Projected Climate Change Impacts on a Mediterranean Catchment under Different Irrigation Scenarios

D.von Gunten, T. Wöhling, C. Haslauer and O.Cirpka, University of Tübingen (Germany), Center for Applied Geoscience

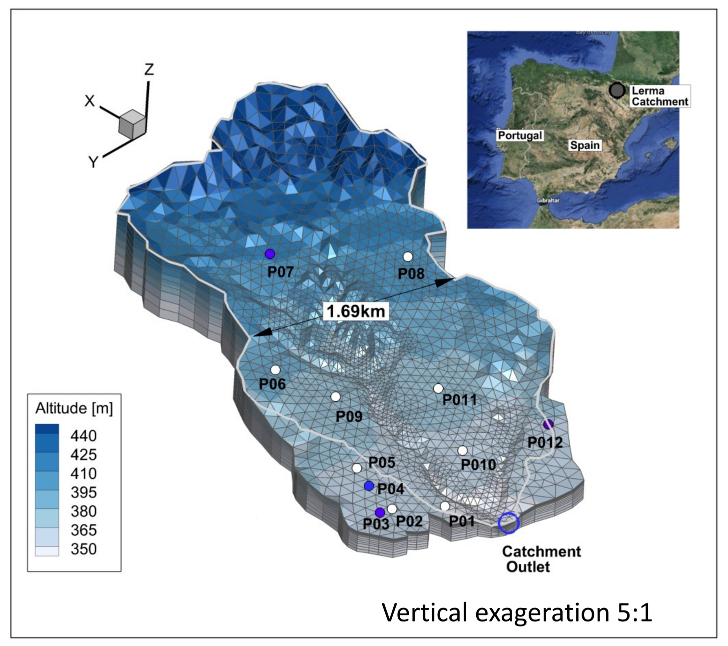
diane.von-gunten@uni-tuebingen.de

Poster number GC13G-0745

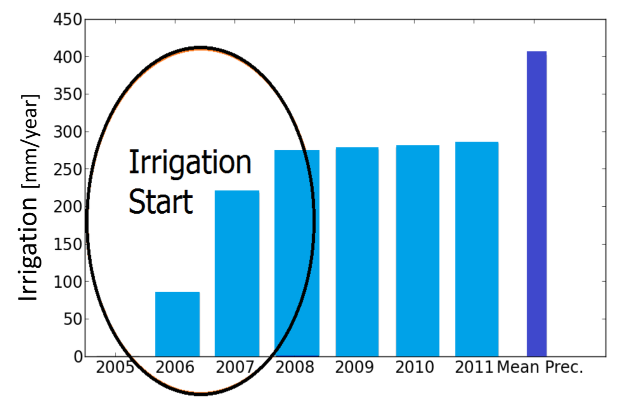
What are the differences between climate change impacts of an irrigated and a non-irrigated catchment?

Study Area and Hydrological Model

The Lerma catchment (NE Spain)



- Area: 7.5 km2
- Land Use: Agriculture
- Altitude: 330-490 m
- Measured Data: Hydraulics Heads, Outflow, Irrigation
- **Start of Irrigation: 2006**

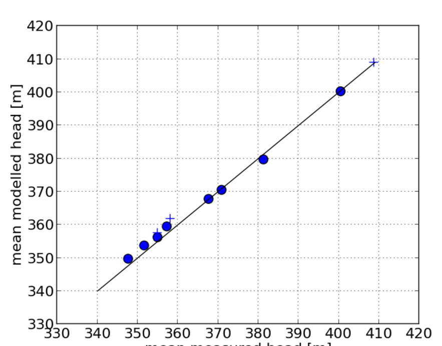


Hydrological modeling – Calibration Results

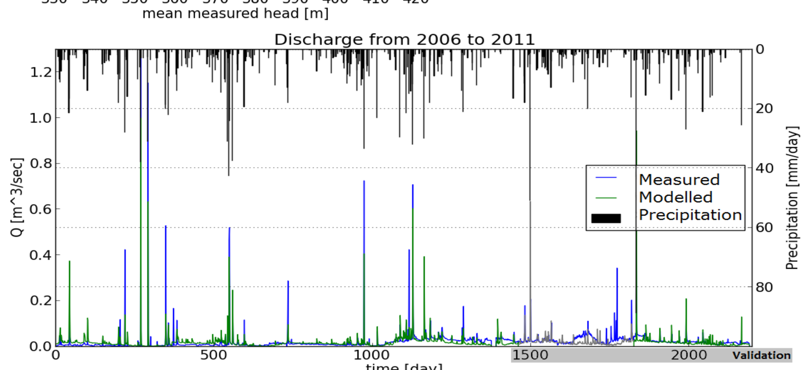
Integrated Catchment Model: HydroGeoSphere

Coupled surface-subsurface feedbacks

Calibration based on grids of increasing spatial resolution



Well order : P01, P02, P03, P010, P04, P05, P012, P011, P09, P06, P08, P07 (Mean 2008-2011)



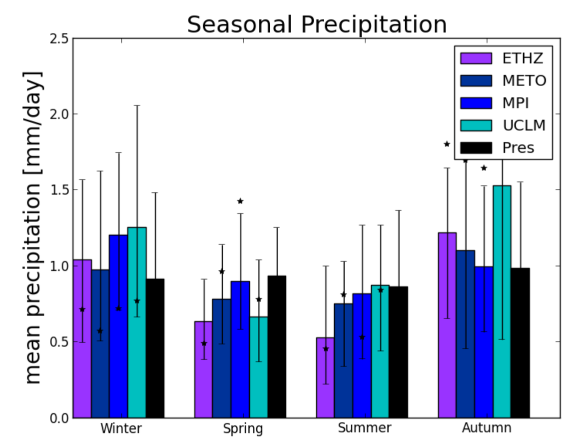
Discharge	Cali.	Valid.
NSE	0.74	0.92
RMSE [%]	3.16	1.36

Climate and Irrigation Scenarios

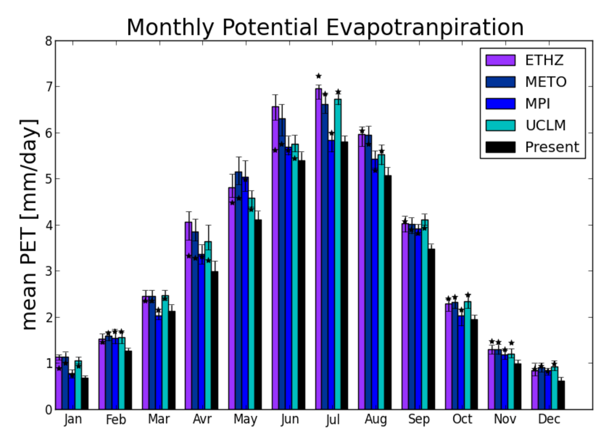
Climate and Irrigation Scenarios

- **Emission scenarios**
  - A1B from IPCC (2050)
- **Climate models**
  - Global: ECHAM5 HadCM
  - Regional: ETHZ, MPI, UCLM, METO
- **Downscaling methods**
  - Weather generator: 30 x 8 years
  - Quantile-based method
- **Irrigation scenarios**
  - No irrigation
  - Present Irrigation
  - Future Irrigation, Present Crops
  - Future Crops

Climate Scenarios – Results



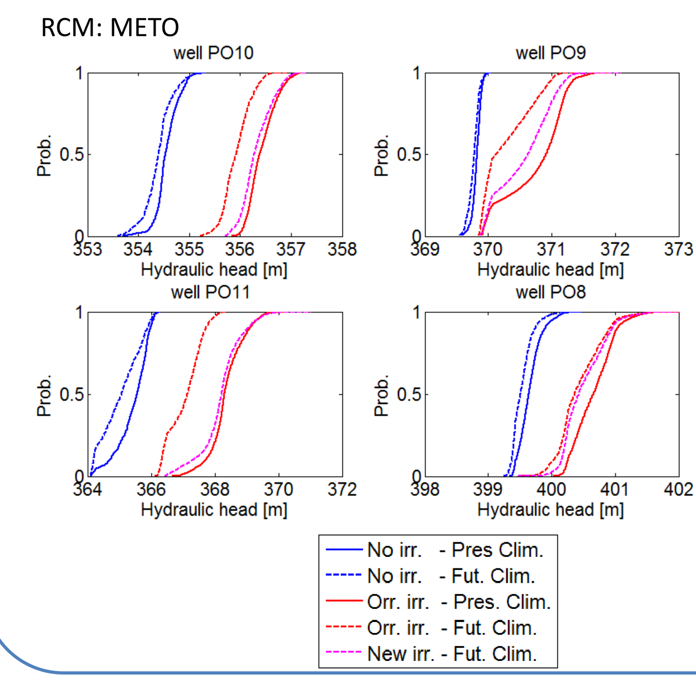
More precipitation in winter, less in summer

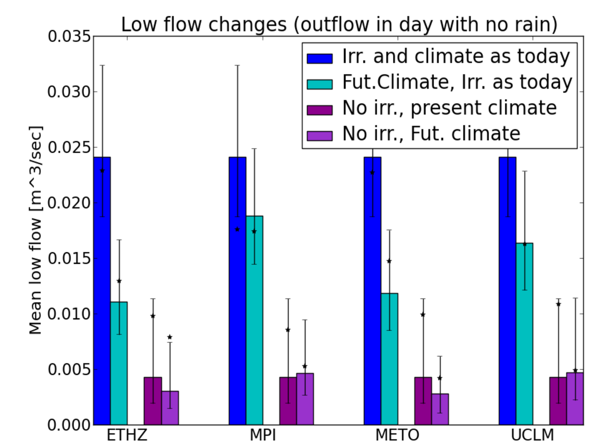


Higher potential evapotranpiration

Simulation Results

Hydrological head and low flow



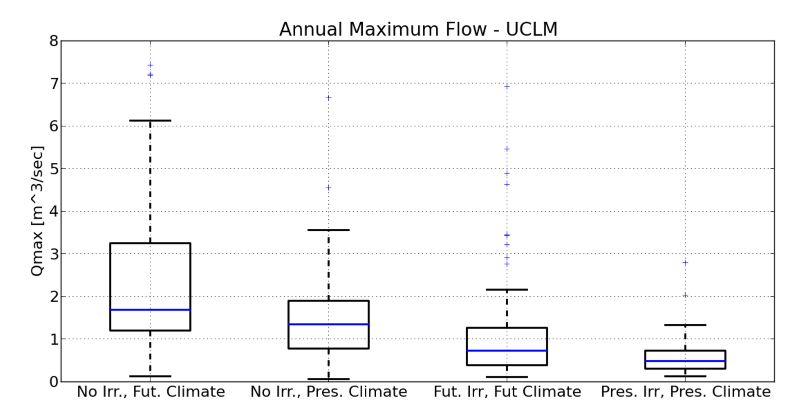


With irrigation, water table is higher. Connectivity with the surface/climate increases. Hence, hydraulics heads and low flows decrease more in scenarios with irrigation in the future

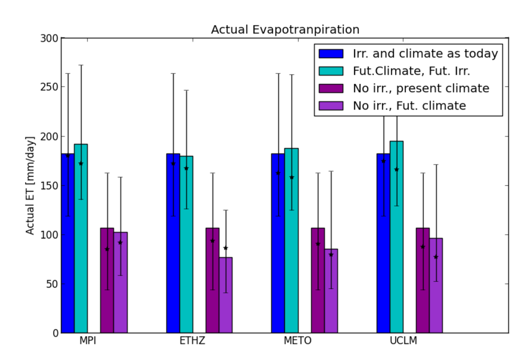
Peak flow

Without irrigation:

- → Dry and undisturbed soil
- → Lower infiltration capacity
- → Sensitivity to change in precipitation variability
- → Higher peak flow
- → Higher flood risk



Actual evapotranspiration (AET)



During summer, in the future:

- More AET with irrigation
- Less AET without irrigation than in the present climate

→ higher humidity gradient in warmer climate

Conclusion

Impact of climate change on the hydrological components of the Lerma catchment with or without irrigation

	No Irrigation	Irrigation
Hydraulic Head	Low change	Decrease
Low Flow	Low change	Decrease
Peak Flow	Increase	Low change
AET in summer	Small Decrease	Small Increase

Land-use matters!

INTEGRATED HYDROSYSTEM MODELLING

EBERHARD KARLS UNIVERSITÄT TÜBINGEN

UNIVERSITY OF WATERLOO

grant GRK 1829/1 of the Deutsche Forschungsgemeinschaft