Ukrainian Hydrometeorological Institute of SES of Ukraine and NAS of Ukraine

LABORATORY OF THE RIVER SYSTEMS MODELING

Klaipeda University Marine Research Institute

P I K

eurizon European network for developing new horizons for RIs

Water Resources of Ukraine Under Future Climate Scenarios

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International SWAT Conference
July, 2024 – Strasboug, France

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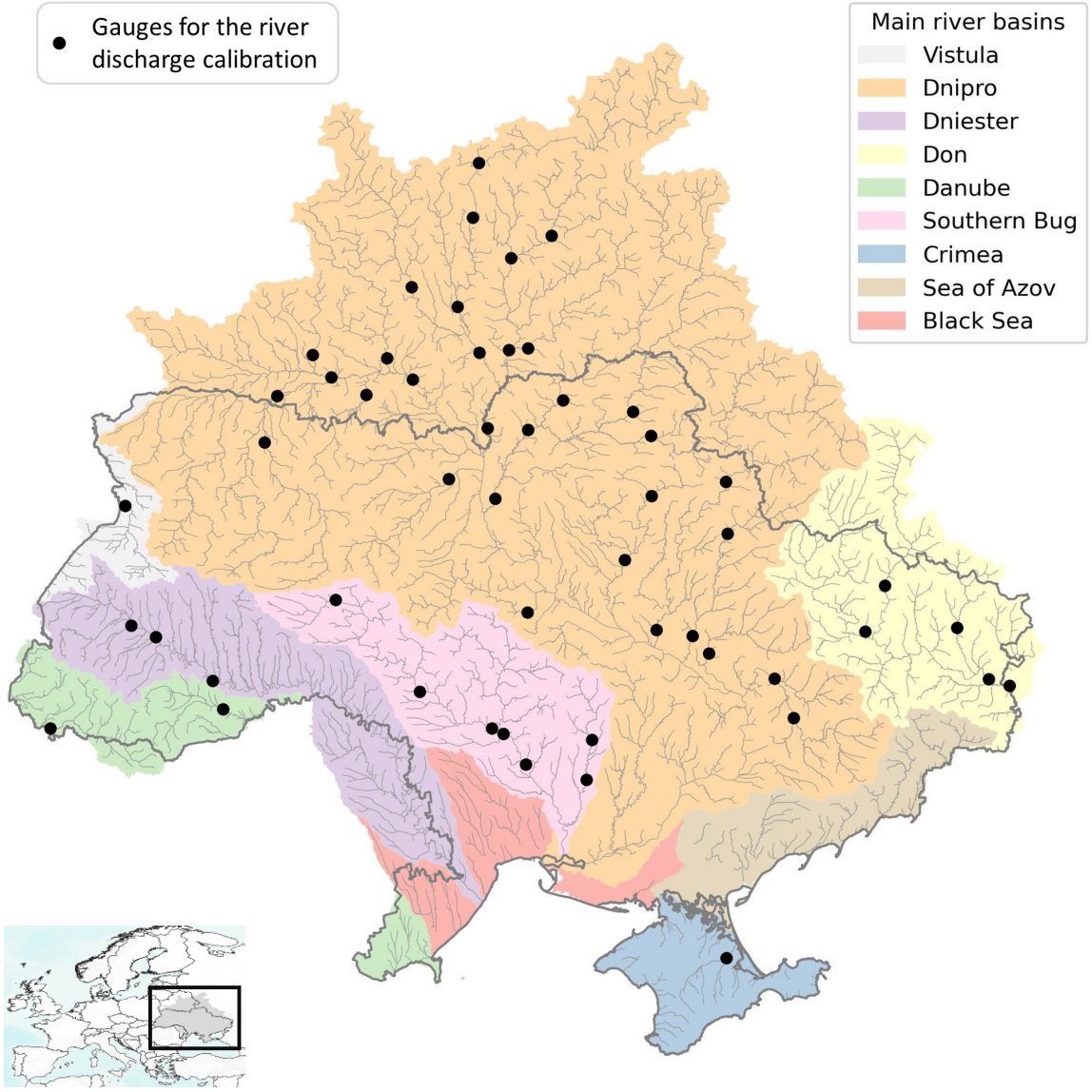
River basins of Ukraine

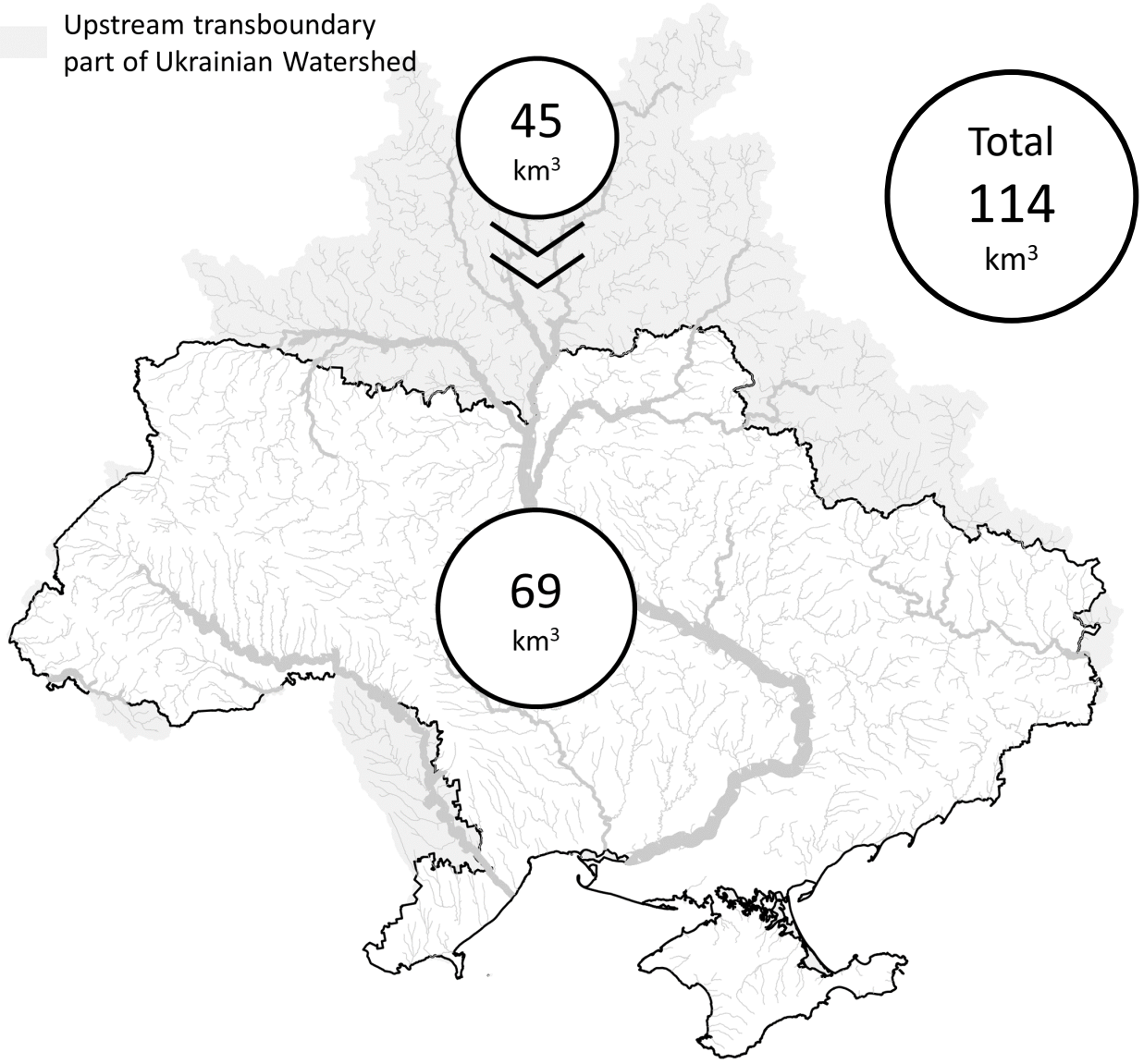
The SWAT model setup:

- 874 000 km^2
- 3 787 Subbasins
- 10 732 HRUs
- landwater.uhmi.org.ua



Annual water runoff

SWAT simulation · 1991-2020



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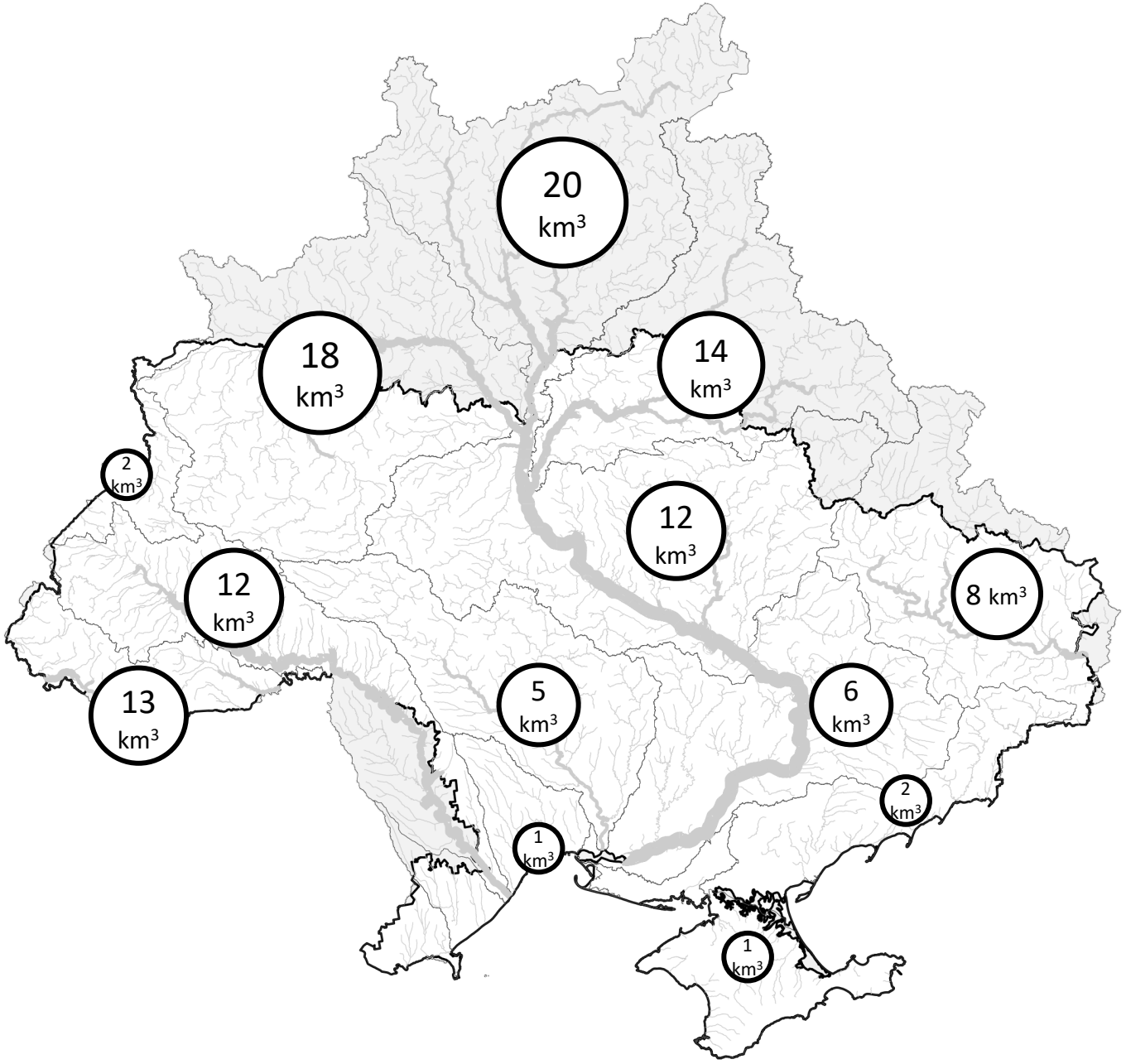
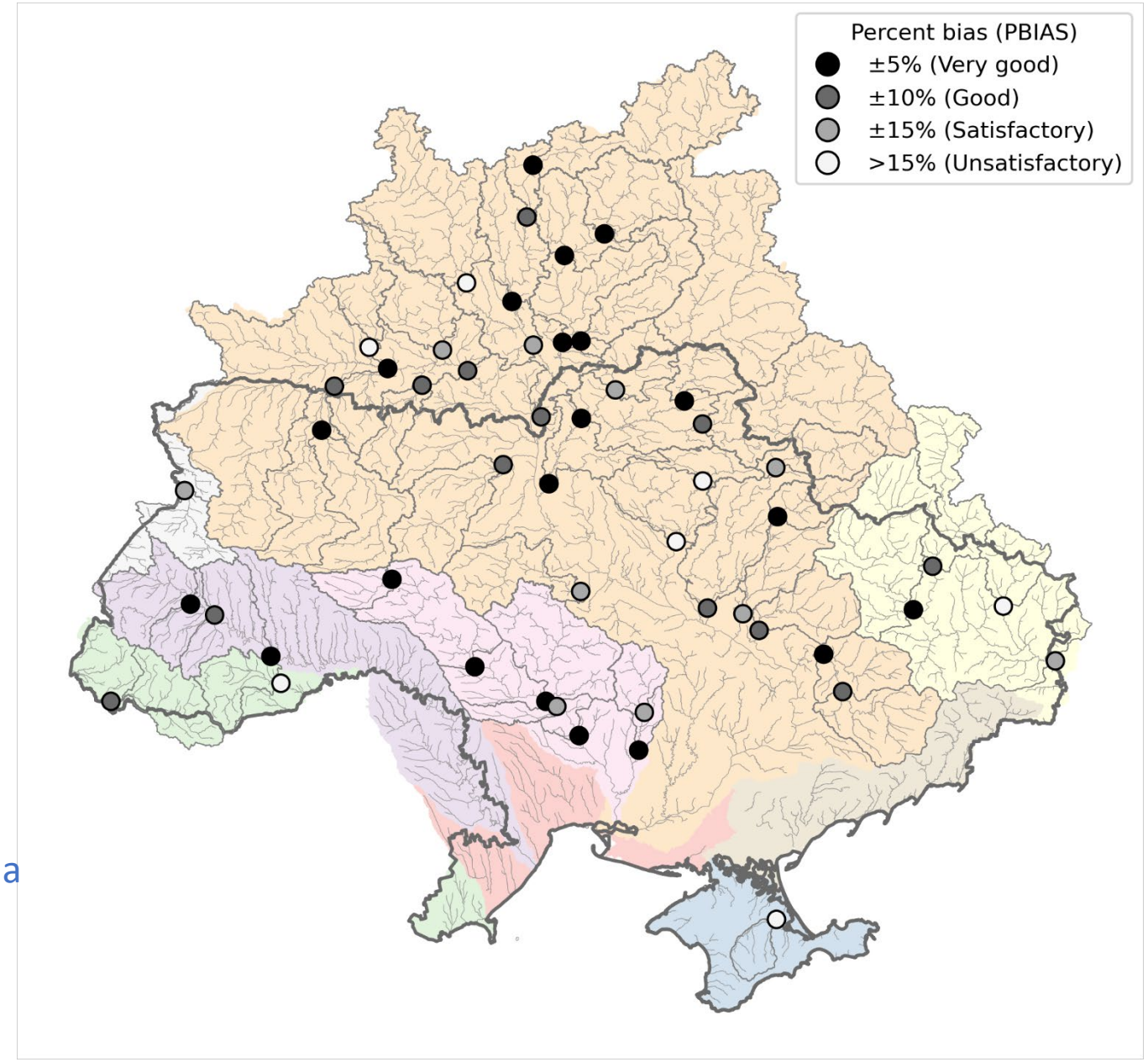
River basins of Ukraine



Calibration results

- 52 discharge gauges
- 61 snow cover sites
- Calibration 2000-2019, Validation 1980-1999
- Daily for free-flow rivers
- Yearly for man-regulated rivers
- Web interface: landwater.uhmi.org.ua

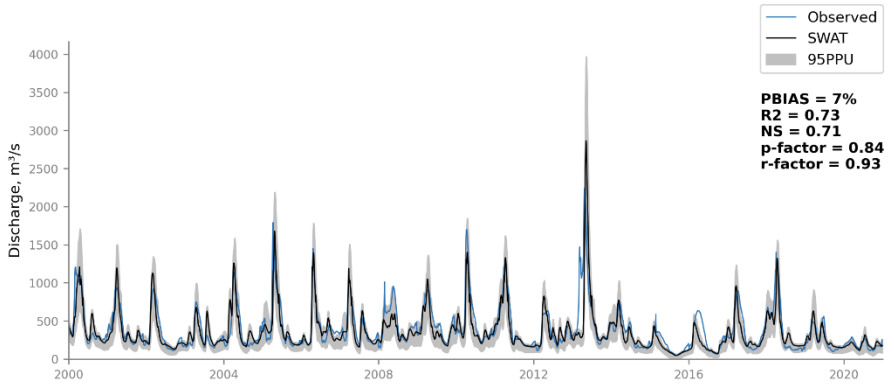


Calibration results

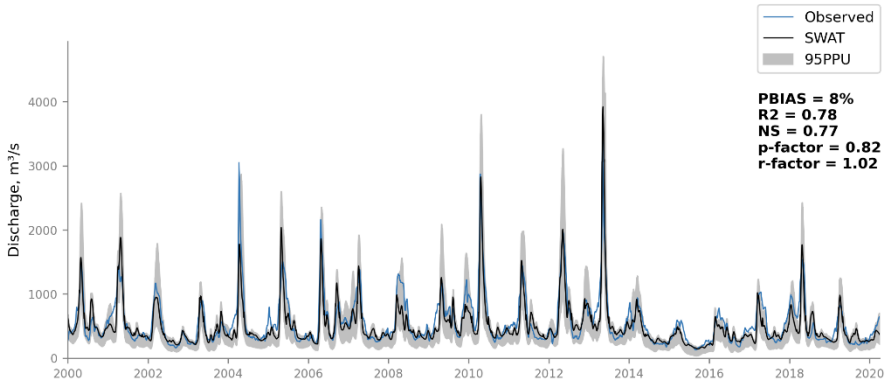
Three largest rivers

- Main cause of error – precipitation inputs from ERA5-Land

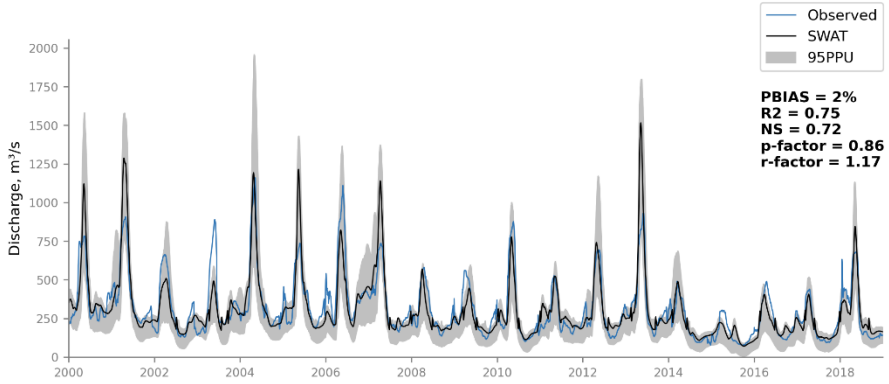
River: **Prypiat**
Gauge: **Mozyr**
Area: **103 615 km²**



River: **Dnipro**
Gauge: **Nedanchichi**
Area: **103 684 km²**



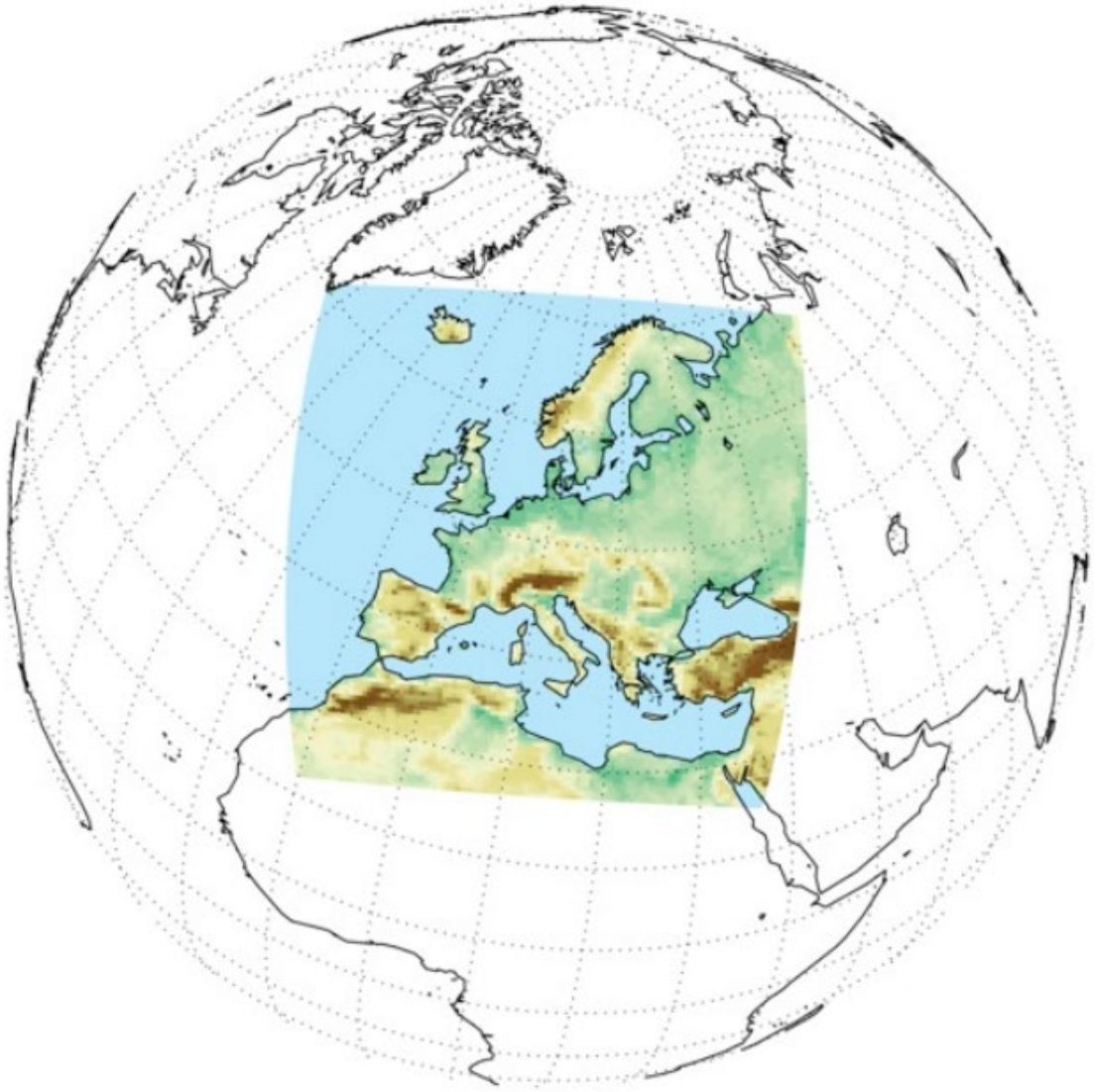
River: **Desna**
Gauge: **Litky**
Area: **88 168 km²**



Climate projections

Euro-CORDEX project:

- 6 models with SWAT parameters
- 0.11° resolution
- 1971-2100

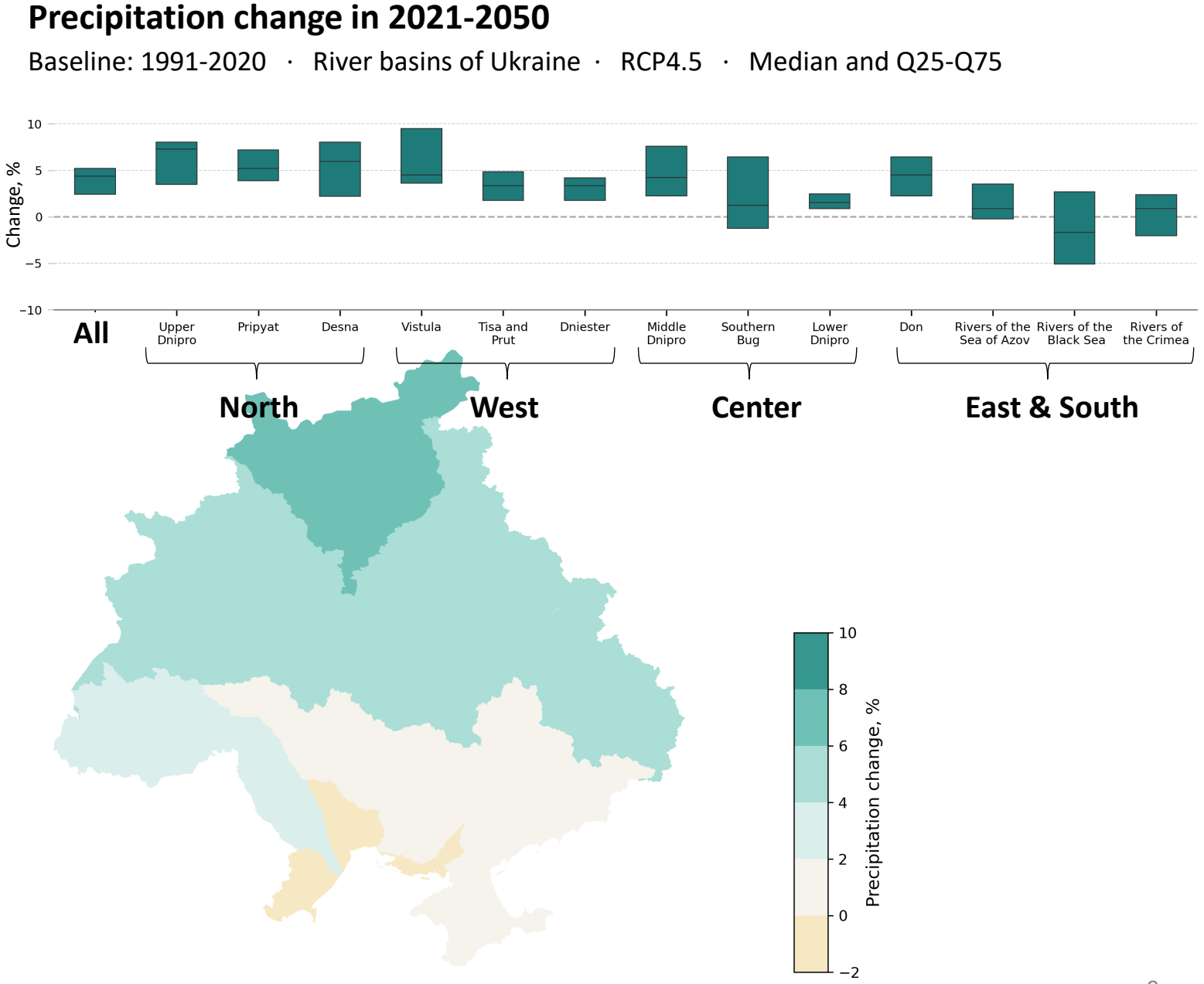


Air temperature change in 2021-2050

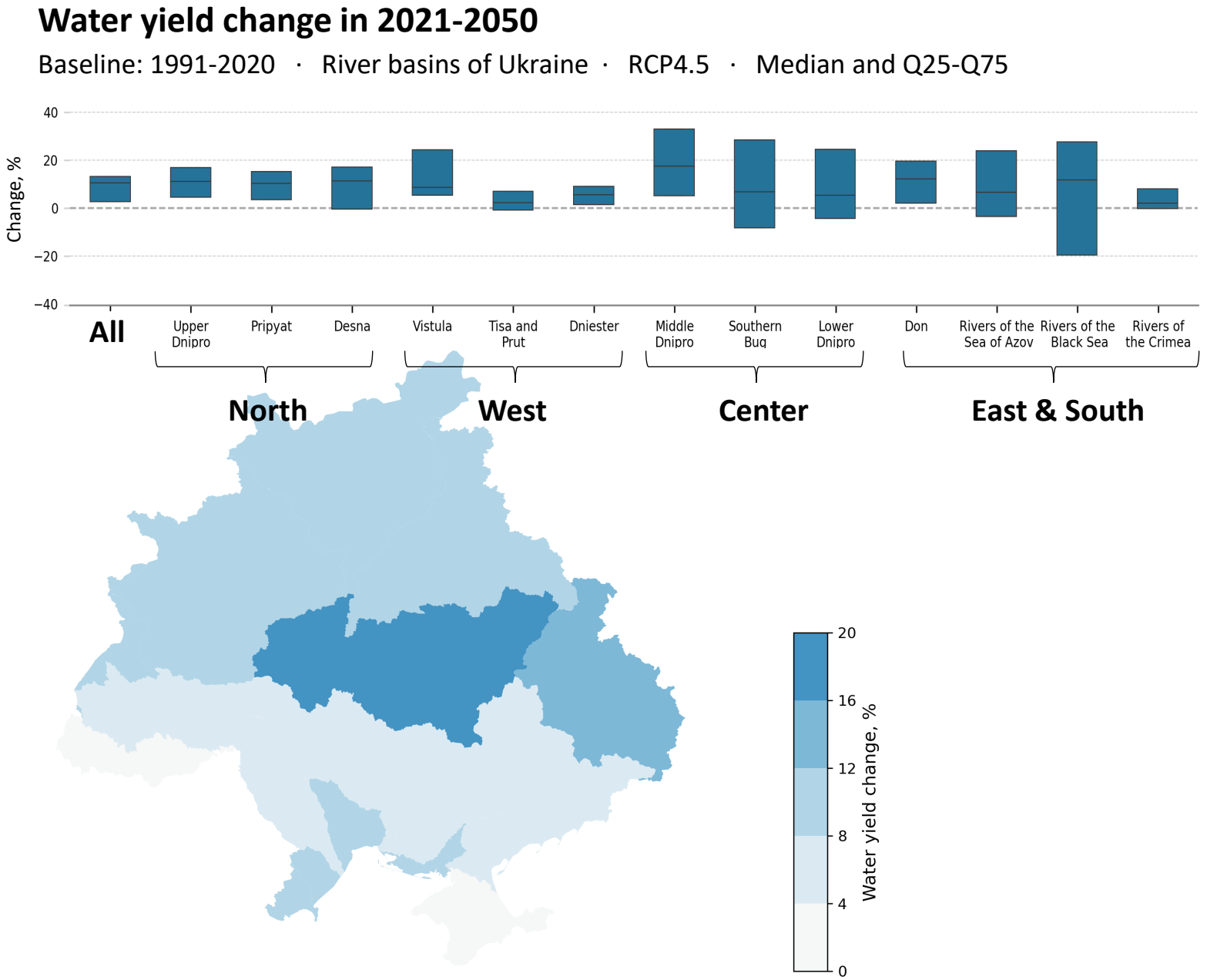
Baseline: 1991-2020 · River basins of Ukraine · RCP4.5

+1 °C

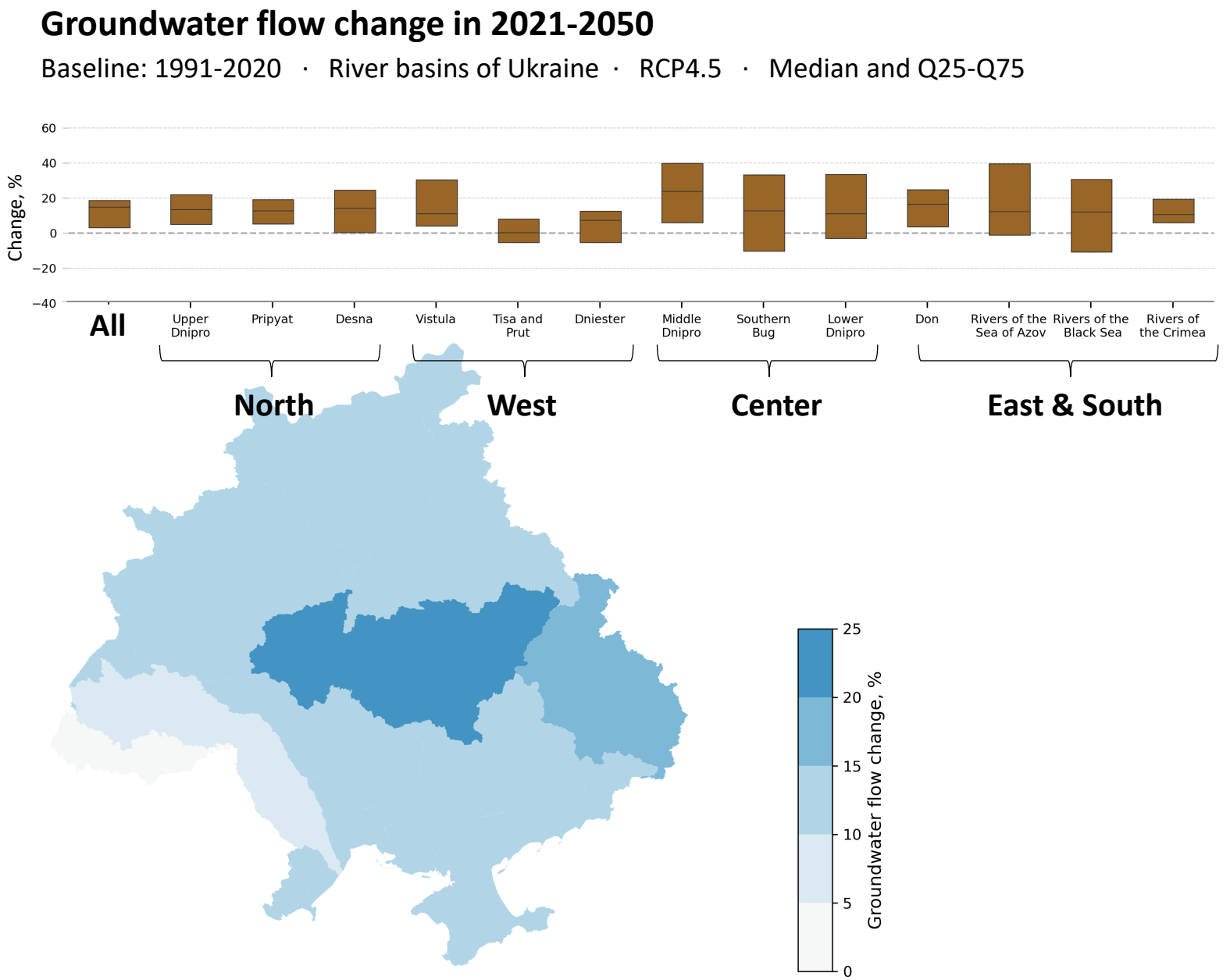
Precipitation will slightly increase



Water runoff will slightly increase



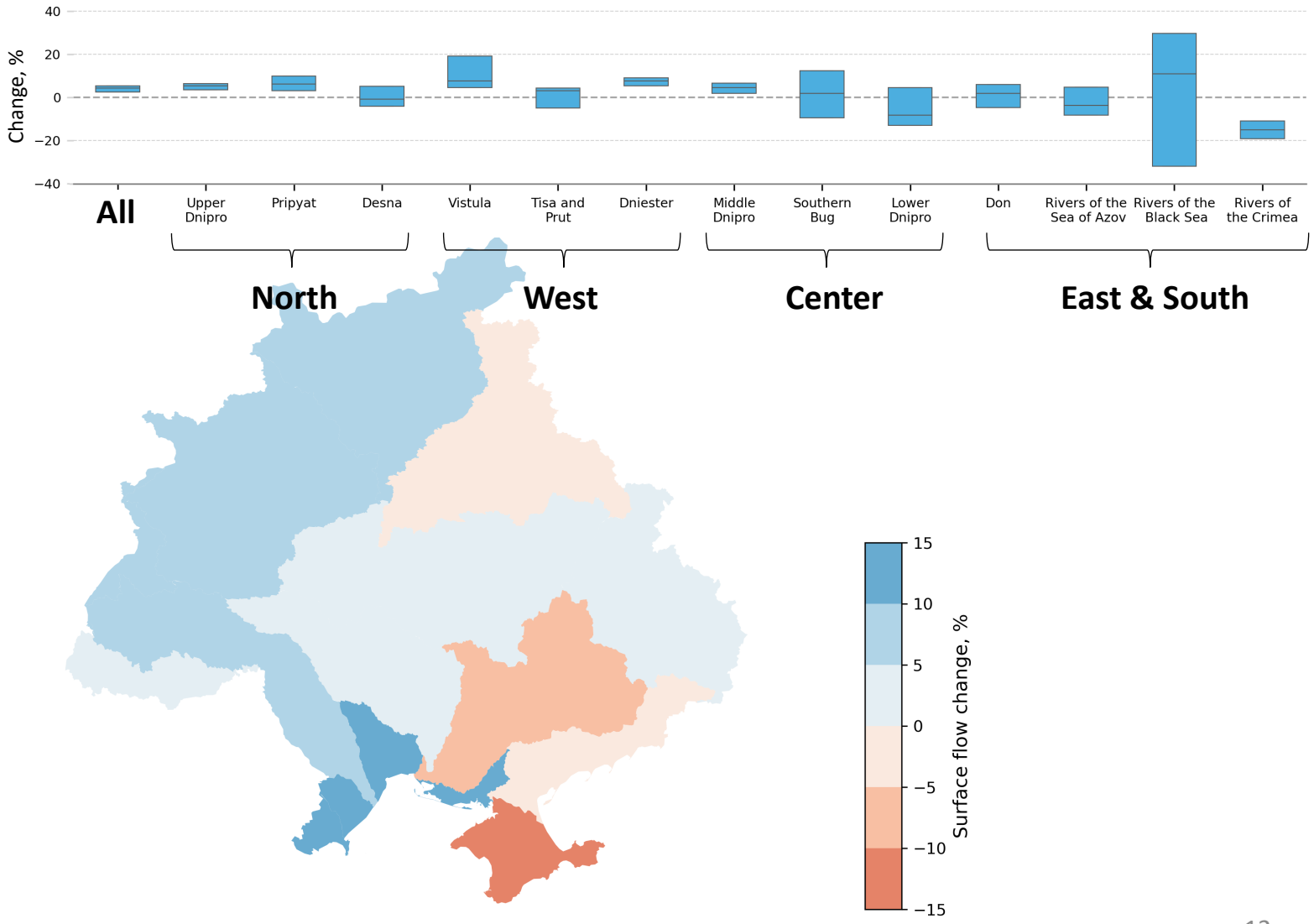
Groundwater contributes more into runoff increase



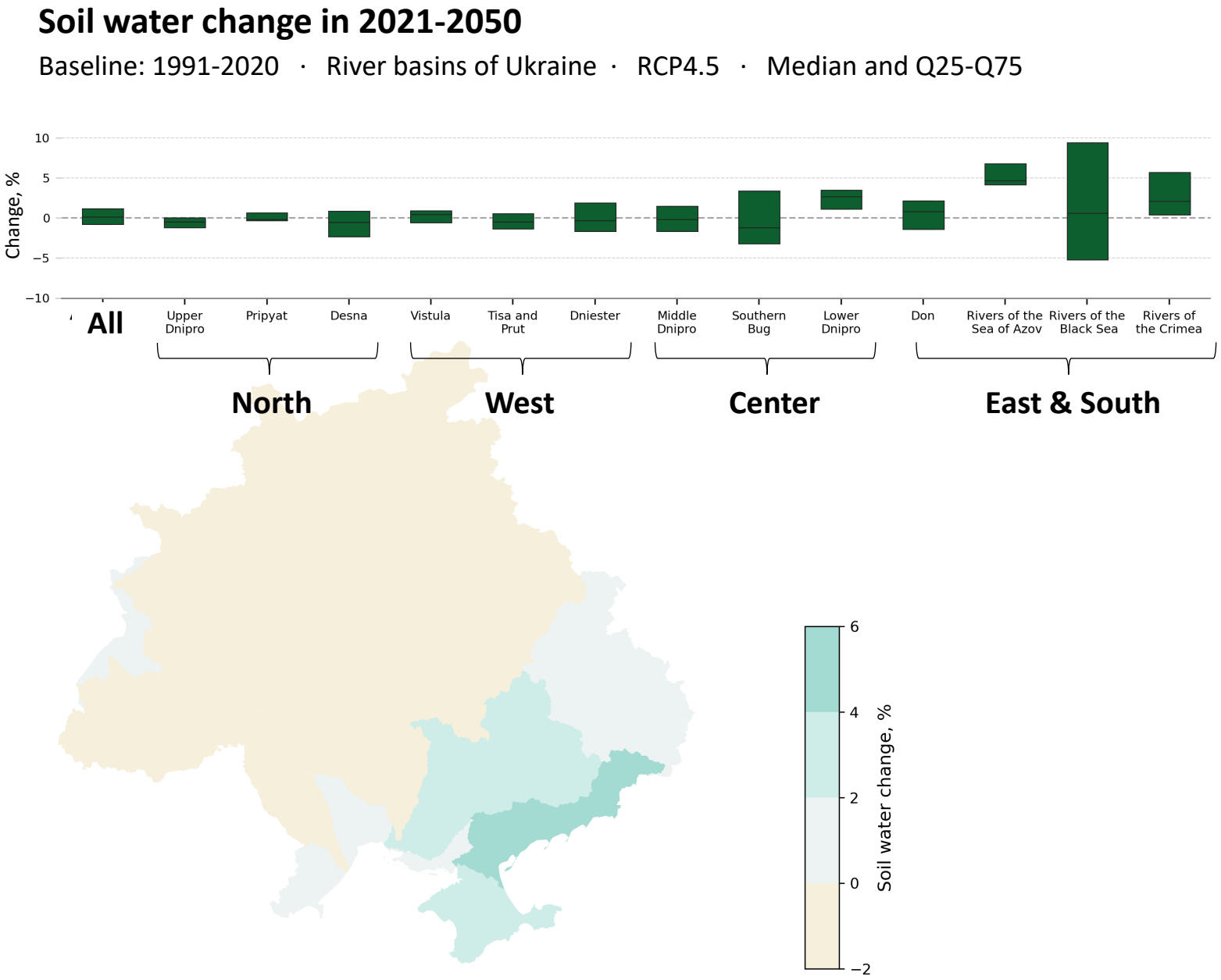
Surface flow tends to increase, though changes are uncertain for some river basins

Surface flow change in 2021-2050

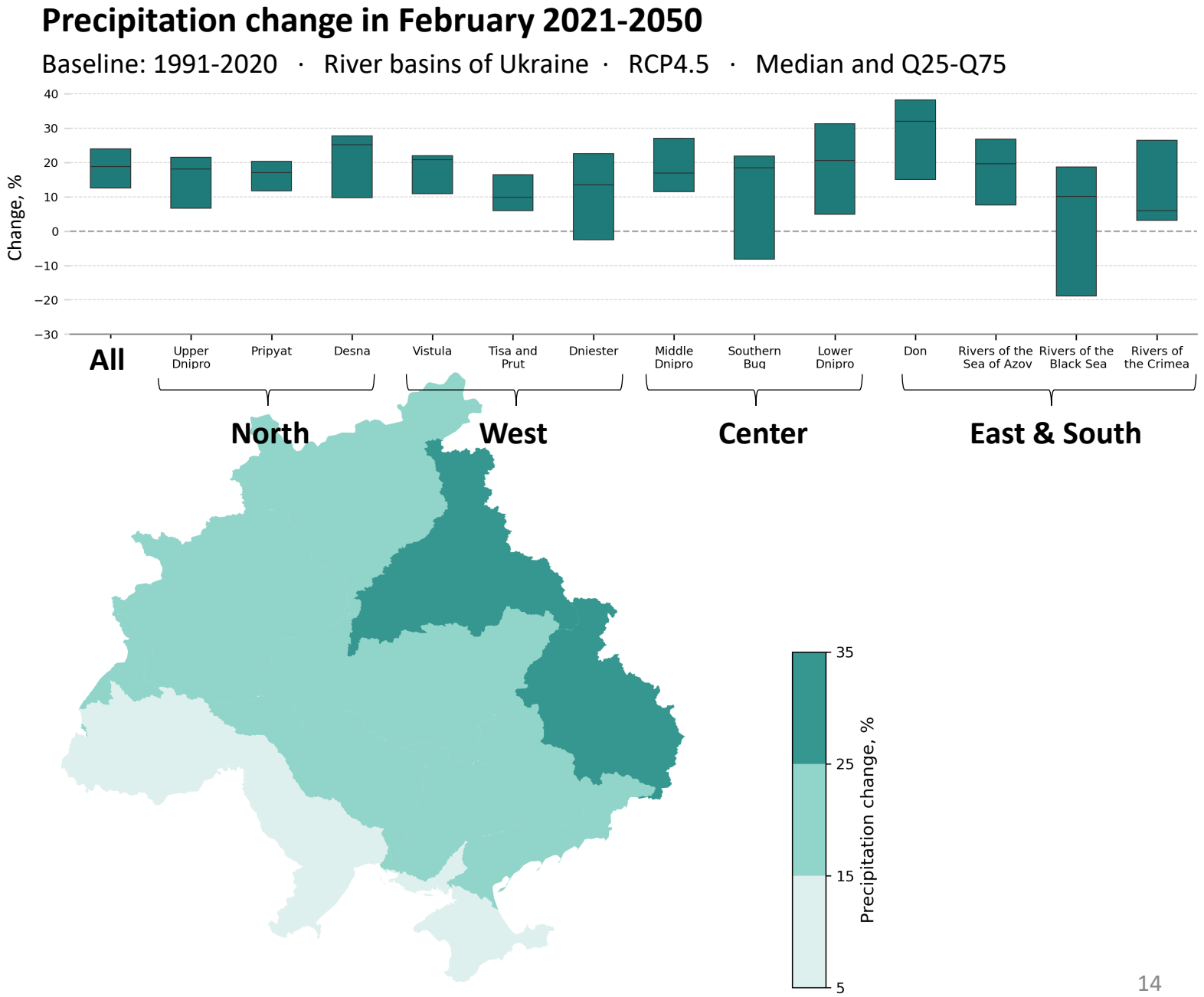
Baseline: 1991-2020 · River basins of Ukraine · RCP4.5 · Median and Q25-Q75



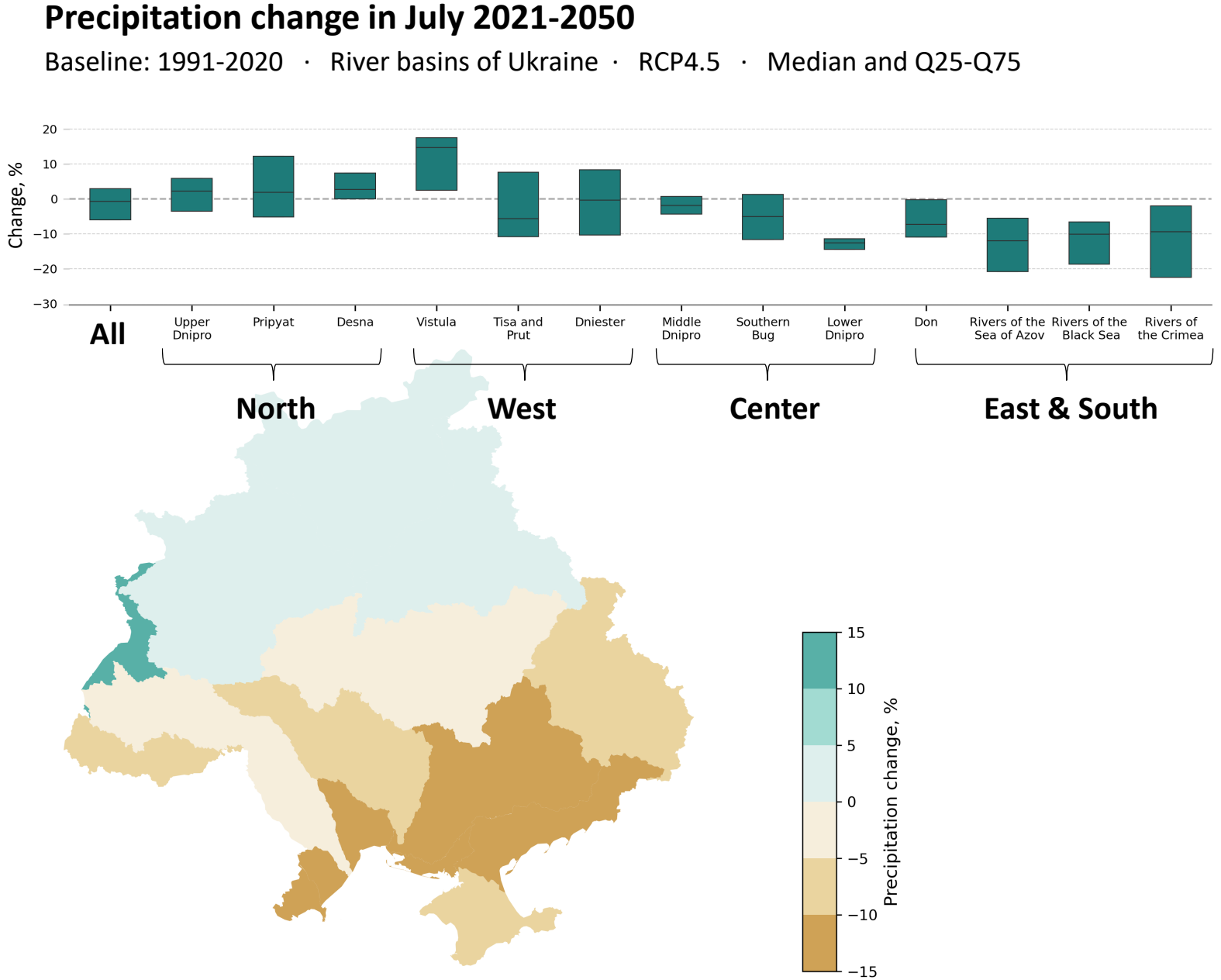
Soil water has no change annually



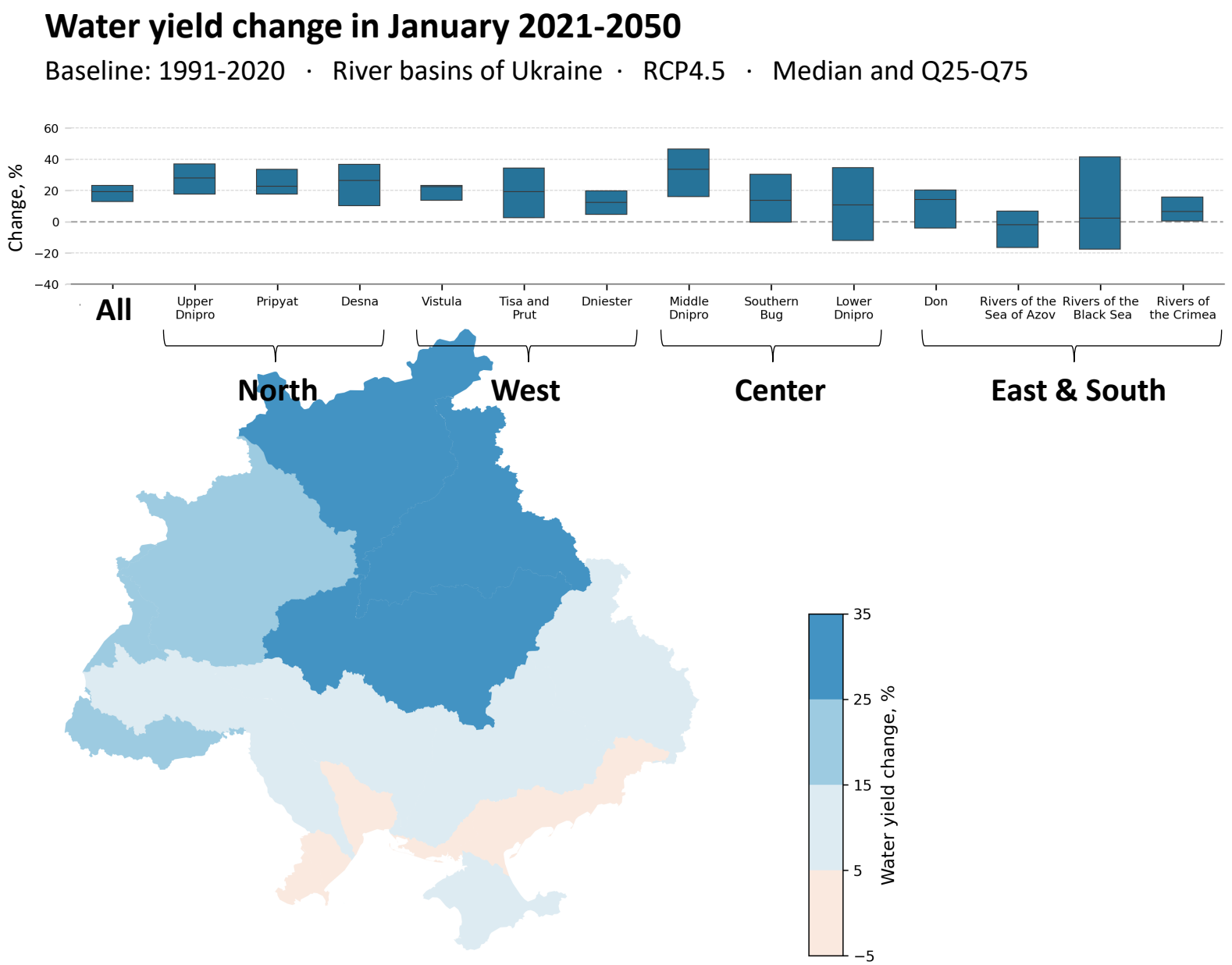
Precipitation will mostly increase in winter



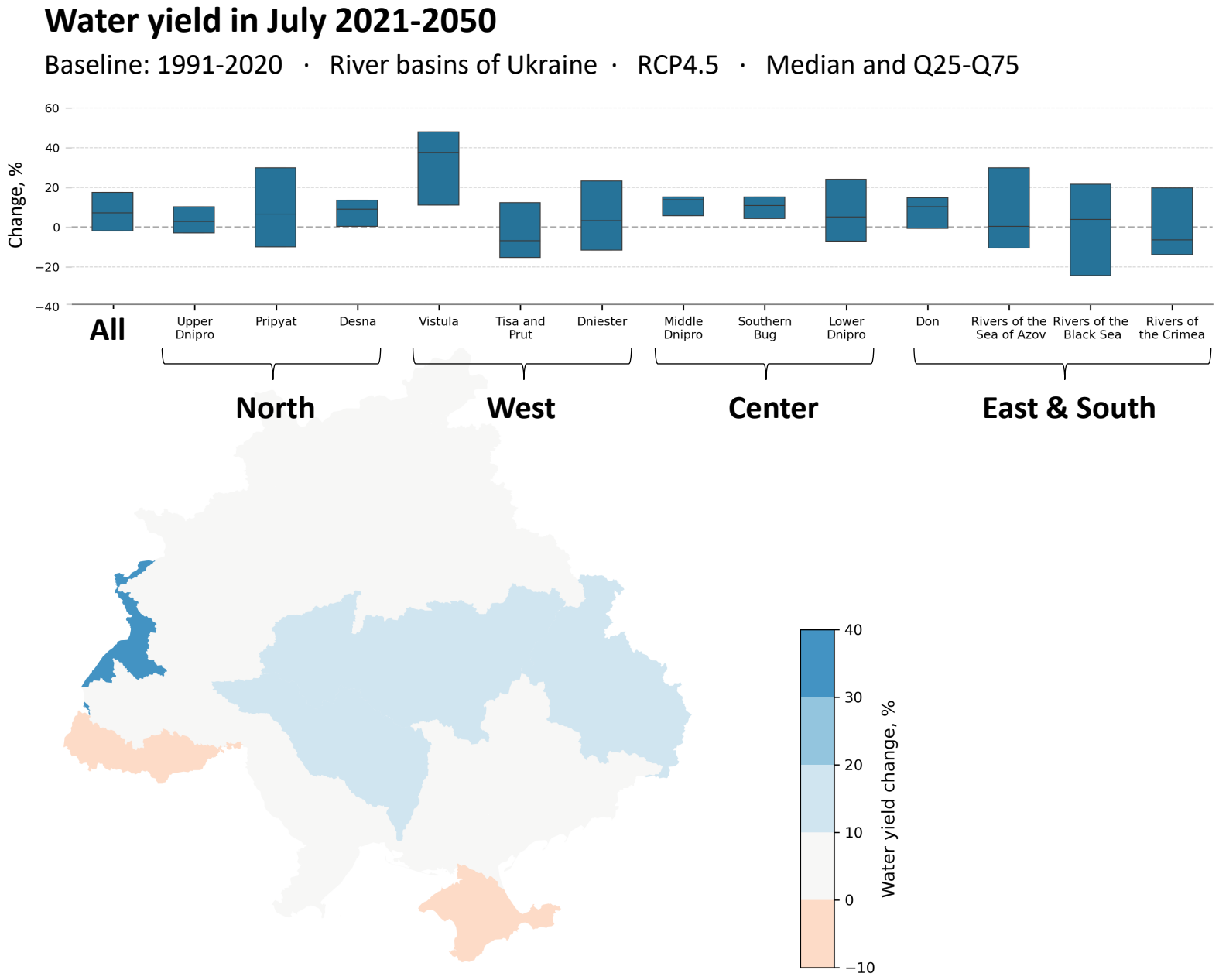
Precipitation in summer will decrease in the Central, East, and South of Ukraine



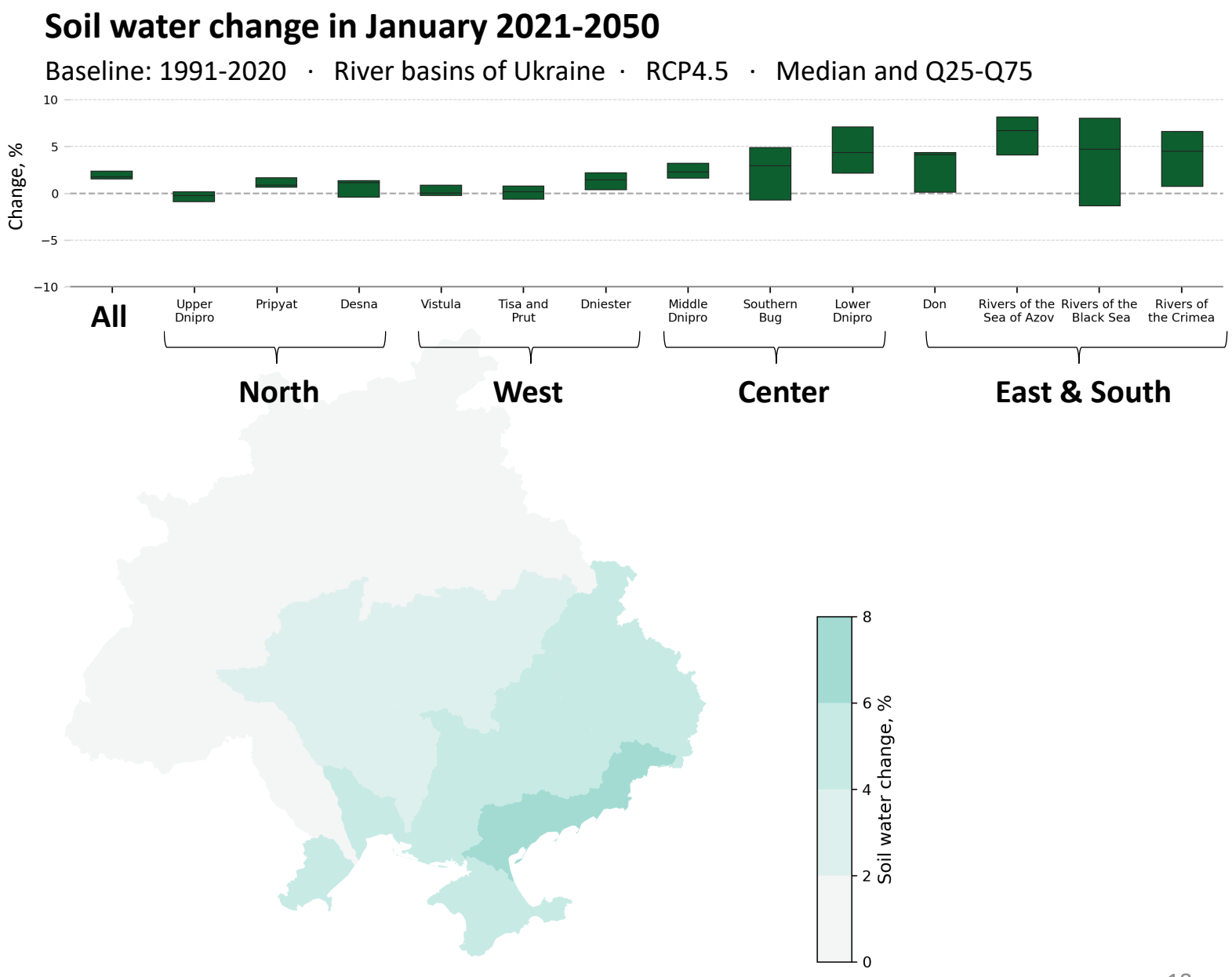
Water yield will mostly increase in winter



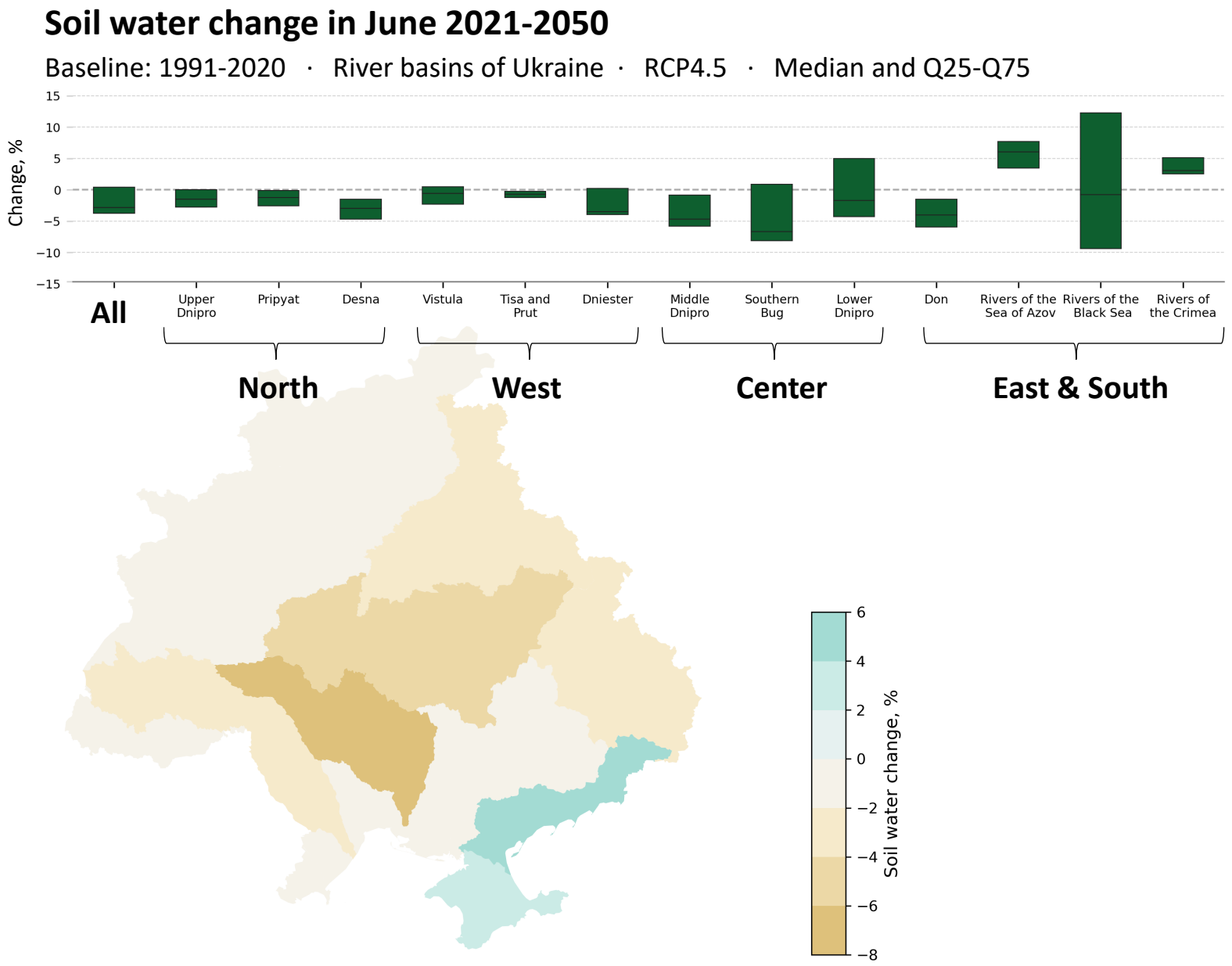
Water yield will slightly increase in summer in the North and Central of Ukraine



Soil water tends to increase in winter



Soil water tends to decrease during vegetation period



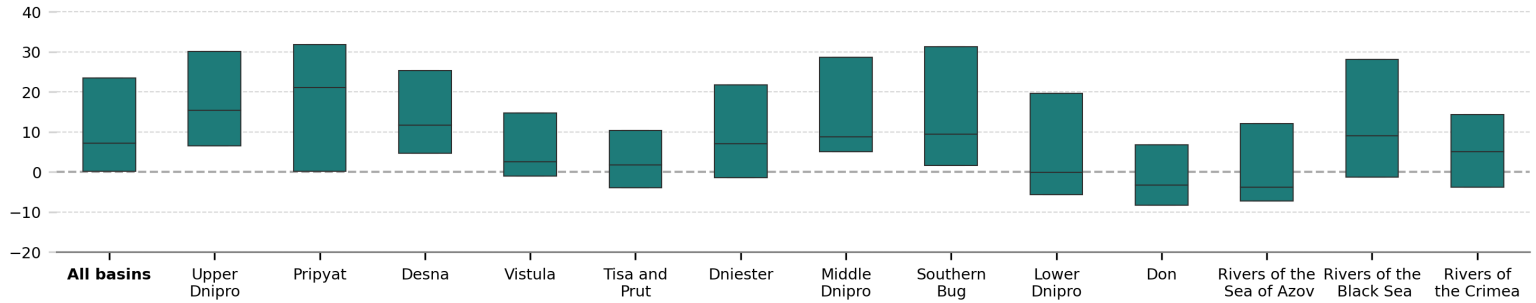
Conclusions

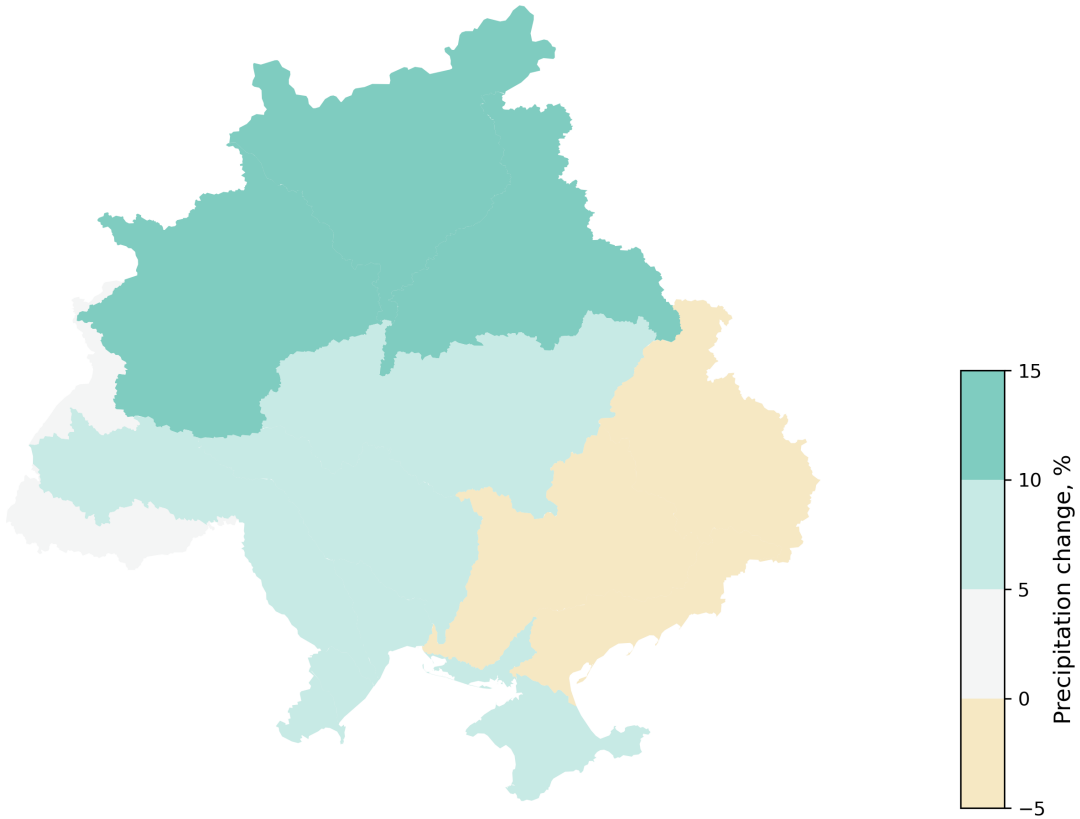
Future: 2021-2050 · Baseline: 1991-2020 · River basins of Ukraine · RCP4.5

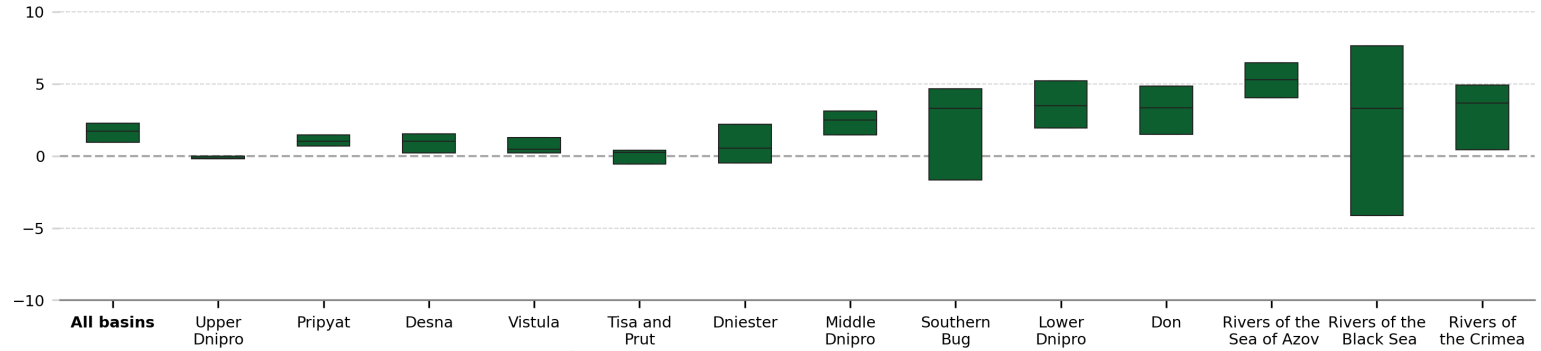
Slightly more water in rivers but less in soils

Thank you for your attention!

Additional slides


40
30
20
10
0
−10
−20
All basins
Upper Dnipro
Pripyat
Desna
Vistula
Tisa and Prut
Dniester
Middle Dnipro
Southern Bug
Lower Dnipro
Don
Rivers of the Sea of Azov
Rivers of the Black Sea
Rivers of the Crimea


15
10
5
0
−5
Precipitation change, %


10
5
0
−5
−10
All basins
Upper Dnipro
Pripyat
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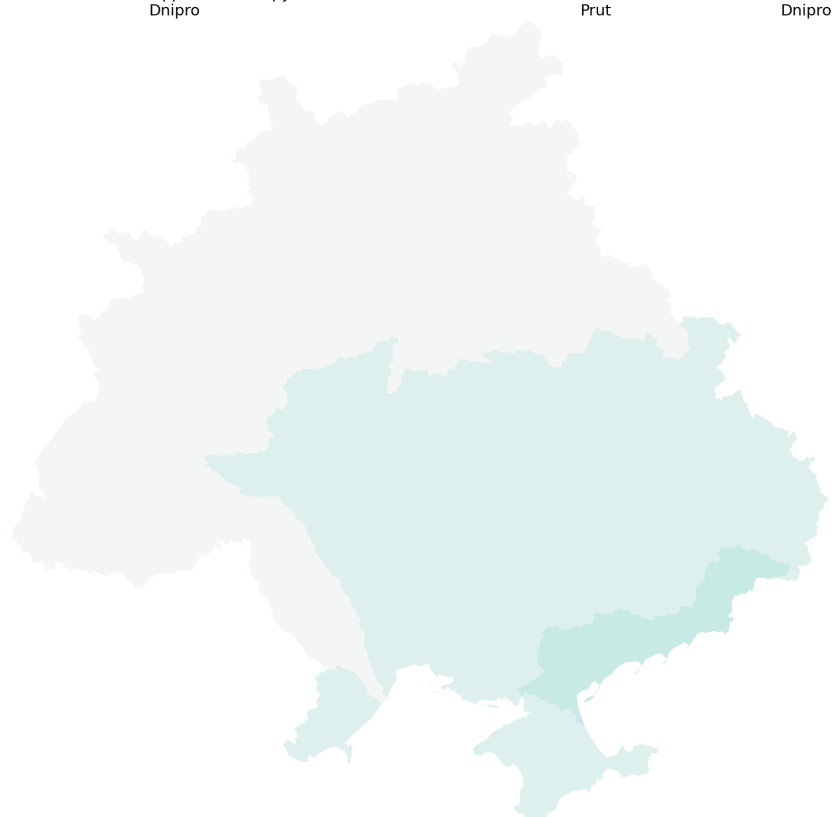
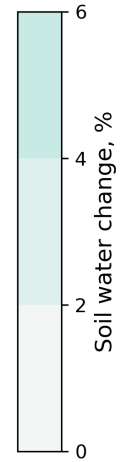
Rivers of the Sea of Azov
Rivers of the Black Sea
Rivers of the Crimea




6
4
2
0
Soil water change, %

AREAkm2	Flow_volume_km3
Basin_and_Dnipro_subs_EN	
Danube	13.6
Desna	13.6
Dniester	12.4
Don	8.3
Lower Dnipro	5.8
Middle Dnipro	12.3
Pripyat	17.9
Rivers of the Black Sea	1.0
Rivers of the Crimea	0.7
Rivers of the Sea of Azov	1.8
Southern Bug	5.4
Tisa and Prut	13.0
Upper Dnipro	19.8
Vistula	1.8