



Climate model performances in assessing air temperature – humidity relationship: a critical framework for stream temperature assessment

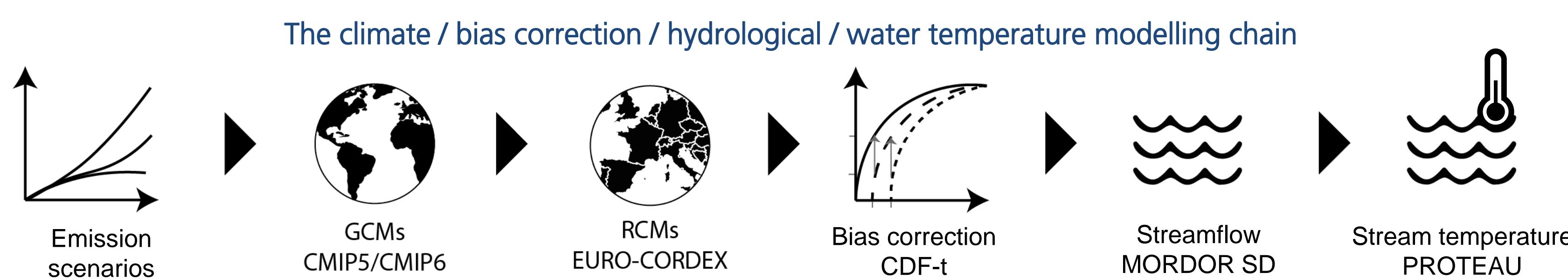
CONTEXT

Climate change impacts water resources, due to changes in air temperature, precipitations and stream temperature patterns. This has direct consequences on hydro and nuclear power plants management. In France, EDF, the main electricity producer and provider, answers strict regulations regarding water resources management. For the protection of biodiversity, the regulation sets limits to the water temperature downstream power plants. **Quantifying climate change impacts on the hydrological cycle** becomes thus crucial to adapt the electricity mix and ensure **resilience to water-dependent power plants**.

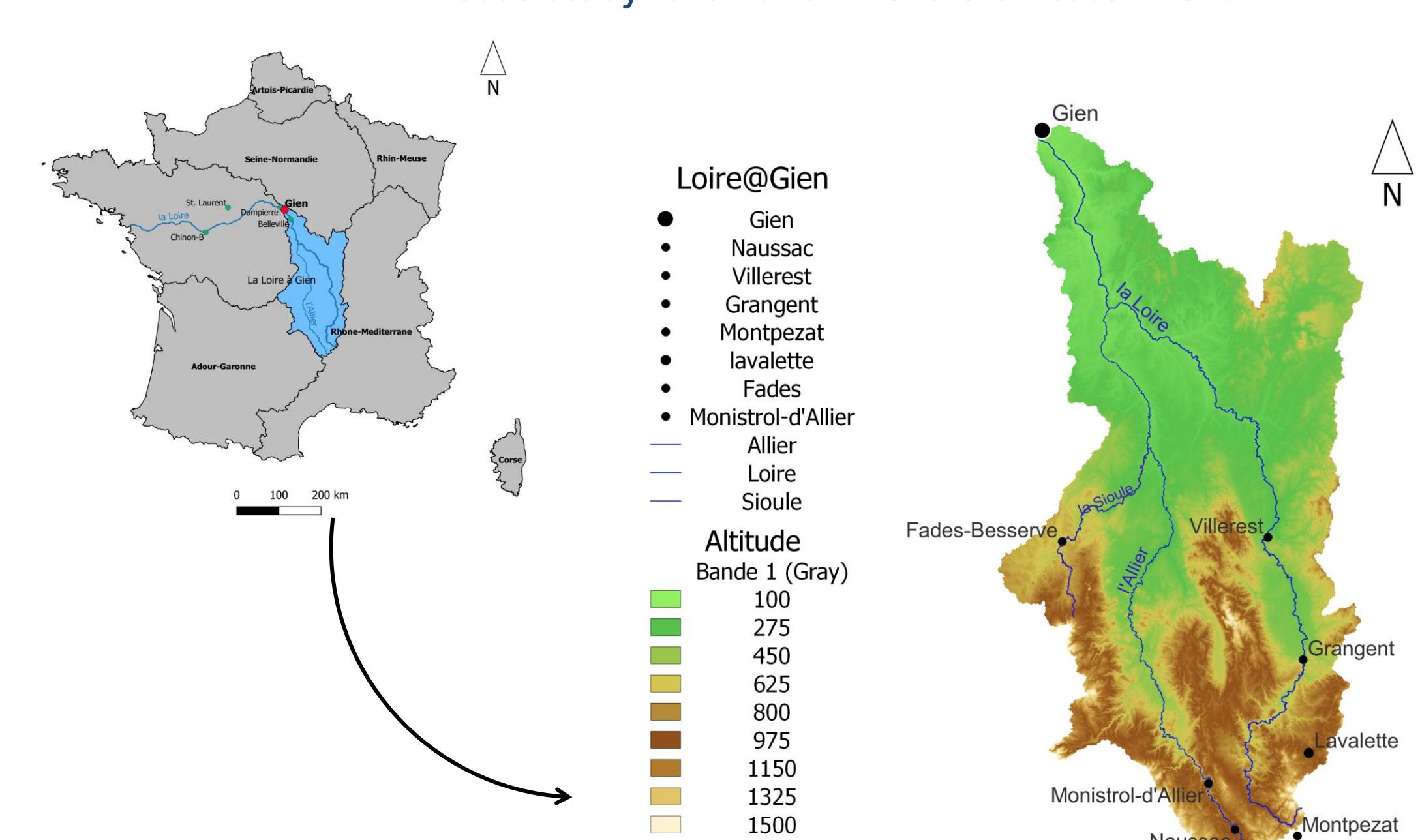
This work focuses on stream temperature assessment in a changing climate context based on EURO-CORDEX simulations. The aim is to develop a **critical framework** on climate model performances and evaluate their **ability in simulating climate variables that constrain the most stream temperature variability**.

MATERIEL & METHOD

This approach is applied to the Loire River catchment that is used as a heat sink to nuclear power plants.

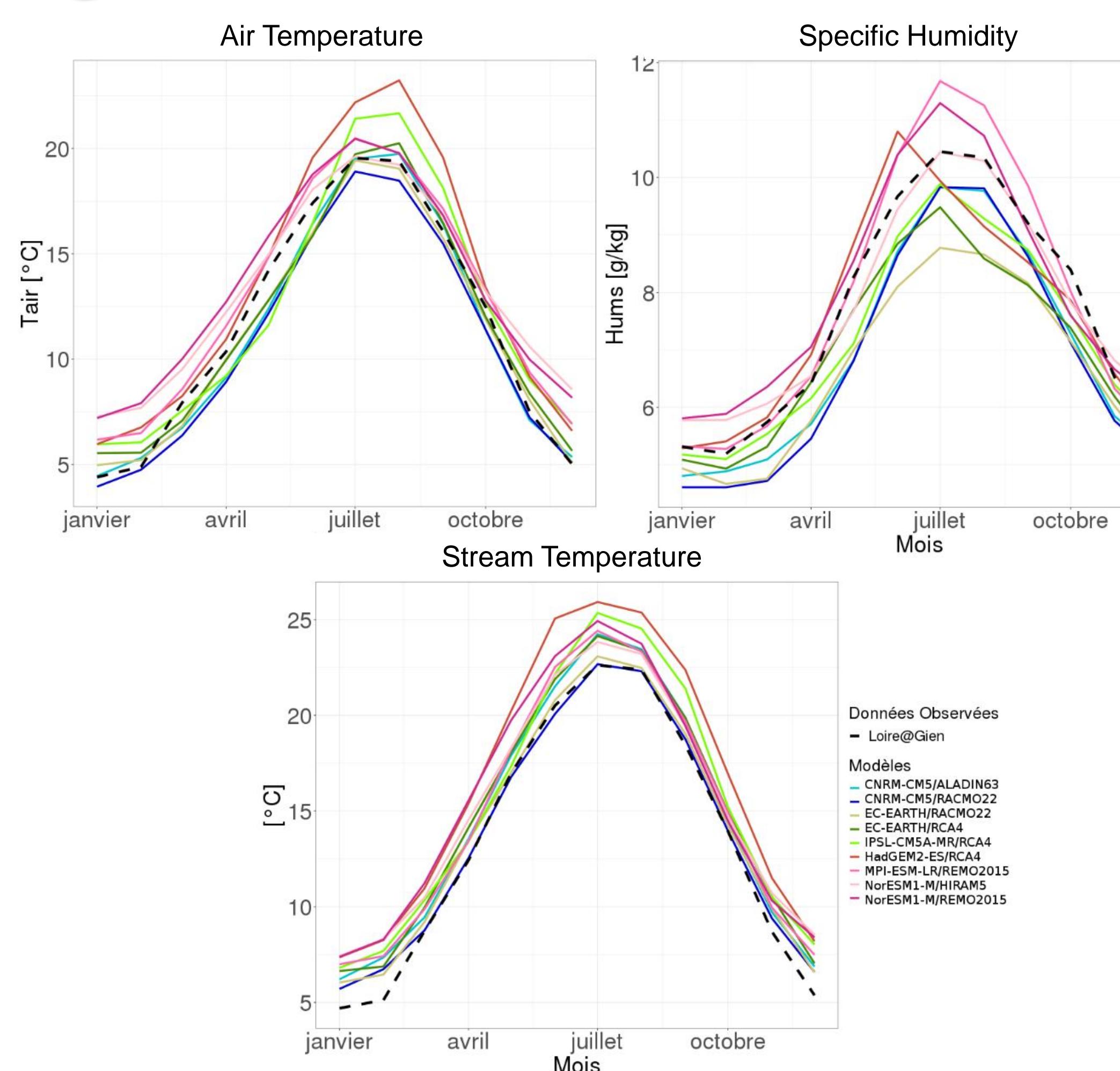


Case study: the Loire River@Gien catchment



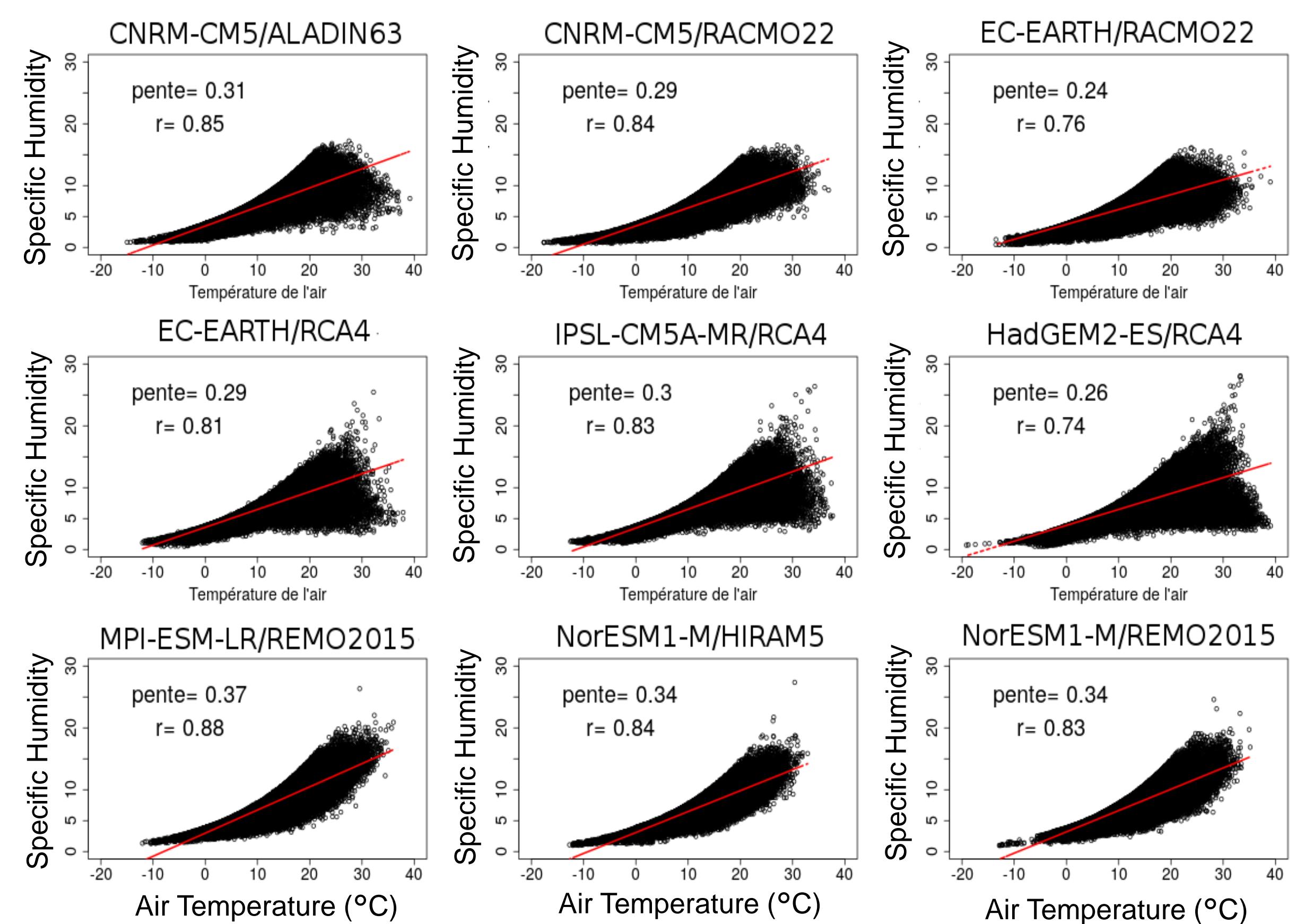
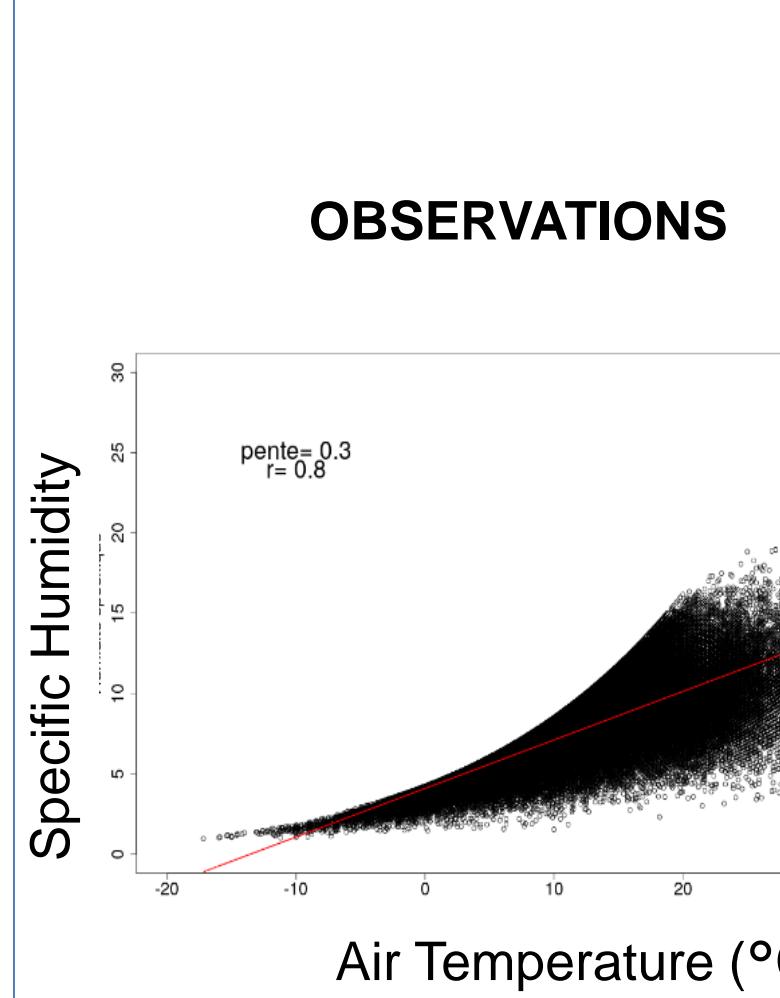
RESULTS

1 Mean annual cycle over 1970-2099:



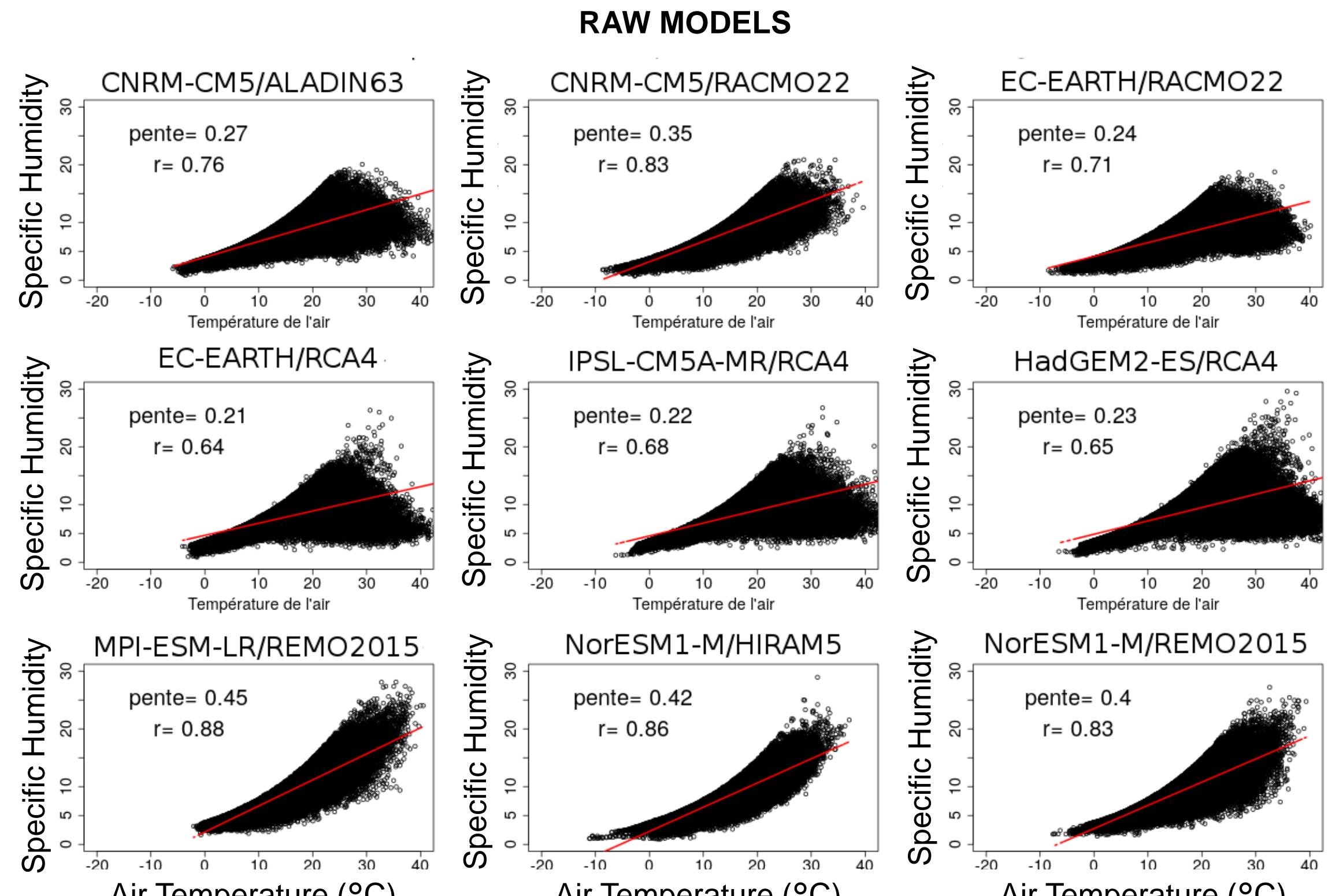
- Fair representation of the air temperature
- Strong air – stream temperature relationship
- Over-estimation of specific humidity leads to heating (because of less evaporative cooling) and over-estimation of stream temperature

2 Air temperature/specific humidity relationship over 1985-2014:

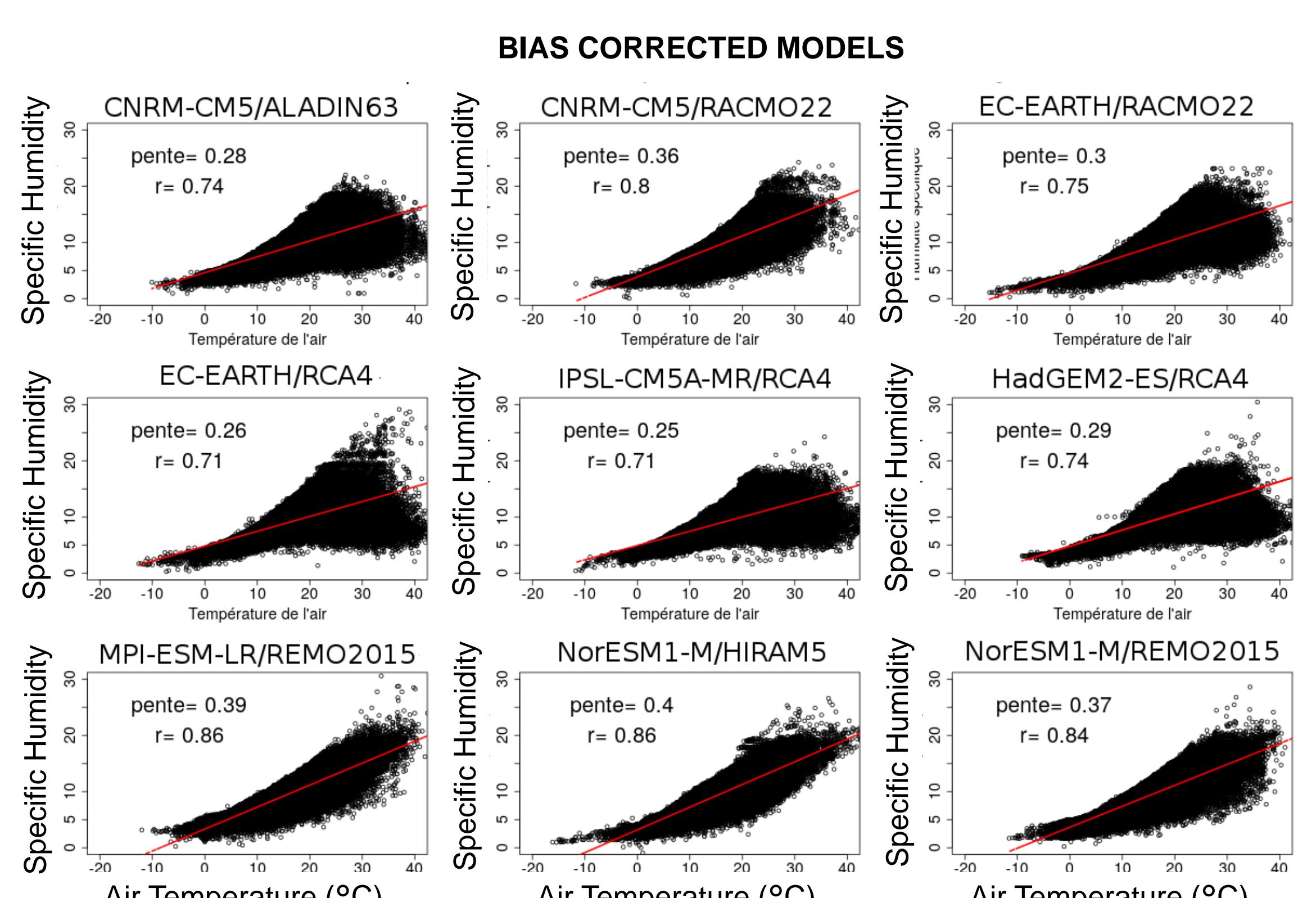


- Strong observed air temperature / specific humidity relationship, weakened for the highest temperatures
- A third of the raw EURO-CORDEX models fairly represent the observed relationship
- The majority of the raw EURO-CORDEX models over-estimate wet heatwaves because of unlimited water availability (Dunn et al., 2017)

3 Modelled air temperature/specific humidity relationship over 2070-2099:



- The realistic models show a decrease in air temperature / specific humidity relationship in the future due to a decrease in water availability
- Trends for the biased models increase in the future



- The statistical bias correction approach (CDFt) does not modify the air temperature / specific humidity relationship