Causes of future Mediterranean precipitation decline depend on the season

**Motivation**

- The Mediterranean is a climate change hot-spot.
- The projected year-round precipitation decline is a central factor.
- We aim to determine the causes of the Mediterranean precipitation decline throughout the year.

**Method**

An ensemble of 2 regional climate simulations is used to simulate the end of century precipitation change (1971-2000 vs. 2070-2099) assuming RCP8.5. The ensemble is based on the GCMs MPI-ESM-LR and HadGEM2-ES and the mean is analyzed. By performing simulations with modified lateral boundary conditions we can assess the importance of four different drivers of climate change. The four different drivers are extracted from future climate projections and each driver is imposed on simulations of the current climate. The following drivers are assessed:

1) Thermodynamics & Lapse-rate (TDLR): Warming, moistening & stability change. No dynamic changes.
2) Sea surface temperature (SSTE): Land-sea warming contrast. No dynamic changes. Includes TDLR.
3) Mean state and circulation (MEA): Slowly evolving changes in mean circulation (e.g. jet shift). Includes SSTE.
4) Full climate change (FCC): Changes in weather systems (e.g. cyclone frequency). Includes MEA.

**Conclusions**

- In summer, thermodynamic and lapse-rate changes, as well as the land-sea warming contrast, explain most of the precipitation decline. Dynamic changes are of secondary importance. This is consistent with findings for temperature changes from a previous study.
- In winter, dynamic changes are the primary cause for the precipitation decline.
- The reliability of the respective causes in climate simulations is considered higher for summer than for winter.

**Causes of mean summer precipitation change**

Changes related to thermodynamics explain ~2/3 of the summer precipitation decline.
Dynamic changes merely enhance the summer precipitation decline.

**Causes of mean winter precipitation change**

Thermodynamic changes alone lead to a winter precipitation increase.
Dynamic changes are the primary cause of the winter precipitation decline.

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