

**TABLE 5** List of predictors used in the regionalization of the HBV parameters

| Thematic description     | Predictor   | Description   |
|--------------------------|-------------|---|
| Climatic Regionalization |             |   |
| Topography               | DEM25_mean  | Mean value of the catchment zonal statistic on the DEM25 (digital elevation model of the terrain at 25 m spatial resolution)                                    |
|                          | gosDEM_mean | Mean value of the catchment zonal statistic on the gosDEM (AEMET ground observation stations digital elevation model)   |
|                          | D_elevation | Value representing the difference between DEM25_mean and gosDEM_mean  |
|                          | Delta_mean  | Mean value of the catchment zonal statistic on an auxiliary raster of differences between DEM25 and gosDEM)   |
|                          | Delta_sd    | Standard deviation value of the catchment zonal statistic on raster (DEM25-gosDEM)  |
|                          | DE_mean     | Mean value of the catchment zonal statistic on the DE (Euclidean distance to the nearest AEMET ground observation station)                                      |
|                          | DE_sd       | Standard deviation value of the catchment zonal statistic on the DE (Euclidean distance to the nearest AEMET ground observation station)                        |
|                          |             |   |
| Climatic                 | T_mean      | Annual mean daily temperature of the long-term series (2008-2019)   |
|                          | P_mean      | Annual mean total precipitation of the long-term series (2008-2019)   |
| Ground Regionalization   |             |   |
| Vegetation coverage      | TCCe        | Percent of tree canopy cover of evergreen forest (needleleaf and broadleaf)   |
|                          | TCCb        | Percent of tree canopy cover of deciduous broadleaf forest  |
|                          | TCCd        | Percent of tree canopy cover of <i>Dehesas</i> in the watershed ( <i>Dehesas</i> are evergreen broadleaf forest with $20 < TCC < 60\%$ )                        |
|                          | CCs         | Percent of evergreen shrubs cover   |
|                          | CCp         | Percent of herbaceous vegetation cover  |
|                          | CCagr       | Percent of agricultural land cover  |
|                          | CCi         | Percent of impervious surfaces  |
|                          |             |   |
| Morphology               | Rf          | Horton form factor  |
|                          | Rc          | Gravellius compactness coefficient  |
|                          | Re          | Elongation ratio  |
|                          | Slope_m     | Mean value of the catchment zonal statistic on the slope derived of the DEM25 (digital elevation model of the terrain at 25 m spatial resolution)               |
|                          | Slope_sd    | Standard deviation value of the catchment zonal statistic on the slope derived of the DEM25 (digital elevation model of the terrain at 25 m spatial resolution) |

| Thematic description | Predictor | Description   |
|----------------------|-----------|---|
| Topsoil properties   | Silt_m    | Mean value of the catchment zonal statistic on silt content in topsoil (0-20 cm)  |
|                      | Silt_sd   | Standard deviation value of the catchment zonal statistic on silt content in topsoil (0-20 cm)  |
|                      | Sand_m    | Mean value of the catchment zonal statistic on sand content in topsoil (0-20 cm)  |
|                      | Sand_sd   | Standard deviation value of the catchment zonal statistic on sand content in topsoil (0-20 cm)  |
|                      | Clay_m    | Mean value of the catchment zonal statistic on clay content in topsoil (0-20 cm)  |
|                      | Clay_sd   | Standard deviation value of the catchment zonal statistic on clay content in topsoil (0-20 cm)  |
|                      | Coarse_m  | Mean value of the catchment zonal statistic on coarse frgements content in topsoil (0-20 cm)  |
|                      | Coarse_sd | Standard deviation value of the catchment zonal statistic on coarse frgements content in topsoil (0-20 cm)                                    |
|                      | Bulk_m    | Mean value of the catchment zonal statistic on Bulk density in topsoil (0-20 cm)  |
|                      | Bulk_sd   | Standard deviation value of the catchment zonal statistic on Bulk density in topsoil (0-20 cm)  |
|                      | awc_m     | Mean value of the catchment zonal statistic on the available water capacity (AWC) for the topsoil fine earth fraction (0-20 cm)               |
|                      | awc_sd    | Standard deviation value of the catchment zonal statistic on the available water capacity (AWC) for the topsoil fine earth fraction (0-20 cm) |
| Subsoil properties   | WRB_RG    | Percent of Regosols (RG)  |
|                      | WRB_LP    | Percent of Leptisols (LP)   |
|                      | WRB_CM    | Percent of Cambisols (CM)   |
|                      | WRB_FL    | Percent of Fluvisols (FL)   |
|                      | WRB_AC    | Percent of Acrisols (AC)  |
|                      | WRB_LV    | Percent of Luvisols (LV)  |
|                      | HG_1      | Percent of hydro-geological class type HG1  |
|                      | HG_2      | Percent of hydro-geological class type HG2  |
|                      | HG_4      | Percent of hydro-geological class type HG4  |
|                      | DIMP_D    | Percent of deep depth (> 80 cm) to the impermeable layer  |
|                      | DIMP_S    | Percent of shallow depth (< 80 cm) to the impermeable layer   |
|                      | AWCSUB_#  | Percent of NaN subsoil available water capacity   |

| Thematic description                 | Predictor | Description  |
|--------------------------------------|-----------|--|
|                                      | AWCSUB_VL | Percent of very low subsoil available water capacity   |
|                                      | AWCSUB_L  | Percent of low subsoil available water capacity  |
|                                      | AWCSUB_M  | Percent of medium subsoil available water capacity   |
|                                      | AWCSUB_H  | Percent of high subsoil available water capacity   |
| Spectral<br>Sentinel- 1<br>(SAR)     | VH_i_j    | j value of the backscattering coefficient of VH polarization in i image date adquisition<br>(i= s for summer; i=w for winter)<br>(j=m for mean; j=sd for standard deviation; j=q25 for 0.25 quantil; j=q50 for 0.50 quantil;j=q75 for 0.75 quantil)  |
|                                      | VV_i_j    | j value of the backscattering coefficient of VV polarization in i image date adquisition<br>(i= s for summer; i=w for winter)<br>(j=m for mean; j=sd for standard deviation; j=q25 for 0.25 quantil; j=q50 for 0.50 quantil;j=q75 for 0.75 quantil)  |
|                                      | VH_i_g_j  | j value of the t texture metric of VH polarization in i image date adquisition<br>(i= s for summer; i=w for winter)<br>(j=m for mean; j=sd for standard deviation; j=q25 for 0.25 quantil; j=q50 for 0.50 quantil;j=q75 for 0.75 quantil)<br>(g=Con for contrast; g=Dis for Dissimilarity; g=GLCMm for GLCMMean; g=GLCMv for GLCMVariance) |
|                                      | VV_i_g_j  | j value of the t texture metric of VV polarization in i image date adquisition<br>(i= s for summer; i=w for winter)<br>(j=m for mean; j=sd for standard deviation; j=q25 for 0.25 quantil; j=q50 for 0.50 quantil;j=q75 for 0.75 quantil)<br>(g=Con for contrast; g=Dis for Dissimilarity; g=GLCMm for GLCMMean; g=GLCMv for GLCMVariance) |
| Spectral<br>Sentinel- 2<br>(Optical) | Bk_j      | j value of the k Sentinel- 2 band<br>(j=m for mean; j=sd for standard deviation; j=q25 for 0.25 quantil; j=q50 for 0.50 quantil;j=q75 for 0.75 quantil) (k= 1, 2, 3, 4, 5, 6, 7, 8, 8A, 11 and 12)   |
|                                      | Bk_g_j    | j value of the t texture metric of the k Sentinel- 2 band<br>(j=m for mean; j=sd for standard deviation; j=q25 for 0.25 quantil; j=q50 for 0.50 quantil;j=q75 for 0.75 quantil)<br>(g=Con for contrast; g=Dis for Dissimilarity; g=GLCMm for GLCMMean; g=GLCMv for GLCMVariance)(k= 1, 2, 3, 4, 5, 6, 7, 8, 8A, 11 and 12)                 |
|                                      | SI_m_j    | j value of the m Soil Index  |

| Thematic description | Predictor | Description  |
|----------------------|-----------|--|
|                      |           | (j=m for mean; j=sd for standard deviation; j=q25 for 0.25 quantil; j=q50 for 0.50 quantil; j=q75 for 0.75 quantil)<br>(m = BI for brightness index; m=CI for colour index)  |
|                      | VI_n_j    | j value of the n Vegetation Index<br>(j=m for mean; j=sd for standard deviation; j=q25 for 0.25 quantil; j=q50 for 0.50 quantil; j=q75 for 0.75 quantil)<br>(n=GNDVI for the green normalized difference vegetation index; n=MSAVI2 for the second modified soil-adjusted vegetation index); n=NDI45 for the normalized difference index; n=NDVI for the normalized difference vegetation index; n= SAVI for the soil-adjusted vegetation index) |
|                      | WI_p_j    | j value of the p Water Index<br>(j=m for mean; j=sd for standard deviation; j=q25 for 0.25 quantil; j=q50 for 0.50 quantil; j=q75 for 0.75 quantil)<br>(p=NDWI for the normalized difference water index)  |