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Technical note: What does the Standardized Streamflow Index actually reflect? Insights and implications for hydrological drought analysis

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Table S1. Description of the SUMMA model parameters and ranges used for calibration.

Parameter	Description	Units	Calibration range	
			Min	Max
K_{soil}	Hydraulic conductivity of soil	m/s	10^{-7}	10^{-4}
θ_{sat}	Porosity	-	0.30	0.60
CritSoilTranspire	Critical Volume of liquid water content when transpiration is limited	-	0.00	1.00
vGn$_n$	Van Genuchten “n” parameter	-	1.00	2.00
vGn$_\alpha$	Van Genuchten "alpha" parameter	1/m	-1.00	-0.01
aquiferBaseflowExp	Baseflow exponent	-	1.00	10.00
aquiferBaseflowRate	Baseflow rate when aquifer storage is equal to Aquifer Scale Factor	m/s	10^{-9}	0.10
summerLAI	Maximum leaf area index at the peak of the growing season	m^2/m^2	0.01	10.00
qSurfScale	Scaling factor in the surface runoff parameterization	-	1.00	100.00
heighCanopyBottom	Height of bottom of the vegetation canopy above ground surface	m	0.00	5.00
heighCanopyTop	Height of top of the vegetation canopy above ground surface	m	0.05	100.00
windReductionParam	Canopy wind reduction parameter	-	0.00	1.00
routingGammaScale	Scale parameter in Gamma distribution used for sub-grid routing	s	360	86400
routingGammaShape	Shape parameter in Gamma distribution used for sub-grid routing	-	1.00	5.00
F_{capil}	Capillary retention as a fraction of the total pore volume	-	0.01	0.10
$\alpha_{decayRate}$	Albedo decay rate	s	10^6	$5 \cdot 10^6$
α_{max}	Maximum snow albedo for a single spectral band	-	0.70	0.95
$K_{macropore}$	Saturated hydraulic conductivity for macropores	m/s	10^{-7}	10^{-1}
K_{snow}	Hydraulic conductivity of snow	m/s	0.005	0.05
tempCritRain	Critical temperature where precipitation is rain	K	272.16	274.16
refInterceptCapSnow	Reference canopy interception capacity per unit leaf area (snow)	kg/m^2	1.00	10.00
refInterceptCapRain	Canopy interception capacity per unit leaf area (rain)	kg/m^2	0.01	1.00
m_{wexp}	Exponent for meltwater flow	-	1.00	5.00
throughfallScaleSnow	Scaling factor for throughfall (snow)	-	0.10	0.90
throughfallScaleRain	Scaling factor for throughfall (rain)	-	0.10	0.90
wettingFrontSuction	Green-Ampt wetting front suction	m	0.10	1.50

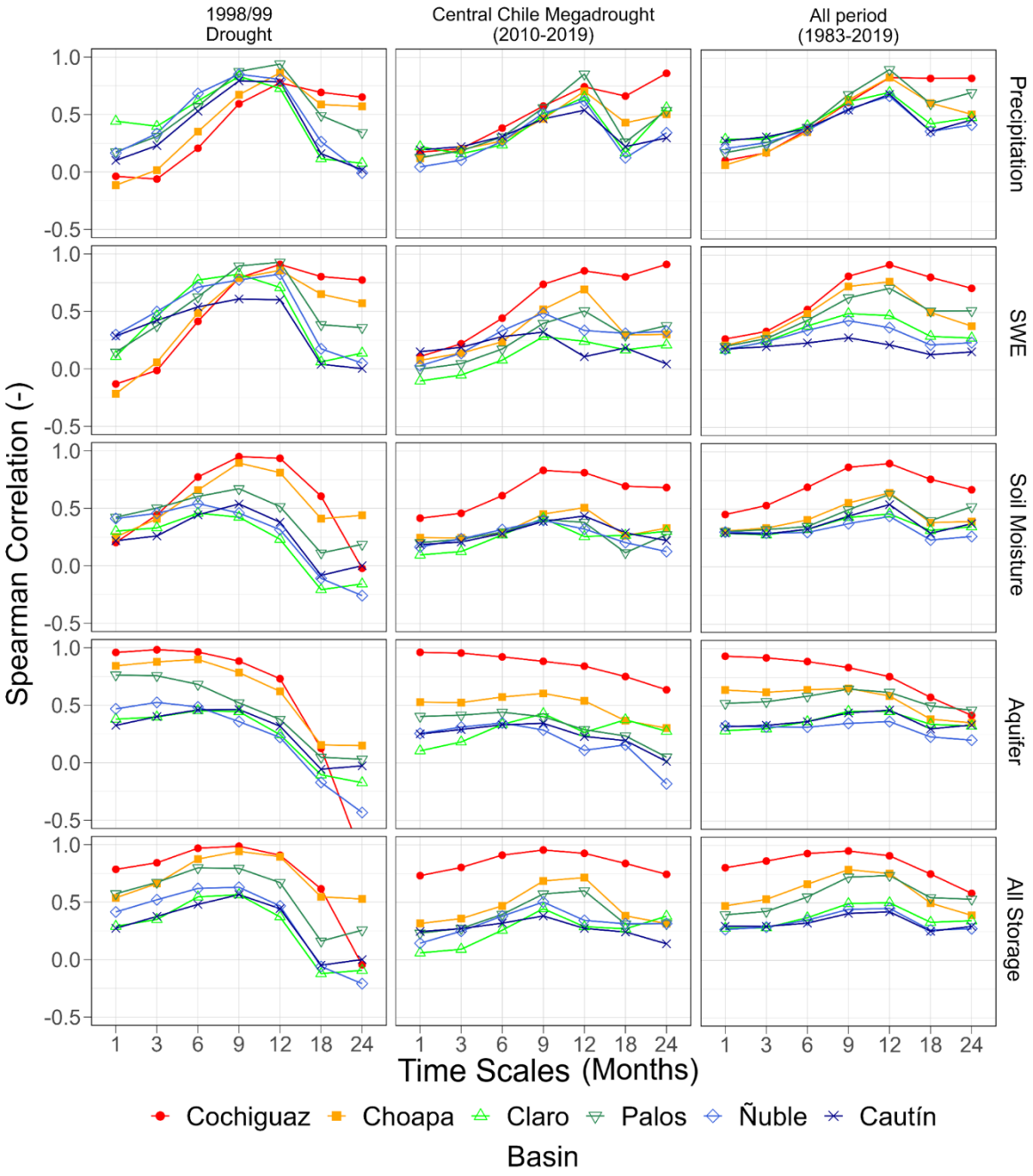

Figure S1. Spearman rank correlation coefficients between SSI-1 and temporally aggregated/averaged catchment-scale explanatory variables (rows) for three different periods: the October/1998-September/1999 drought event (left), the central Chile megadrought (April/2010-March/2019, center), and the entire analysis period (April/1983 - March/2020, right).

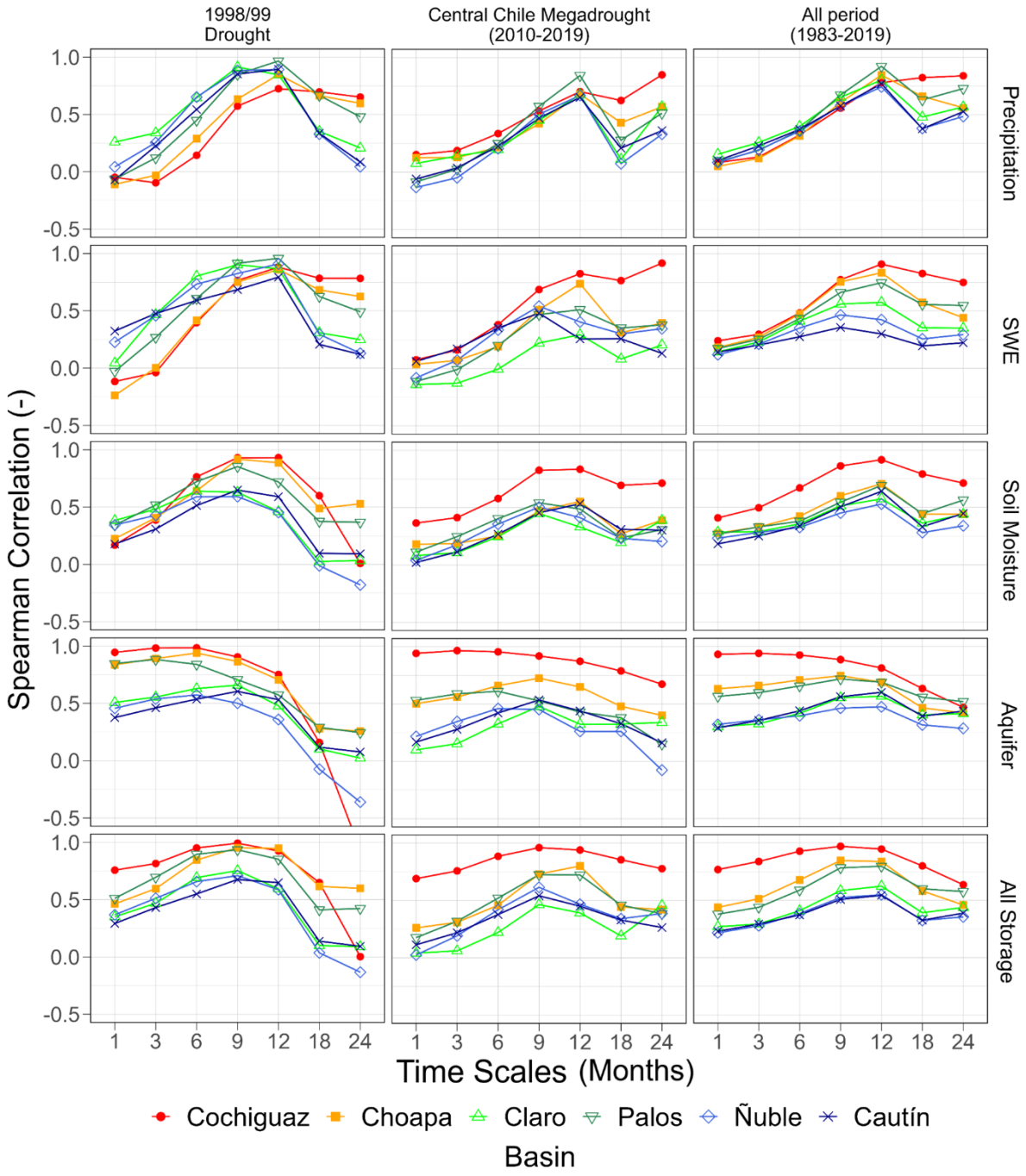

Figure S2. Spearman rank correlation coefficients between SSI-3 and temporally aggregated/averaged catchment-scale explanatory variables (rows) for three different periods: the October/1998-September/1999 drought event (left), the central Chile megadrought (April/2010-March/2019, center), and the entire analysis period (April/1983 - March/2020, right).

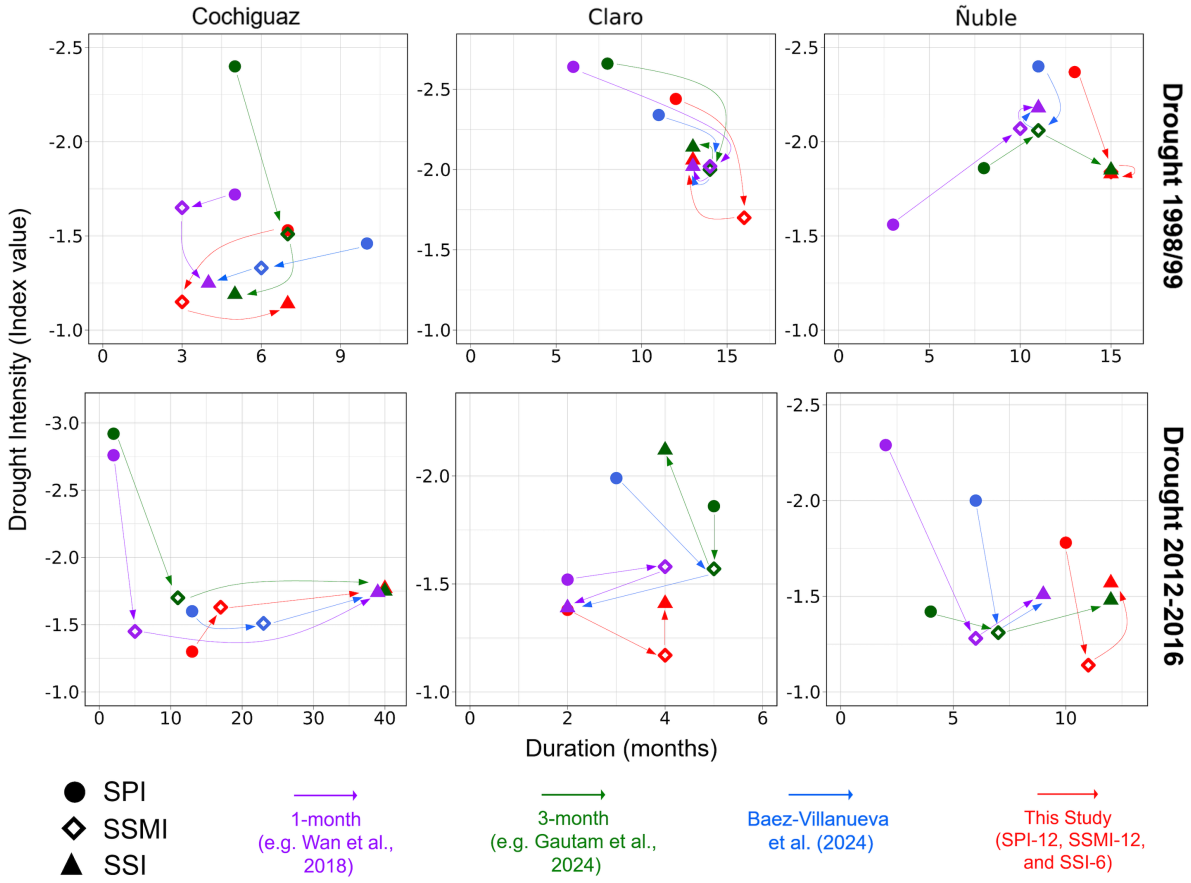

Figure S3. Propagation from meteorological (circles) to soil moisture (diamonds) and hydrological (triangles) droughts for two selected events (1998/99 and 2016/17, displayed in different rows) and three basins with different hydrological regimes: (a) Cochiguaz (snowmelt-driven, left), (b) Claro (rainfall-driven, center) and Ñuble (mixed regime, right). The x-axis shows the duration in months, and the y-axis displays the intensity. The colors indicate trajectories obtained with time scales recommended by different studies (see main manuscript for details).

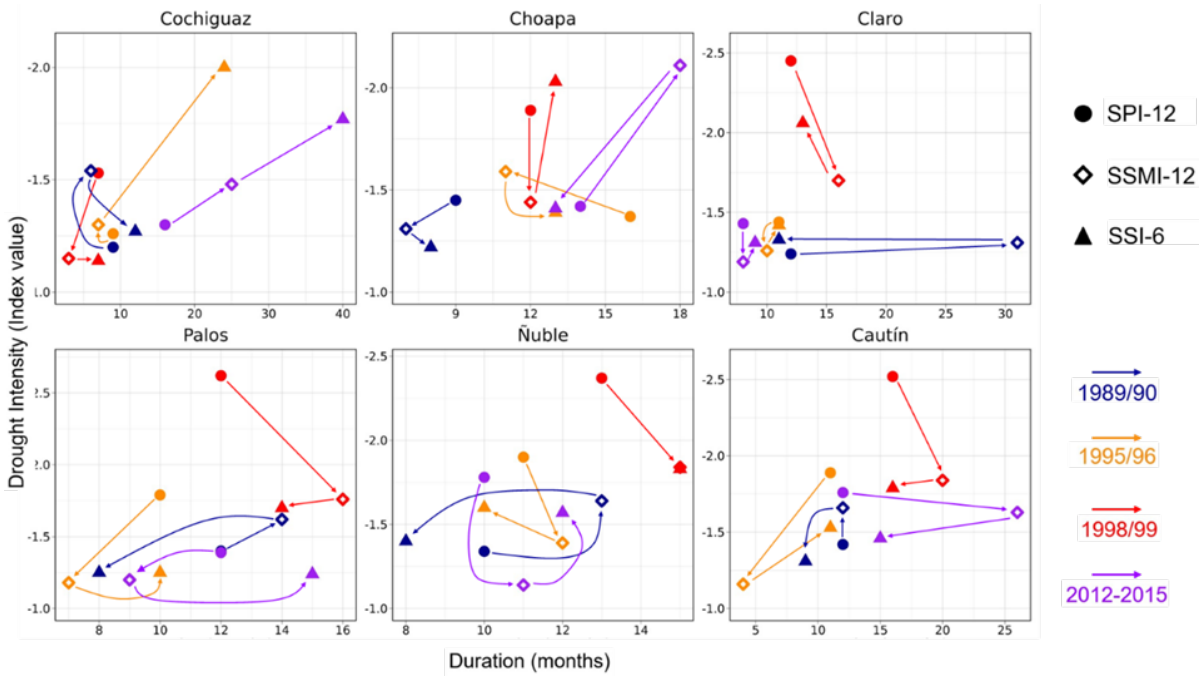

Figure S4. Propagation from meteorological (circles) to soil moisture (diamonds) and hydrological (triangles) droughts for four selected events (1989/1990, 1995/96, 1998/99 and 2012/15, shown with different colors) and three case study basins. The x-axis shows the duration in months, and the y-axis displays the intensity. The time scales used to compute the standardized indices were selected based on exploratory correlation analysis (see main manuscript for details).