Seasonal Climate Predictions in support of Water Reservoirs Management in Spain

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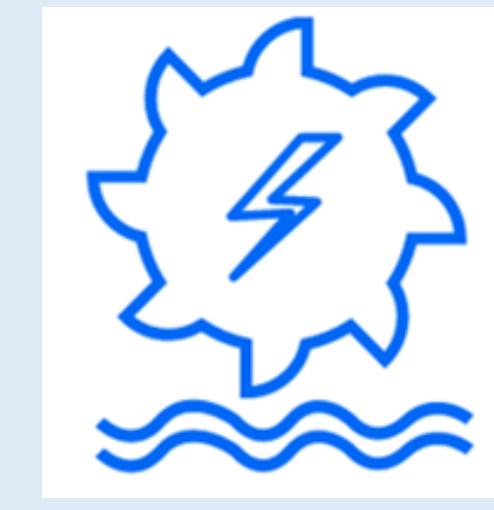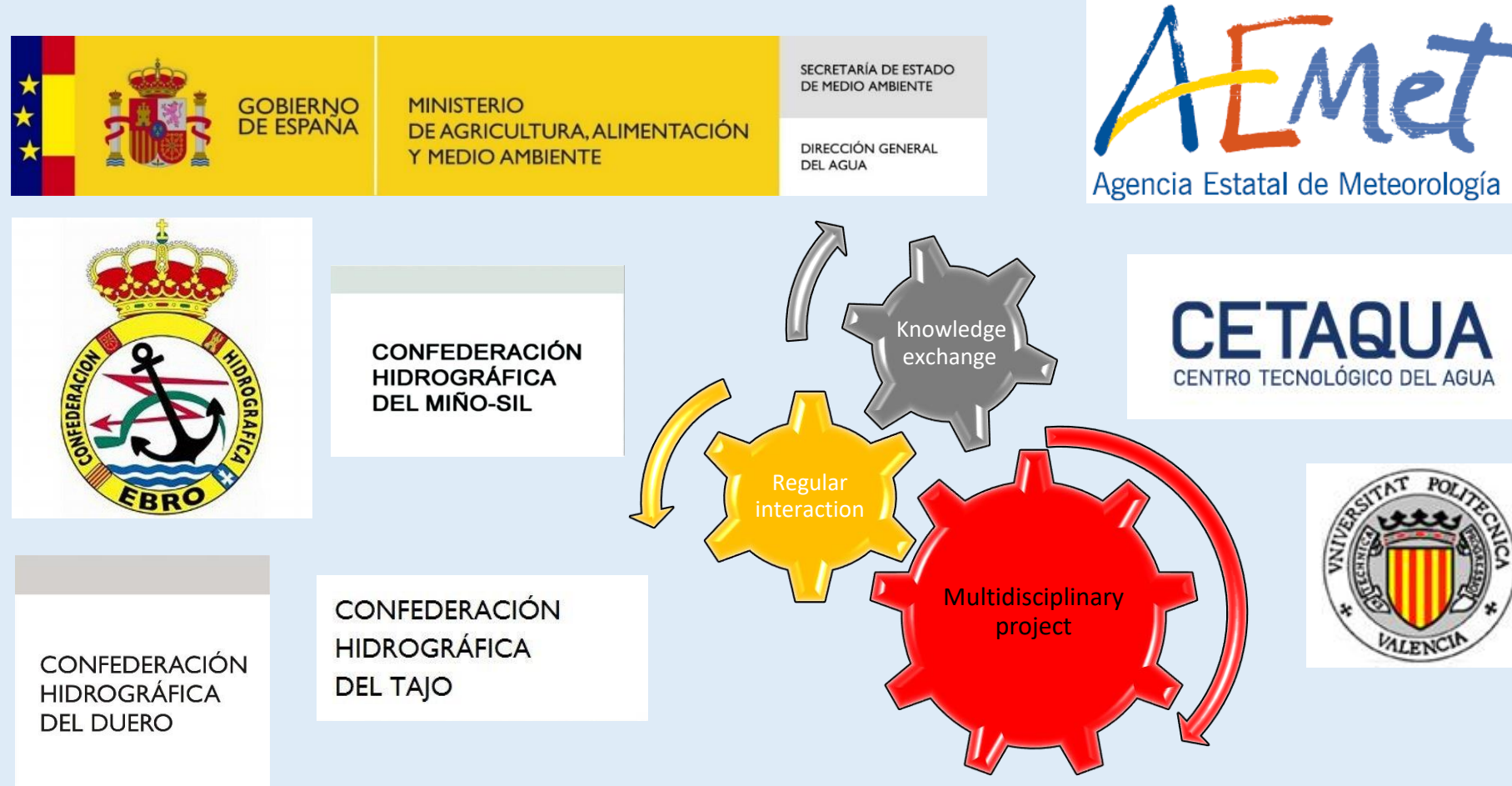(8) Universidad Politécnica, Valencia, España

S-ClimWaRe OUTLINE

S-ClimWaRe is a **pilot climate service developed by a multidisciplinary team for application of seasonal climate predictions in water reservoirs management.** The adopted methodology follows similar experiences carried out by the IRI (International Research Institute for Climate and Society) and tested in some places of Asia and America (Brown et al., 2010). The main components of the pilot climate service S-ClimWaRe are:

1. **A tool for hydroclimatic risk evaluation**
2. **A seasonal forecasting system of dam inflows**
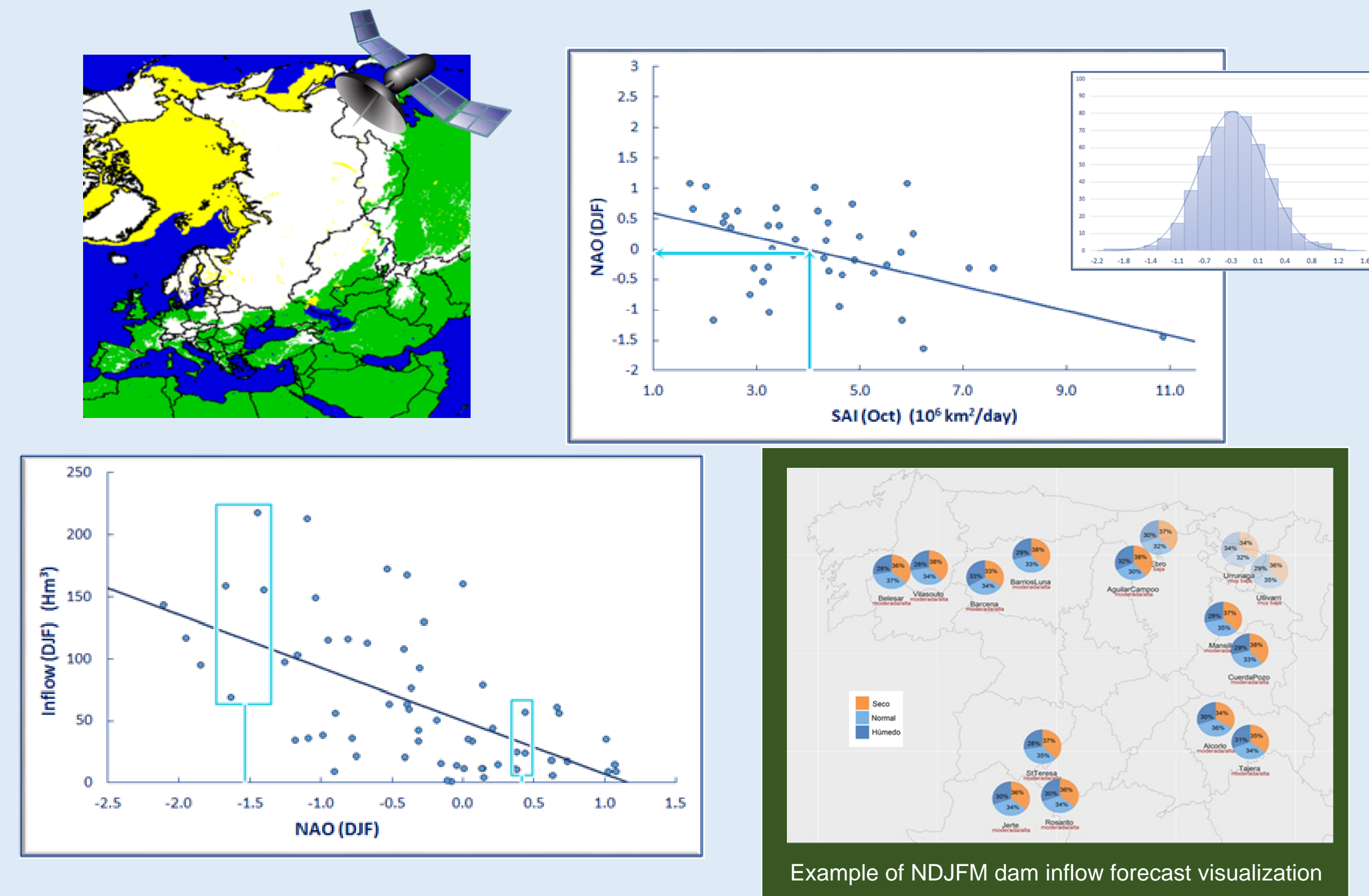3. **A decision support tool for water reservoirs: SIMRISK**

S-ClimWaRe is characterized by a strong stakeholders interaction through meetings, seminars and workshops, under a common Work Plan revised on a continuous basis.

DAM MAIN USES

1.- HYDROCLIMATIC RISK EVALUATION

Winter precipitation in wide areas of Spain is strongly related to the North Atlantic Oscillation (NAO), a dominant climate variability pattern in the North Atlantic area (Rodríguez-Puebla et. al., 1998). Based on this fact, a GIS based software tool has been developed by AEMET, according to DG Water and River Basin Authorities requirements, to obtain different diagnostics of the hydroclimatic risk linked the NAO for any selected dam.
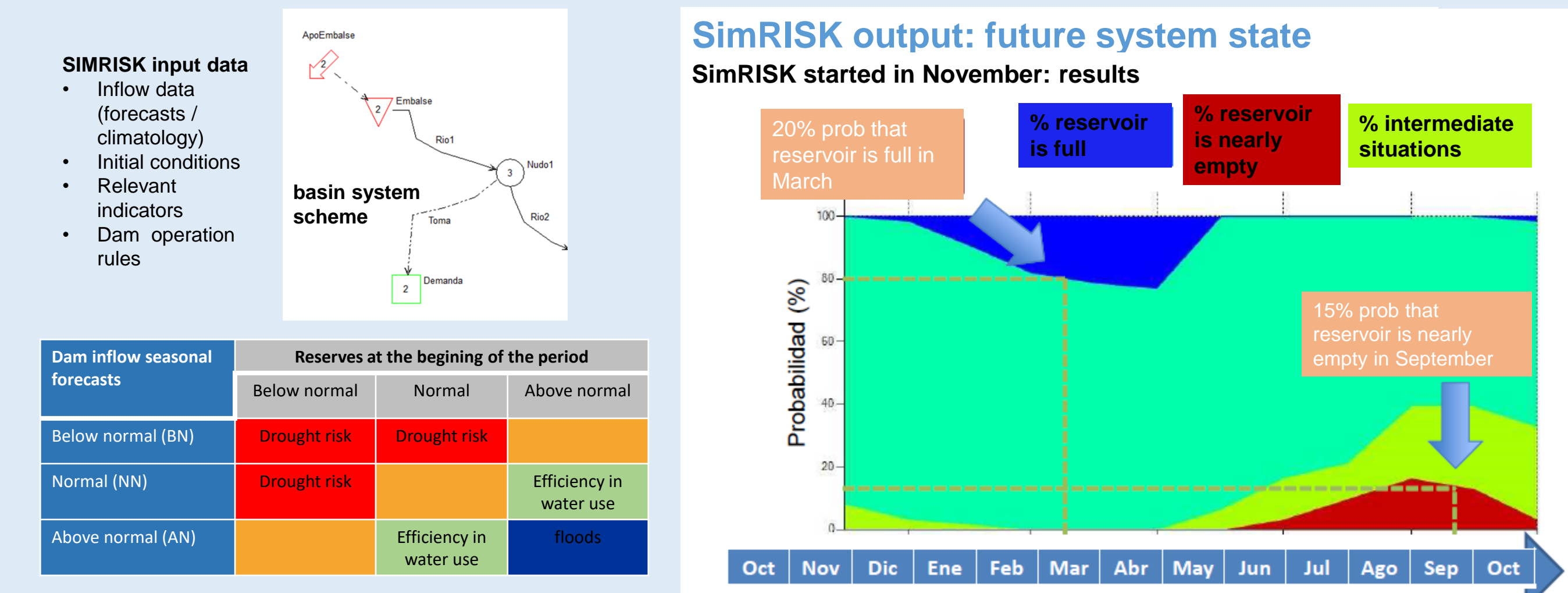
2.- SEASONAL FORECAST FOR DAM INFLOW

As the skill of seasonal forecasts from most dynamical models over this geographical area is generally very low (Sánchez-García et al. 2014, Butler et al. 2016), AEMET has developed the S-ClimWaRe empirical system for the probabilistic seasonal prediction of winter dam inflows (Voces et al. 2016). It is based on the fact that wintertime NAO is statistically associated with snow cover advance during the previous October (SAI) (Cohen and Jones 2011). The forecast system output is an ensemble of forecasted inflows, from which probabilities for the different terciles (dry,normal,wet) are calculated. Accordingly, the inflow to the dam during winter are already known in early November.

Example of NDJFM dam inflow forecast visualization

The forecast system has been retrospectively tested over different long hindcast periods for several pilot water reservoirs located in different Spanish river basins that have been selected by the participating stakeholders. The assessment includes objective verification of the probabilistic seasonal forecasts using standard metrics.
The results obtained show significant skill to discriminate wet and dry inflow/precipitation (bars/points) terciles for dams in the Atlantic river basins (Miño-Sil, Douro, Tagus and Guadalquivir).

3.-DECISION SUPPORT TOOL FOR WATER RESERVOIRS: SIMRISK

The inflow seasonal forecasts are finally introduced in a water management model developed by CETaqua and UPV (Pouget et al. 2015), using an existing commercial tool software: SIMRISK (Haro,D. et al. 2014). The simulation provides information on the probability of future water deficit and probability of having a convenient reservoir state. The whole system is being developed and tested in close collaboration with water managers from the River Basin Authorities and DG Water. The value is currently evaluated through different key indicators calculated by simulating in hindcast mode (e.g. reduction of the probability of water deficit for the different demands; higher probability of having a convenient reservoir state). The information provided will be useful for water management of reservoirs systems, especially in prevention of future droughts.
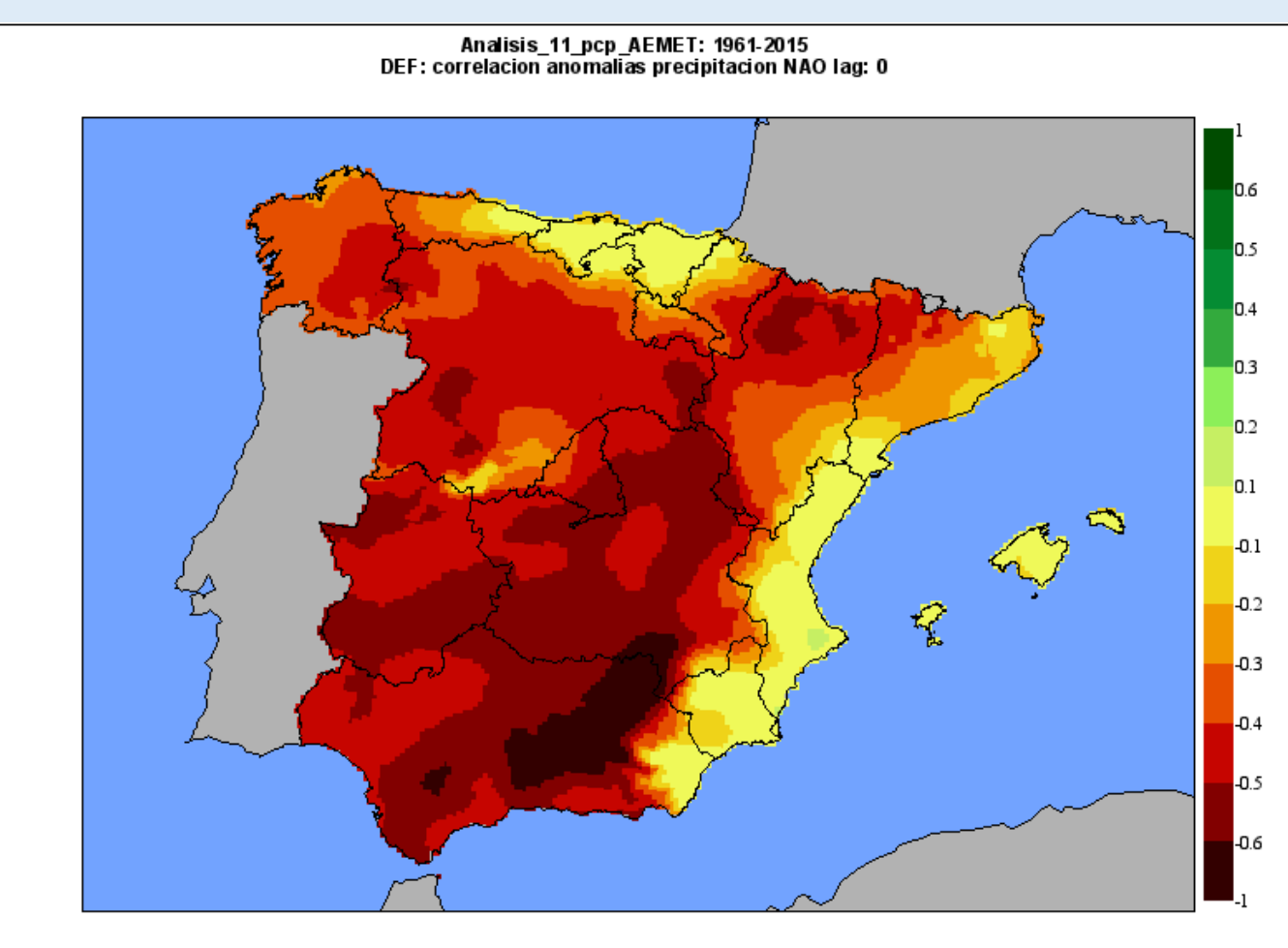

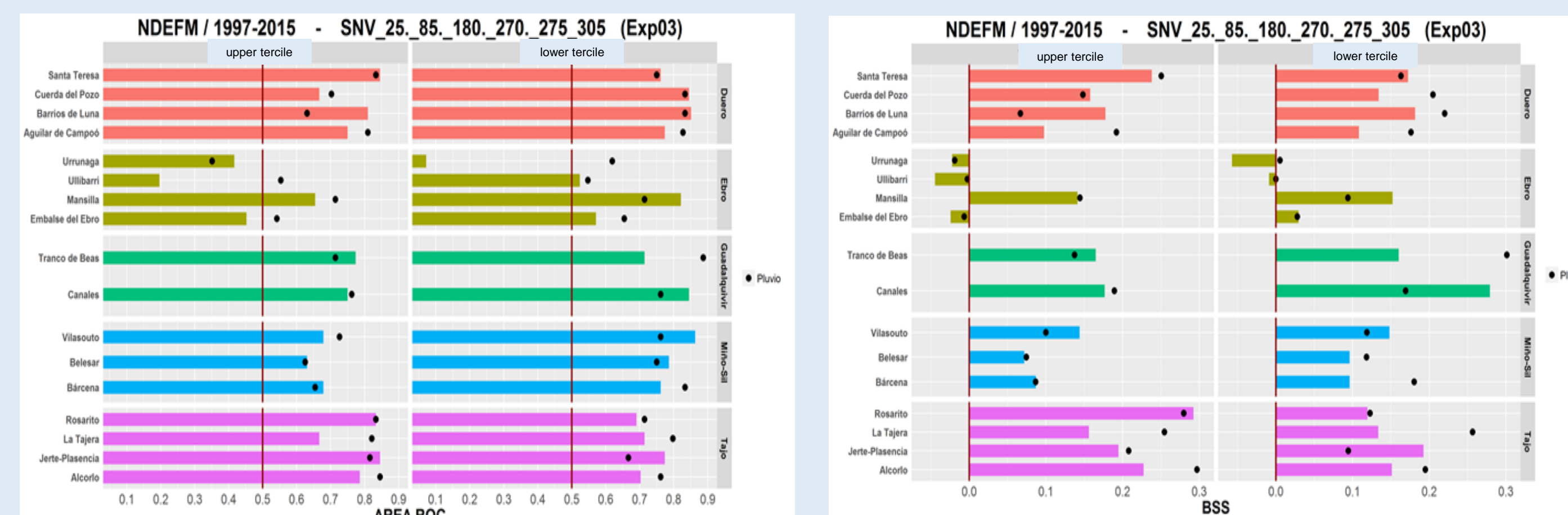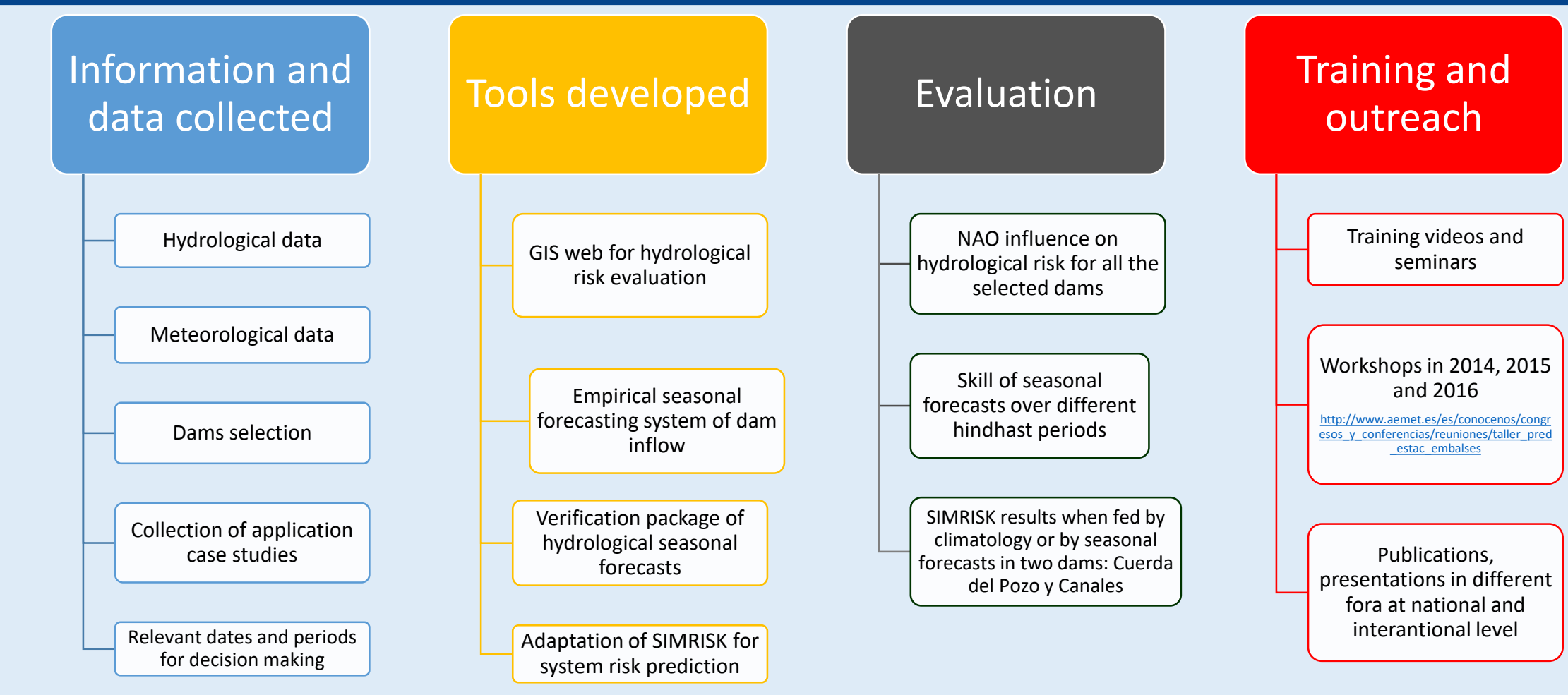SimRISK output: future system state

SimRISK results

Forecasted inflow as input

Year	Inflow			Observed DJF Category	Dam reserve			Forecasted. 1st March	Demand deficit
	Seasonal Forecast (Dic-Jan-Feb)				Observed	Forecasted 1st October			Forecasted 1st October
	% BN (Dry)	% NN	% AN (Wet)	Observed DJF Category	1st December	Proba < 30Hm3	Proba < 70 hm3	>98% Vol max	Fallo≥5%
1976	9	43	48	BN	71	5%	23%	26%	5%
1980	41	37	22	BN	105	6%	23%	13%	6%
2007	41	39	20	BN	132	0%	10%	22%	0%
2009	20	37	43	AN	147	0%	0%	52%	0%

Climatological inflow as input

Year	Inflow			Observed DJF	Dam reserve			Forecasted. 1st March	Demand deficit
	Climatology				Observed	Forecasted 1st October			Forecasted 1st October
	% BN (Dry)	% NN	% AN (Wet)	Observed DJF	1st Dicember	Proba < 30Hm3	Proba < 70 hm3	>98% Vol max	Fallo≥5%
1976	33	33	33	AN	71	13%	39%	18%	13%
1980	33	33	33	BN	105	5%	18%	20%	5%
2007	33	33	33	BN	132	0%	8%	33%	0%
2009	33	33	33	AN	147	0%	0%	41%	0%

S-ClimWaRe achievements

Information and data collected
- Hydrological data
- Meteorological data
- Dams selection
- Collection of application case studies
- Relevant dates and periods for decision making

Tools developed
- GIS web for hydrological risk evaluation
- Empirical seasonal forecasting system of dam inflow
- Verification package of hydrological seasonal forecasts
- Adaptation of SIMRISK for system risk prediction

Evaluation
- NAO influence on hydrological risk for all the selected dams
- Skill of seasonal forecasts over different hindcast periods
- SIMRISK results when fed by climatology or by seasonal forecasts in two dams: Cuerda del Pozo y Canales

Training and outreach
- Training videos and seminars
- Workshops in 2014, 2015 and 2016
- Publications, presentations in different fora at national and international level

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