

EL MEDITERRÁNEO OCCIDENTAL COMO REGIÓN CLAVE PARA ESTUDIAR LA RELACIÓN ENTRE EL DÉFICIT DE TRANSPORTE DE HUMEDAD Y LA OCURRENCIA DE SEQUÍAS

WESTERN MEDITERRANEAN AS A KEY REGION TO STUDY THE RELATIONSHIP BETWEEN MOISTURE TRANSPORT DEFICIT AND DROUGHT OCCURRENCE

Luis Gimeno-Sotelo ⁽¹⁾, Milica Stojanovic ⁽¹⁾, Rogert Sorí ⁽¹⁾, Raquel Nieto ⁽¹⁾, Sergio M. Vicente-Serrano ⁽²⁾, Luis Gimeno ⁽¹⁾

⁽¹⁾ Centro de Investigación Mariña, Universidade de Vigo, Environmental Physics Laboratory (EPhysLab), Ourense, Spain

⁽²⁾ Instituto Pirenaico de Ecología, Consejo Superior de Investigaciones Científicas (IPE-CSIC), Campus Aula Dei, Zaragoza, España



Universidade de Vigo



1) REGIONS WITH PROJECTED DROUGHT TRENDS

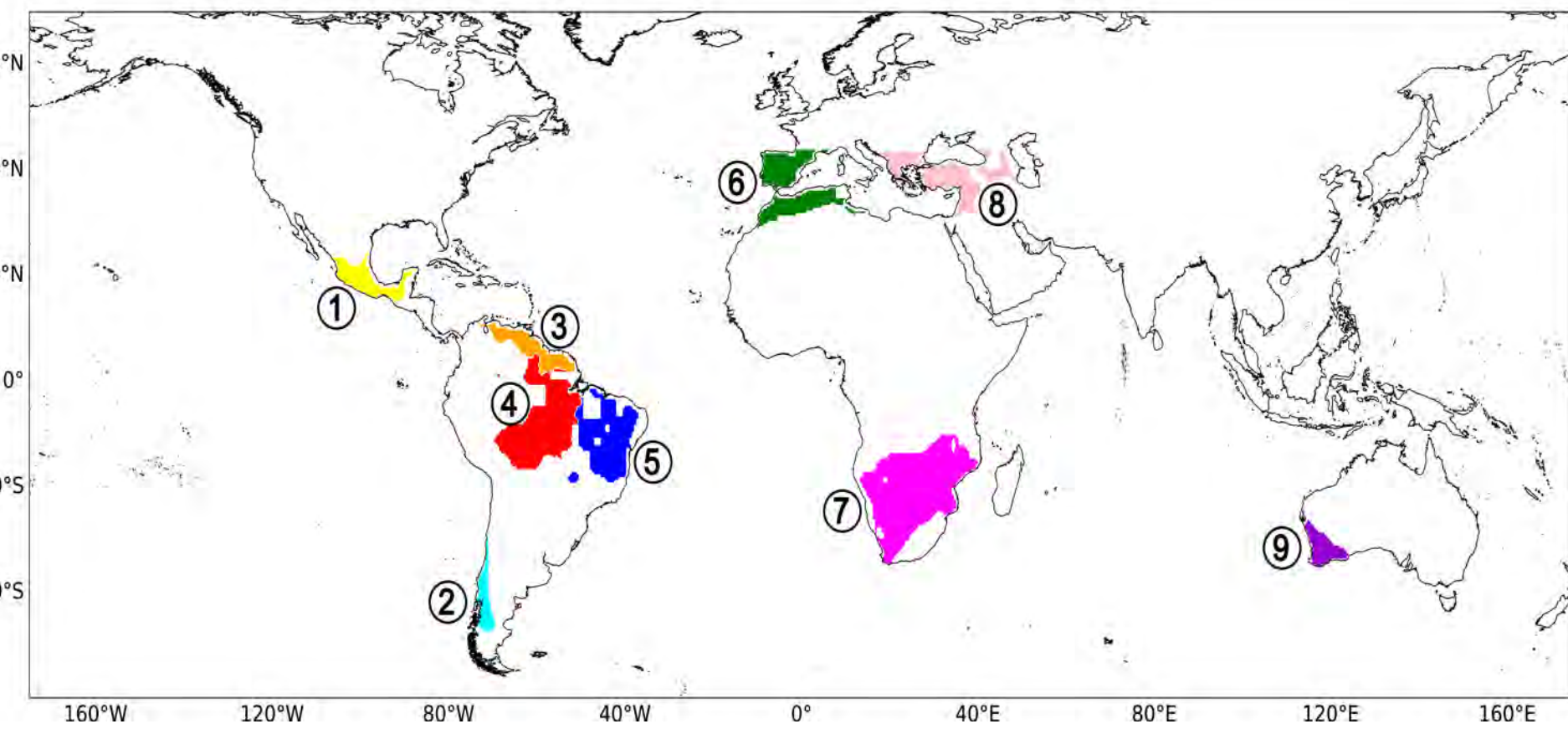


Figure 1: Regions where at least 90% of the CMIP6 models used in this study agreed on a **significant increase in precipitation-based drought magnitude from 1850 to 2100**. 18 CMIP6 models: ACCESS-CM2, ACCESS-ESM1-5, CanESM5-CanOE, CanESM5, CMCC-ESM2, CNRM-CM6-1-HR, CNRM-CM6-1, CNRM-ESM2-1, FIO-ESM-2-0, GFDL-ESM4, GISS-E2-1-G, HadGEM3-GC31-LL, HadGEM3-GC31-MM, INM-CM4-8, IPSL-CM6A-LR, MIROC-ES2L, MIROC6, MRI-ESM2-0. Significance assessed using the Mann–Kendall test.

Western Mediterranean (Region 6) is among the world regions where drought magnitude is projected to increase from 1850 to 2100 under a high anthropogenic emissions scenario

2) SPECIFIC MOISTURE SOURCES AND CONTRIBUTION TO PRECIPITATION

- To identify the main specific climatological moisture sources, **global outputs of the FLEXPART model** were used for the period 1980–2018. The air masses that reach each independent region were **backwards-tracked in time**. **Areas where air masses gain moisture along their pathway** were identified as moisture sources.
- Once the main moisture sources of each region were defined, the air masses were tracked **forward** in time. **Negative values of the net moisture balance ($E - P < 0$)** indicate areas where precipitation exceeds evaporation, and the sum of these values over the target region is assumed to indicate the precipitation coming from the source involved in the analysis, i.e., its **contribution to the precipitation** in that target region.

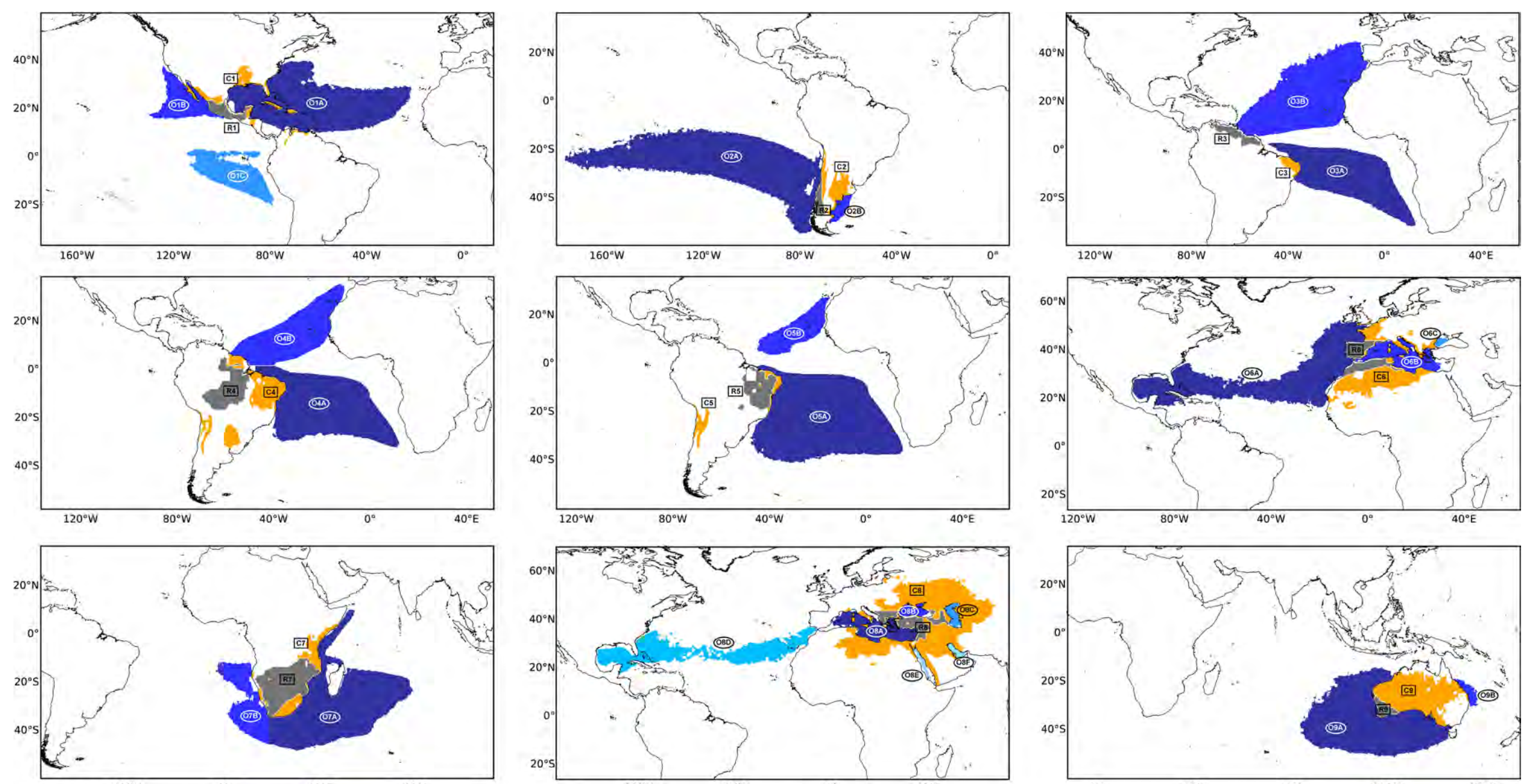


Figure 2: Specific moisture sources for the nine studied regions.

3) DOMINANT MOISTURE SOURCES FOR DROUGHT OCCURRENCE

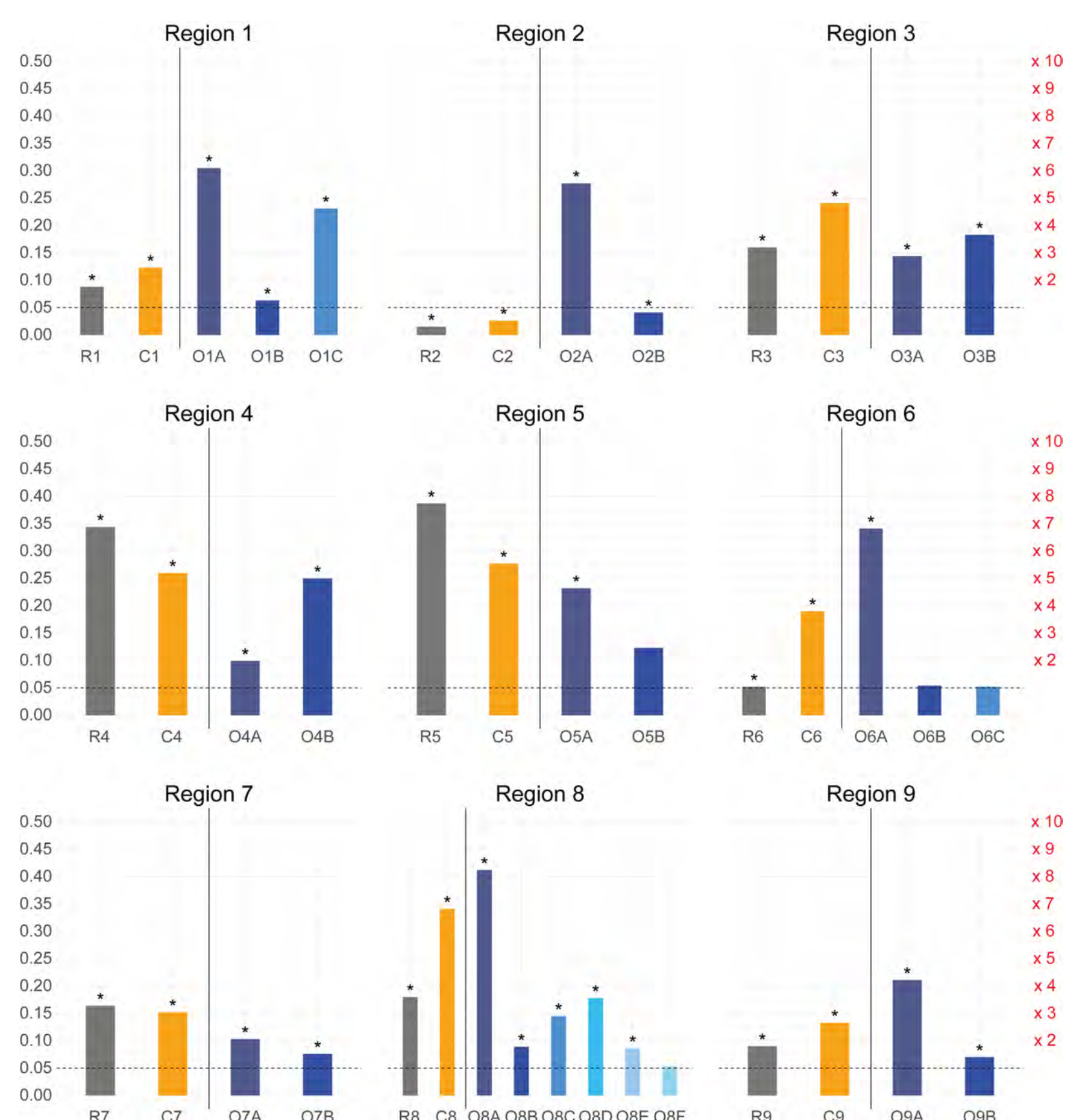


Figure 3: Conditional probability of drought occurrence given an equivalent moisture deficit from each of the specific moisture sources of each of the nine analysed regions.

- The **standardised precipitation index (SPI)** was used for the identification of meteorological droughts. For the SPI calculation, the **MSWEP** dataset (<http://www.gloh2o.org/>) was used for the period of 1980–2018.
- For each region, analogous indices to the SPI were computed for the contribution to the precipitation in the region from its specific moisture sources (**SPI_c**).
- Copulas** were used to estimate the conditional probability of drought given an equivalent moisture deficit from a source, i.e., $P(SPI \leq -1.64 | SPI_c \leq -1.64)$.

The **dominant moisture source** (the one for which the deficit is associated with the highest drought probability) is:

- The specific **oceanic moisture source** that contributes most to precipitation in that region: **central America, southwestern South America, the western Mediterranean, the eastern Mediterranean and southwestern Australia** (regions 1, 2, 6, 8 and 9).
- Its **own region**: the **Amazon, northeastern Brazil and southern Africa** (regions 4, 5 and 7).
- The **nearby terrestrial source**: **northern Brazil** (region 3)

We should focus on what will happen in these **dominant moisture sources** to correctly interpret how moisture transport deficits affect droughts at the regional scale

Acknowledgements

MCIN/AEI/10.13039/501100011033 : SETESTRELO project (grant no. PID2021-122314OB-I00), EXMERISK/ESMORGA projects (TED2021-129152B-C41/TED2021-129152B-C43); Xunta de Galicia; grant ED431C2021/44, Programa de Consolidación e Estructuración de Unidades de Investigación Competitivas (Grupos de Referencia Competitiva)); ERDF “A way of making Europe”; computing resources and technical support provided by CESGA

