountain of Chile

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Water quantity and quality response of forest catchments to climate and land-use change are difficult to understand and predict due to complexities of subsurface water flow paths. The main focus of forest hydrology in Chile has been the effect of canopy and soil together with rain in water availability. Groundwater, as a factor in water availability especially during dry season, has not been studied. Only a few studies have been carried out in northern Chile in a non-forestry area using the stable isotopes of the water to characterize recharge and depletion of the aquifer.

We use tritium for understanding the dynamics of groundwater through small watersheds over a latitudinal gradient in the coastal range of Central Chile. The zone constitutes rapid growth plantations and a large population that depend on surface water and groundwater for drinking, agriculture, pasture and industry. The study areas have metamorphic bedrock with a Mediterranean weather, and precipitation ranging from 700-800 mm year-1 in the North (Constitución area) to 2300-2500 mm year-1 in the South (Valdivia area). The watersheds have been forested with *Pinus radiata* in 2003 and 1990 respectively, and flow stations were installed in 2008 by Forestal Arauco S.A. to identify the forest management impact on the water cycle.

Tritium is present in meteoric water and decays through radioactive decay. In groundwater, which is separated from the tritium production source in the atmosphere, the tritium concentration decreases over time and therefore allows for determination of the residence time of the water in the groundwater system, and the lag time between recharge of the water, and discharge into the streams.

Preliminary results of rain samples collected in 2014 in Constitución confirm the tritium input estimate that we made using the New Zealand input data from similar latitude, and the IAEA data (http://www-naweb.iaea.org/napc/ih/IHS_resources_gnip.html). The mean residence time of the water in the stream at base flow is between 9 and 15 years, older during summer. The results of the Valdivia rain samples collected in 2014 show that the tritium input is slightly higher than estimated from the IAEA and New Zealand rain data. The mean residence time of the water in the stream at base flow is 5–7 years in winter, and approximately 10 years in summer.

In the next phases of this study we will incorporate more watersheds from different precipitation and land use zones into the tritium survey, derive groundwater storage in the catchments, and develop water flow models that are validated by the tritium data.