PRIN 2022 project SPHERE "Seasonal Prediction of water availability: enHancing watER sEcurity from high mountains to plains"

Abstract

The Mediterranean region is warming faster than the global average, heat waves are projected to intensify and summer rainfall will likely be reduced with increasing water shortages. Also relatively water-rich mountain regions such as the **Alps registered an increased frequency of droughts and this tendency is expected to further strengthen in the future**, triggering conflicts among different sectors of water use including agriculture, energy production, tourism, industry, household, and biodiversity conservation.

Among adaptation strategies to reduce adverse effects of water-related risks, **seasonal predictions** have been considered with growing interest for their potential to provide early warning of extreme seasons, so that decision makers can take necessary actions to minimize adverse impacts. However, hydrological seasonal predictions are still in their infancy. Recent studies show skill in seasonal prediction of mountain snow water equivalent, but it is unclear if this is reflected in skillful prediction of streamflow and water availability.

The SPHERE project – a PRIN Italian National project in collaboration between CNR-ISAC and Politecnico of Torino, and supported by Fondazione CIMA – will employ the most advanced dynamical seasonal forecasting systems, hydrological models, downscaling and analysis tools to **develop a semi-operational forecast chain** that delivers **high-resolution spatially distributed seasonal forecasts of hydrological indicators, i.e. snow water equivalent, meltwater runoff and streamflow, to estimate the amount of water that will be available** for the ecosystems and socio-economic activities in the season ahead, providing early information if extreme dry/wet conditions are expected in the forthcoming 6 months. Moreover, seasonal forecasts of meteorological variables and a coupled soil water balance - crop growth model will be used to **predict irrigation requirements in agricultural areas** in the downstream plains. The predictions of water availability and irrigation requirements will be used to **identify possible issues in the water supply with a few months lead time**. The skill of the forecast chain will be evaluated over the Po river basin.

Overall, the SPHERE project will deliver: 1) an innovative, flexible, **open-source forecast chain for seasonal prediction of mountain snow water equivalent and downstream water availability** that is directly applicable, with minor adaptations, to any mountain catchment; 2) retrospective hydrological forecasts over the Po river basins; 3) a comprehensive **analysis of the forecast skill** of the modelling chain over the Po river basin.

Contacts:
CNR-ISAC, Silvia Terzago (silvia.terzago@cnr.it)