

A limited area climate downscaling for the Adriatic Sea

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ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Interreg
Italy - Croatia
AdriaClim

European Regional Development Fund



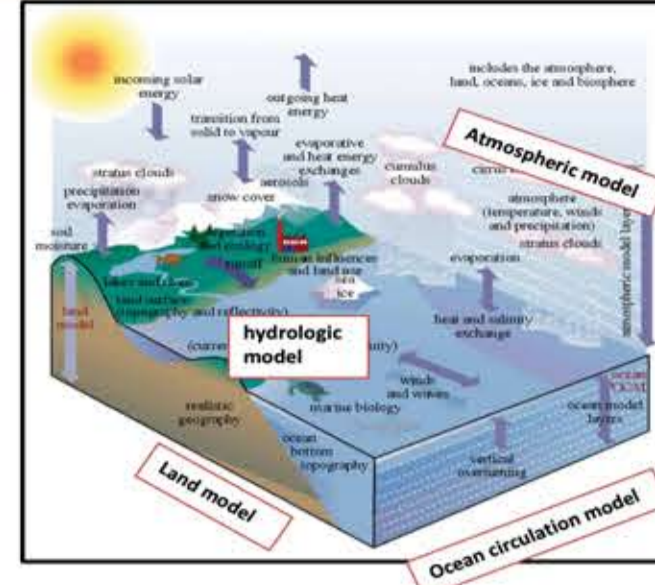
AIM Bridge gap between **large scale** of climate scenarios and **local scale** of climate impacts



SPECIFIC OBJECTIVES

- High res. Integrated and multi-physics modeling
- CC indicators from regional to local scales
- Site specific adaptation plans

Where and WHY? The Adriatic Sea



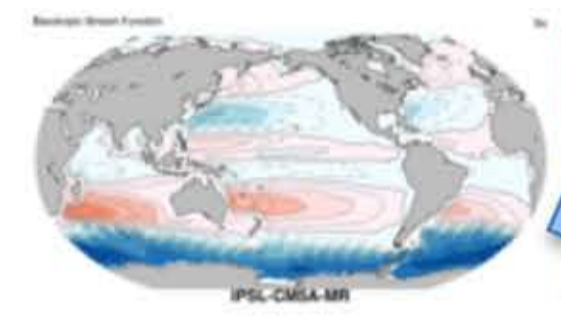
- CLIMATIC COMPLEXITY
- CLIMATE CHANGE HOTSPOT WITH LOCAL PECULIARITIES
- NATURAL LABORATORY FOR WATER CYCLE MODELING

~150 catchments ending into Adriatic Sea

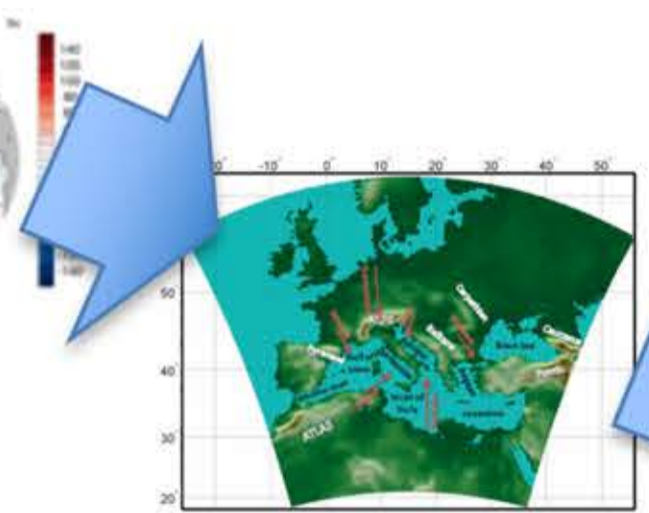


WHAT METHOD?

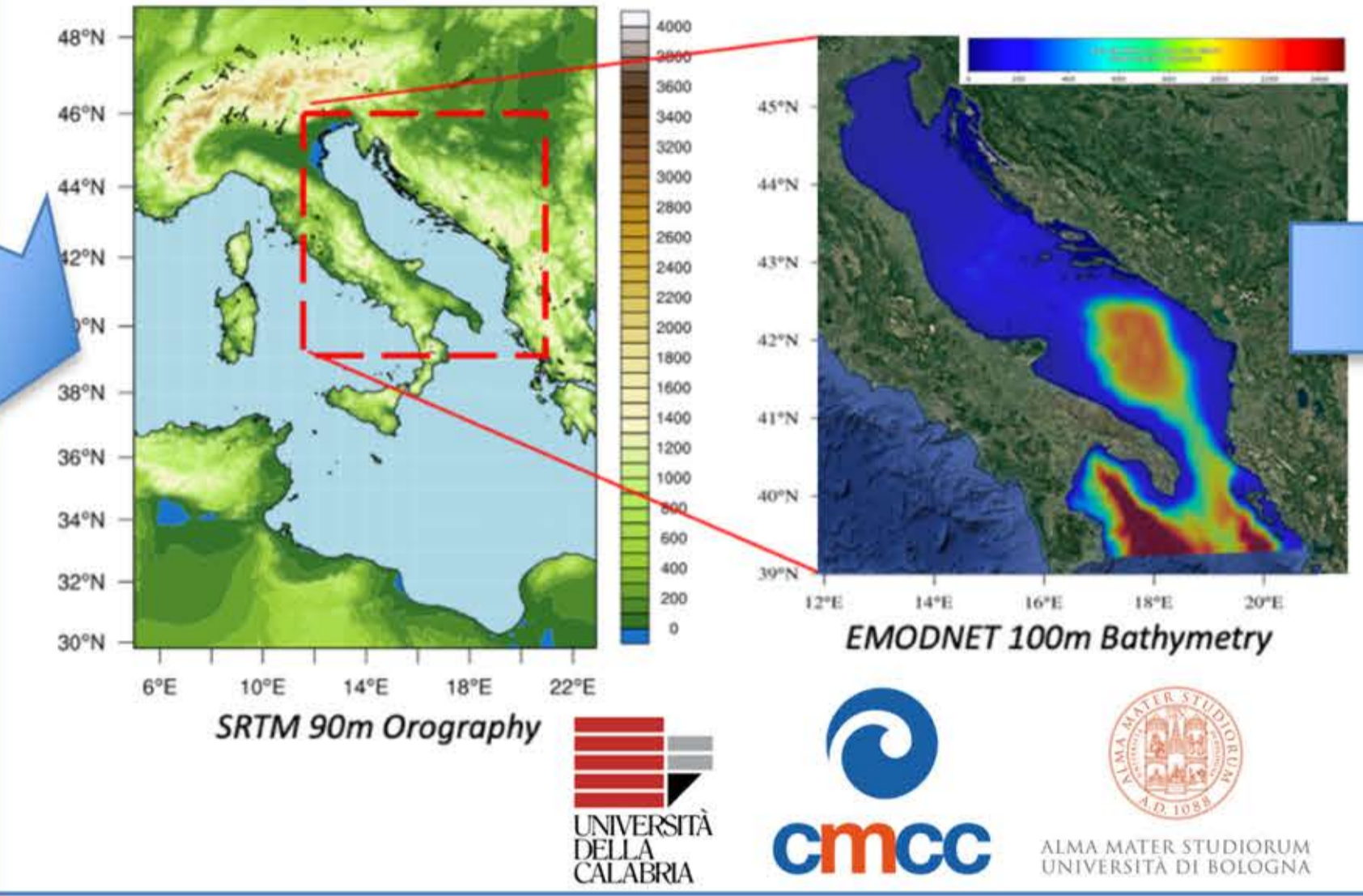
GLOBAL CLIMATE MODEL (CMIP5) IPSL-CM5A-MR



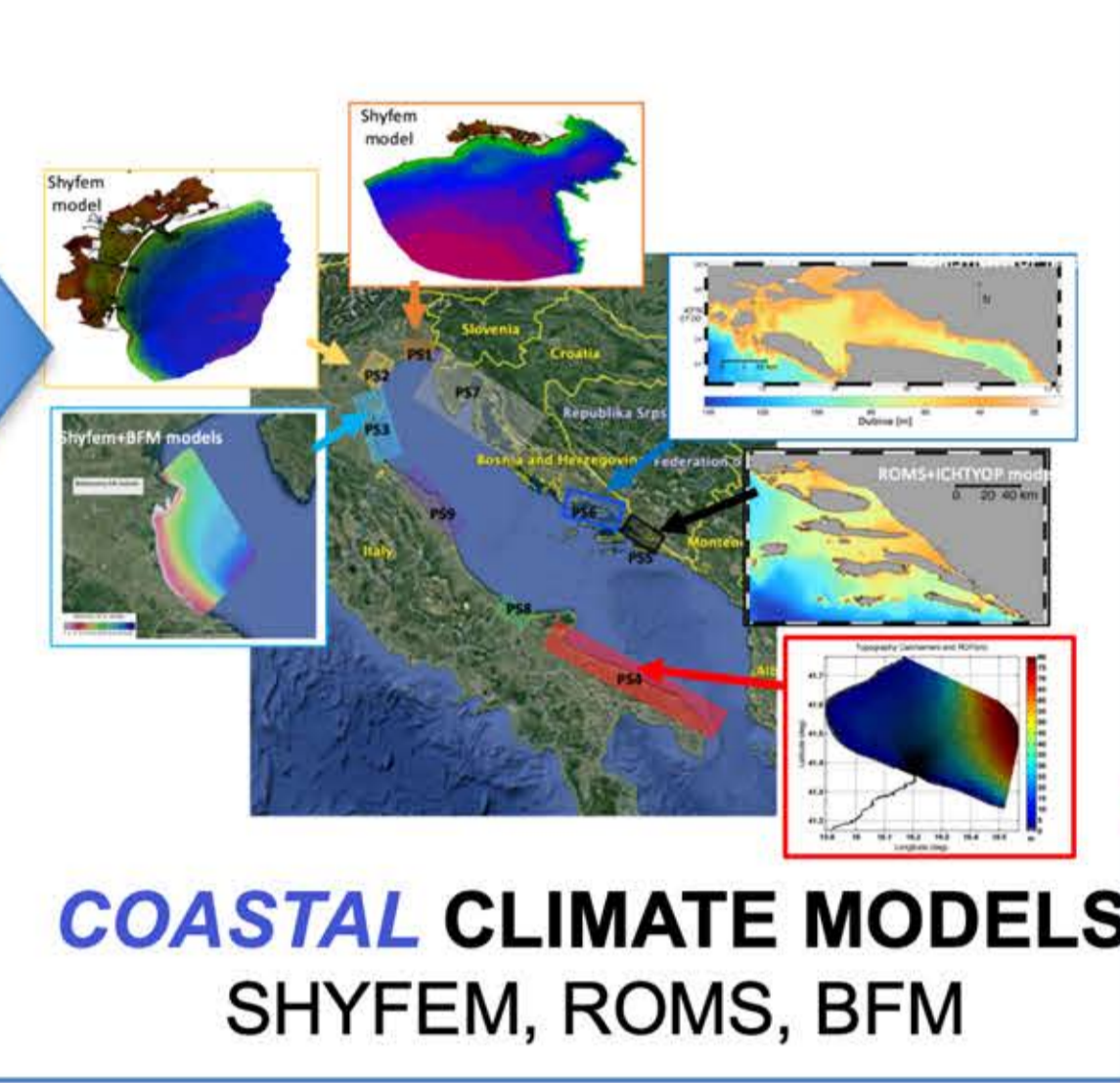
REGIONAL CLIMATE MODEL (MEDCORDEX) LMDZ+NEMO



SUB-REGIONAL CLIMATE MODEL WRF+WRFHYDRO + NEMO+BFM+WW3



LIMITED AREA MODELING WORKFLOW



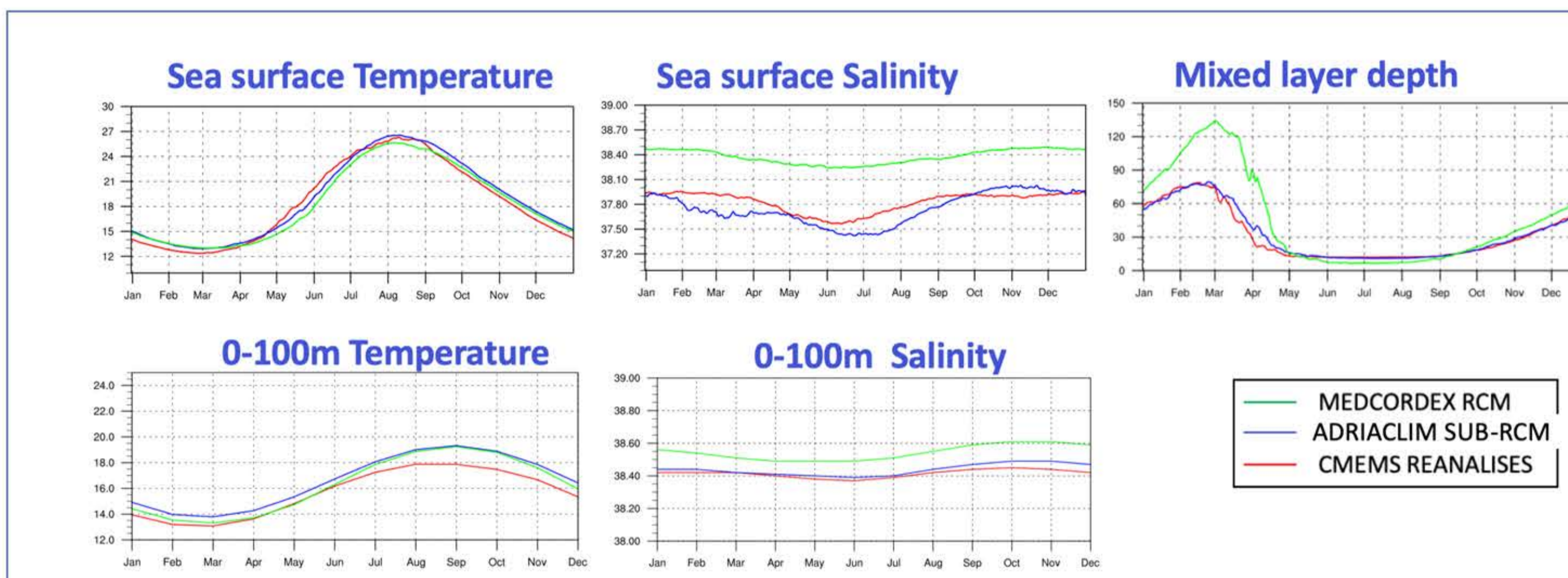
GRID SPACING

- ✓ WRF-NOAH LSM: 6km
- ✓ WRFHYDRO: 600m
- ✓ NEMO-WW3-BFM: 2km

CLIMATE EXPERIMENTS

- ✓ Historical: 1990-2020
- ✓ Projection RCP8.5: 2020-2050

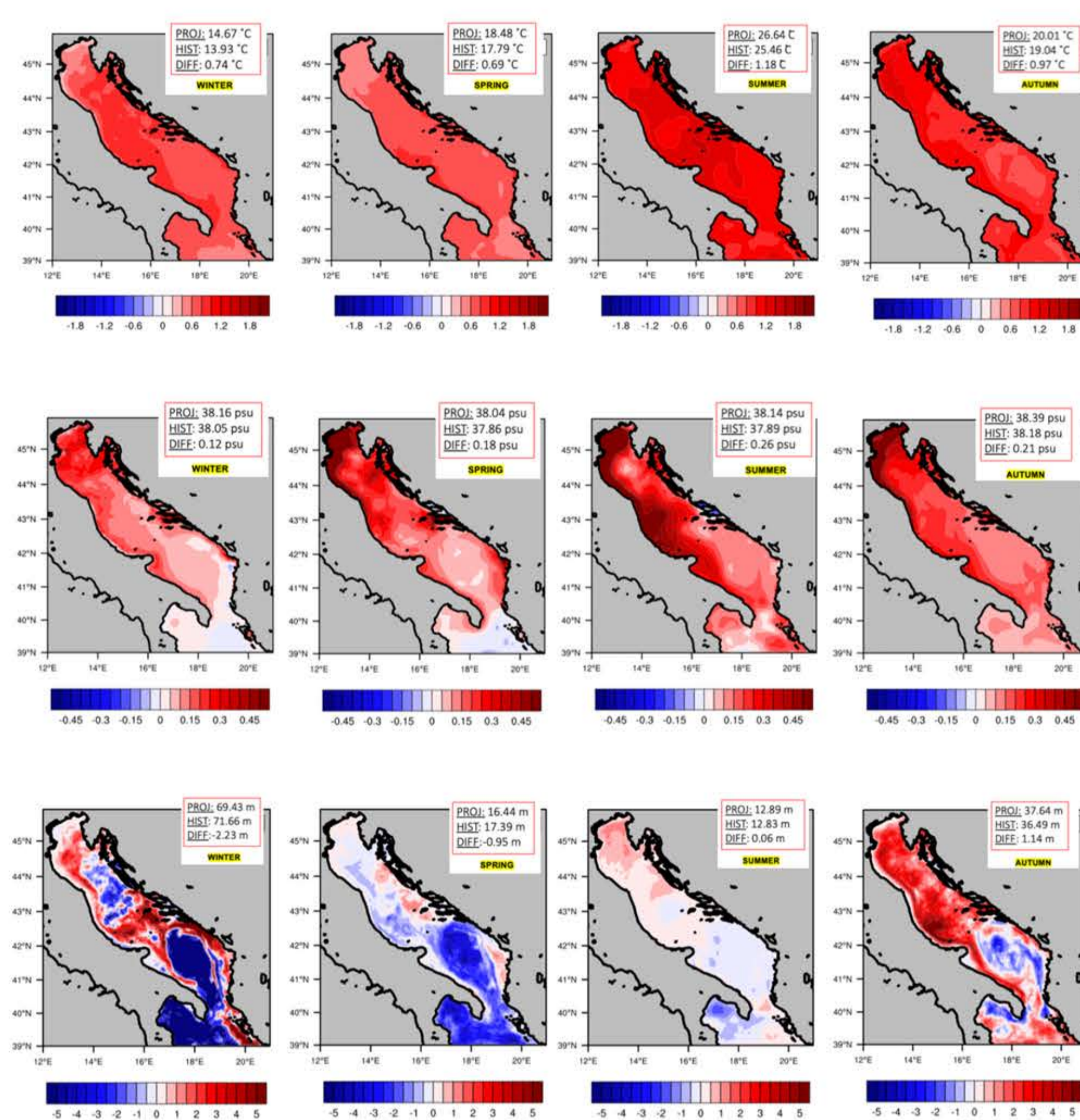
DOES THE SUBREGIONAL DOWNSCALING IMPROVE THE KNOWLEDGE OF THE ADRIATIC CLIMATE?



HISTORICAL RANGE SEASONAL EVALUATION WITH RESPECT TO THE DRIVING RCM

- ✓ The **subregional CM (ADRIACLIM)** outperforms the **driving regional CM (MEDCORDEX)** in reproducing the **seasonal cycle** of salinity and MLD

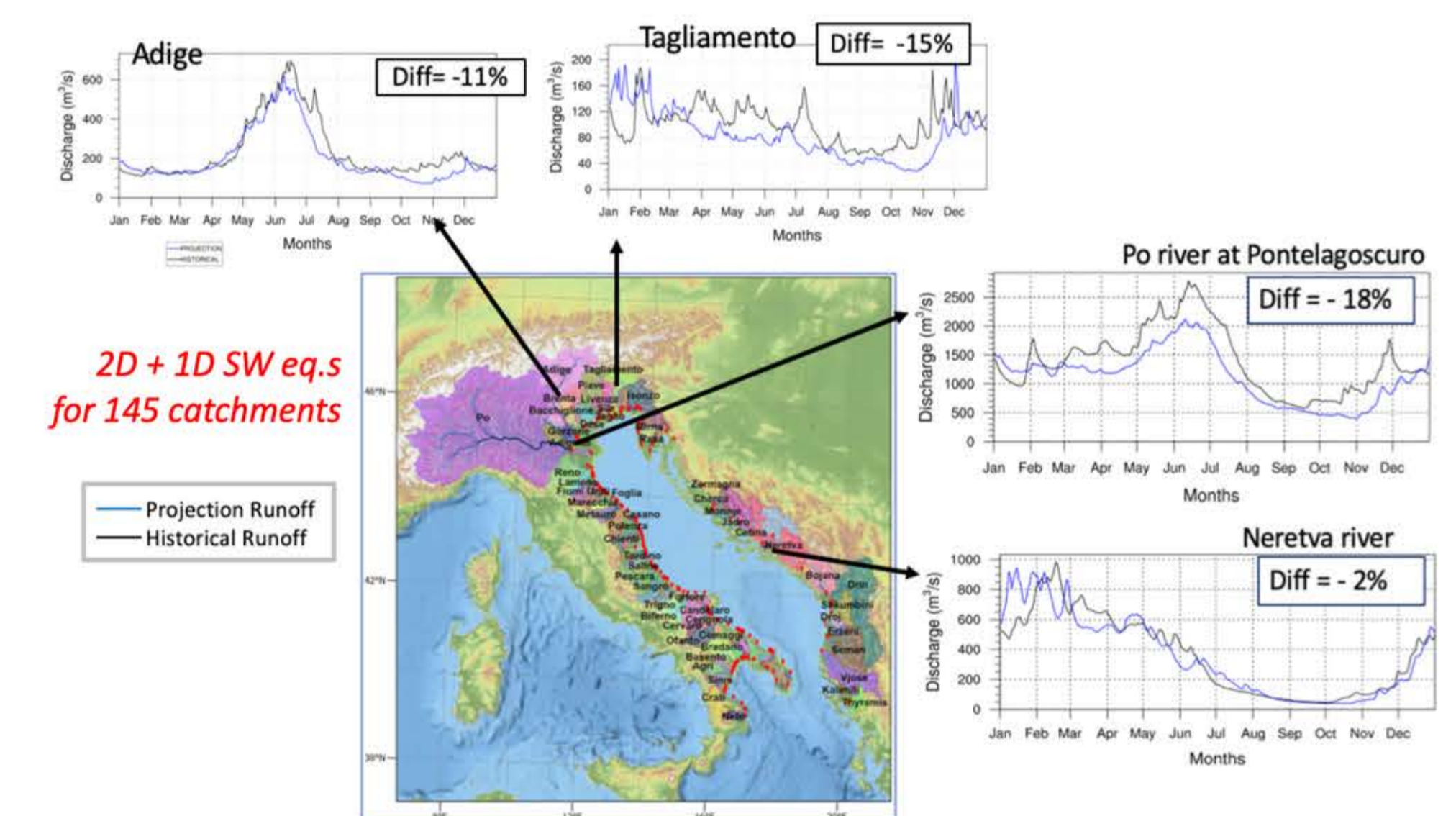
SEASONAL DIFFERENCES BETWEEN PROJECTION AND HISTORICAL RANGE



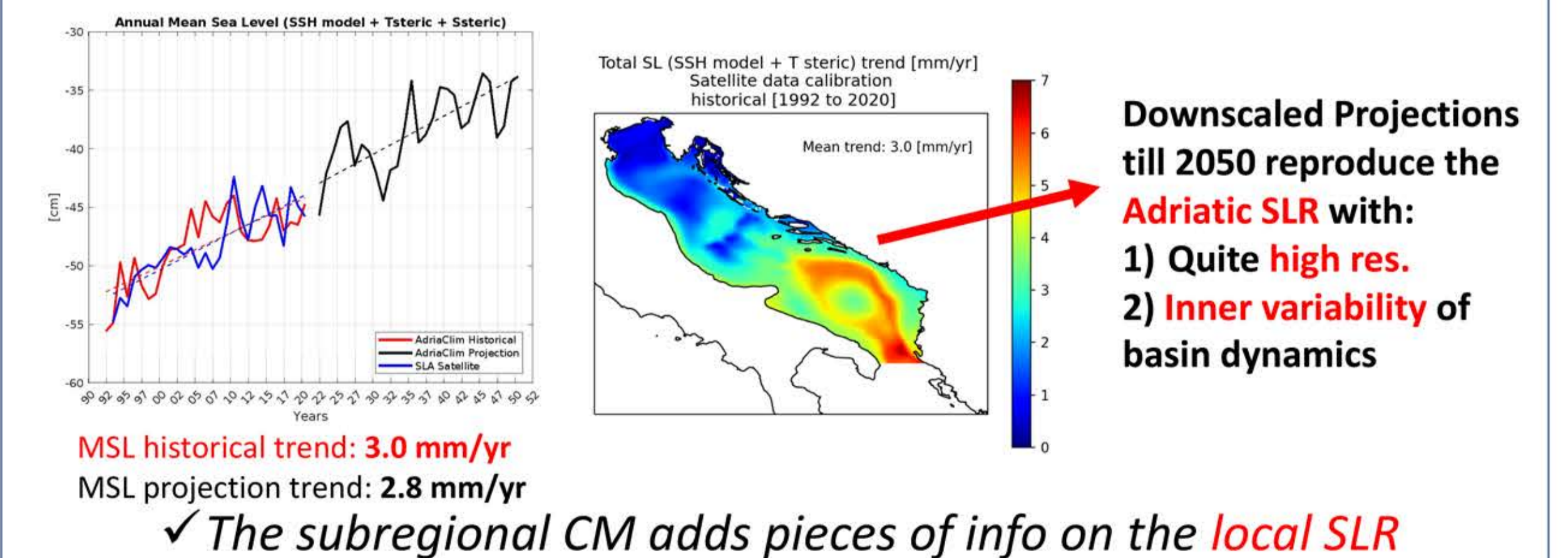
- ✓ The **Adriatic surface water masses** will be **warmer, saltier** on 2022-2050 than 1992-2020
- ✓ The **Southern Adriatic surface water masses** will be **more stratified** on 2022-2050 than 1992-2020

THE RIVER DISCHARGE INTO THE ADRIATIC SEA

- ✓ By 2050, The **TOTAL RIVERINE RELEASE** into the Adriatic basin shows **12% decrease** than present day



THE ADRIATIC SEA LEVEL RISE



- Downscaled Projections till 2050 reproduce the **Adriatic SLR** with:
- 1) **Quite high res.**
 - 2) **Inner variability** of basin dynamics

CONCLUDING REMARKS

- Plus values of the AdriaClim **sub-regional downscaling**
- ✓ **High resolution and integrated** modeling of the Adriatic local **water cycle**
 - ✓ Outperforming of the driving MEDCORDEX RCM
 - ✓ New **pieces of information** about the Adriatic present and future climate (Adriatic freshwater release, local SLR, MHWs, DWs..)

OUTLOOK

- Higher resolution RCMs/GCMs as **DRIVING CLIMATE FORCINGS**
- **HYBRID STATISTICAL-DYNAMICAL** downscaling
- **FULLY COUPLING** (2way feedbacks at **air-sea** and **land-sea** interfaces)
- Multi-physics and multi-model **ENSEMBLE** downscaling for uncertainty estimation



FUTURE COASTAL OCEAN CLIMATES
FLAME

FLAME - Future Coastal Ocean Climates Workshop
21-23 February 2023