Challenges in Regional Climate Modeling of Coastal Dynamics

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Introduction

- Lebassi et al. (2008)

  Observed 1970-2005 Cooling of Summer Daytime Temperatures in Coastal California

- *DATA:*
  - daily T_{min} temp.
  - daily T_{max} temp.

  DTR = T_{max} - T_{min}
  - SST (hourly values)
  - Sea – level coastal pressure gradients (ECMWF)
  - GCM downscaled T_{ave} values

What happens?

- Long – term daily 2-m temp. trends generally show diurnal asymmetric warming rates
- T_{min} have warmed faster than T_{max}
- Decreases daily temp. range (DTR)

Why?

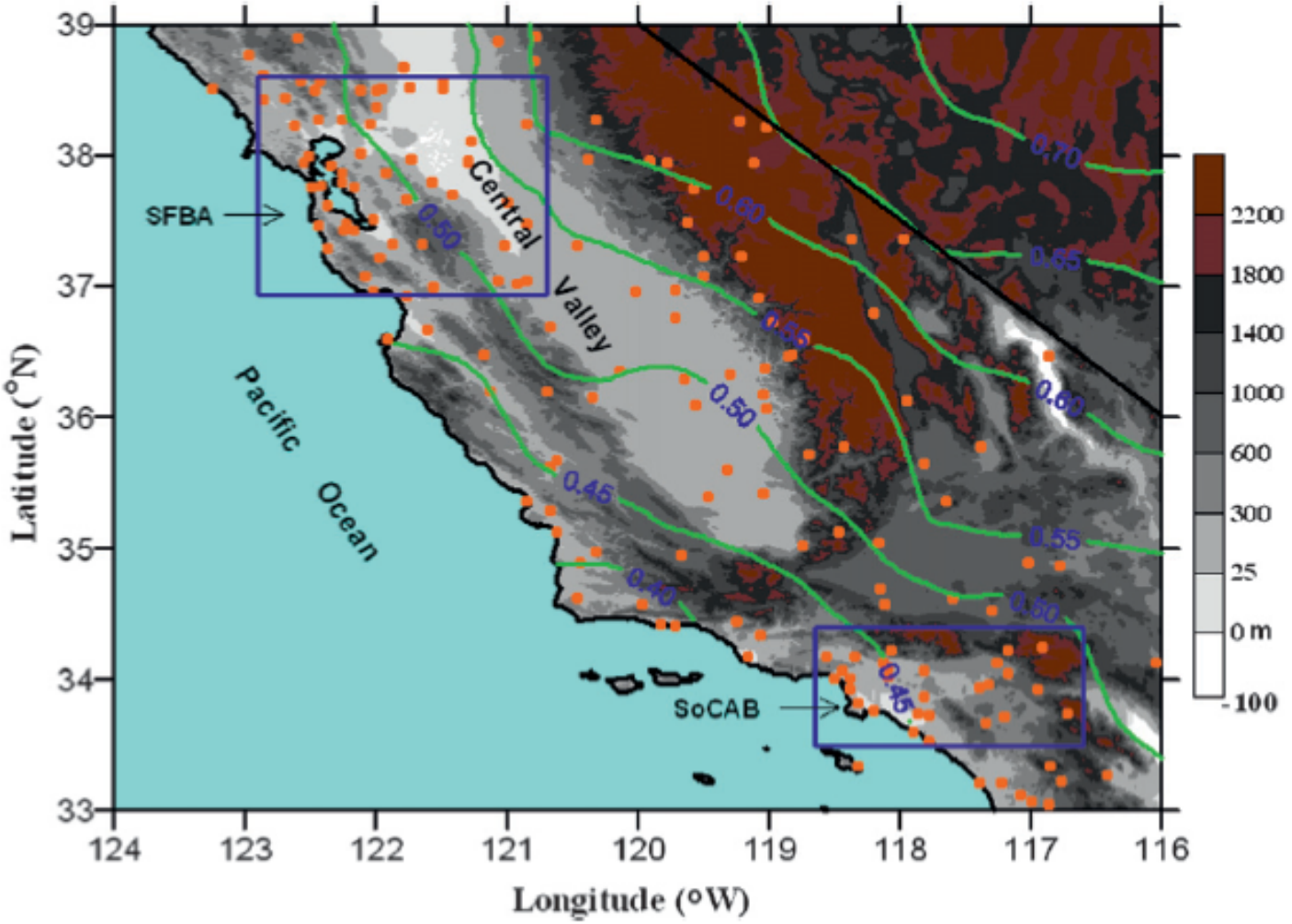
- Increased evaporation from increased SSTs
- Solar reflection and absorption by aerosols reduce T_{max} warming rates
- Increased GHGs
  - reduce nocturnal IR cooling and thus increase T_{min} values
  - increase land-ocean pressure and temp. gradients → enhances upwelling
- Antropogenic land cover conversions

California studies

- Goodridge (1991) → 112 sites, warming in coastal (warming SSTs) and inland urban areas (UHI effects)
- LaDochy et al. (2007) → 331 sites, 1950-2000

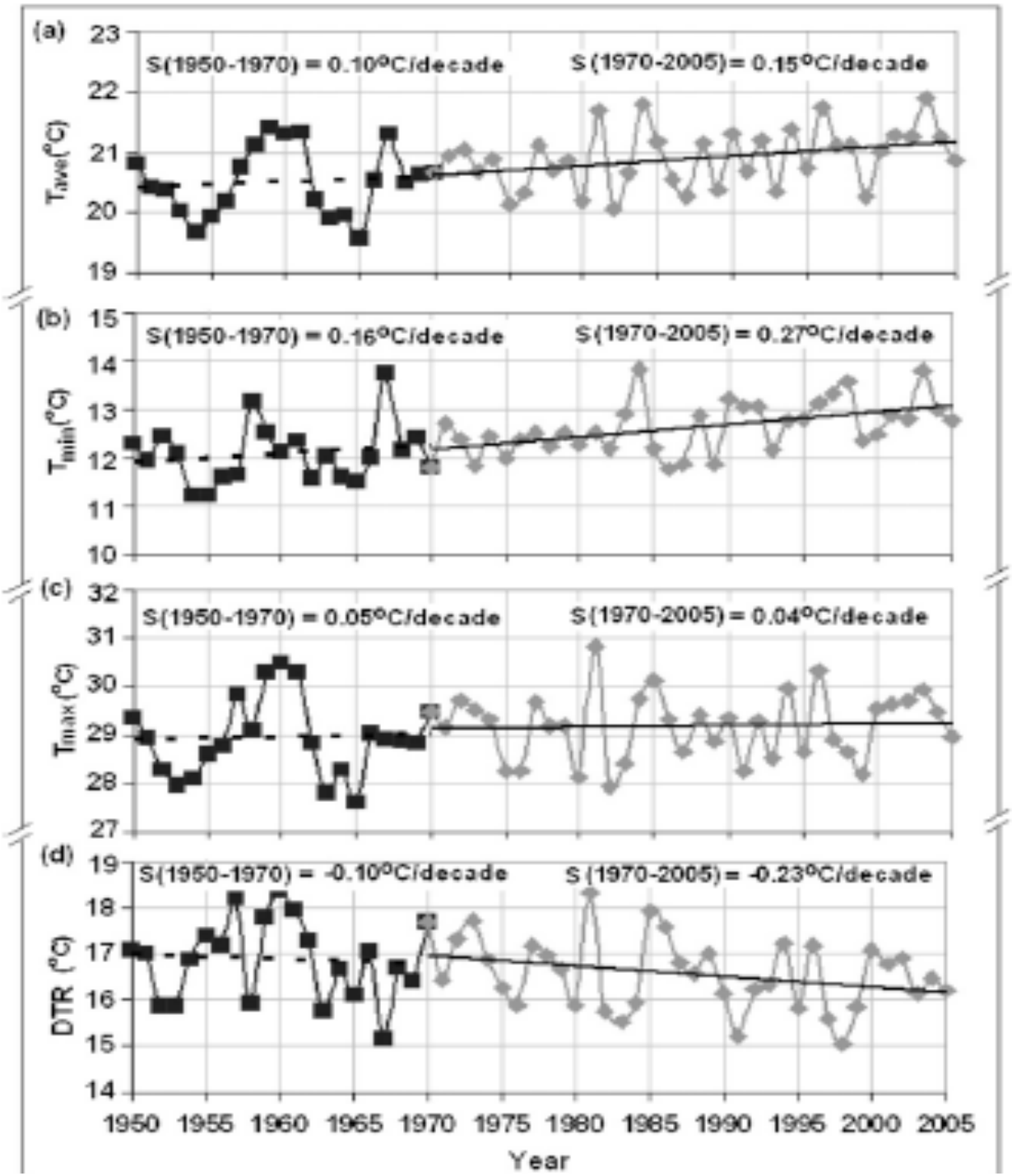
Lebassi et al.

- 273 sites
- 2 air basins
- 1950 – 2005
- JJA



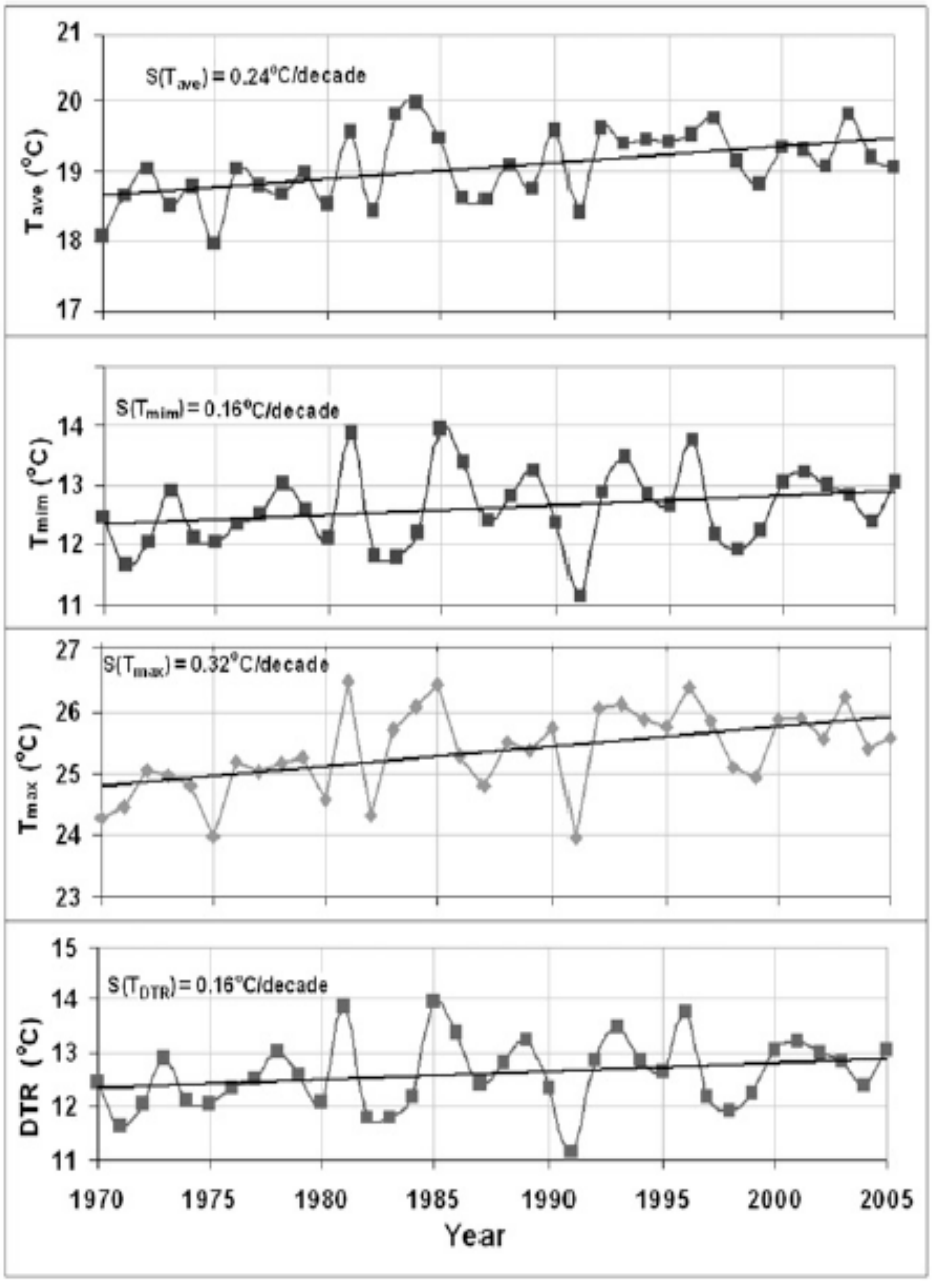
Temporal-trend slopes

→ all 253 California sites

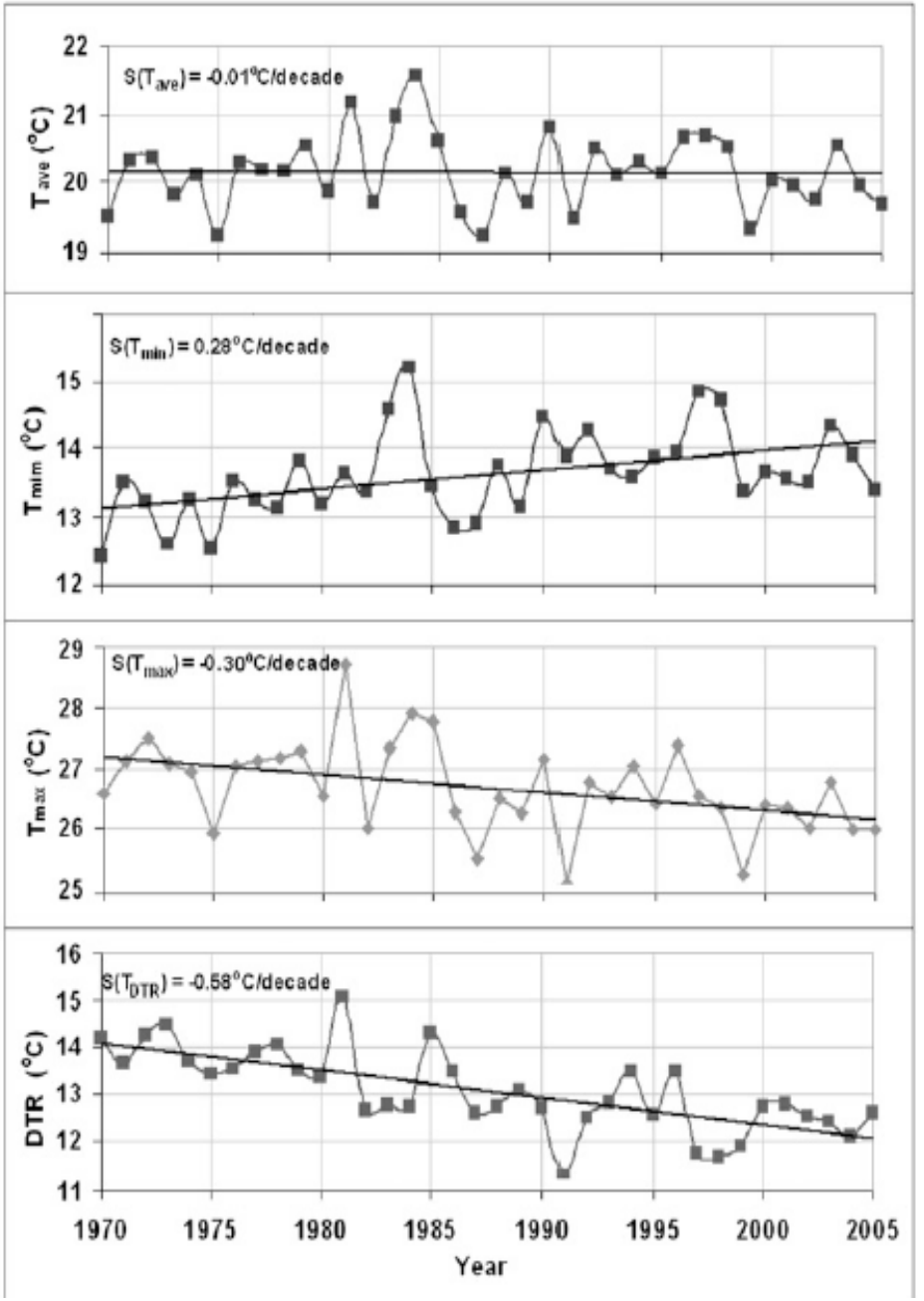


SFBA and SoCAB

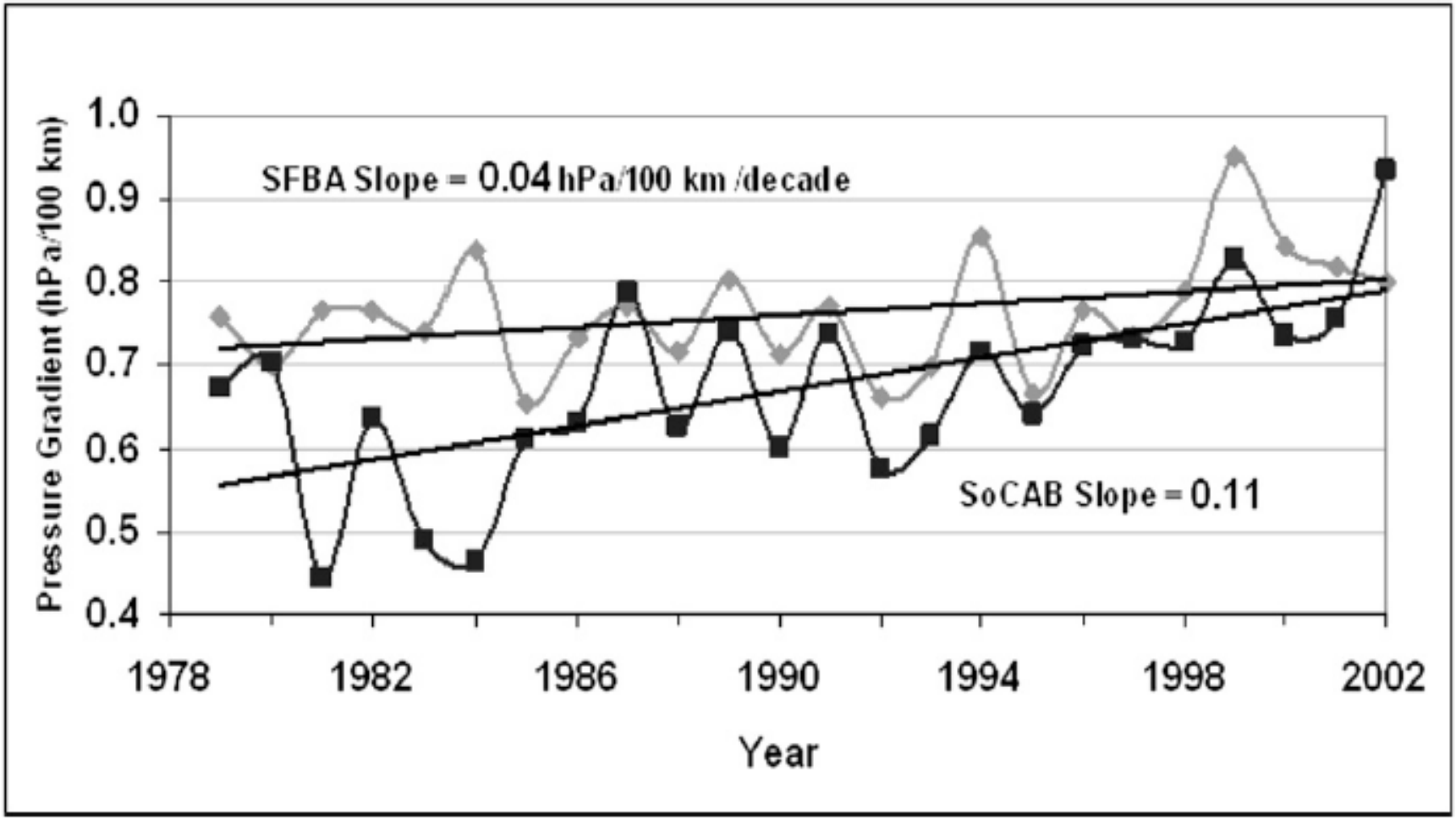
Inland warming



Coastal cooling

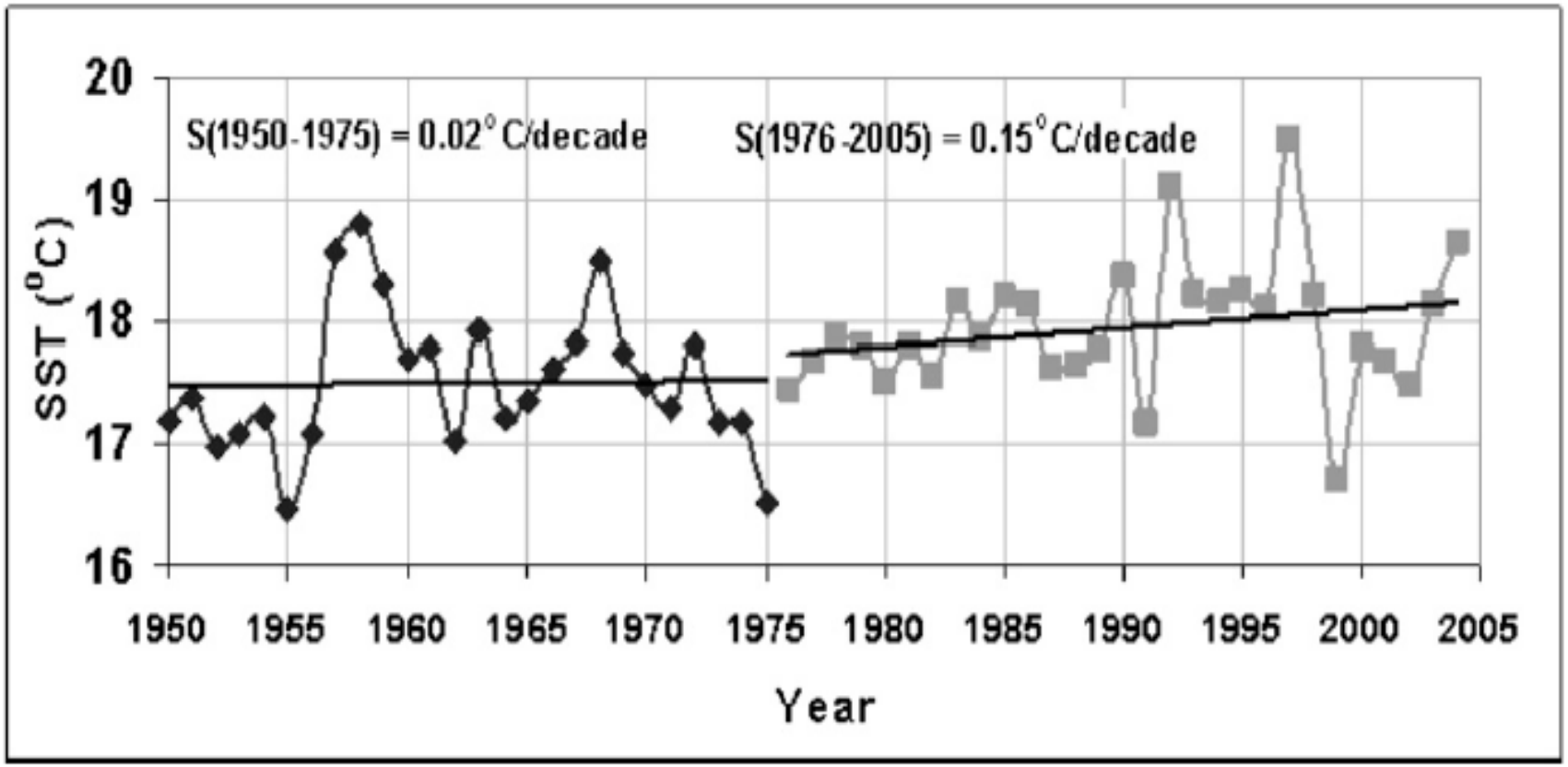


Temporal trend in coastal sea – level pressure gradient



Trends in ocean minus land summer 1800 UTC sea level pressure gradient (hPa/ 100 km/decade) for SFBA and SoCAB.

Temporal trend in SSTs

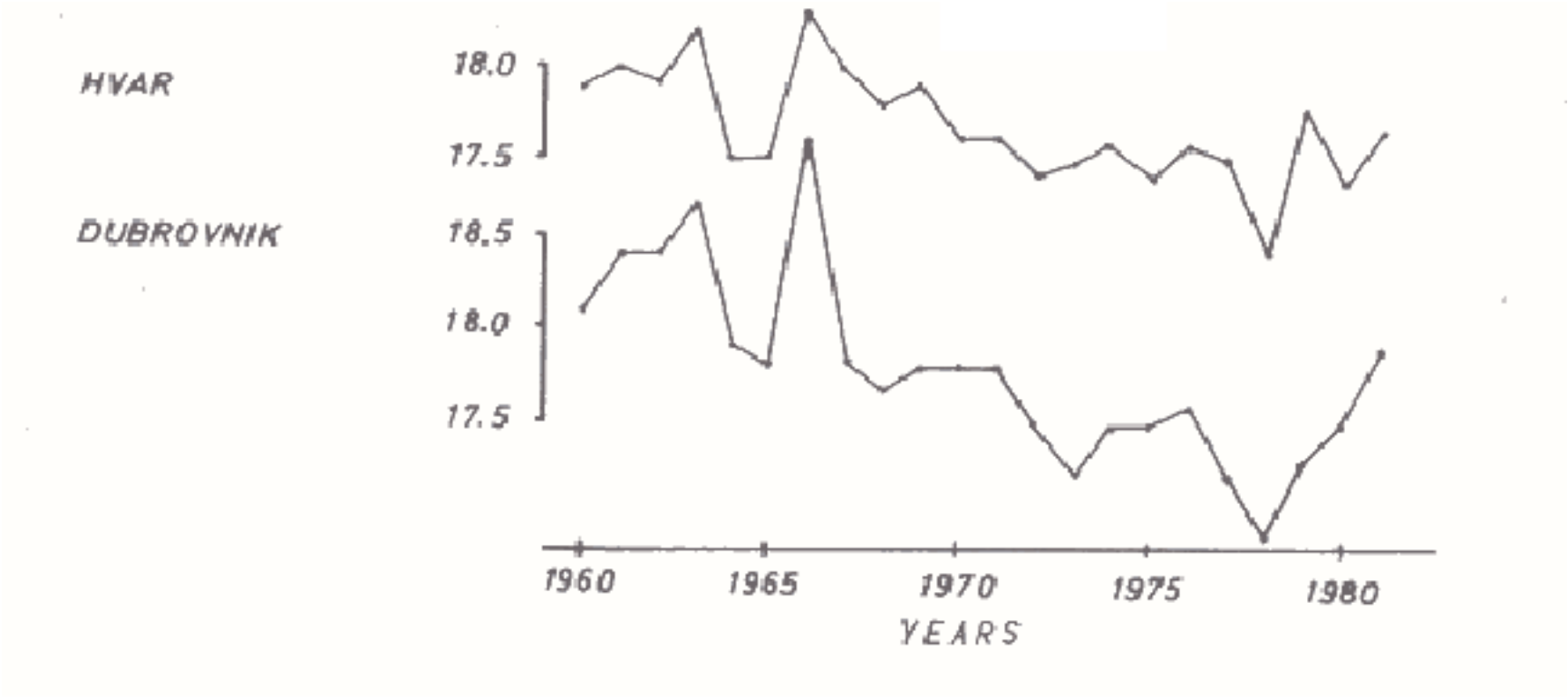


Trend in summer average SSTs [°C/decade]

Croatian climate

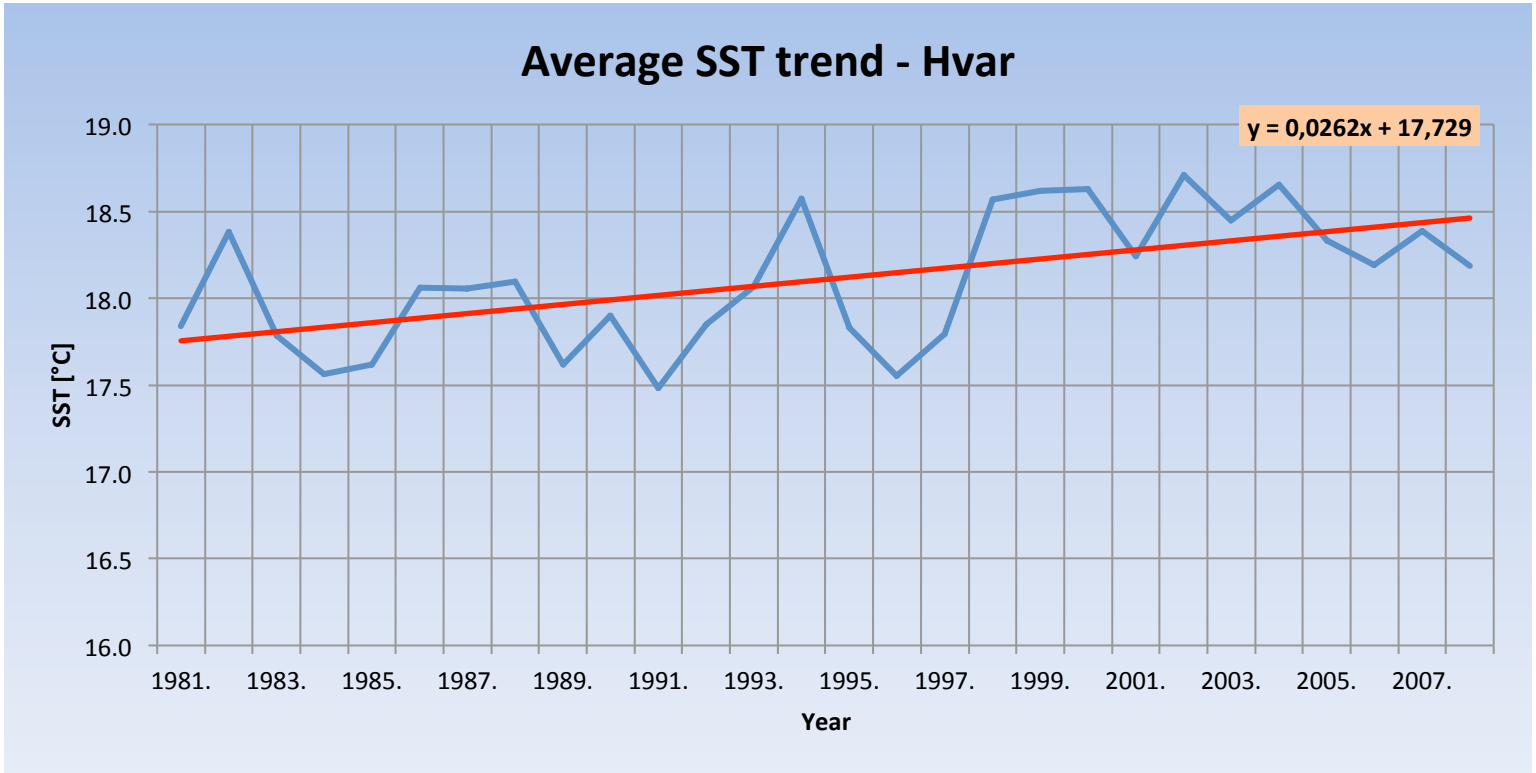
- Previous studies:
  - **Supić, Orlić (1992)**

    SSTs during 20 years at 21 stations along the east Adriatic coast



Year-to-year variability of the mean annual SST

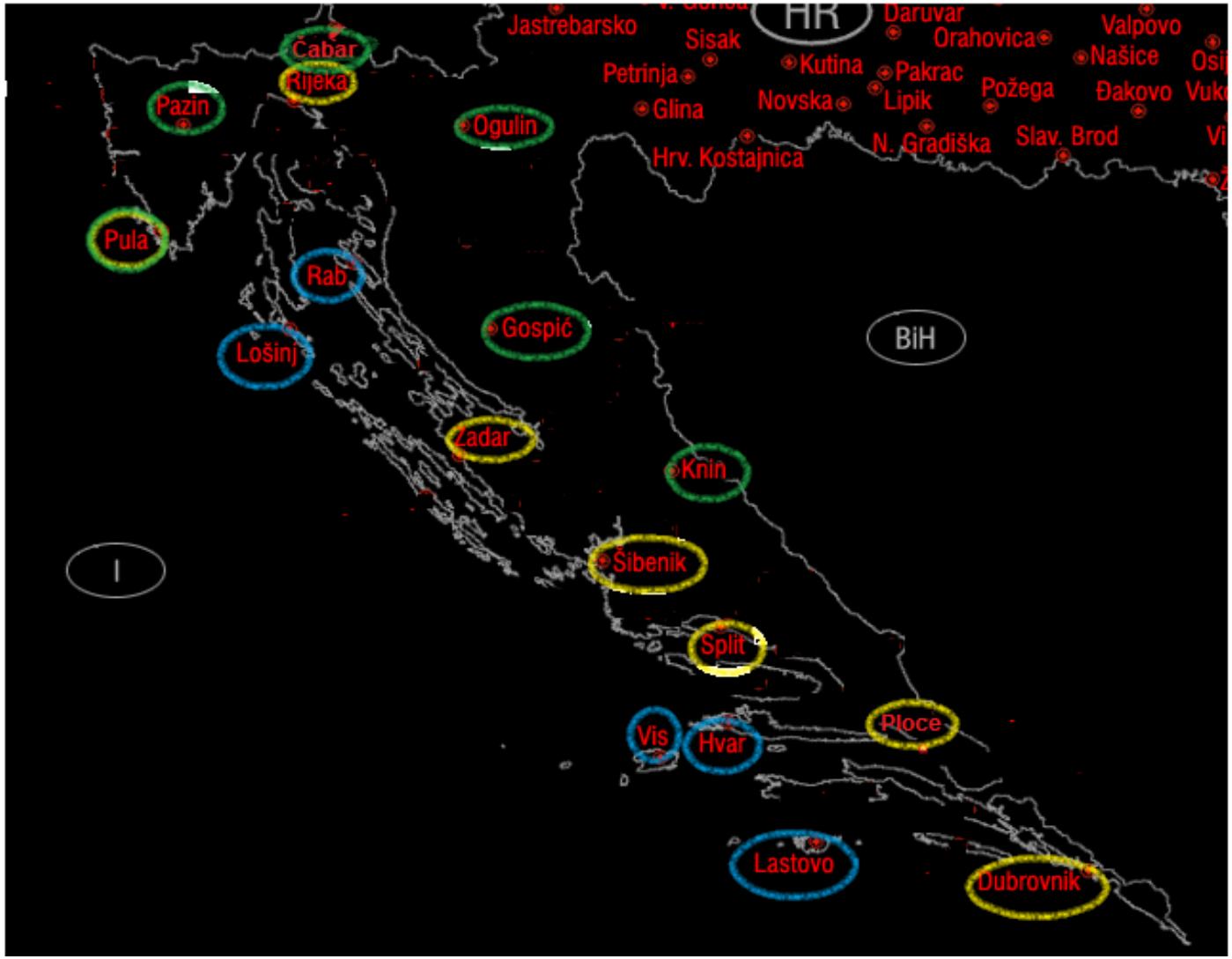
- 1981-2008 data
- daily values at 7, 14, 21 h LT
- annual cycle of SSTs
- possible decadal variability



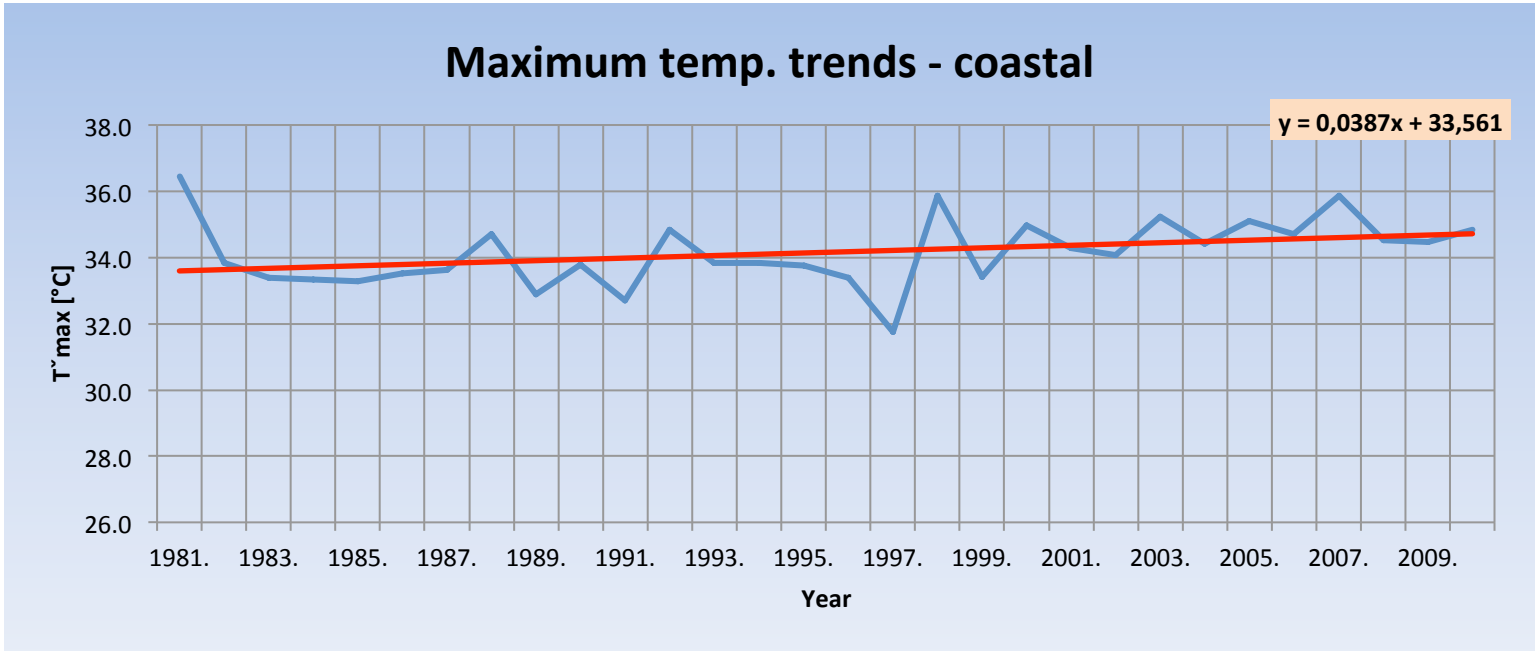
- **Pasarić, Orlić (2004)**
  - ECHAM4 model, T106 Gaussian grid of 1.125° horizontal resolution
  - Scirocco and bora; present day and predicted climate conditions
  - 30 year interval
  - 6-h ourly wind exceeding the value of 7m/s

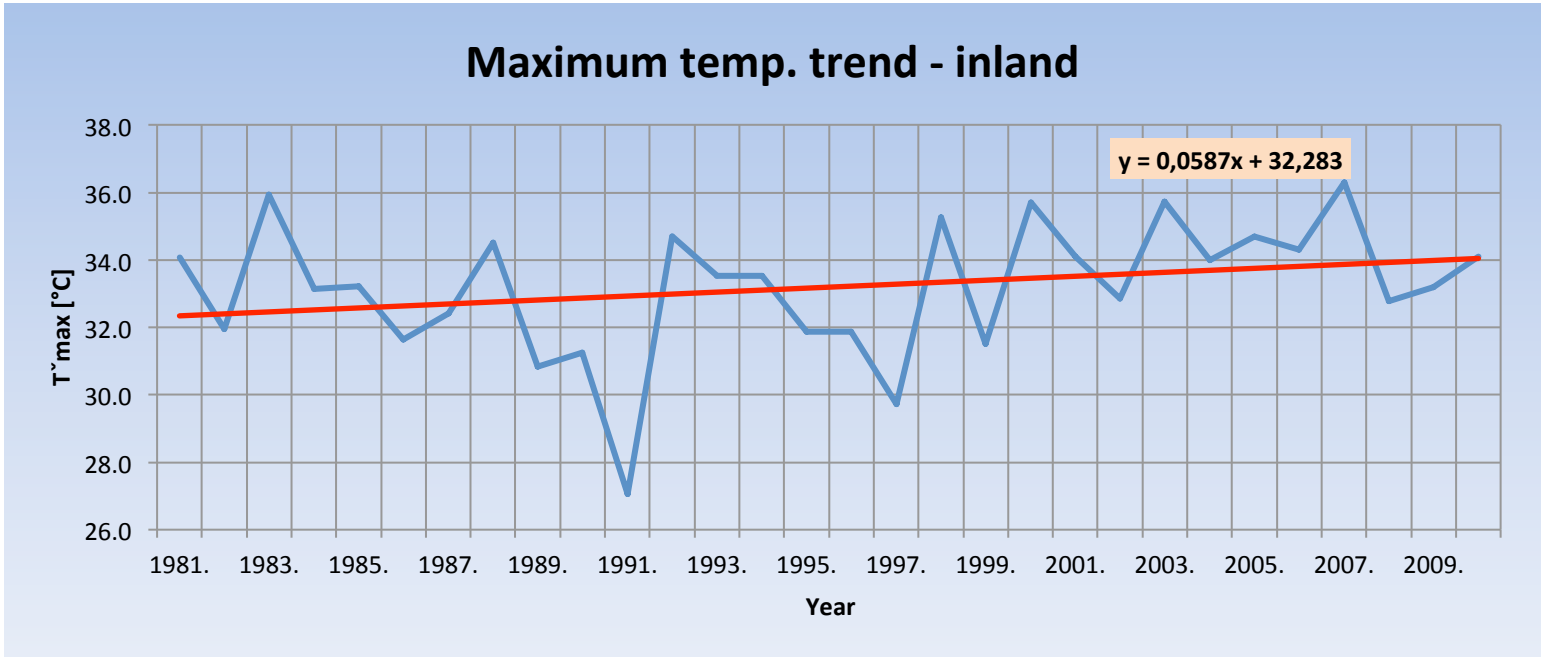
-**3 belts**
  - inland
  - coastal
  - sea

- **1981 – 2010**
- **JJA**



Coastal vs. inland





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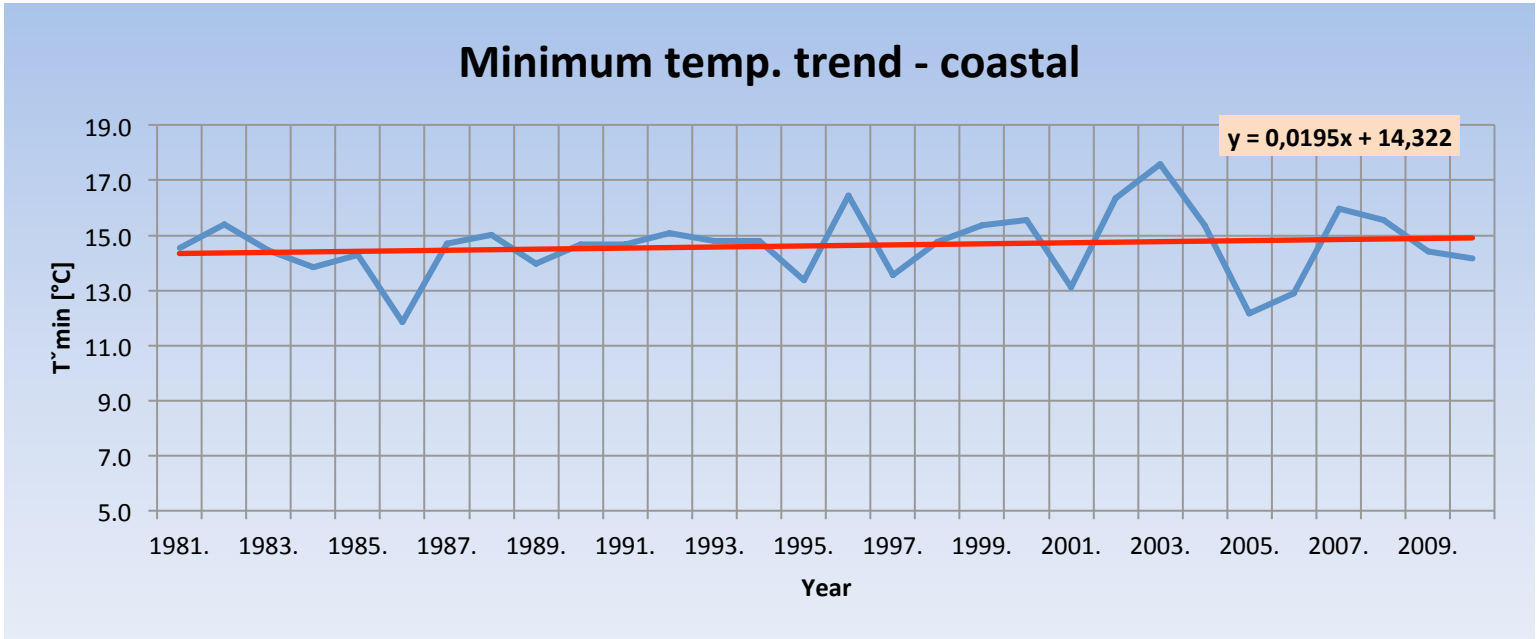

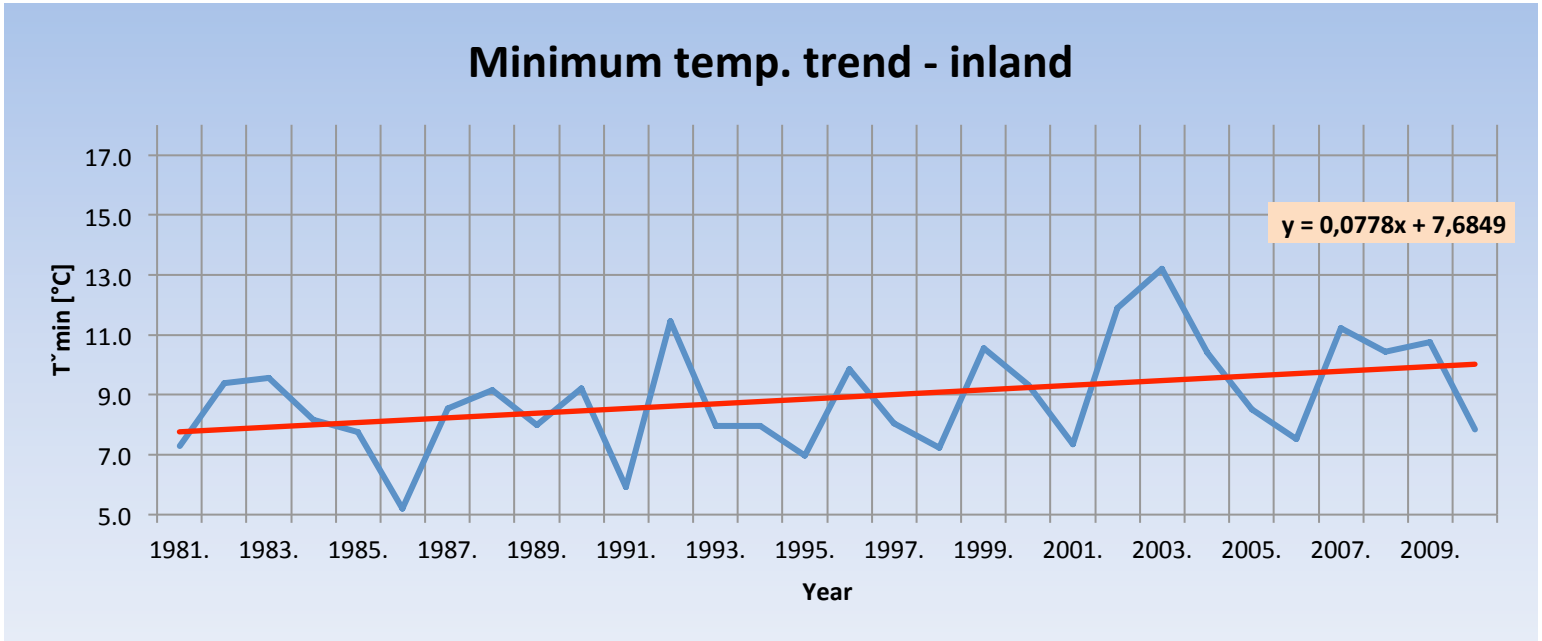

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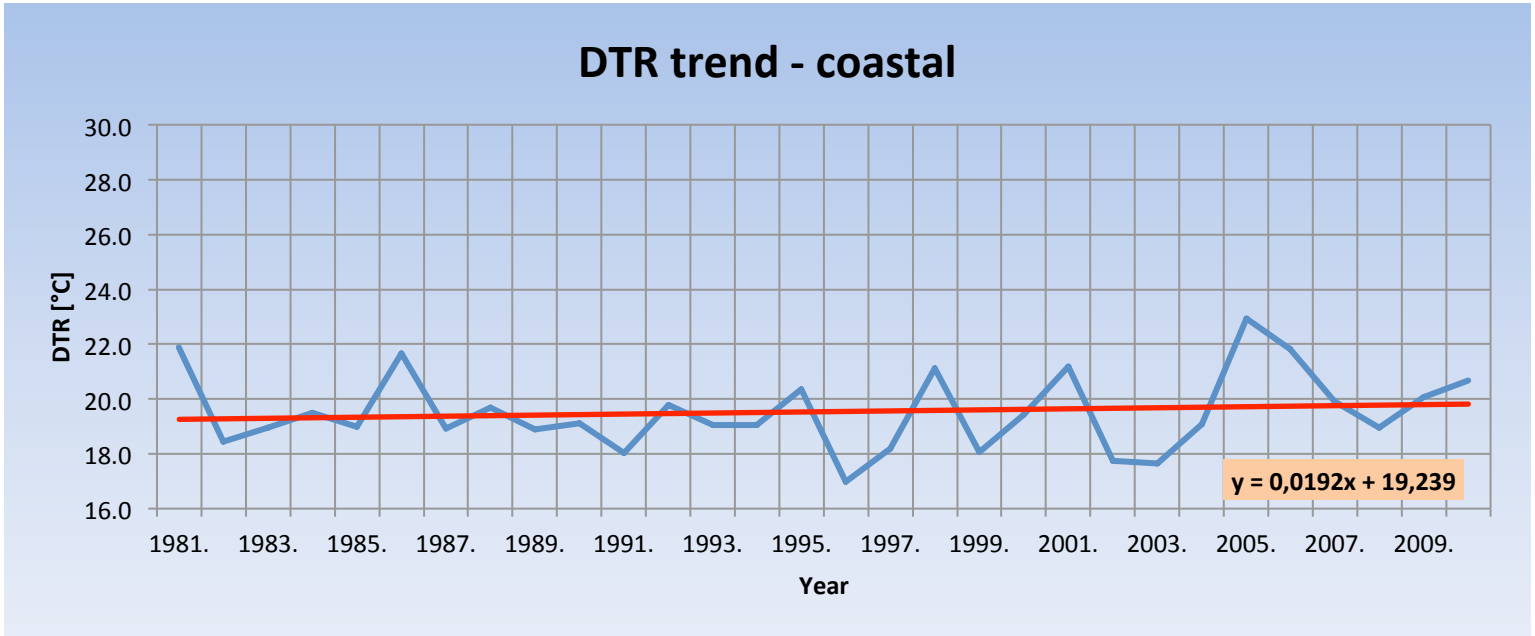

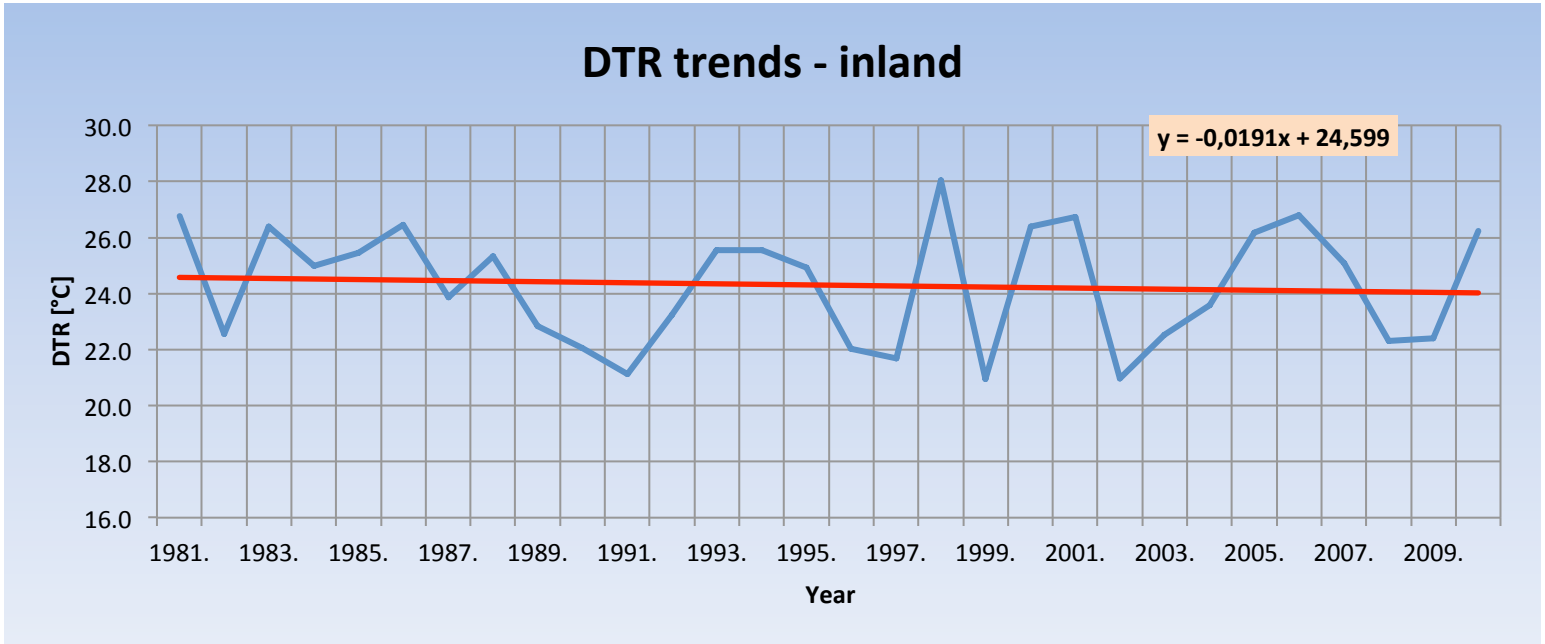

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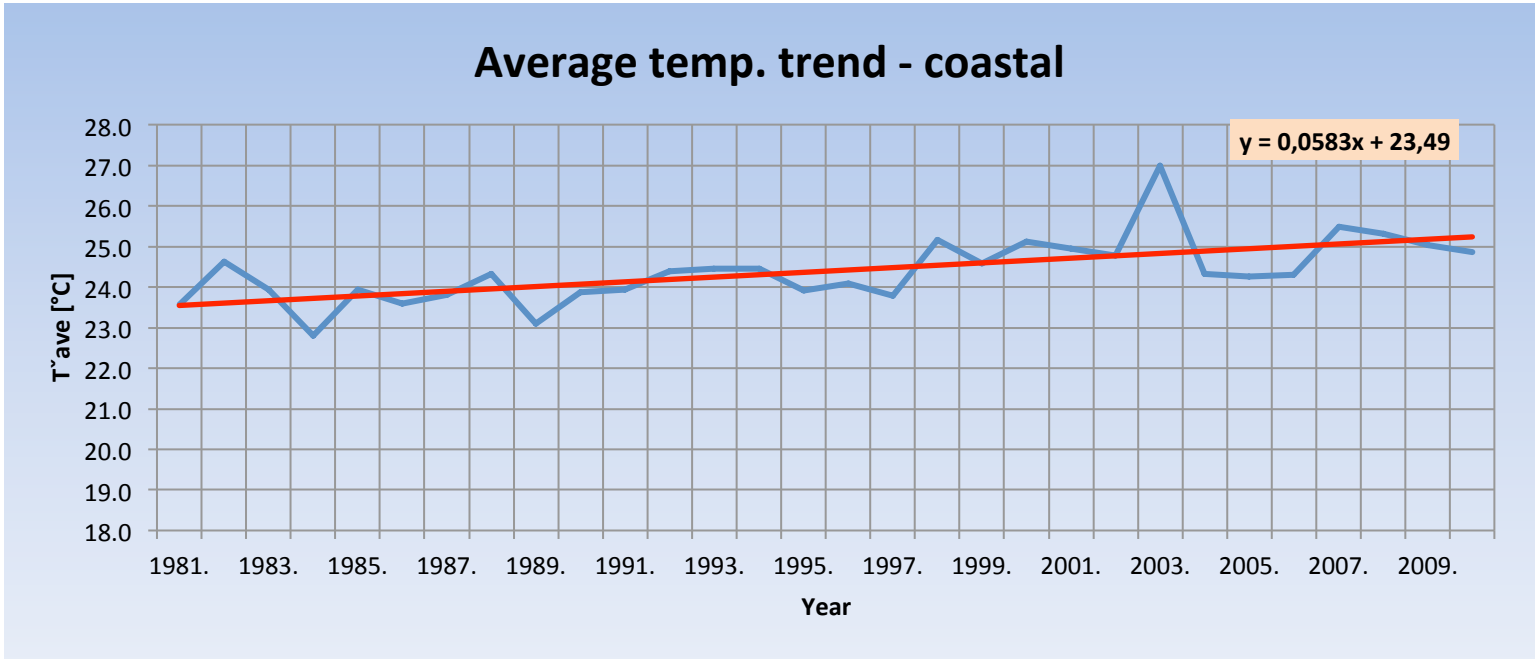

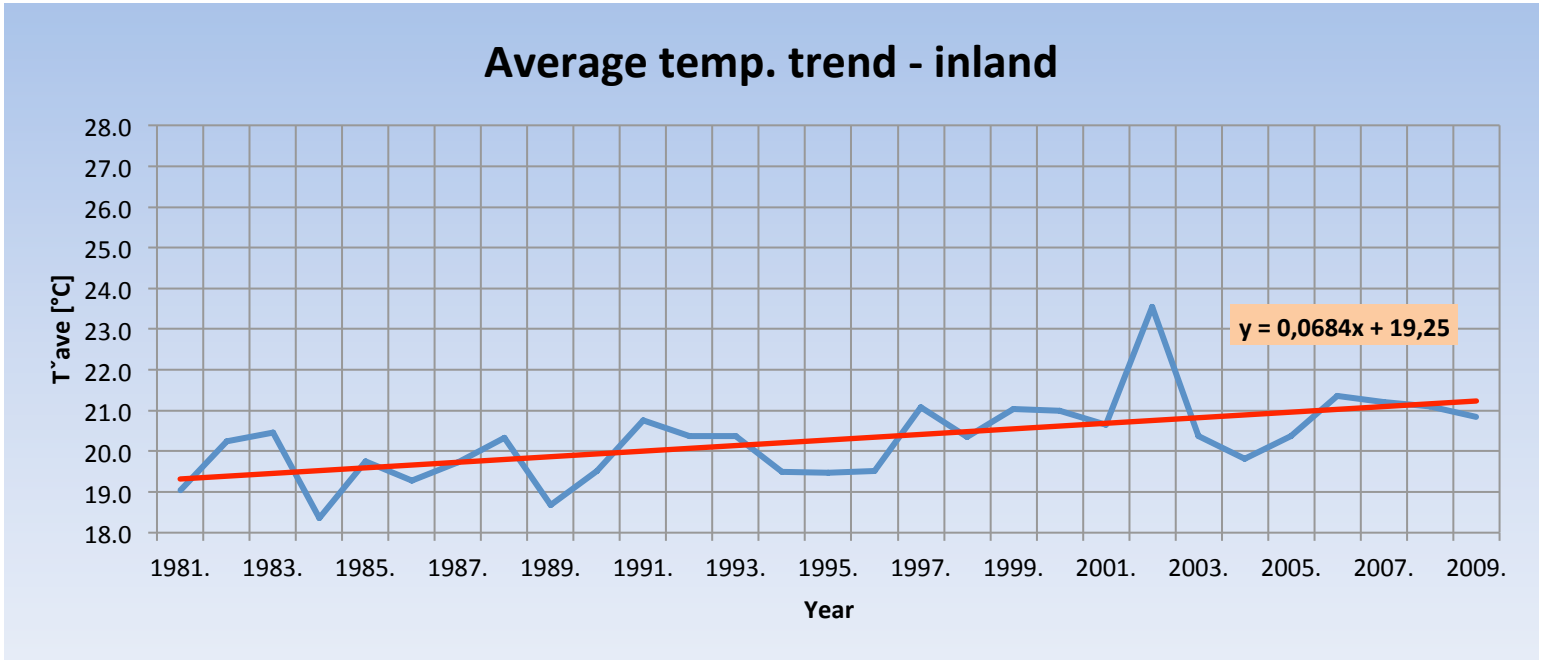

Conclusions

- Inland taken into account
- Observed asymmetric warming
- Adriatic SST observations in agreement with Californian, possible interdecadal variability

Further research:

- Topography, precipitation and sea lever pressure gradient
- Investigate sea breeze
- GCM downscaling

Thank you for your attention!