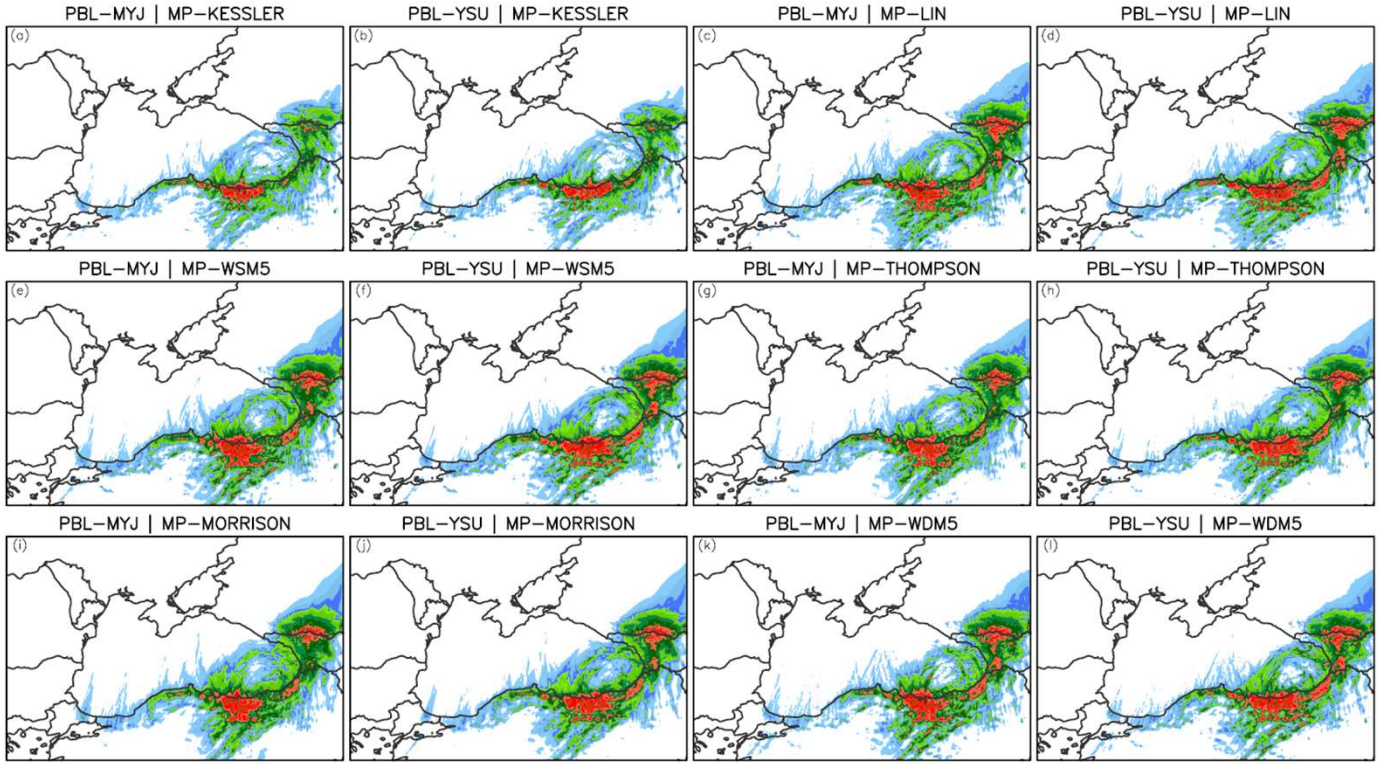
EGU General Assembly

23-27 May 2022 Vienna, Austria & Online

Sensitivity to Microphysics and PBL Schemes for Extreme Precipitation over the Black Sea Region in Future Climate: Warm and Cold Cases



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Motivation

- Regional Climate Models (RCMs) are major tools for regional climate studies.

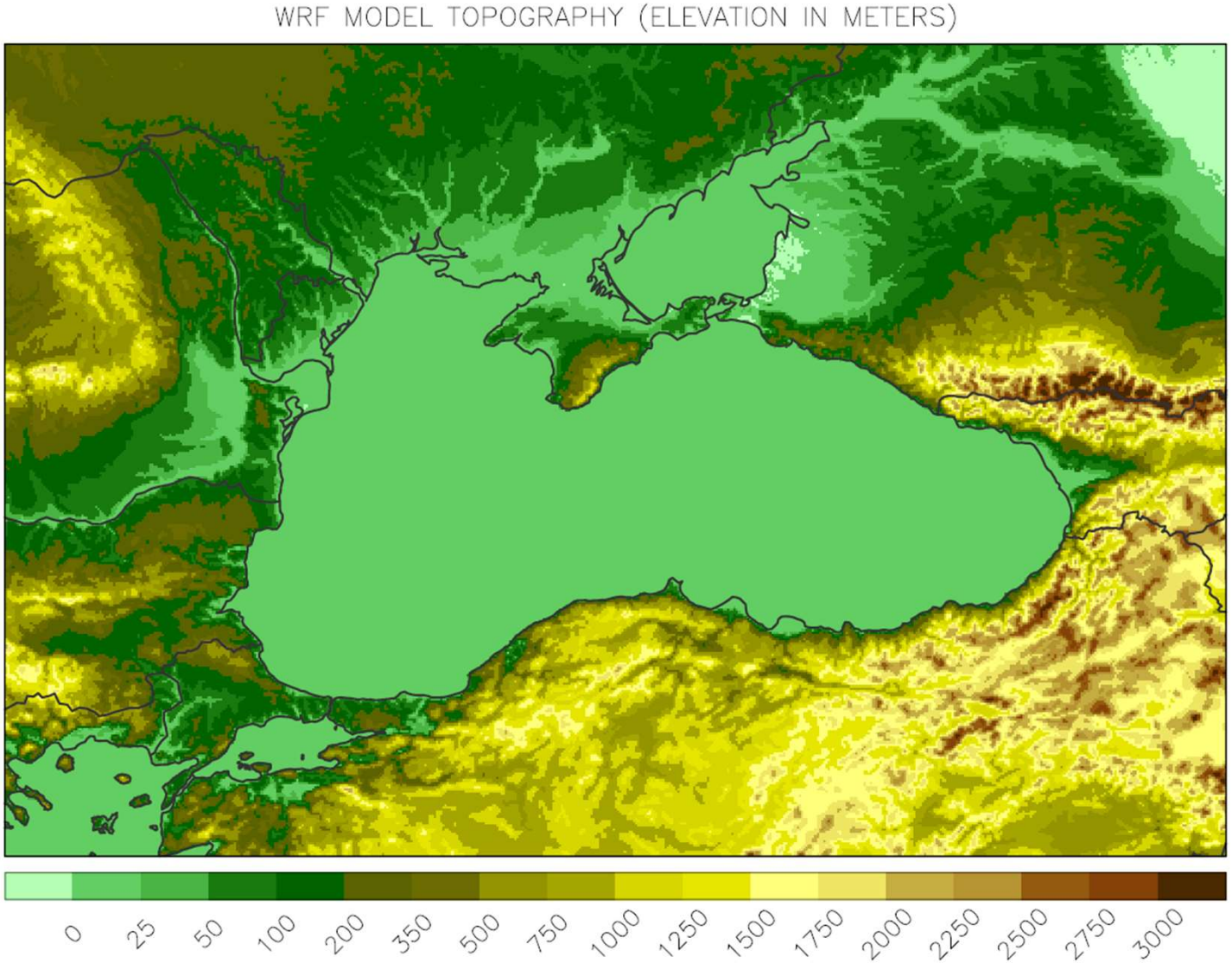
- Recently, RCMs are run at convection-permitting scale for around 10-years simulation period. They are based on CMIP5 protocols (RCP scenarios for future simulations).

- In this study, we run **WRF model at 3 km horizontal resolution** over complex topography of the Black Sea Region, which has diverse topographical features and strong air-sea interactions, using **CMIP6 MPI-ESM1.2-HR** ESM outputs.

- **SSP5-8.5** future 3-days long **case studies.**

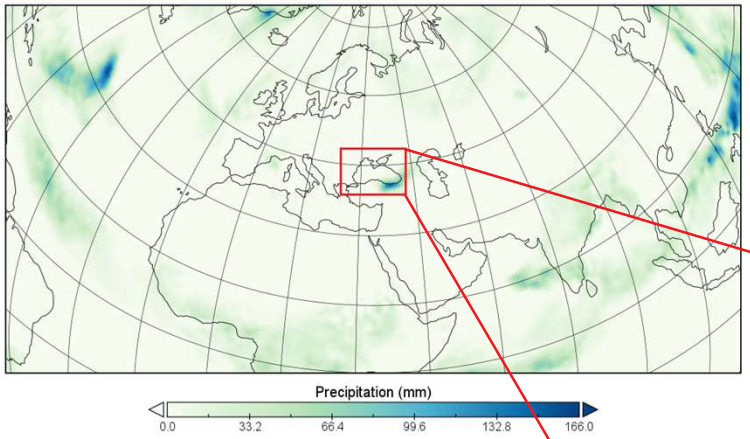
Model Configuration

MPI-ESM1.2-HR (~100km) -> WRF -> 3km

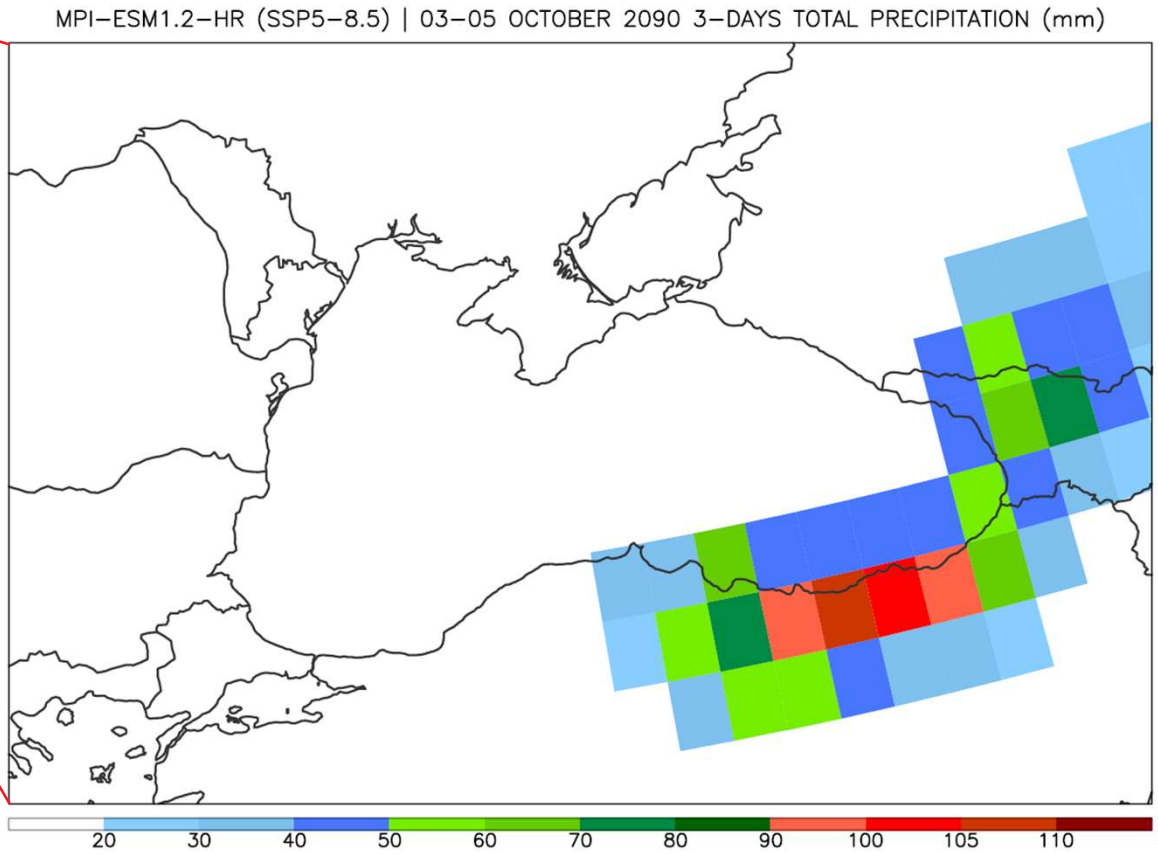


- WRF v3.9.1
- 547x364 grid points (1642x1092 km^2)
- YSU and MYJ PBL schemes.
- Kessler, Lin, WSM5, Thompson, Morrison, WDM5 microphysics schemes.
- Noah land model.

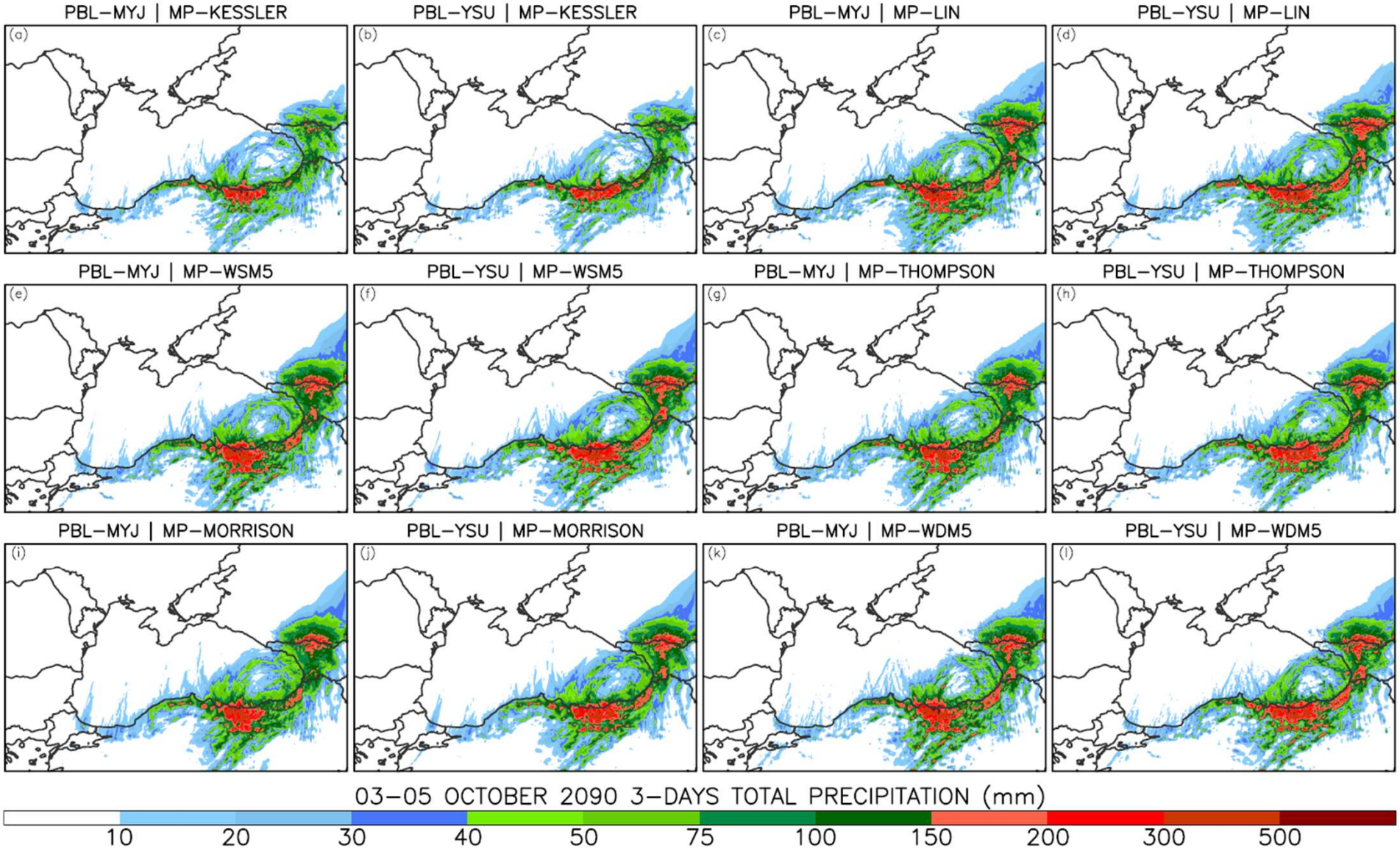
SSP5-8.5 3-5 October 2090 Warm Case



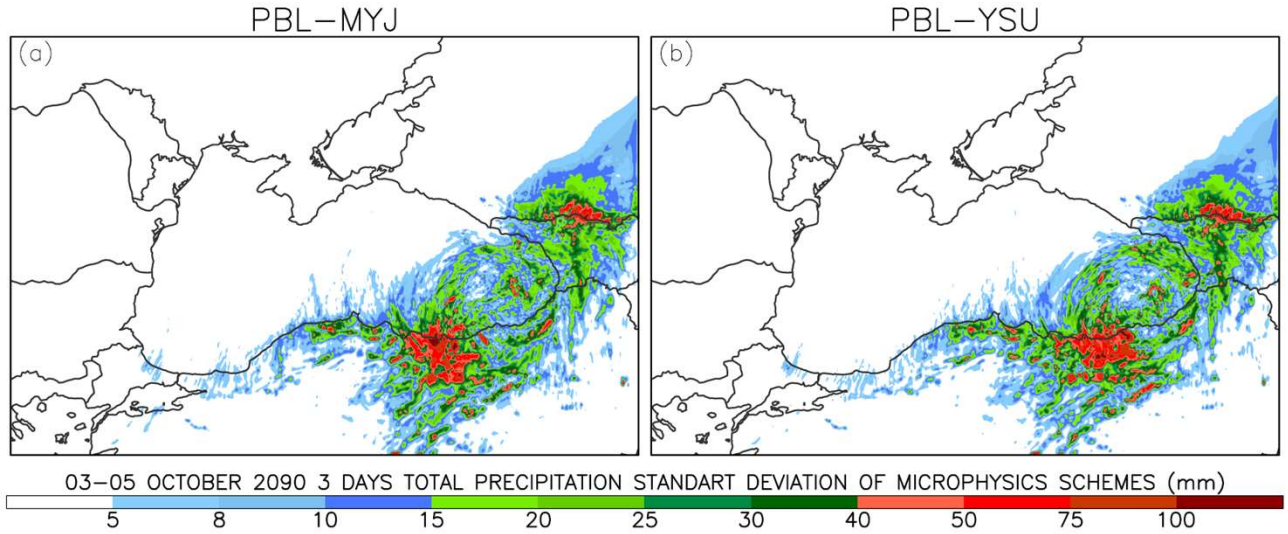
GCM 3-Days Total Precipitation



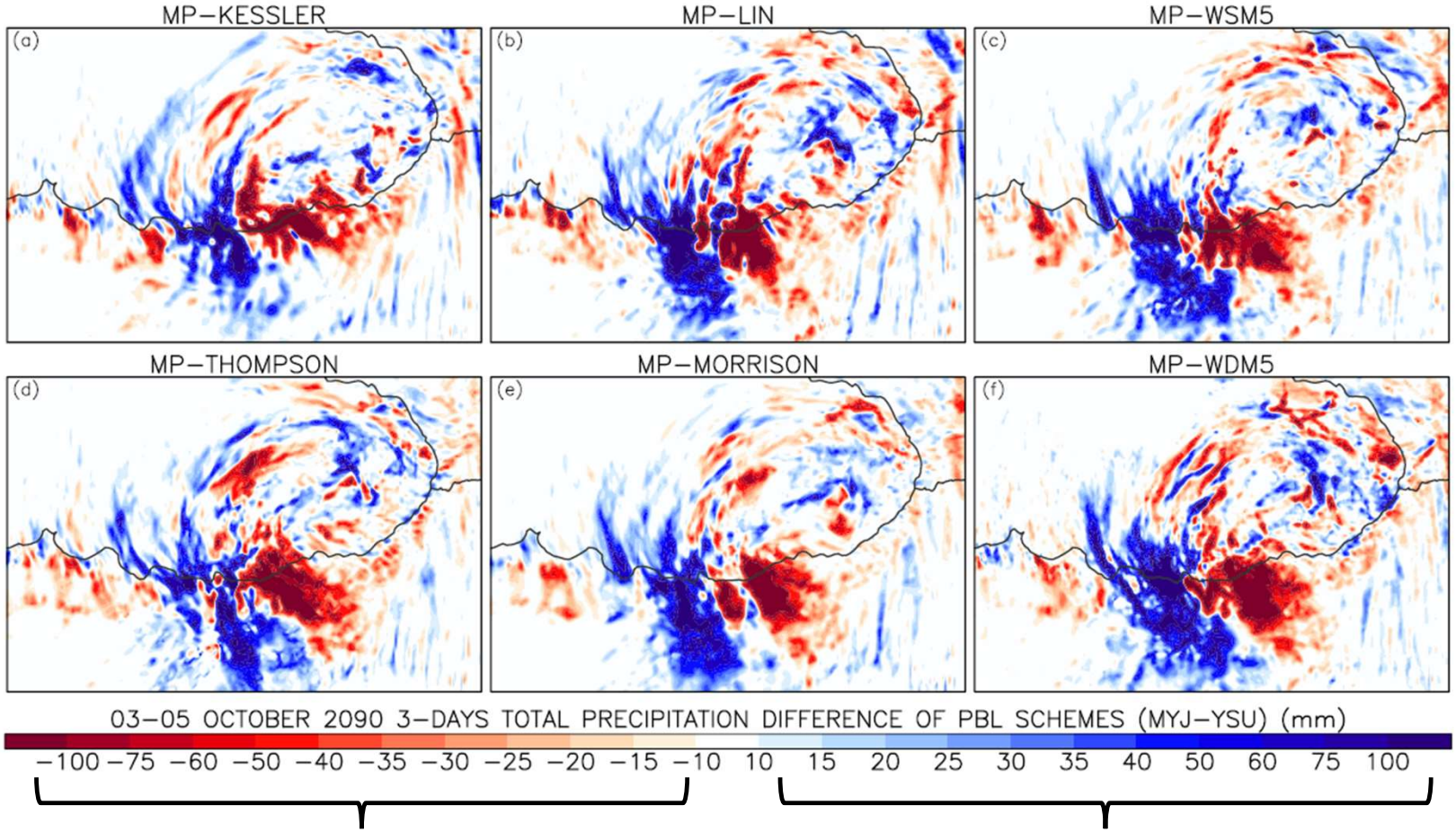
WRF 3km Future Warm Case



- Extreme future!
- System movement is sensitive to PBL scheme.



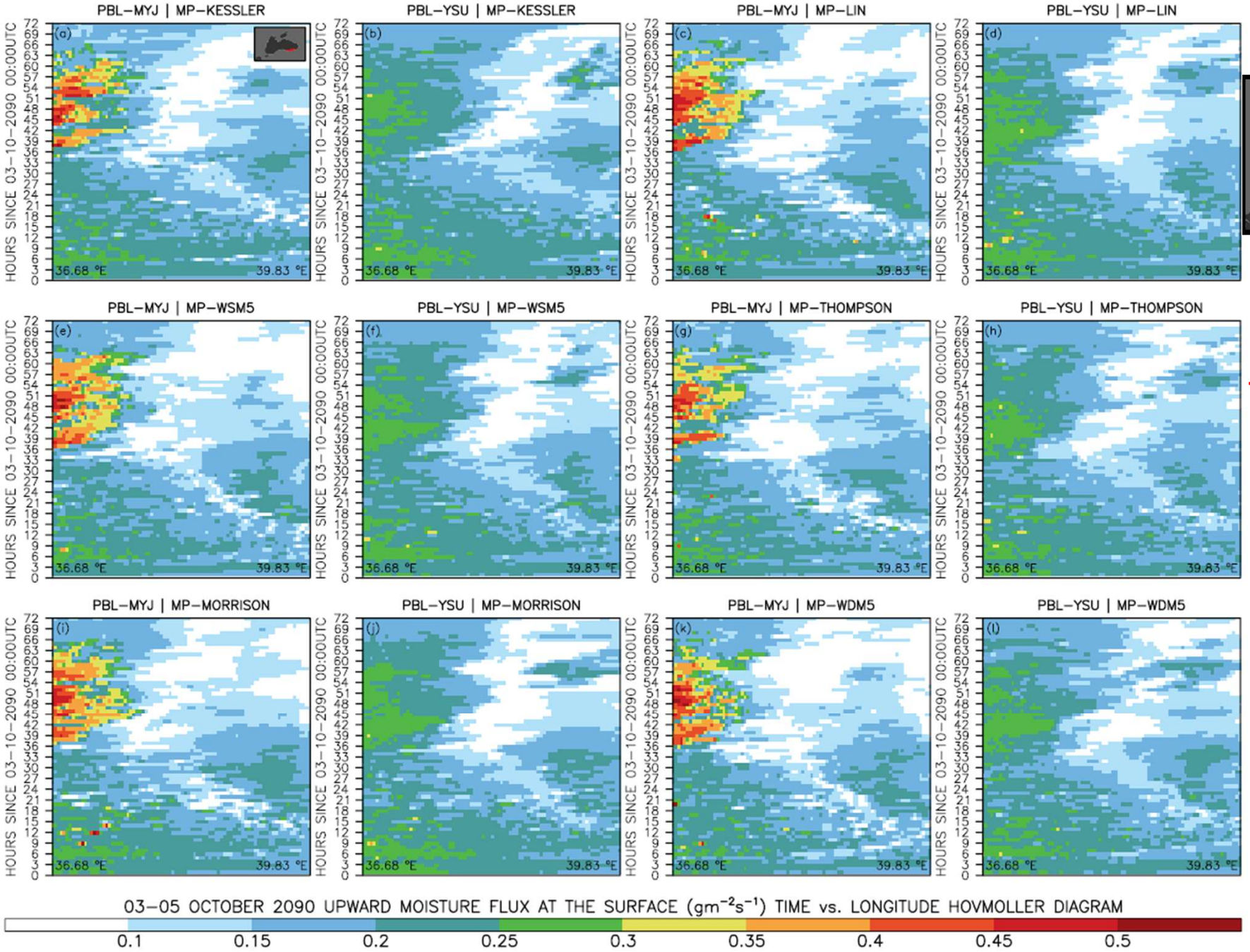
- Microphysics scheme affects precipitation amount.

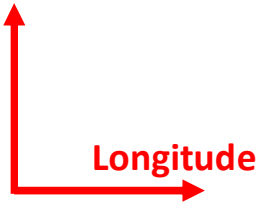


- PBL scheme changes the location of maxima.
- YSU moves the system eastward.

YSU is wetter

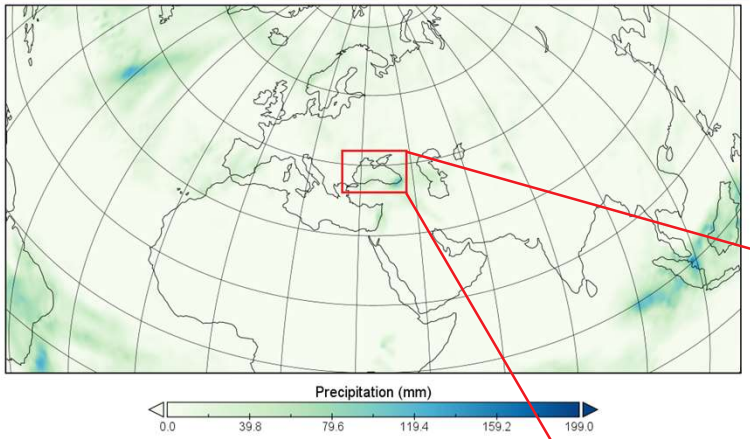
MYJ is wetter



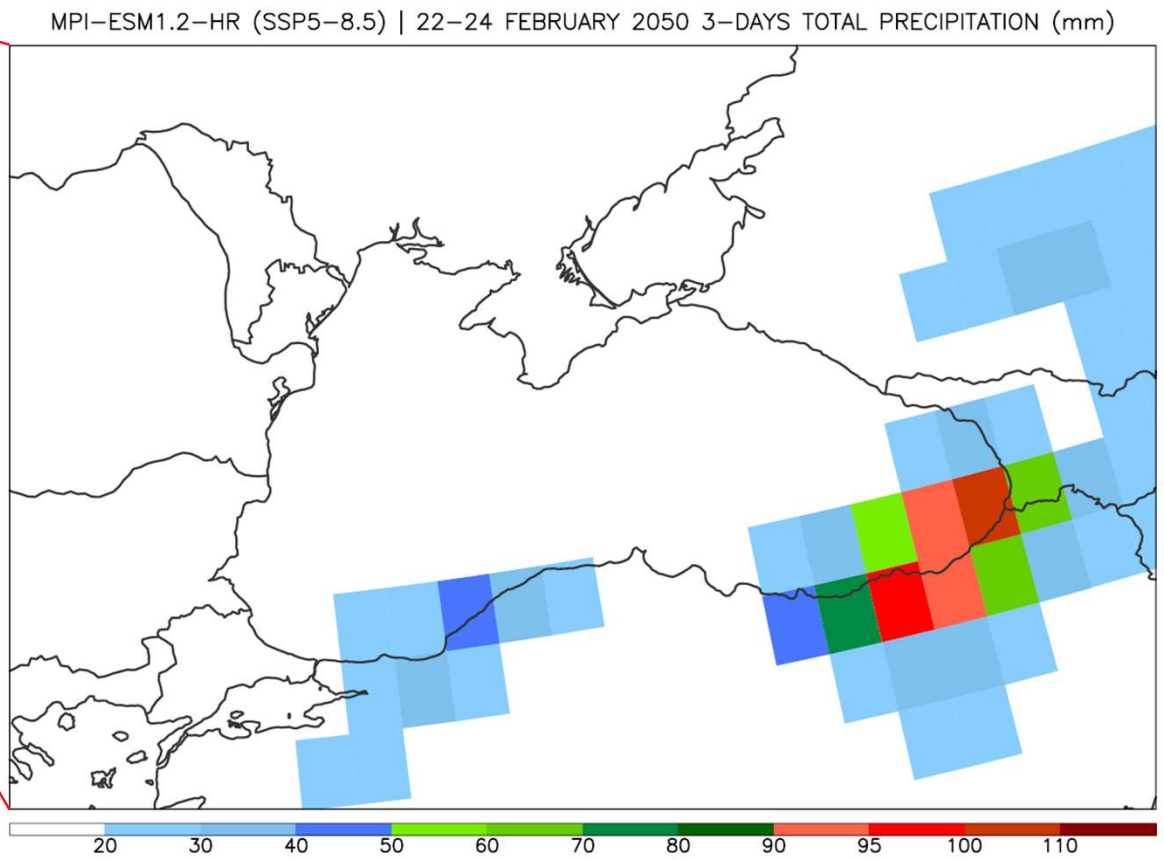


- Stronger upward moisture flux over the west for MYJ.

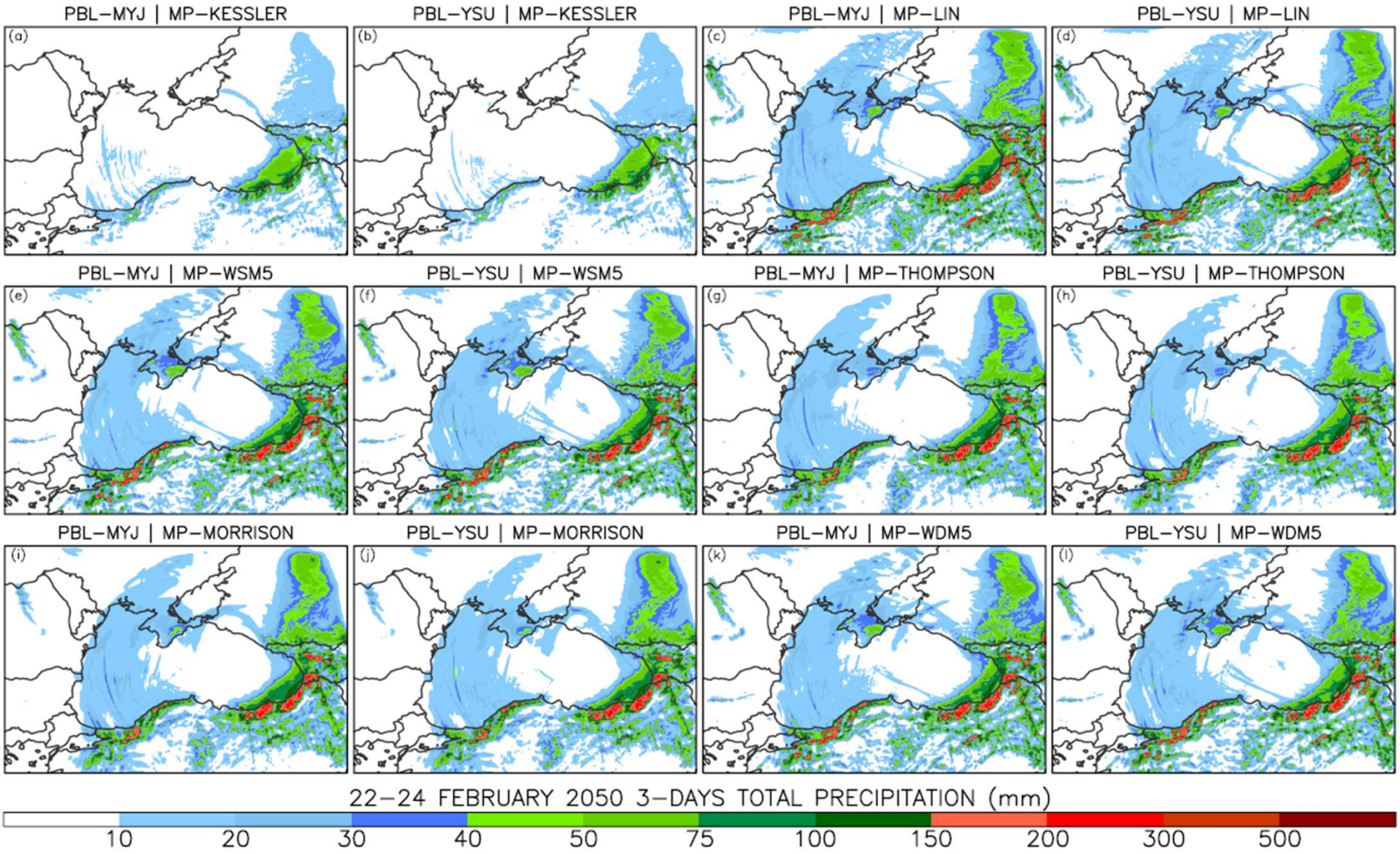
SSP5-8.5 22-24 February 2050 Cold Case



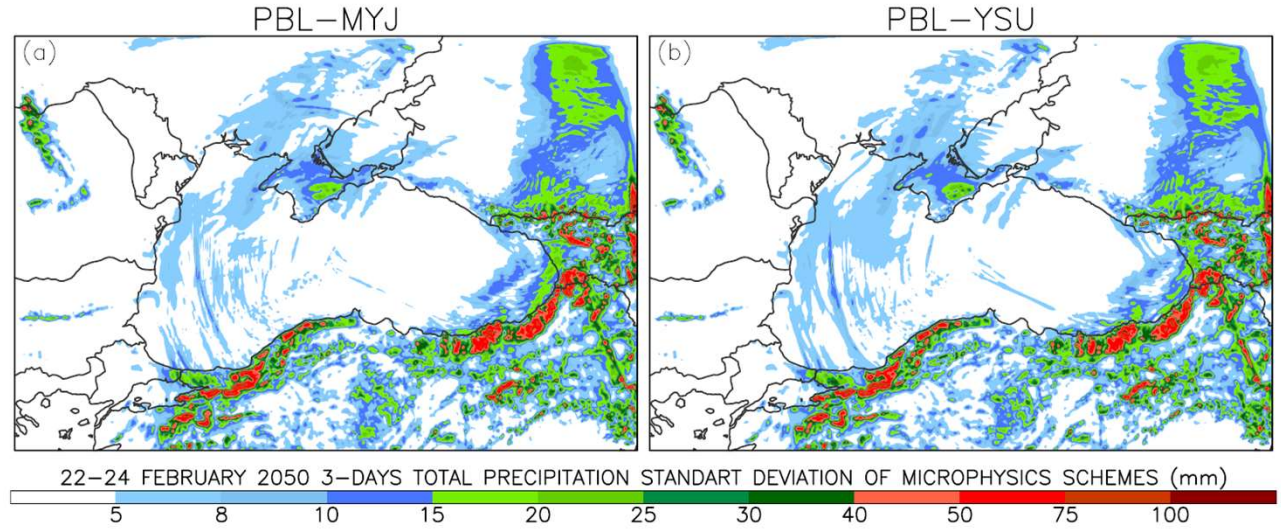
GCM 3-Days Total Precipitation



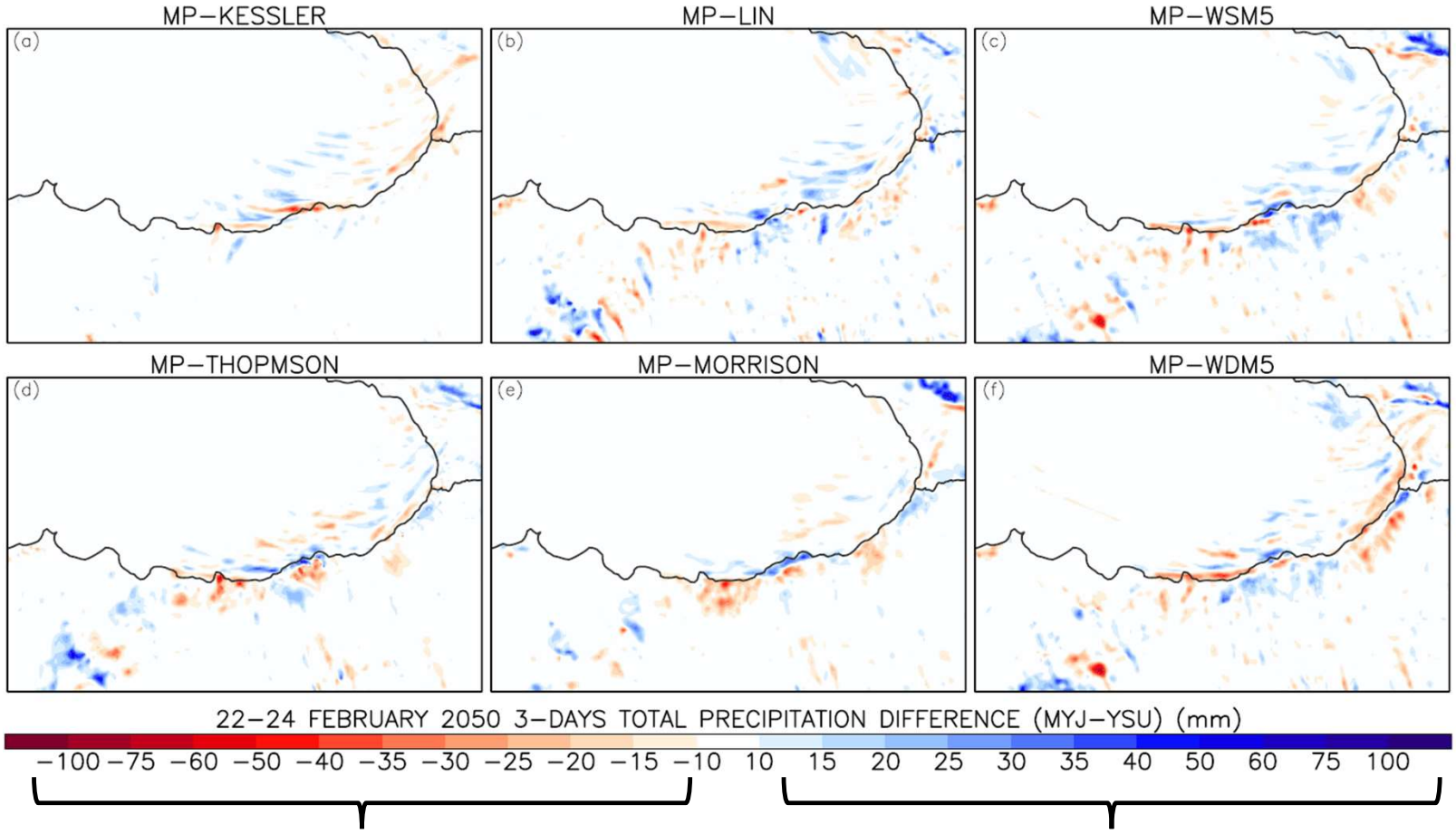
WRF 3km Future Cold Case



- Sensitive to microphysics scheme.



- Microphysics scheme affects precipitation amount.



- PBL scheme does not have a significant effect for a cold case.

Conclusions

- WRF model is sensitive to
  - microphysics scheme in an extreme cold case,
  - PBL schemes in an extreme warm case.
- Microphysics scheme affects precipitation amount and PBL scheme changes the location of maxima.
- WRF model is beneficial to be used as a regional climate model.
- Future plan: 10-years long **convection-permitting climate simulation using SSP3-7.0 scenario** (2061-2070 or 2071-2080 period).