THE EBRO BASIN DROUGHT PLAN

Drought indicators

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INTRODUCTION (1)

➢ **Working on drought indicators since 2002.**

➢ **Most of indicators based on the variables measured by the SAIH system. The best way to get early warning.**

➢ **The need of reliability of the system.**

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DROUGHT INDICATORS (1)

➢ **Variables used:**

- **Monthly precipitation (19 stations)**
- **Three-month water flow (15 stations)** } **SAIH**
- **Water stored in reservoirs (32 stations)**

- **Snow quantity (9 sub-basins)** → **ASTER model**

- **Head levels in aquifers (17 piezometers)**

➢ **Monthly updating**

DROUGHT INDICES (1)

➢ **PRECIPITATION**

NATIONAL METEOROLOGICAL AGENCY

- **Standard Precipitation Index (SPI)**

- **Percental data.**

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DROUGHT INDICES (2)

➢ **HYDROLOGY**

The basin has been divided into 35 areas, grouped in two main types:

1. Areas with natural or almost natural flow regimes. Water demand very little. Upstream rivers.

Indices based on three-month river flow.

15 areas

DROUGHT INDICES (3)

➢ HYDROLOGY

2. Areas where large dams modify flow regimes and where the greater water demands are located downstream. Low valleys.

Indices based mainly on water stored, but taking into account other variables such as flow, snow, or even head levels in aquifers.
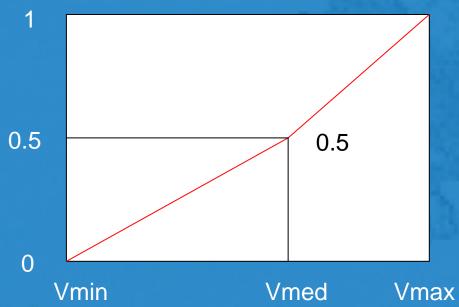
20 areas

DROUGHT INDICES (4)

➢ **HYDROLOGY**

- **Index based on one indicator or a combination of two or more indicators with different weighs**

- **Using historical data**

- **Homogenization (Index between 0 to 1)**

➢ STATUS INDEX (Ie)

$$- Si \quad V_i \geq V_{med} \quad \Rightarrow \quad I_e = \frac{1}{2}\left[1 + \frac{V_i - V_{med}}{V_{max} - V_{med}}\right]$$

$$- Si \quad V_i < V_{med} \quad \Rightarrow \quad I_e = \frac{V_i - V_{min}}{2(V_{med} - V_{min})}$$

DROUGHT INDICES (6)

➢ **THRESHOLDS**

- **Ie > 0.5 Normality**

- **0.5 > Ie > 0.3 Pre-alert**

- **0.3 > Ie > 0.15 Alert**

- **0.15 > Ie Emergency**

DROUGHT INDICES (10)

➢ **Main characteristics:**

- **Easily and quickly updated (thank to the SAIH System)**

- **Adapted to the Ebro basin and sub-basins**

- **Friendly to a non scientific community**

- **Based on the experience more than in models**

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