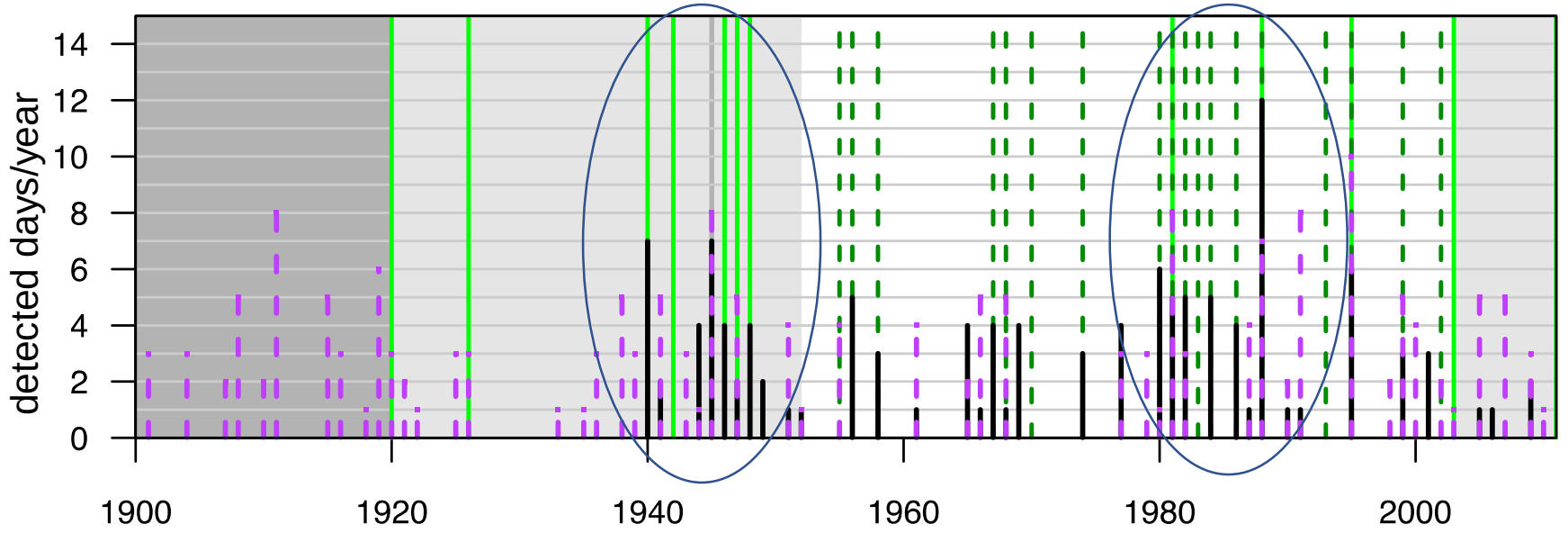
Temporal variability of trans-basin rain-on-snow floods

Our downscaled reanalysis provides the high-resolution four dimensional atmospheric state (4DAS) during the 20th century. This allows us to analyse the atmospheric conditions of spatially extended winter floods in Germany and in particular their temporal variability:



Observed trans-basin winter floods by Uhlemann et al. 2010

Observed trans-basin winter floods detected in **SP1**

Detected days/year of the 120 highest ranked days according to our **atmospheric flood proxy**,

based on station data

based on our 4DAS

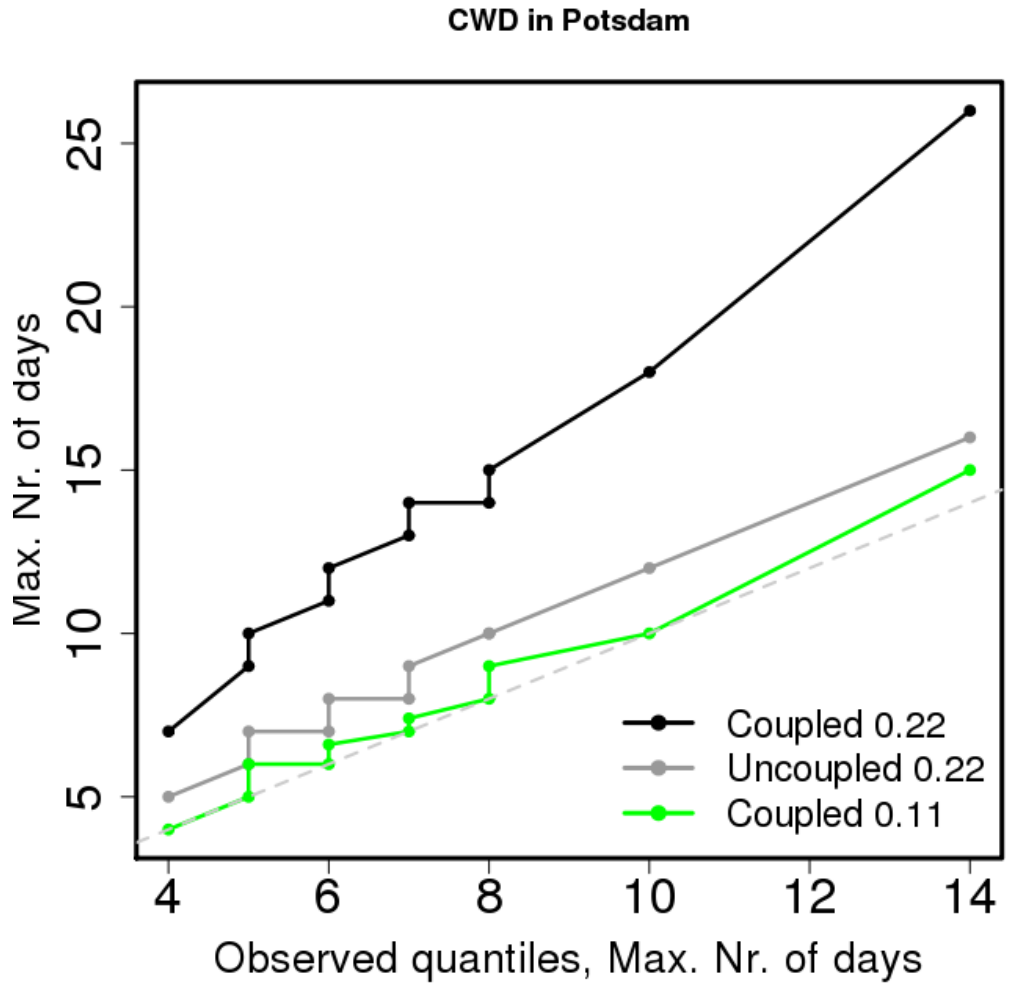
Time-periods not covered by the hydrological flood classification are grey-shaded.

Climate change indices

4DAS provides us with the evolution of climate change indices during the 20th century. In addition, we can compare the current 4DAS, using a coupled ocean and atmosphere (Dx = 0.11°) modelling system, with two previous 4DAS of lower resolution 0.22° (an atmosphere-only simulation and its coupled version).

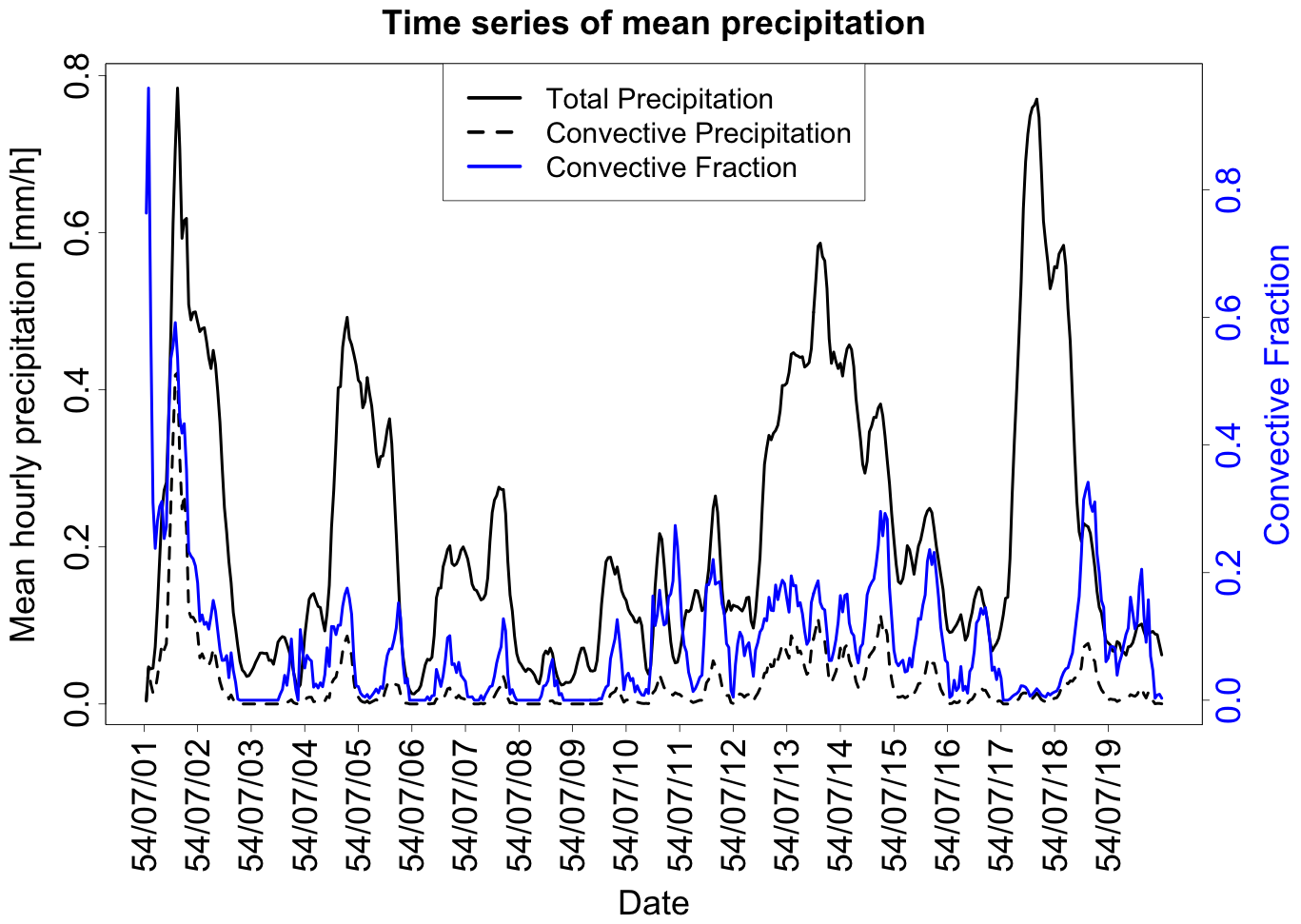
The Figure compares the 4DAS distributions of annually longest wet spells (CWD, maximum number of consecutive wet days with precip. > 1mm per) against observation.

The new 4DAS (0.11°) performs very well!



Convection permitting simulations (CPS)

For particular extreme events, we further downscaled our 4DAS with CPS and analysed convective precipitation as flood amplification factor:



Extreme Danube flood event in July 1954

Up to 60% of the peak precipitation are indicated convective

The contribution of convective precipitation has a pronounced diurnal cycle (with potential impact on flood timing in smaller catchments)