May 30th, 2023

ON THE COMBINED USE OF MULTIPLE SATELLITE-DERIVED VARIABLE FOR MONITORING DROUGHT AND WATER RESOURCES

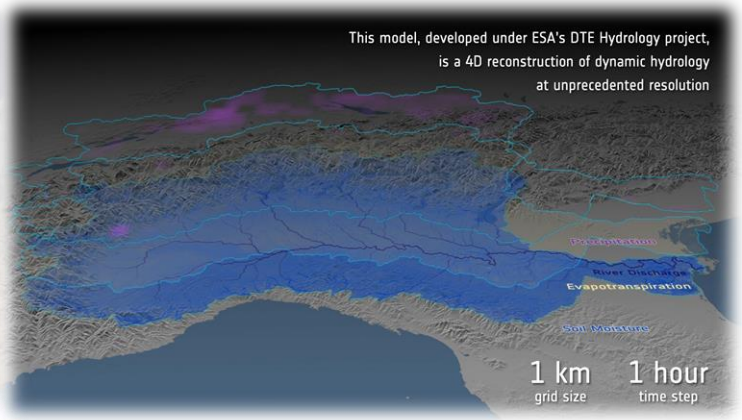
Acknowledgements

H SAF EUMETSAT European Commission OPEN EARTH MONITOR esa 4DMED HYDROLOGY DTE Hydrology

Brocca Luca et al.

National Research Council,

Research Institute for Geo-Hydrological Protection



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#broccadrought

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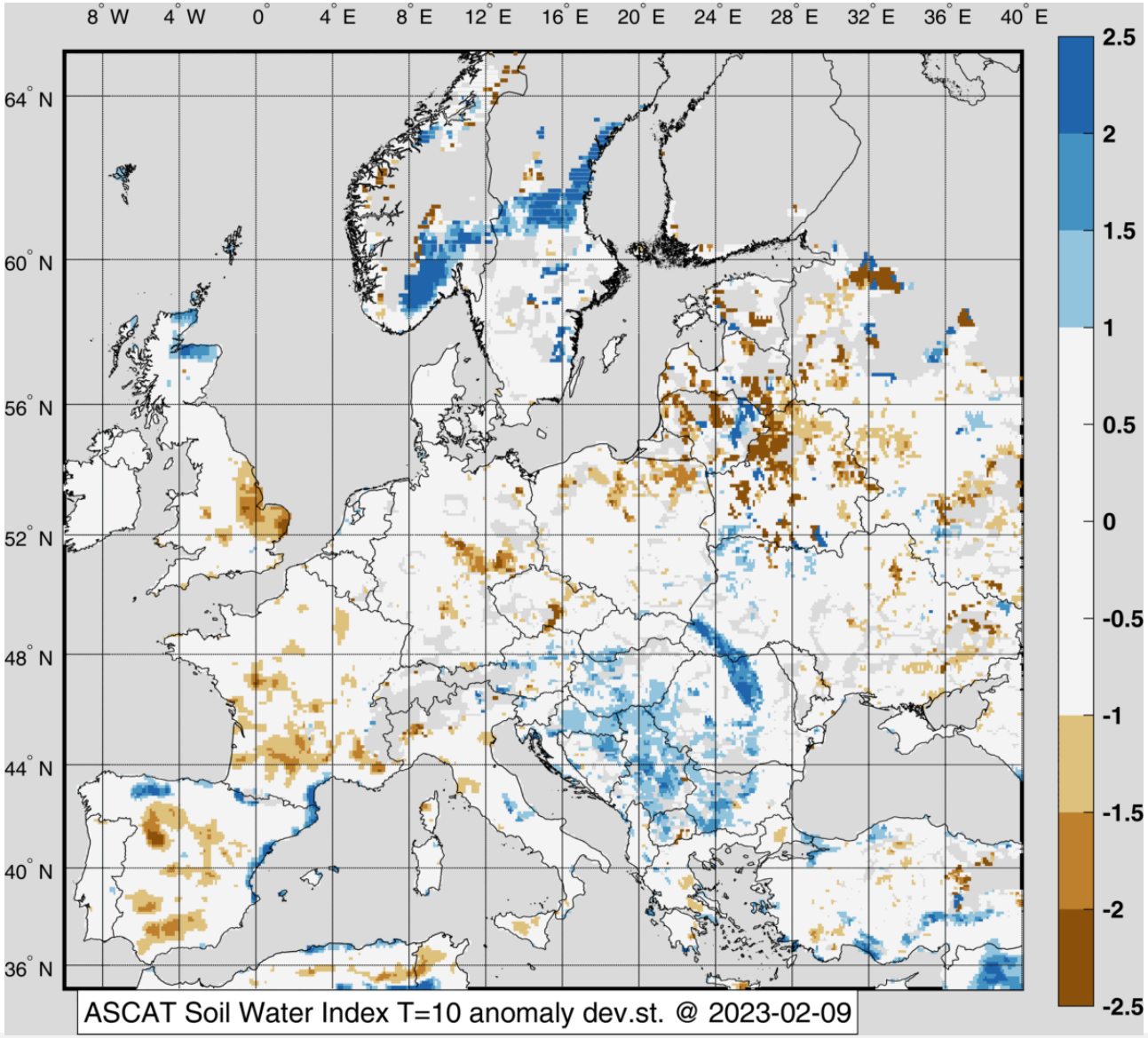
OBJECTIVES

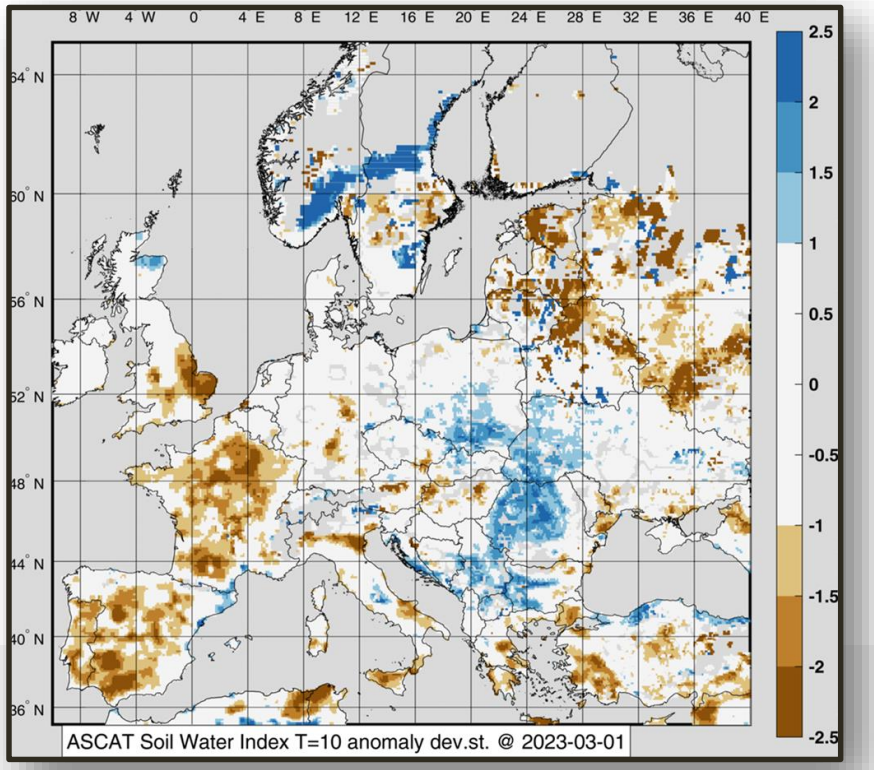
Assess drought risk based on (new) satellite observations (soil moisture, precipitation, snow water equivalent, evaporation)

Translate drought risk information in real-world decision for water resources management

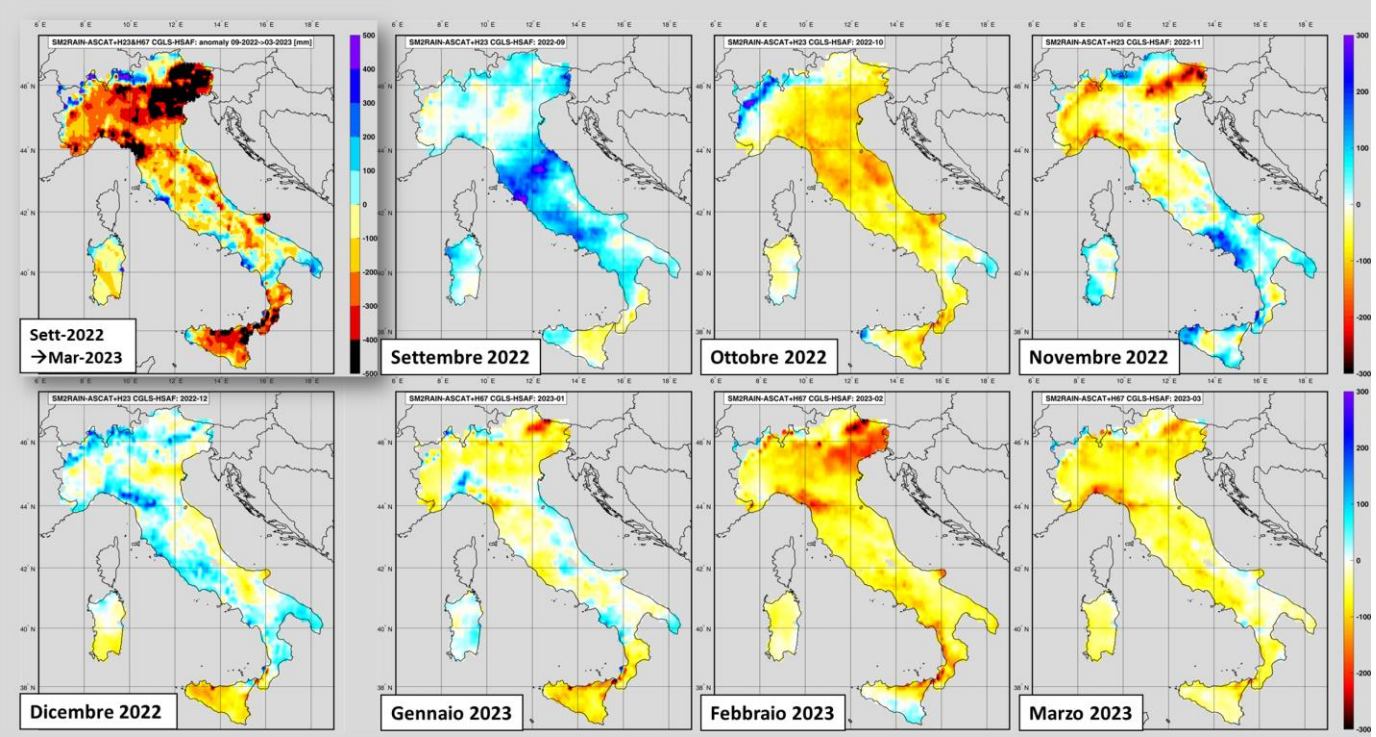
WHAT HAS HAPPENED IN EUROPE THIS YEAR?

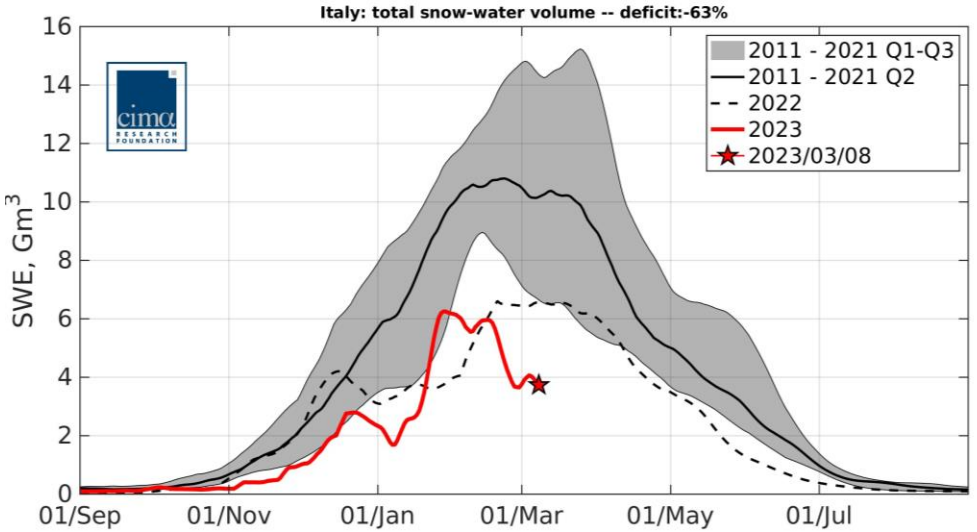


At the end of February 2023 drought conditions in Europe were severe in Italy (North), Spain, France and UK with large deficit in soil moisture

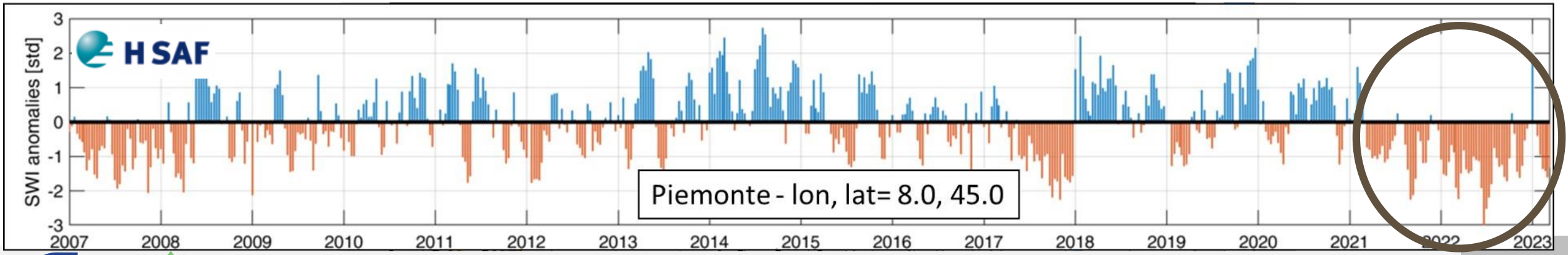


DROUGHT IN ITALY IN 2023

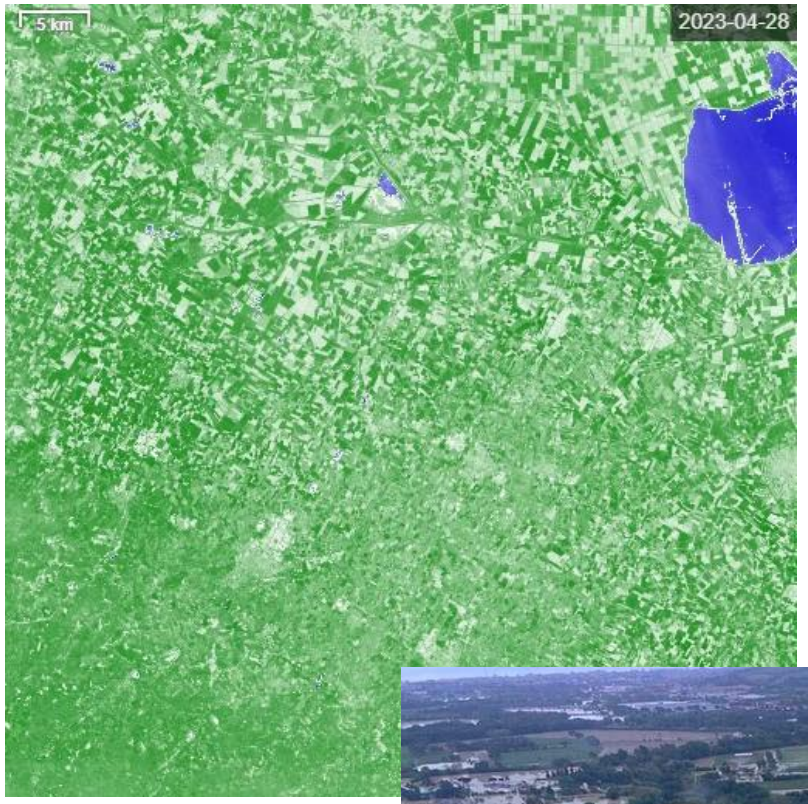




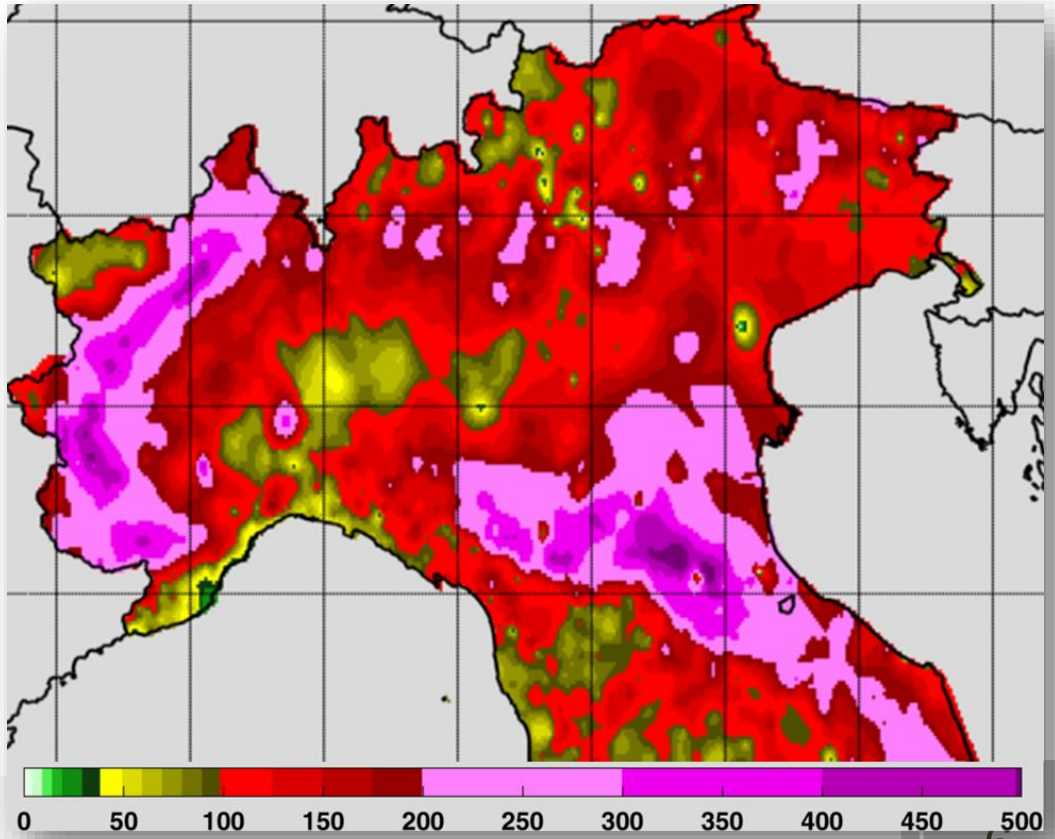
At the end of March the deficit in precipitation was 300 mm, in snow water equivalent 60%, in soil moisture 40%. Persistent drought in northern Italy from April 2021!



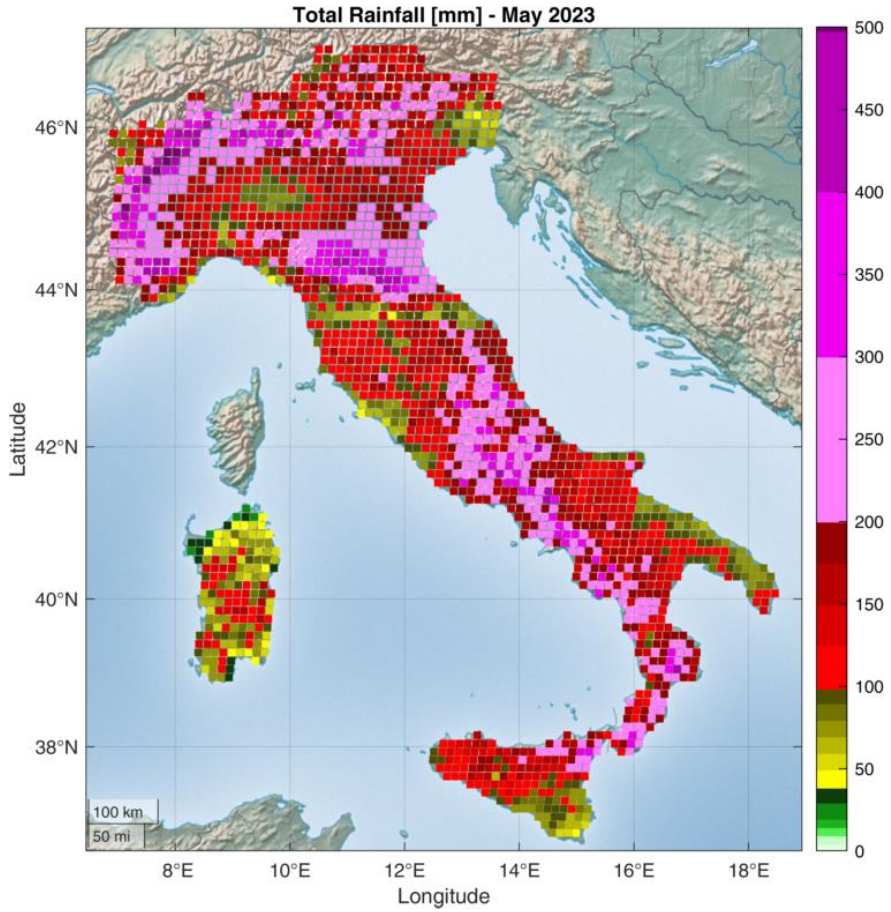
From Drought to Flood - Italy

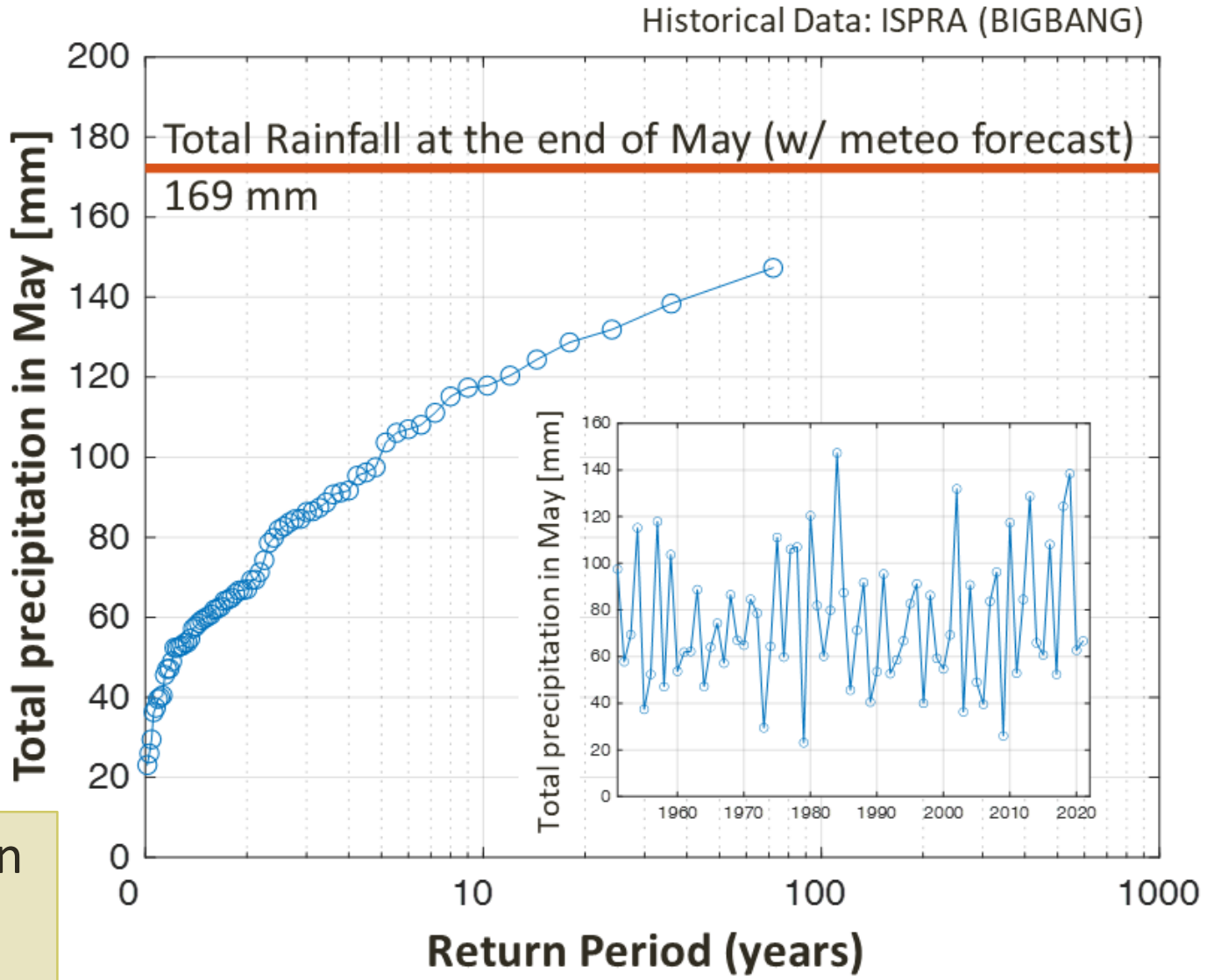


In May 2023 the amount of rainfall occurred over the Romagna region (Northern Italy) has caused widespread flooding and damages



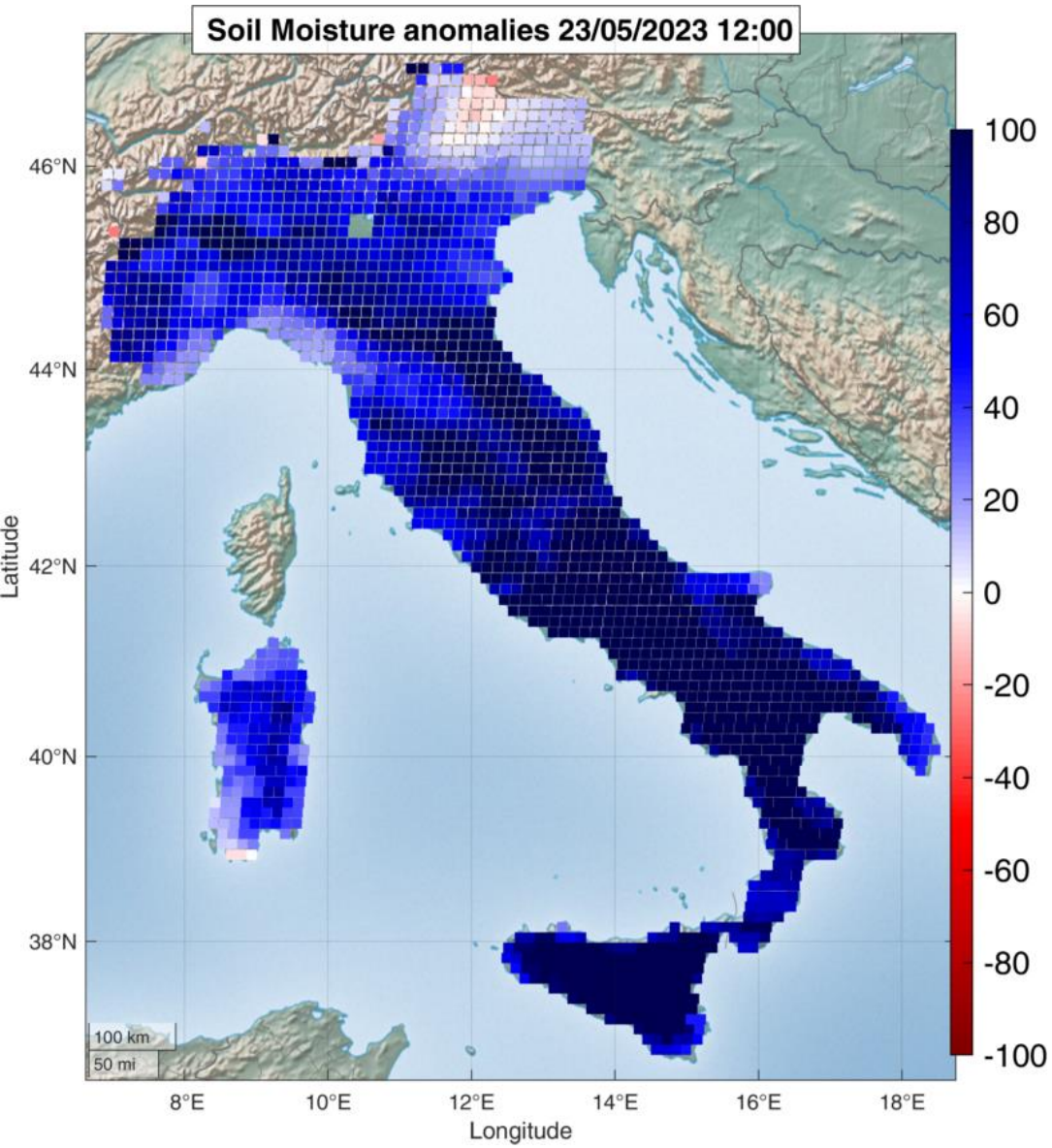
FROM DROUGHT TO FLOOD - ITALY

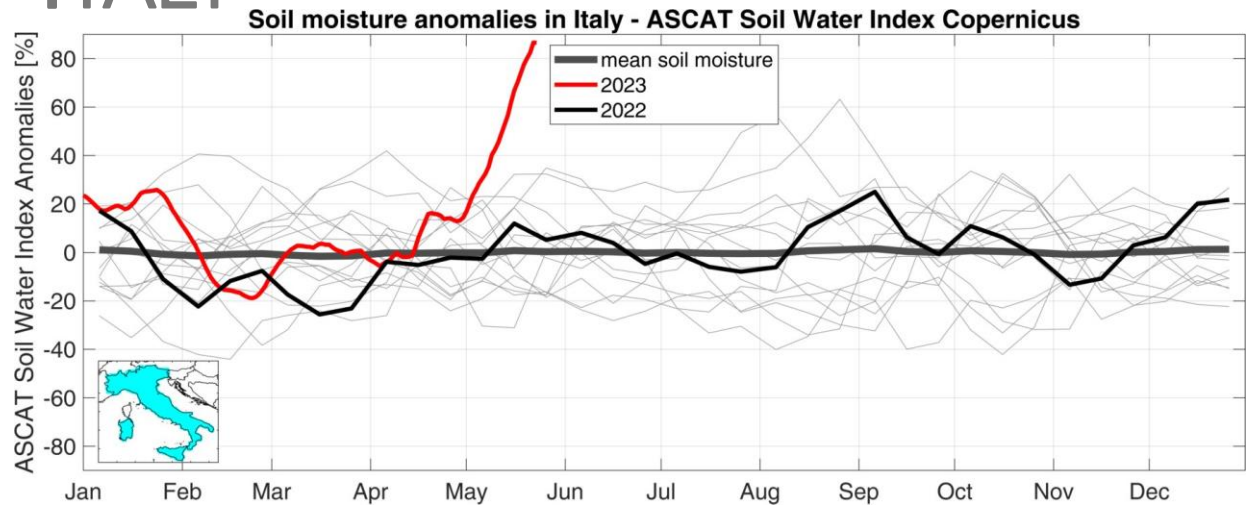


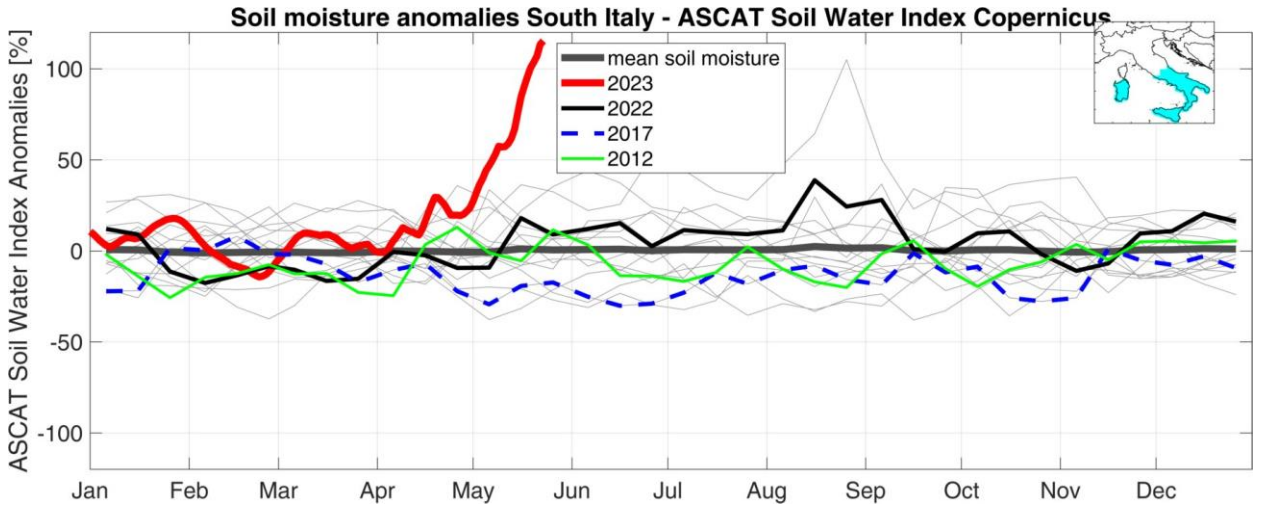


In Italy, it has been the highest accumulation of precipitation for the month of May from 1951 to the present day.

FROM DROUGHT TO FLOOD - ITALY







Soil moisture in May 2023 has reached the largest positive anomaly from 2007 to now

FROM DROUGHT TO FLOOD - SPAIN

Also in southern Spain from extreme drought to flooding

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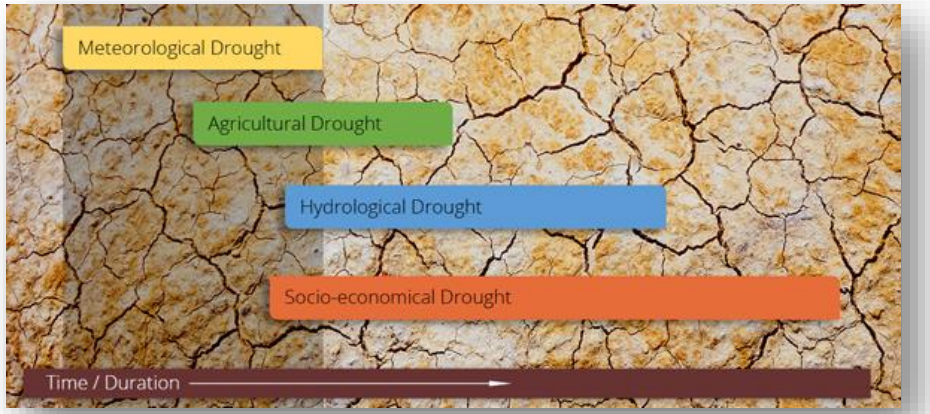
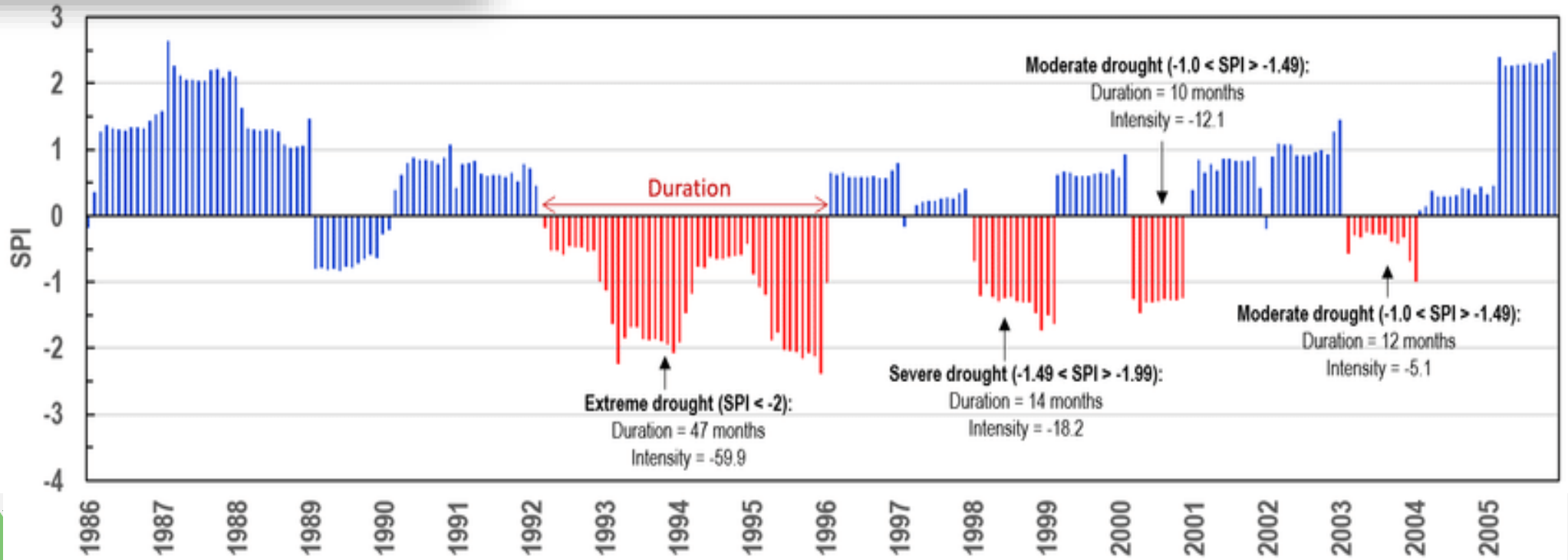
Is drought still there in northern Italy?

ⓘ Start presenting to display the poll results on this slide.

How to assess drought risk?



"A drought is a period of time when a region experiences below-normal precipitation. The lack of adequate precipitation (rain or snow), can cause reduced soil moisture or groundwater, diminished stream flow, crop damage, and a general water shortage. Droughts are the 2nd-most costly weather events after hurricanes."



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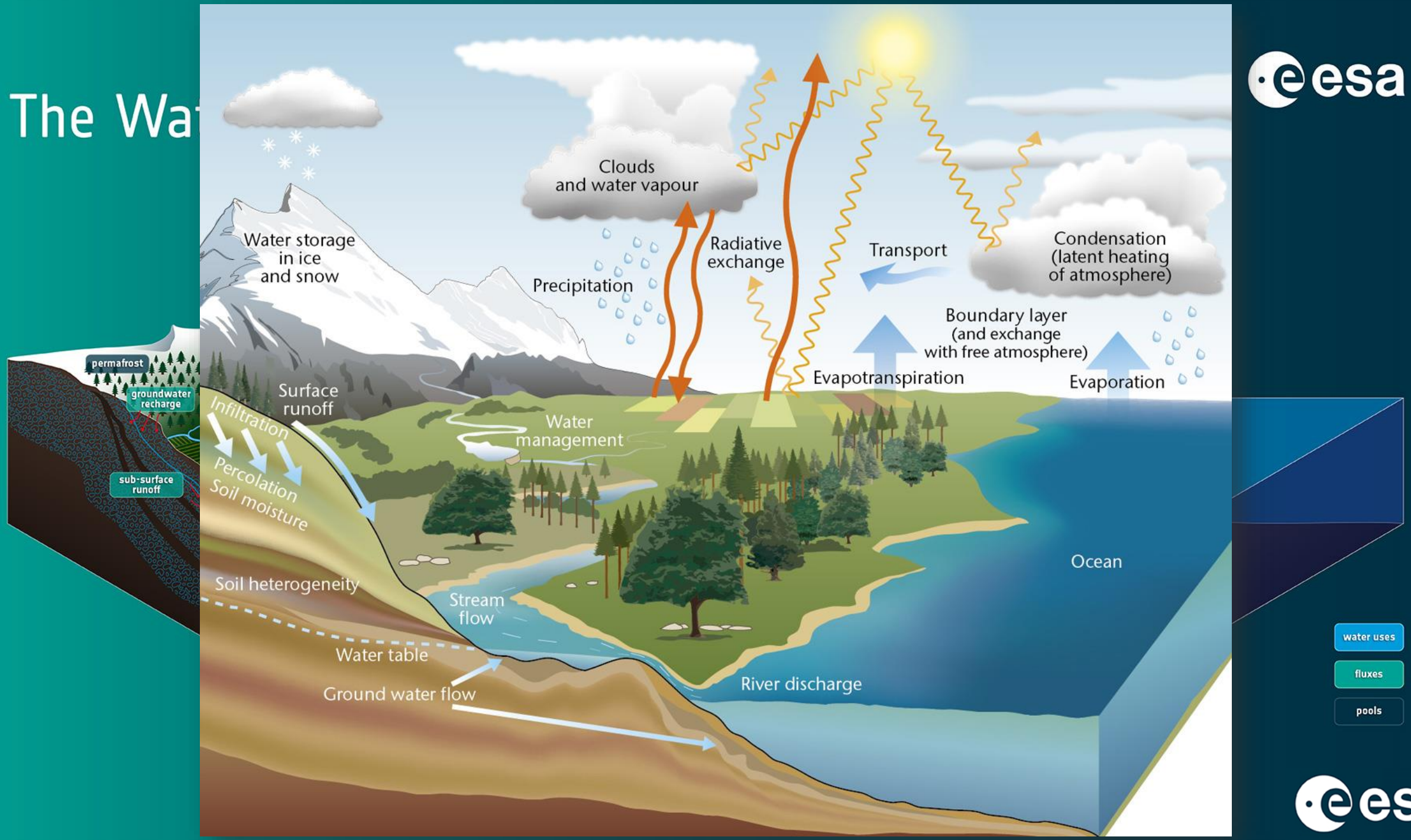
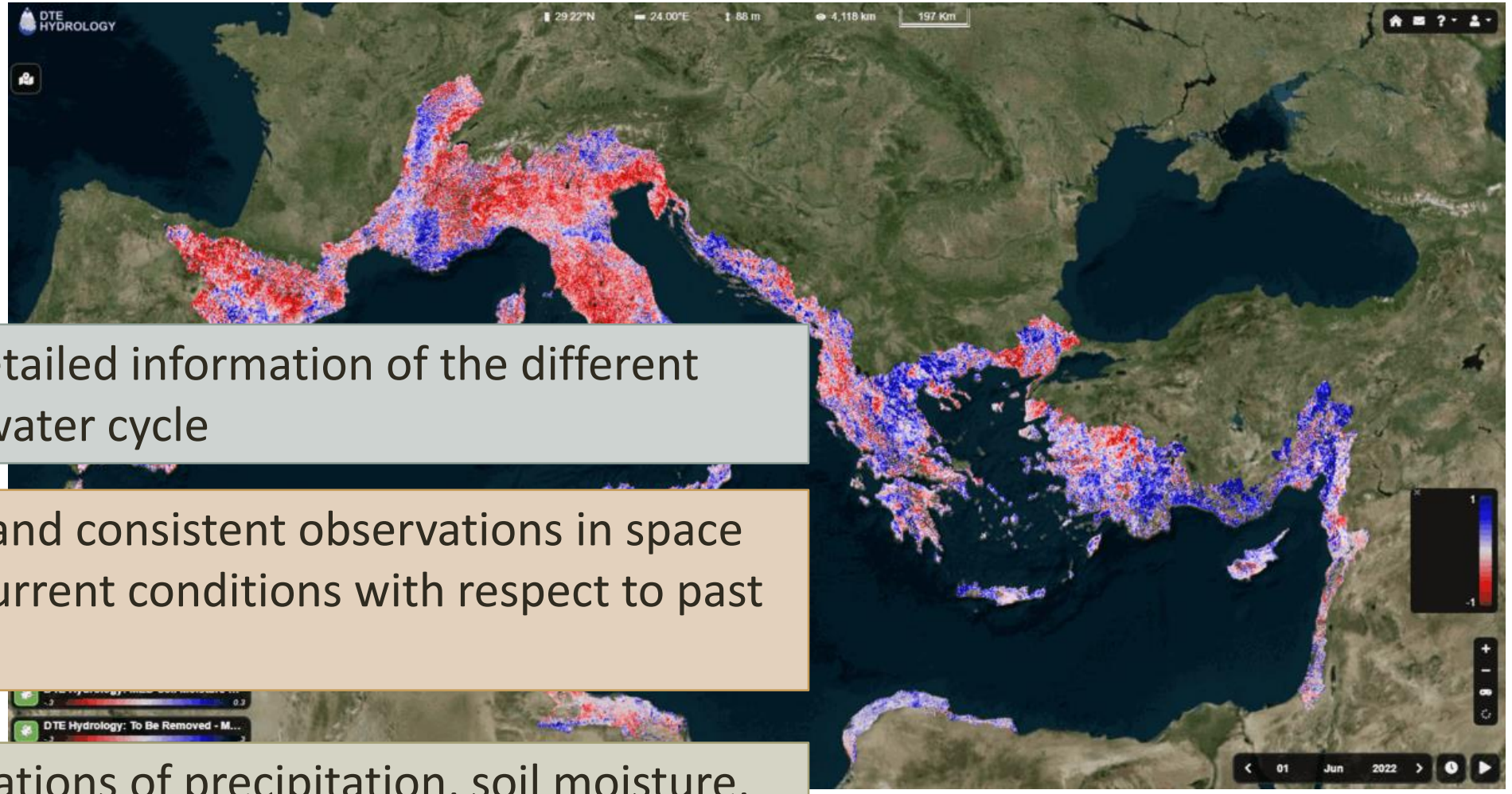

Clouds
and water vapour
Water storage
in ice
and snow
Precipitation
Radiative
exchange
Transport
Condensation
(latent heating
of atmosphere)
Boundary layer
(and exchange
with free atmosphere)
Evapotranspiration
Evaporation
Surface
runoff
Infiltration
Percolation
Soil moisture
Water
management
Soil heterogeneity
Stream
flow
Water table
Ground water flow
River discharge
Ocean
permafrost
groundwater
recharge
sub-surface
runoff
water uses
fluxes
pools

How do you rank drought conditions?



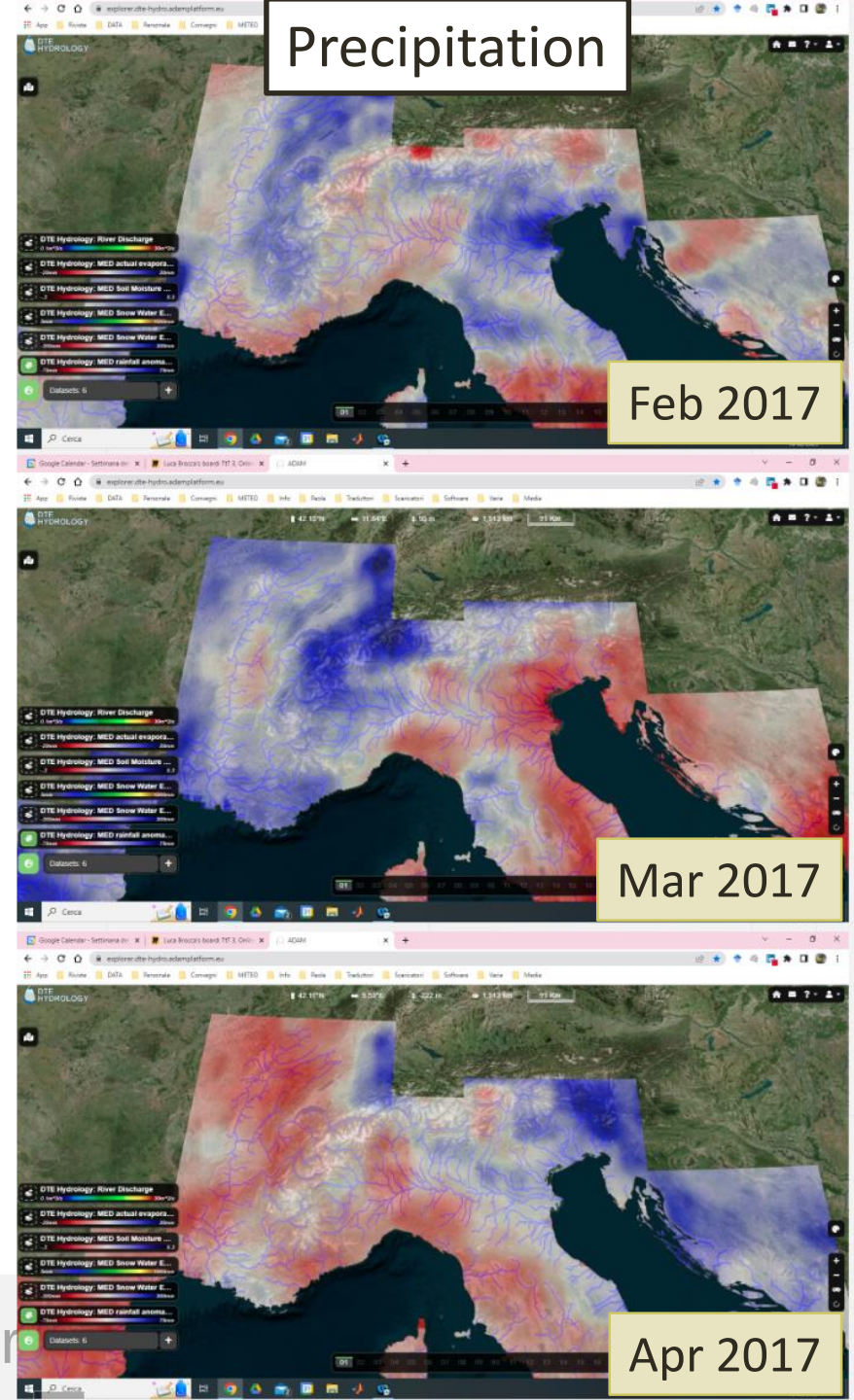
We need spatially detailed information of the different components of the water cycle

We need long-term and consistent observations in space and time to assess current conditions with respect to past conditions

New satellite observations of precipitation, soil moisture, snow and evaporation provide a more clear assessment of current drought conditions in space and time

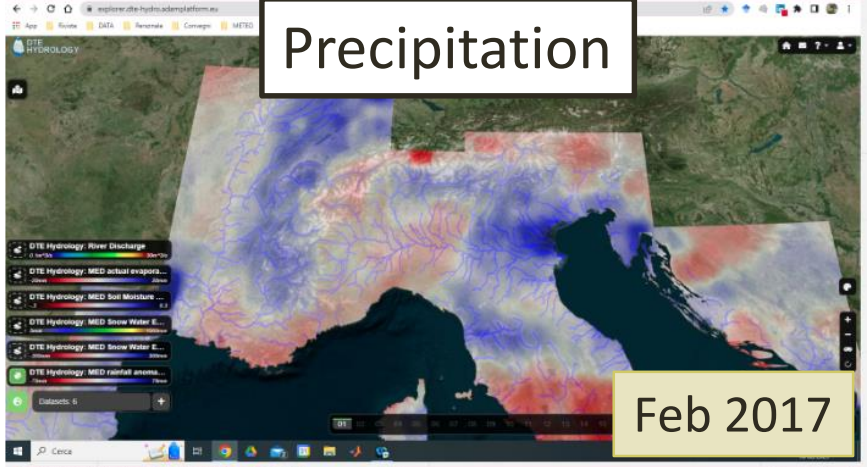
https://explorer.dte-hydro.adamplatform.eu/?use_case=1

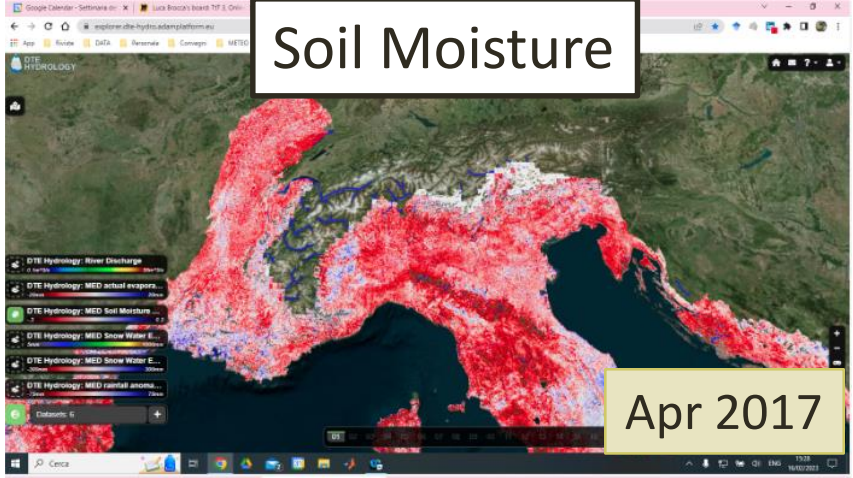
How to assess drought risk?

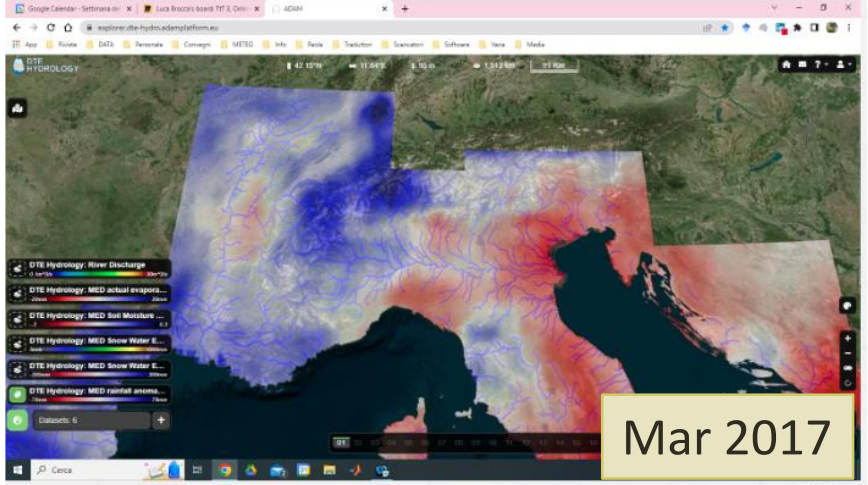


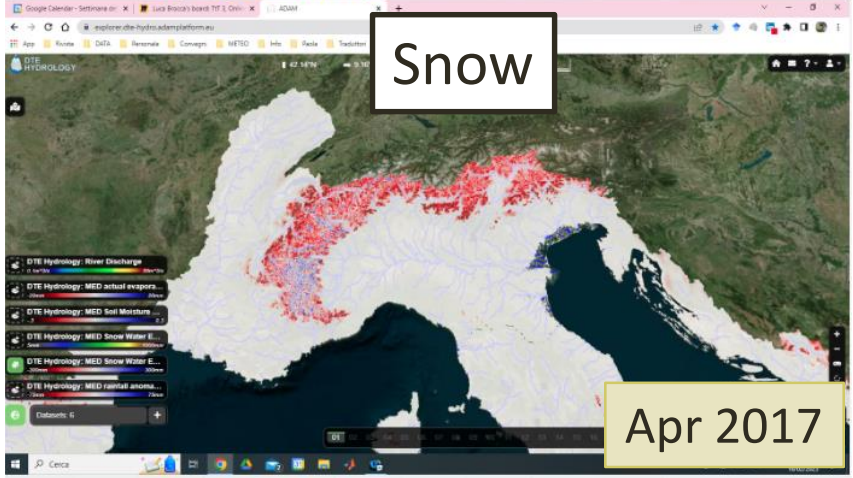
How to assess drought risk?

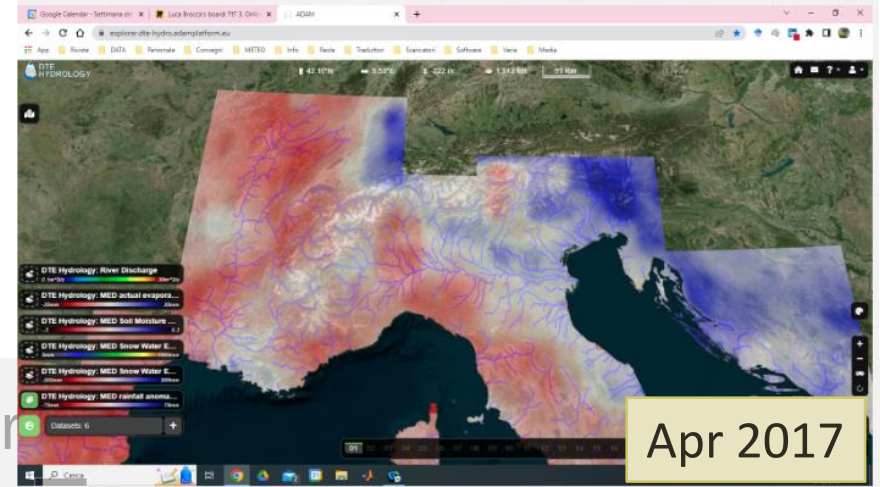
Please stop using only SPI for drought risk assessment!

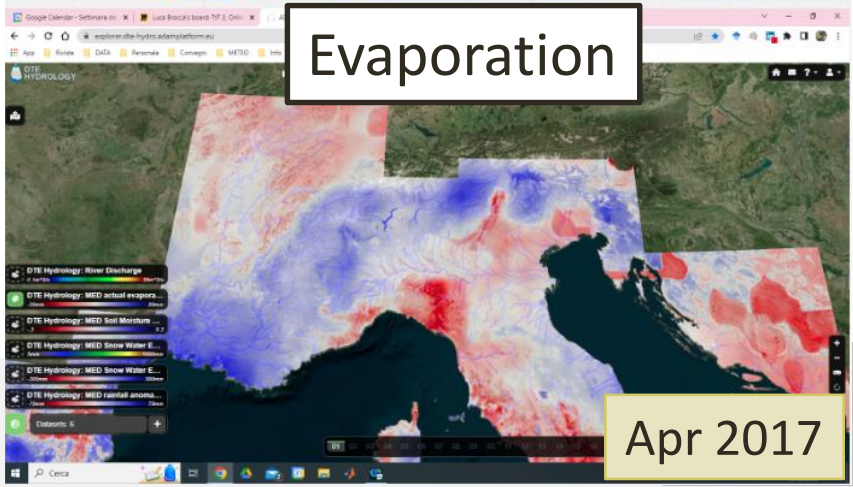






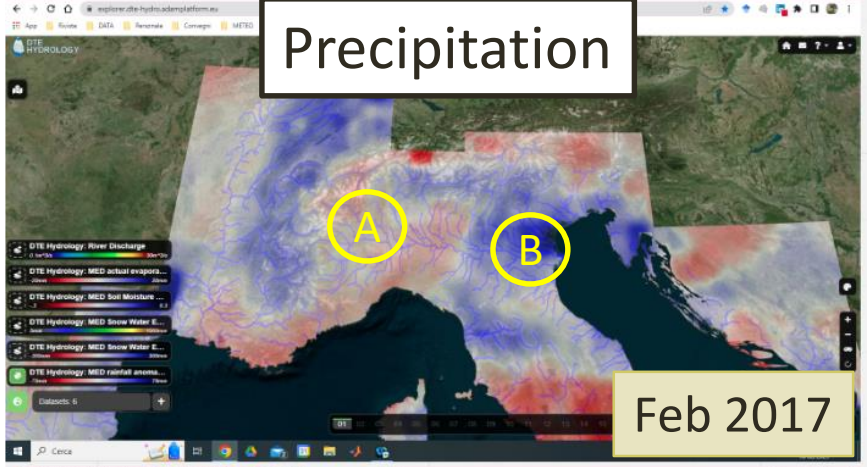


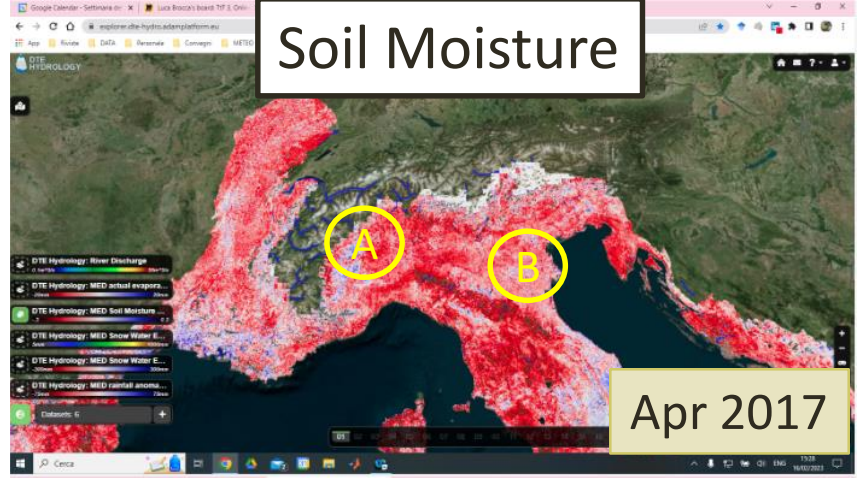


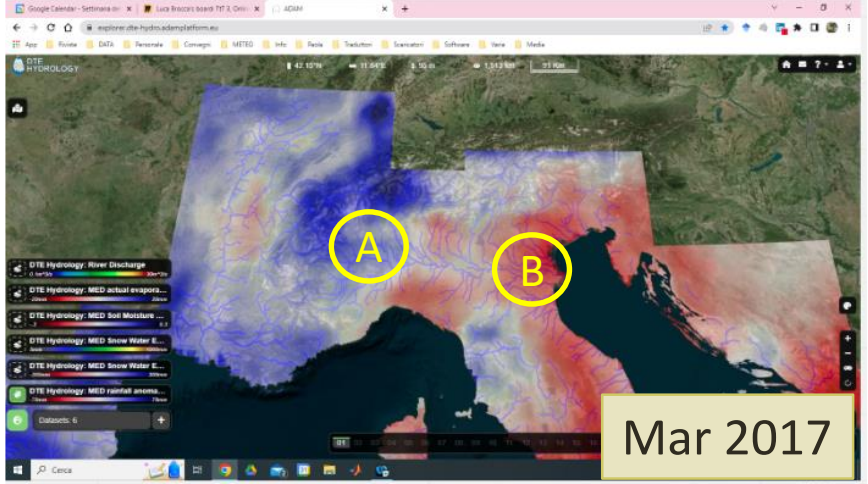


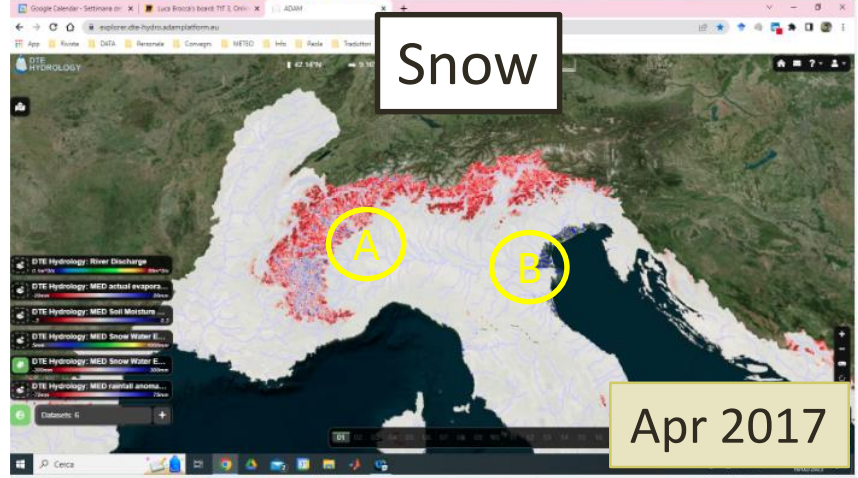
How to assess drought risk?

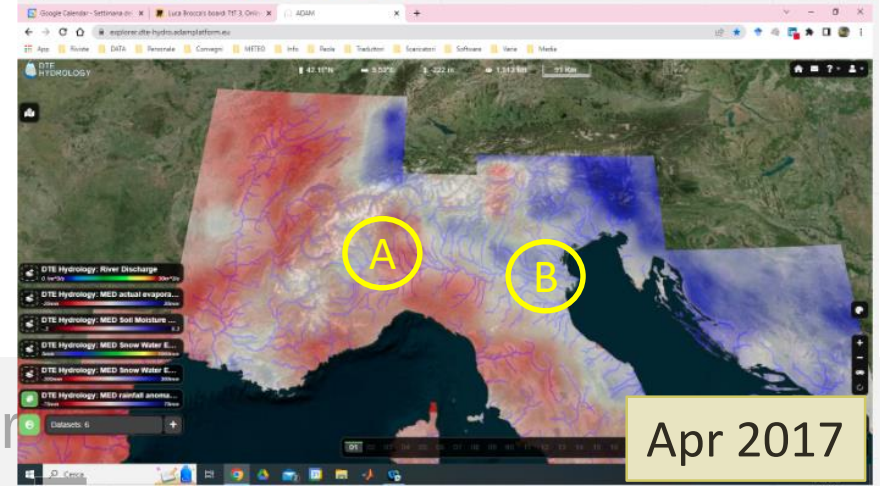
What is the location in which drought risk is higer?

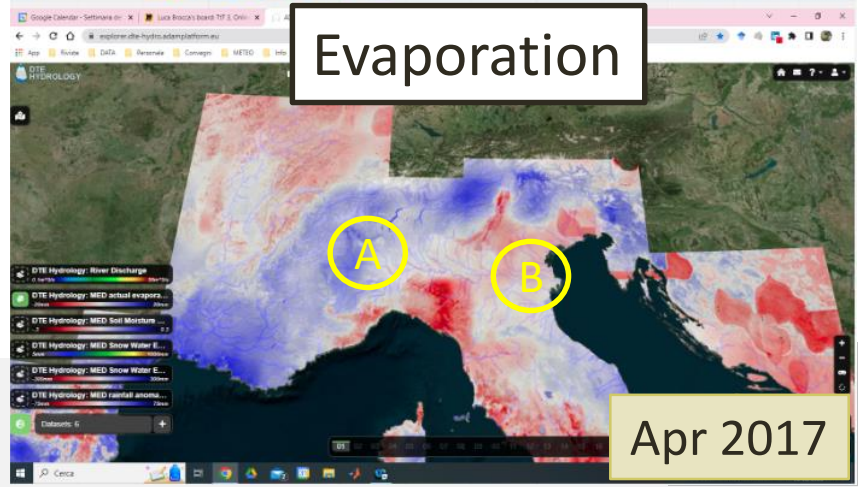












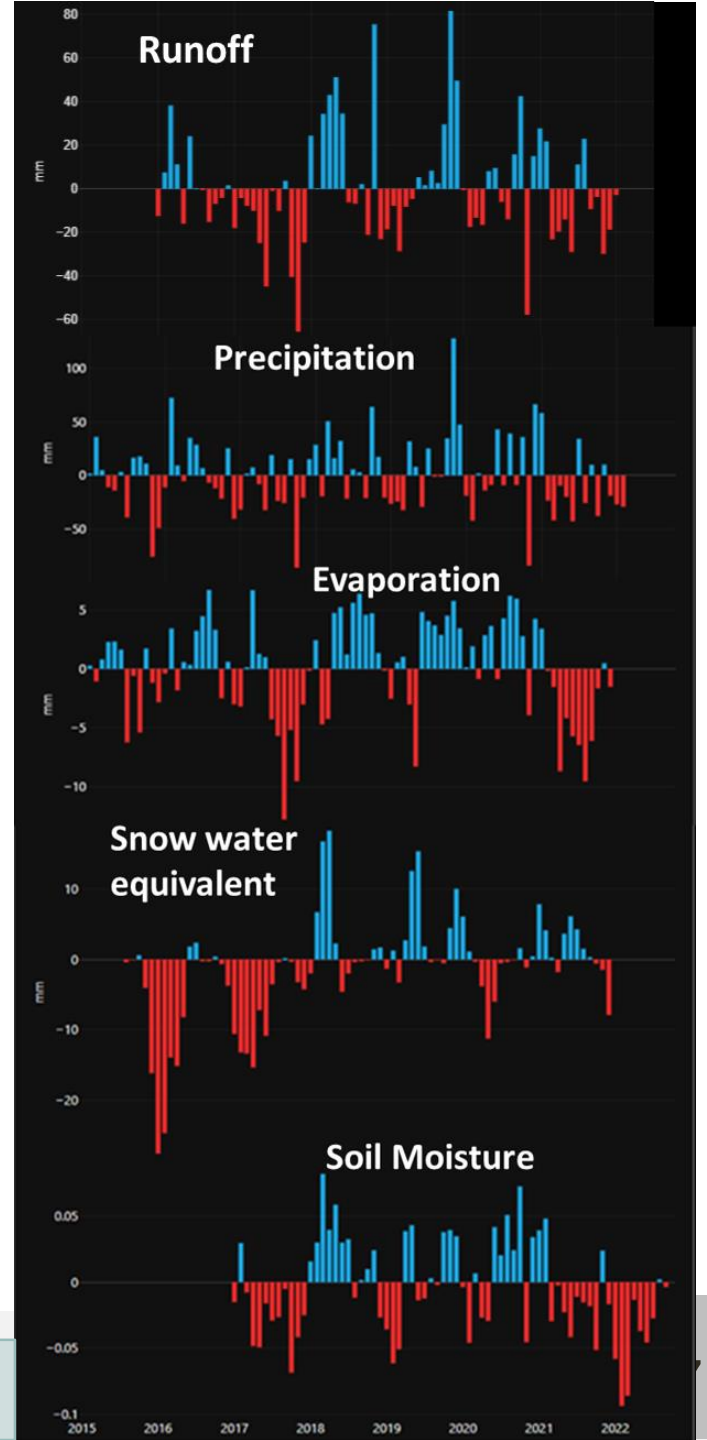
How do you rank drought?

We need to know **where the water is**?
Snow, Soil moisture, Evaporation, River
The knowledge of the water storage allows us to know **when the water will be available**

We need spatially detailed information of the different components of the water cycle

We need long-term and consistent observations in space and time to assess current conditions with respect to past conditions

New satellite observations of precipitation, soil moisture, snow and evaporation provide a more clear assessment of current drought conditions in space and time



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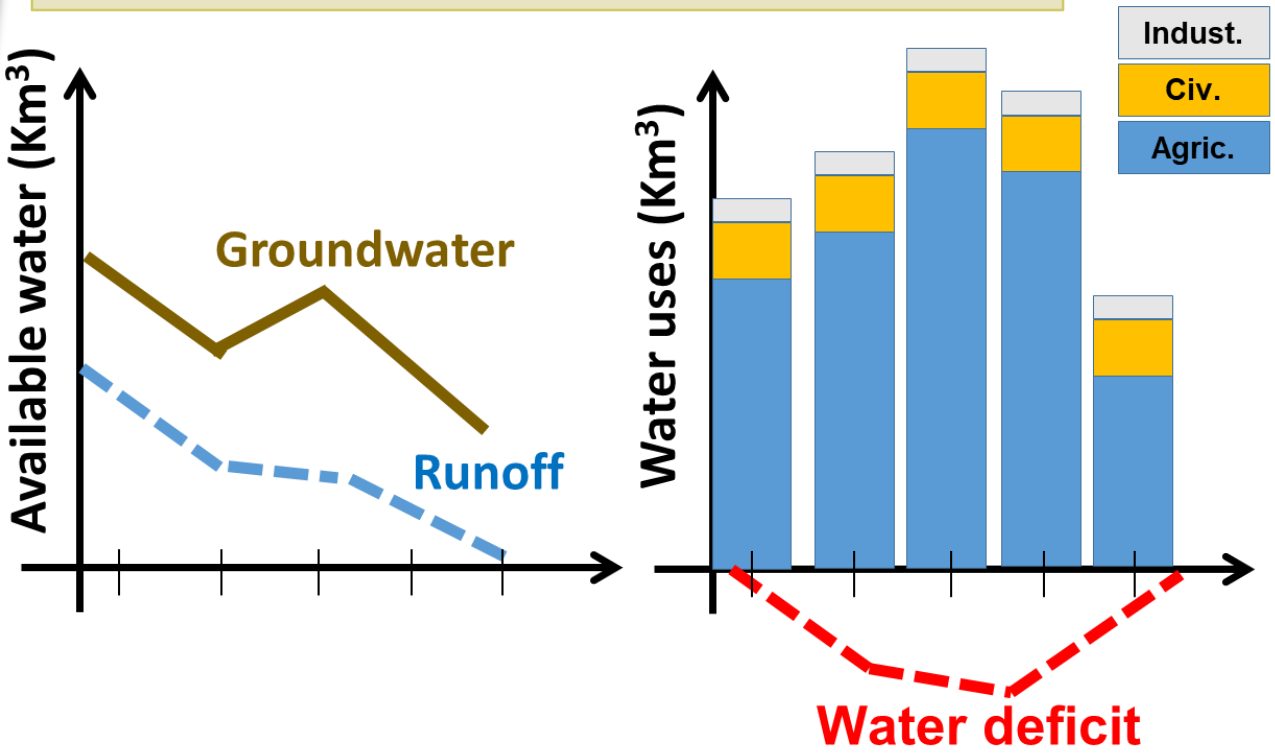
You are a stakeholder involved in water resources management in Northern Italy. We are in April 2023. What do you need to know for the management of water resources in the next summer?
Rank the variables below

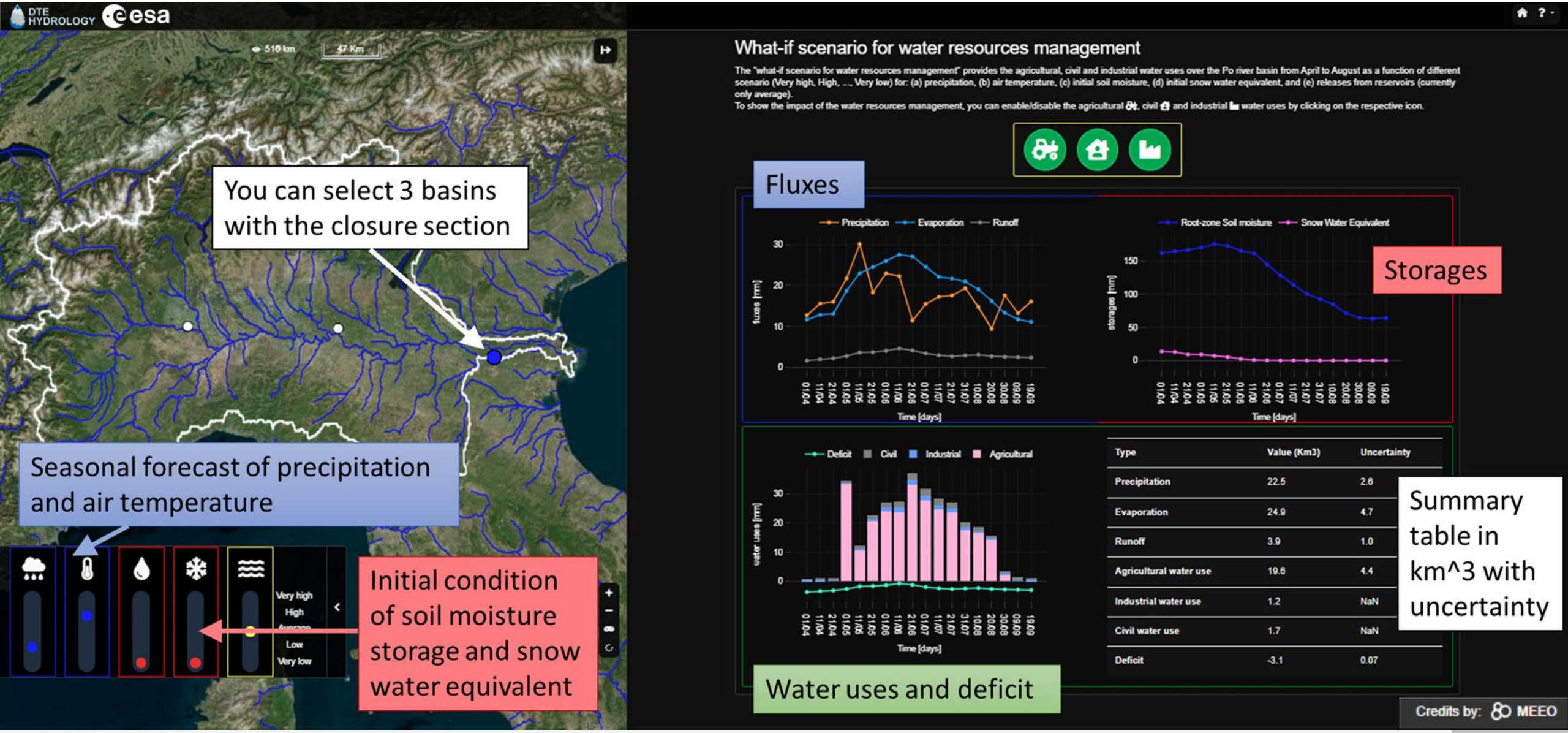
ⓘ Start presenting to display the poll results on this slide.

WHAT-IF SCENARIO WATER RESOURCES MANAGEMENT

Quickly assess the water availability for the spring/summer period (April to September) and the water that can be used for agricultural, civil and industrial purposes



WHAT-IF SCENARIO WATER RESOURCES MANAGEMENT



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Which combination will result in the higher water deficit? (Assuming very low initial snow and a forecast of high air temperature in the summer)

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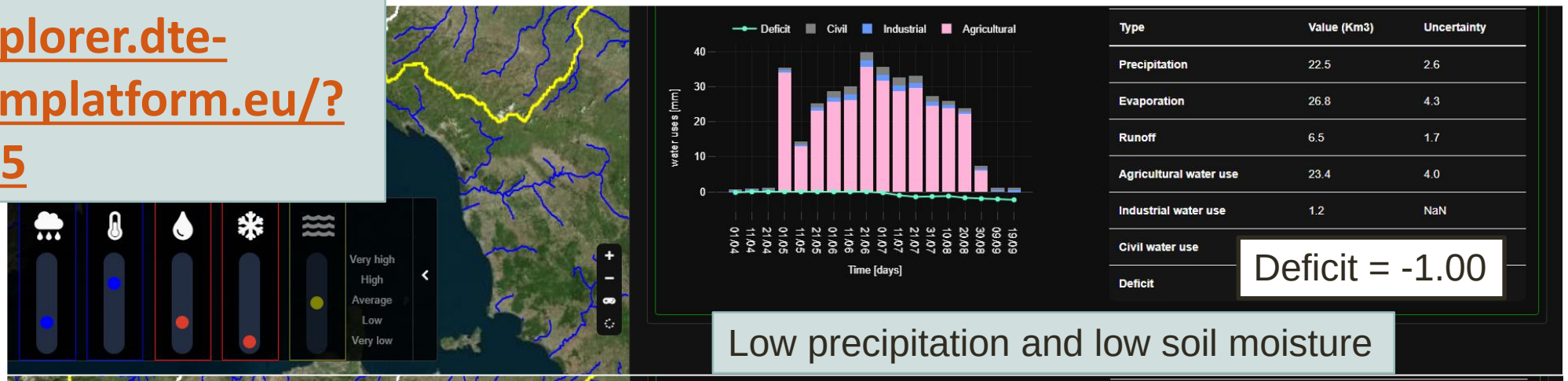
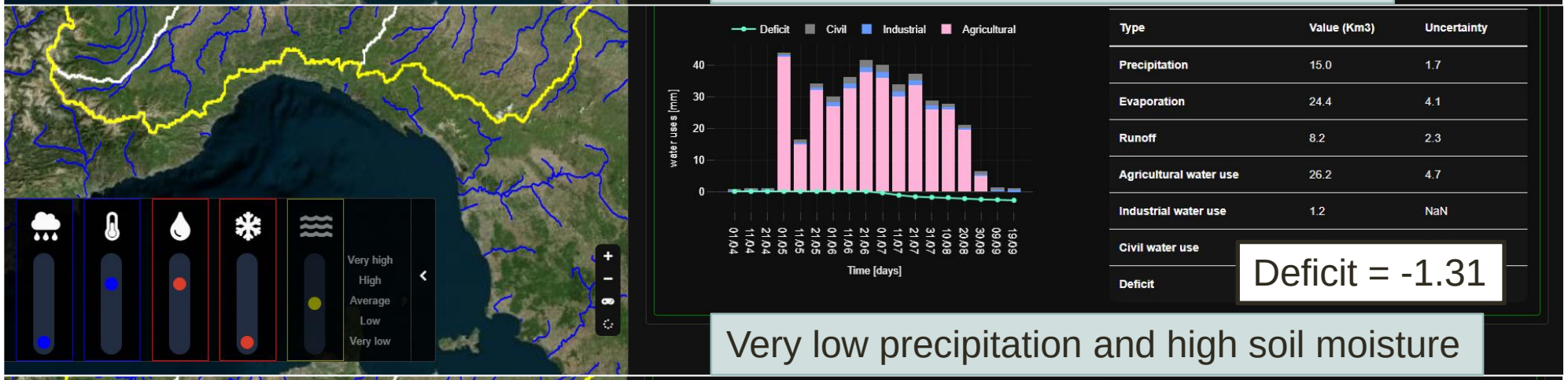
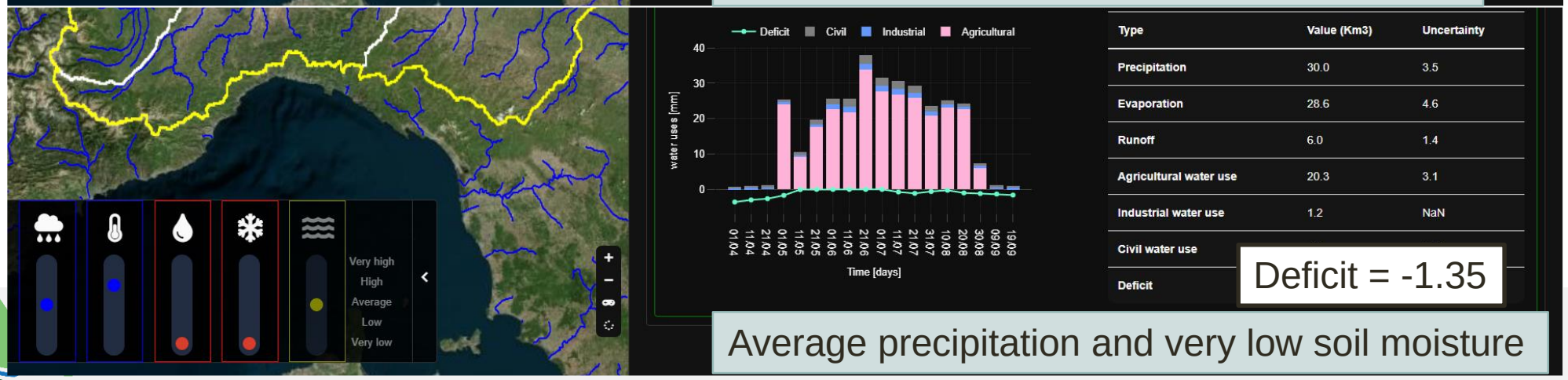


Low precipitation and low soil moisture



Very low precipitation and high soil moisture



Average precipitation and very low soil moisture

TAKE HOME MESSAGE

Drought is going to be the new normal in Europe. Drought is a complex phenomenon, long-lasting, strictly connected to the interaction of the human with the water cycle. Cascade events, i.e., after drought fires, floods and landslides events are common and exacerbate the climate related damages

New satellite observations of precipitation, soil moisture, snow and evaporation provide a more clear assessment of current drought conditions in space and time

Satellite observations are spatially distributed and currently available over long-term periods and developed with consistent approaches

The integration of satellite observations and modelling allows us to build what-if scenario for drought monitoring and water resources management, thus offering new tools for decision makers involved in the assessment of future water uses in an uncertain framework

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How was the webinar?

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