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## **Group C02: Climate change and its impact on beekeeping and sheep breeding in Ukraine**

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*Alina Semerhei-Chumachenko*

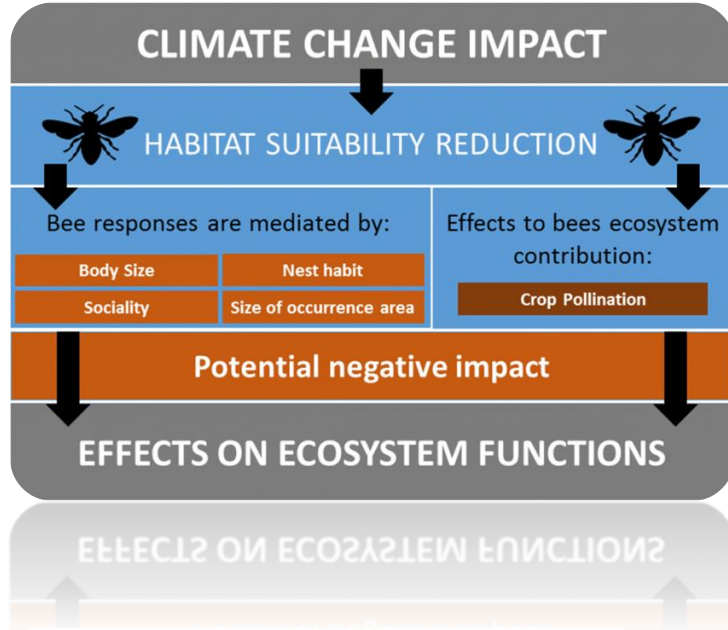
**OSENU** - Odessa State Environmental University  
(Odessa, Ukraine)



*Kryvyi Vladyslav*

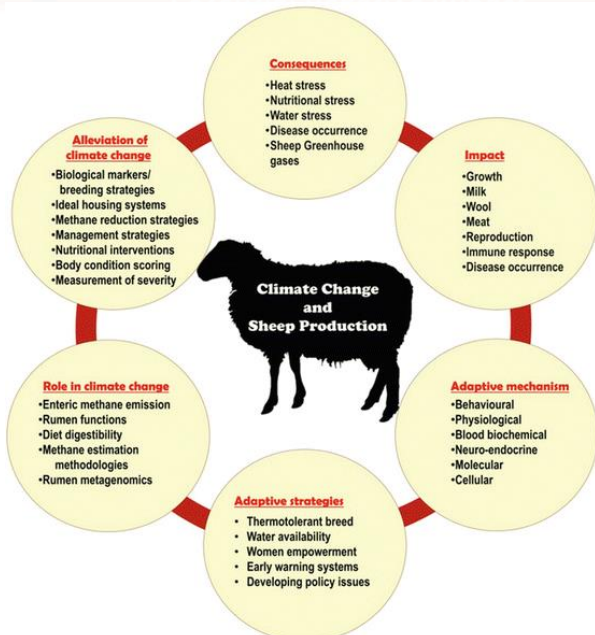
**KhSAEU** - Kherson State Agrarian and Economic  
University (Kherson, Ukraine)





## RELEVANCE OF THE STUDY OF THE C02 GROUP

Climate change has a significant impact on all sectors of Ukraine's agricultural sector, including **livestock**. In 2021, climate change caused damage to the **beekeeping industry** due to the large impact of temperature, humidity and sharp temperature fluctuations.

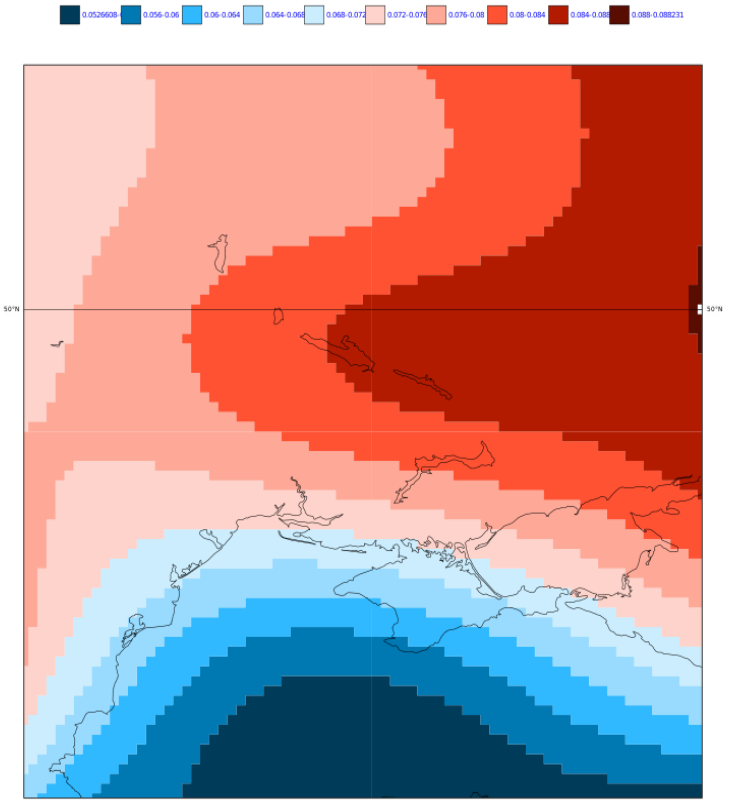
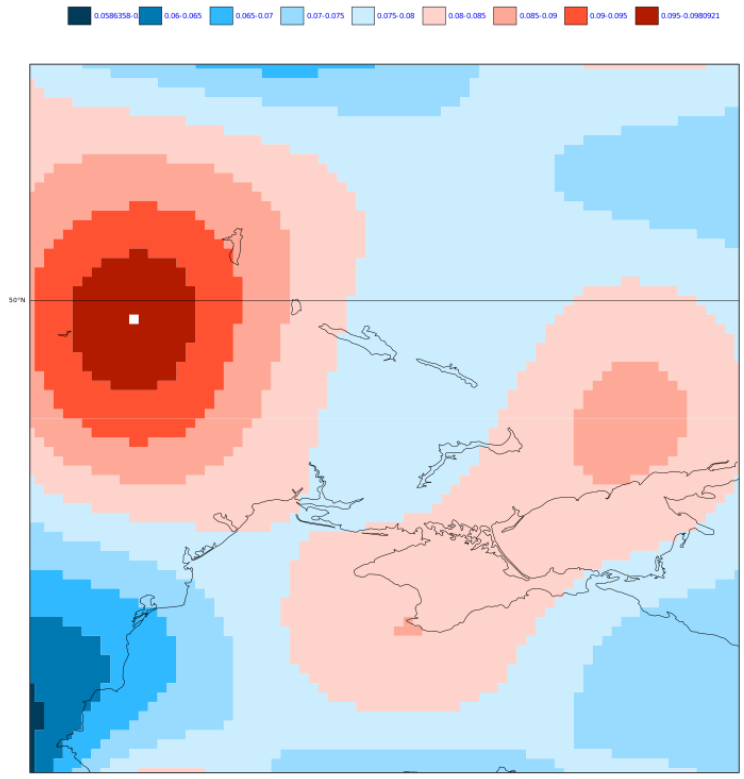
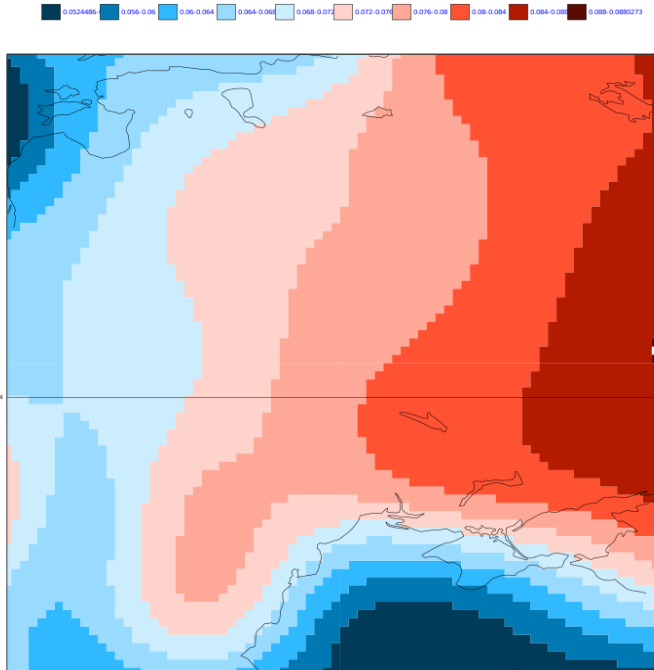
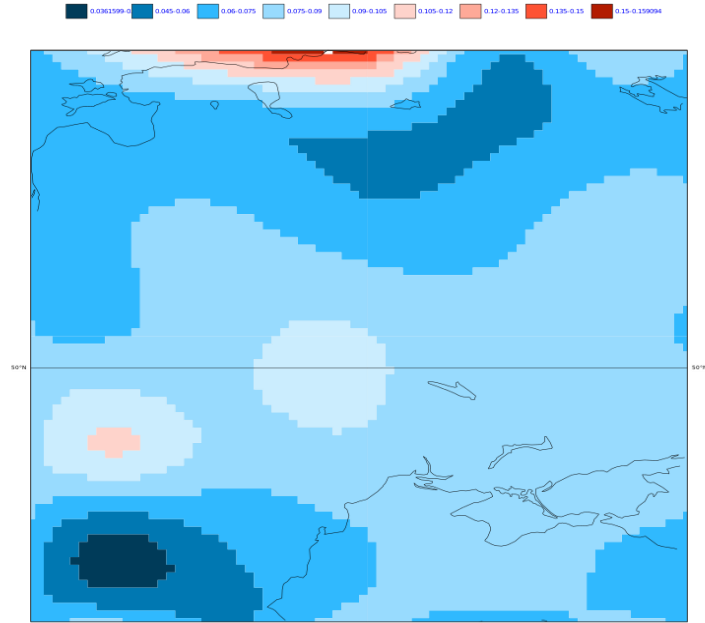


## Research Goal C02 Group -

to determine the nature of the impact of climate change on the work of livestock (for example, beekeeping or sheep breeding) in Ukraine (or individual locations) using such applications with a set of climate data (1991-2020)

# Ukraine

# Southern Ukraine



Calculate trends 1991-2020

Calculate trends 1991-2020

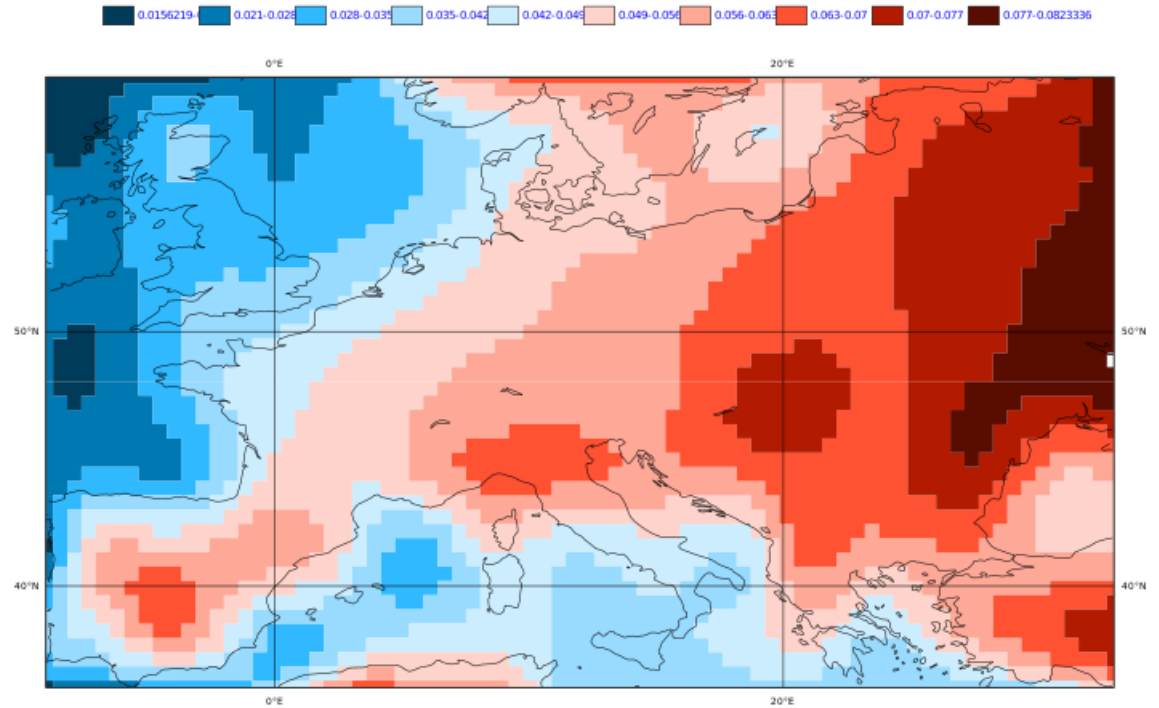
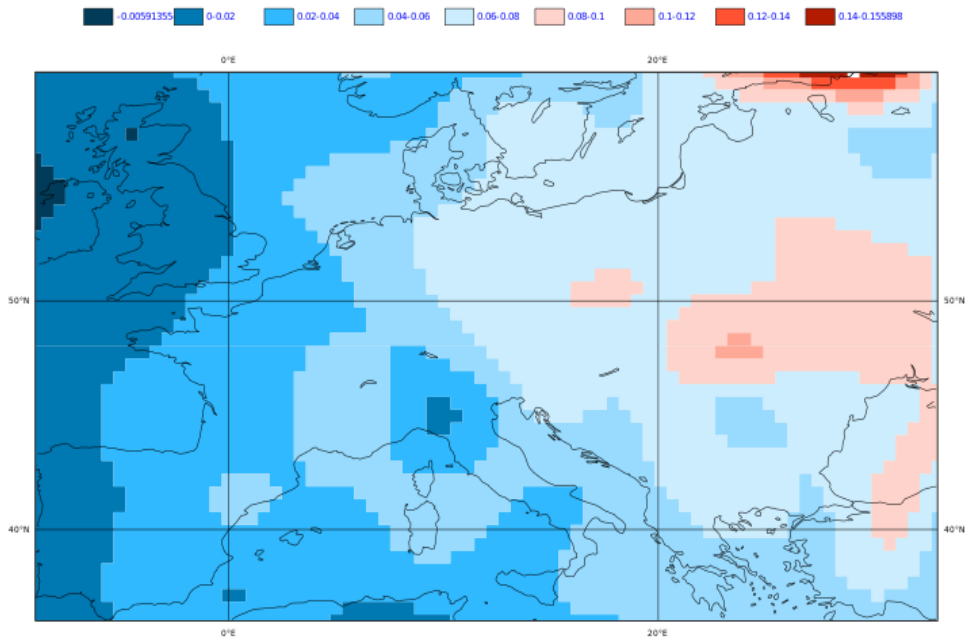
# Europe

Near surface air temperature trend

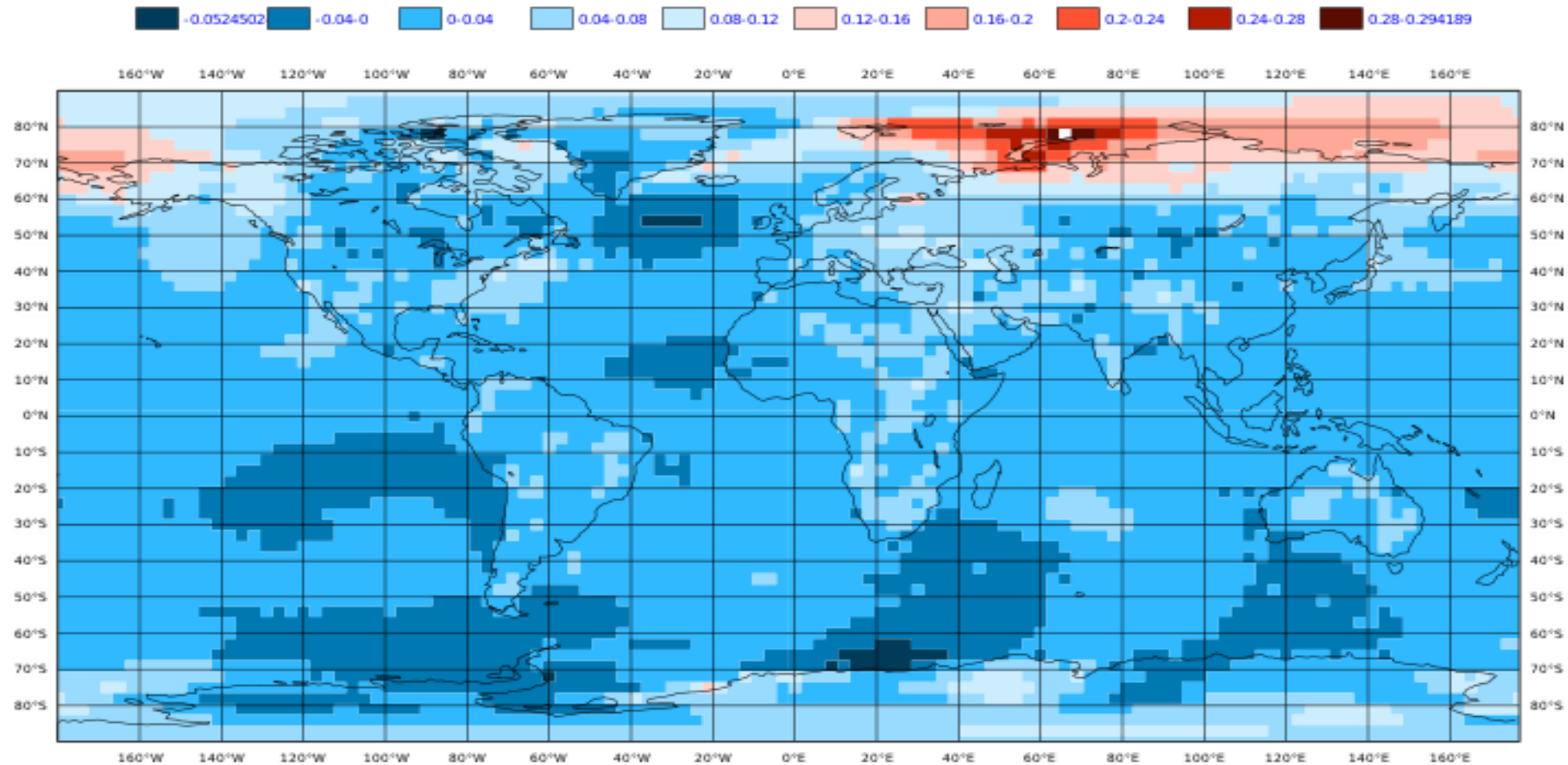
Near surface air temperature trend standard deviation

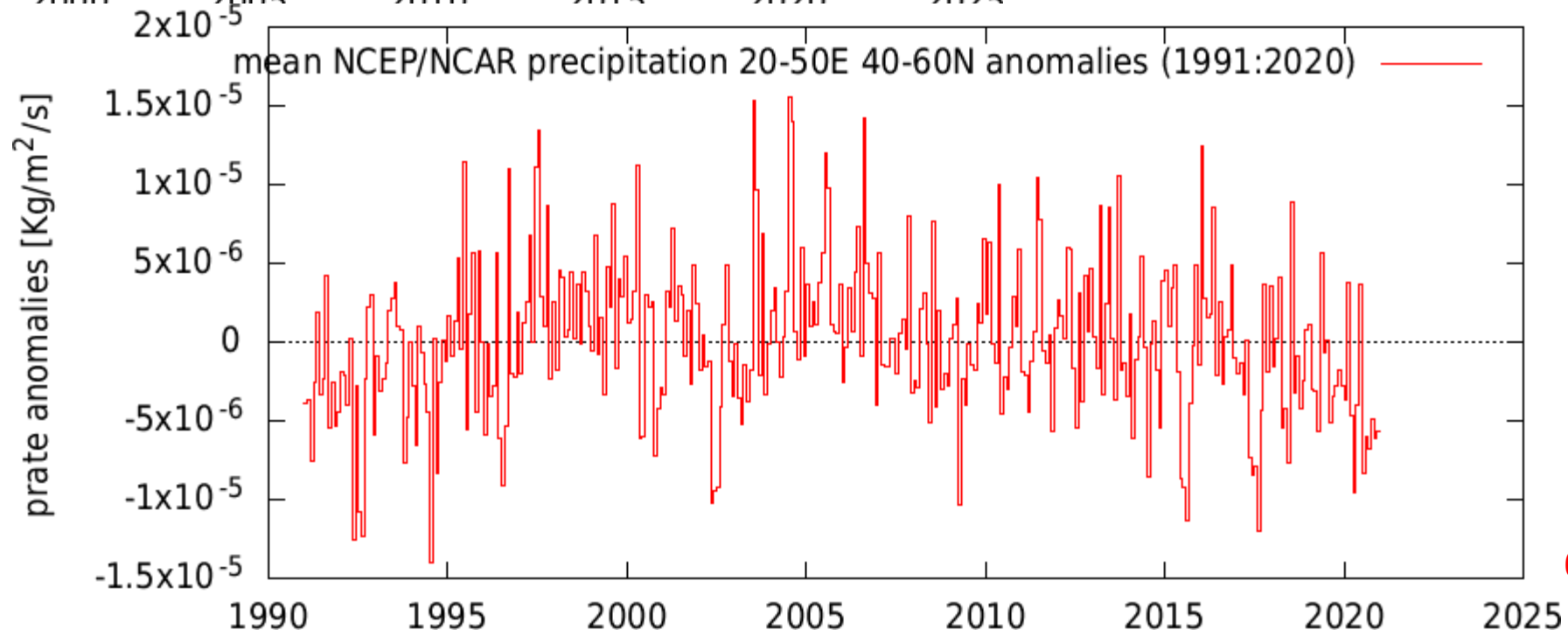
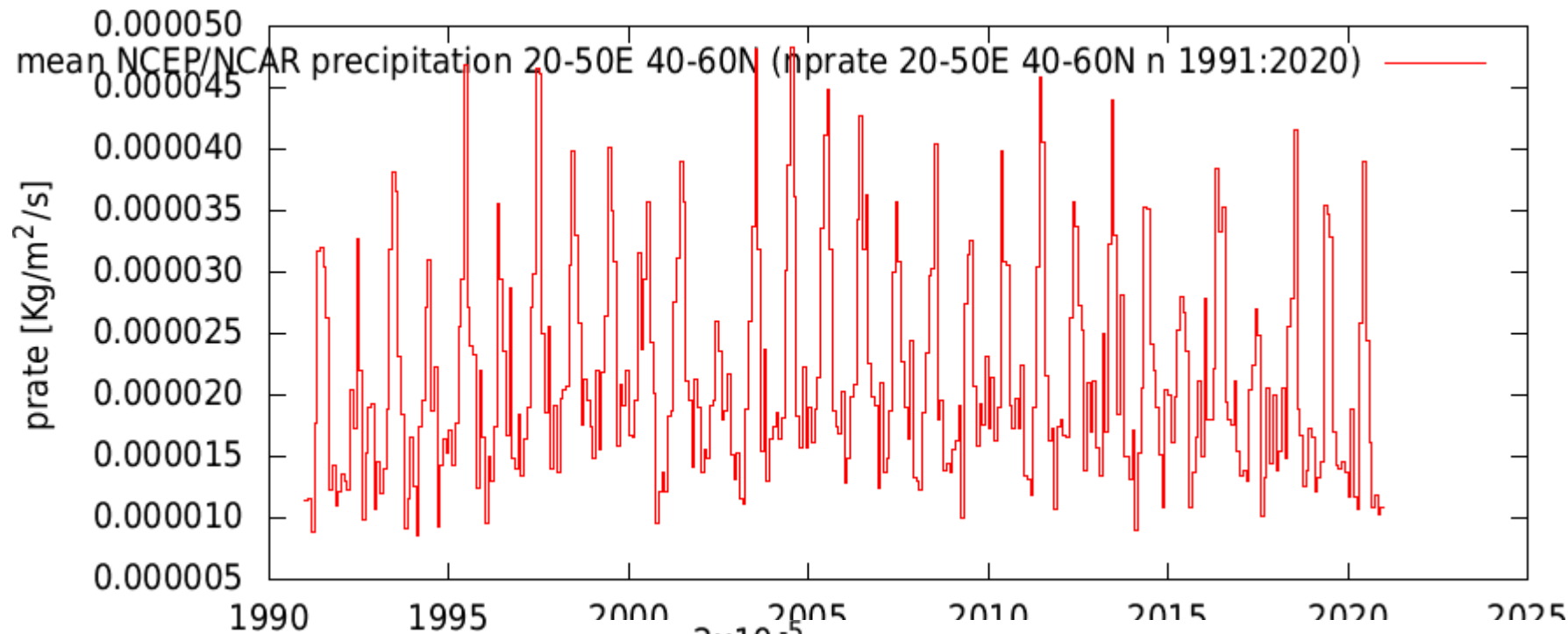
ear surface air temperature trer

temperature trend standard dev



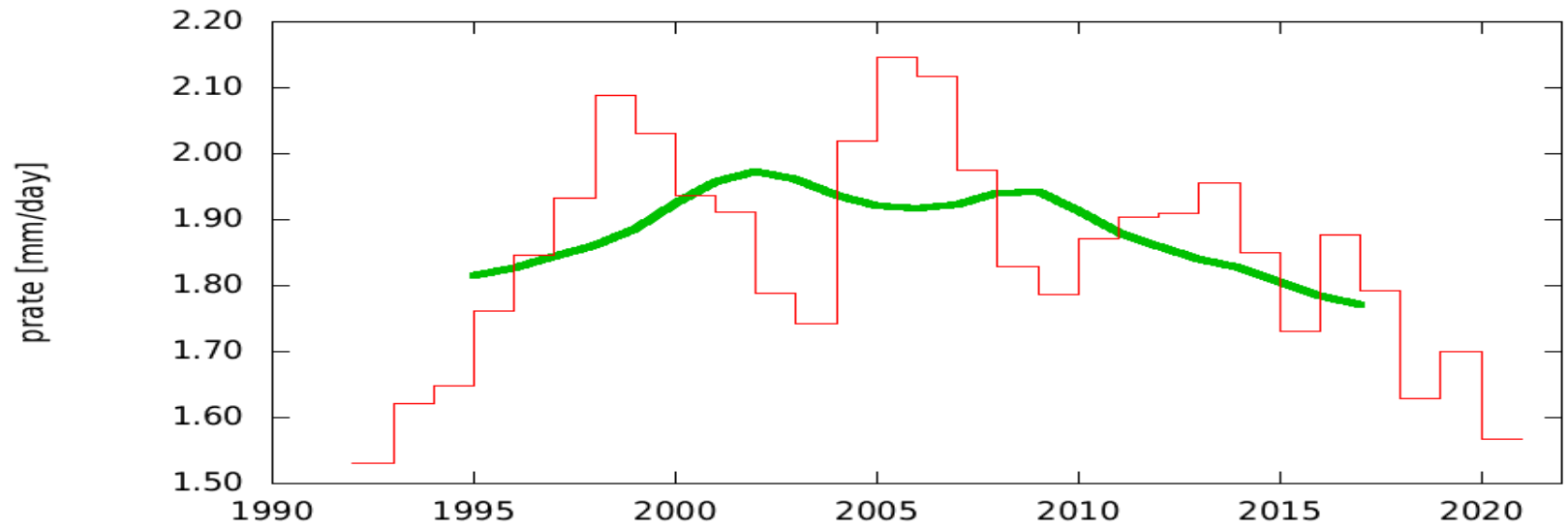
# ear surface air temperature trer



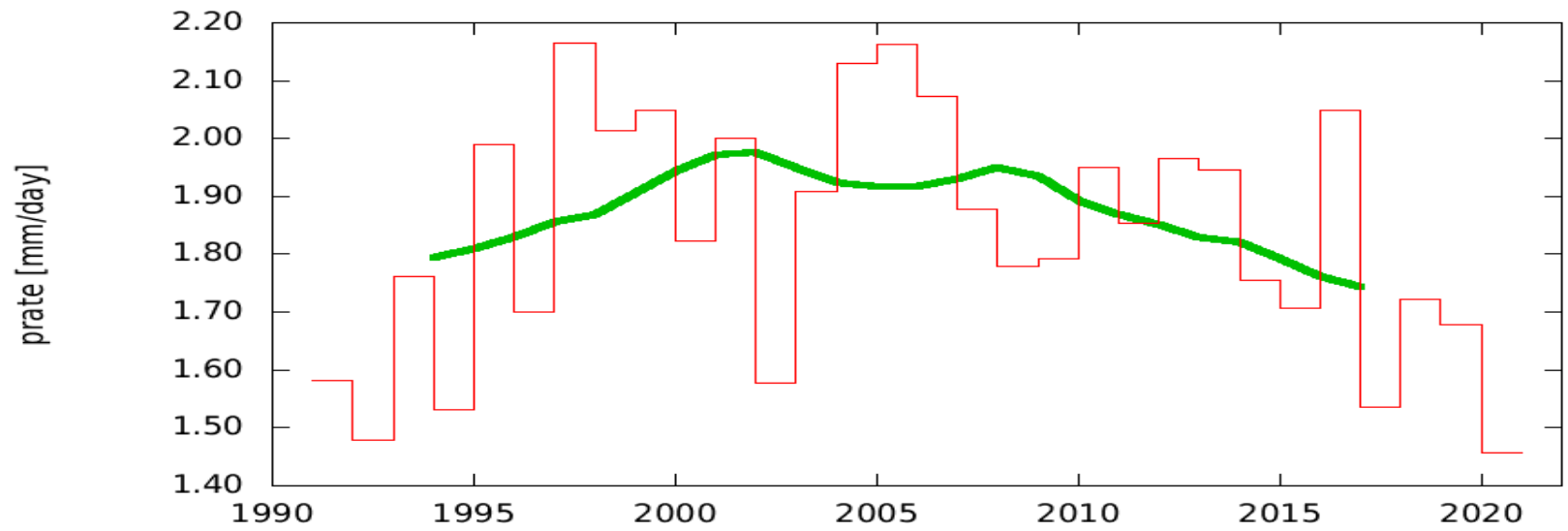


# Time series plots per half year

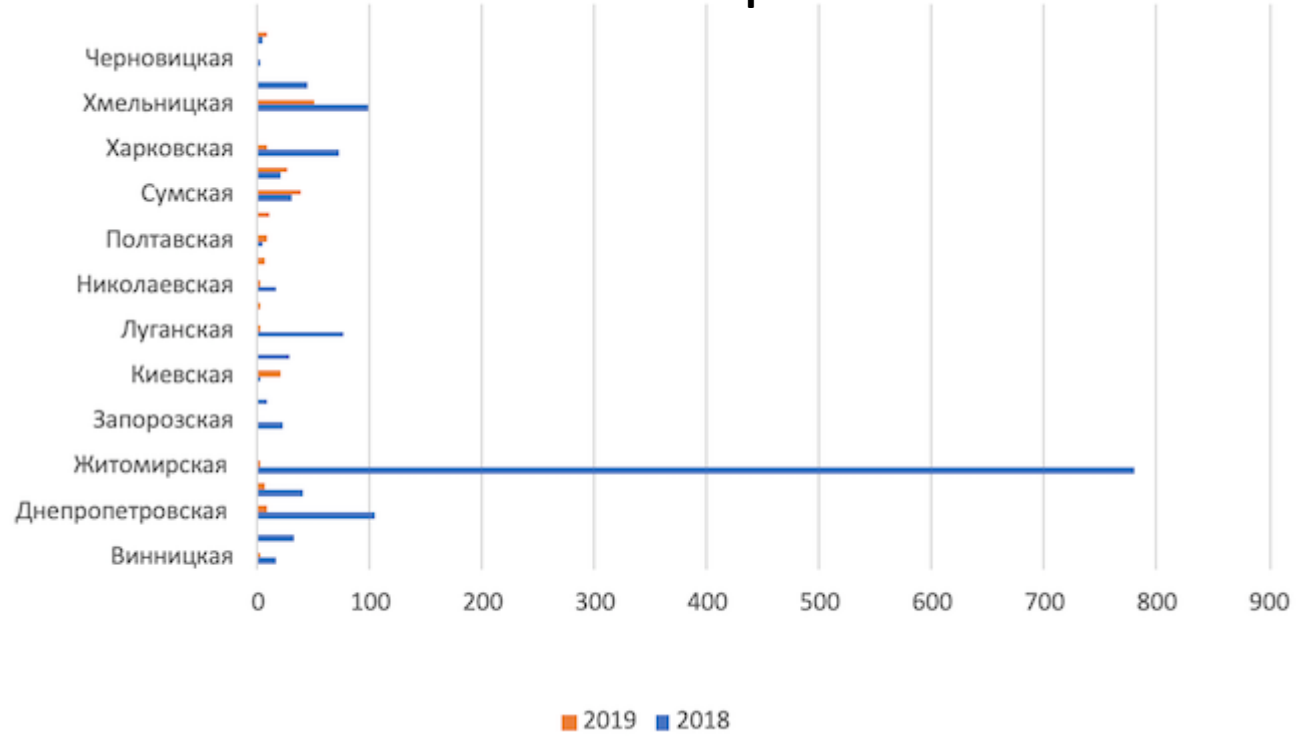
lar mean monthly mean NCEP/NCAR precipitation 20-50E 40-60N (nprate 20-50E 40-60N n 1991:2020 mean1 anom)



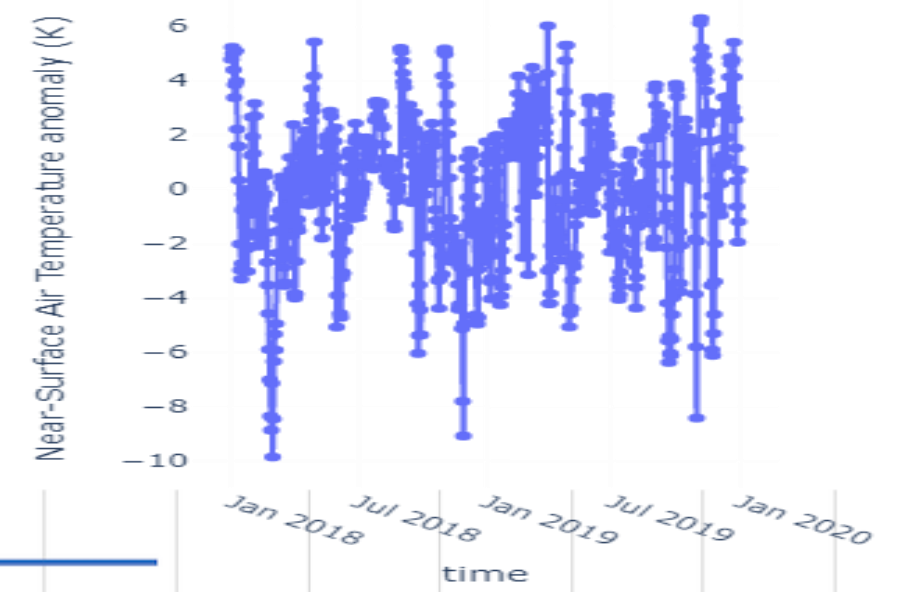
ep mean monthly mean NCEP/NCAR precipitation 20-50E 40-60N (nprate 20-50E 40-60N n 1991:2020 mean1 anom)



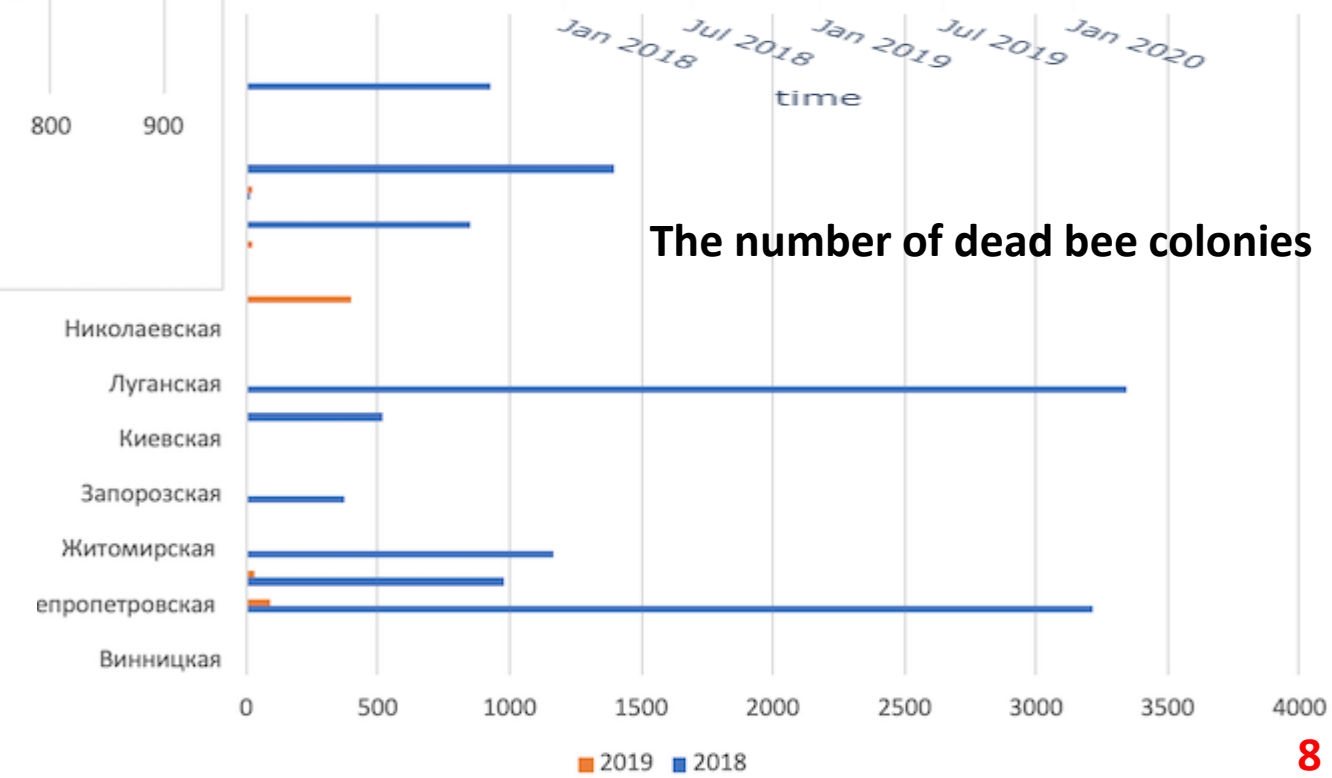
### Number of affected apiaries



### Region: Ukraine

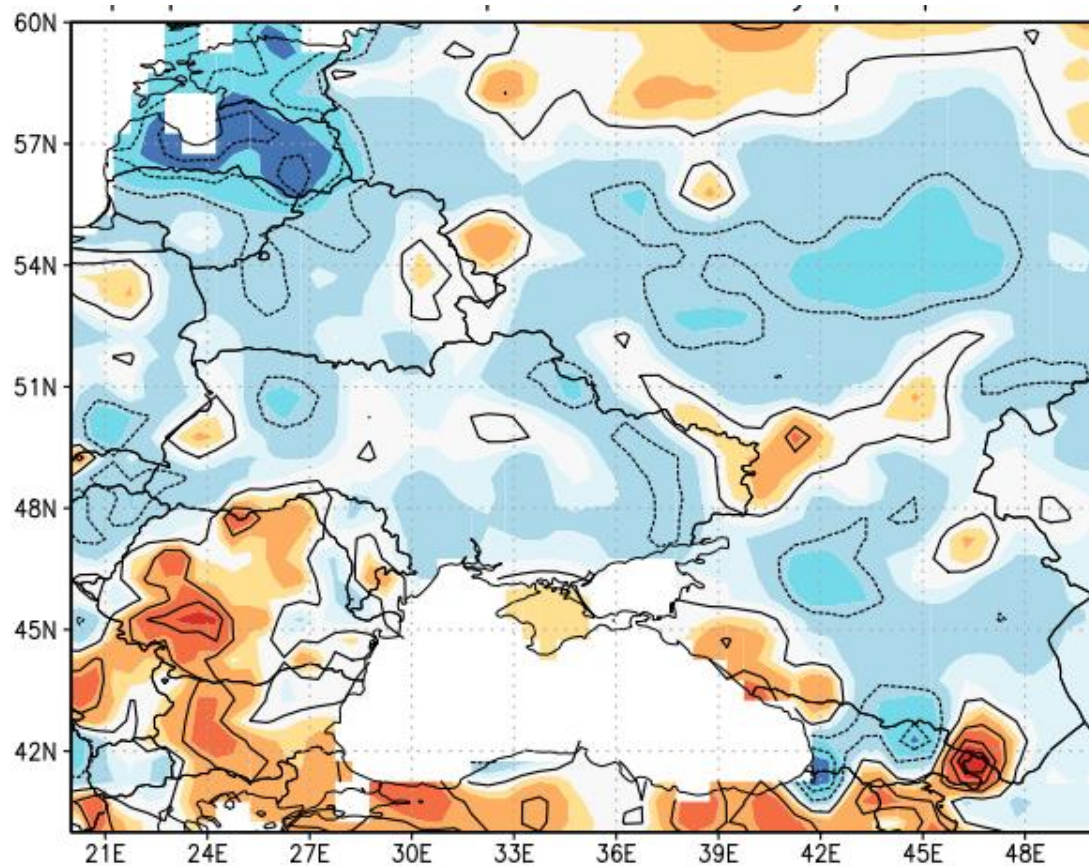


### The number of dead bee colonies

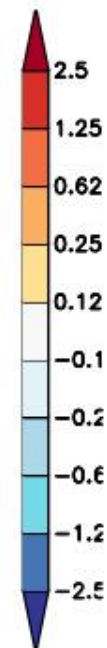


<https://agroportal.ua/publishing/rassledovaniya/izmenenie-klimata-vs-agrarii-pochemu-v-ukraine-massovo-gibnut-pchely/>

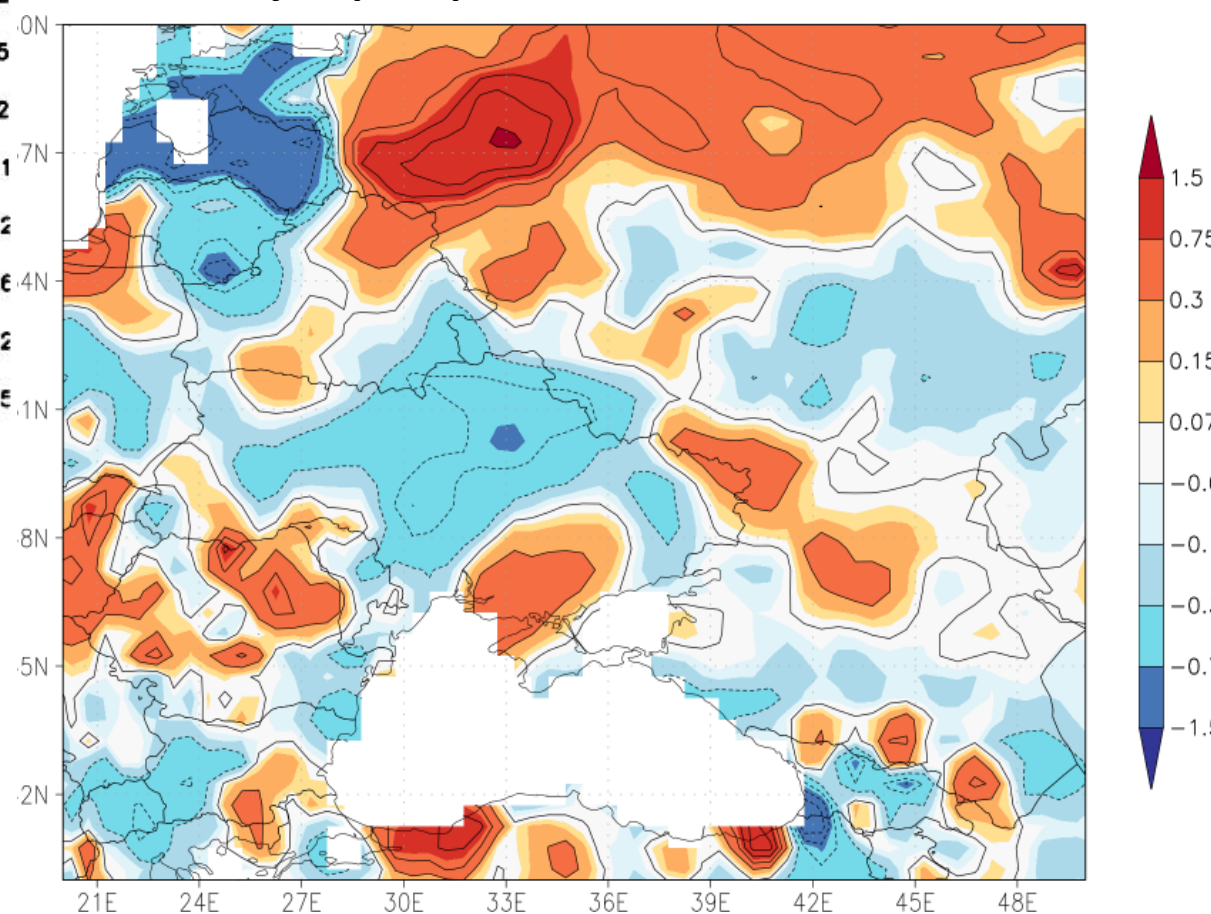




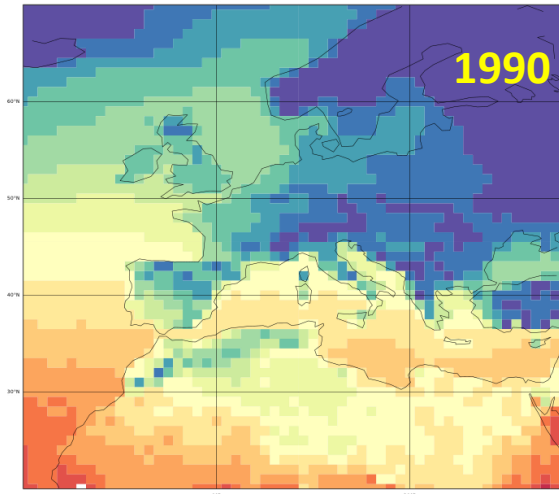
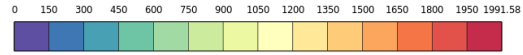
**Anomaly of precipitation for the warm half of 2018**



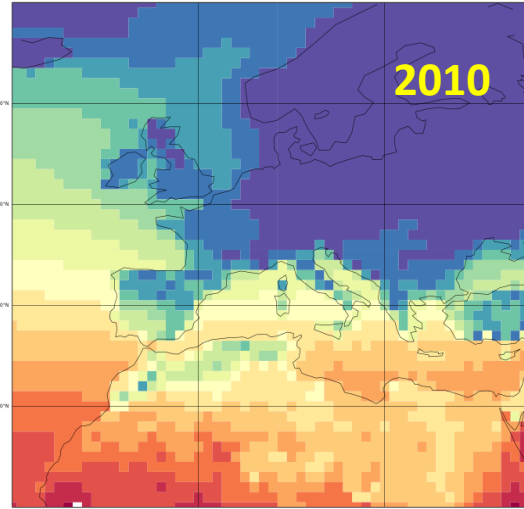
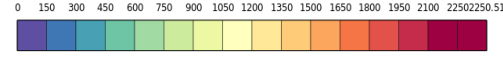
**Anomaly of precipitation for the warm half of 2019**



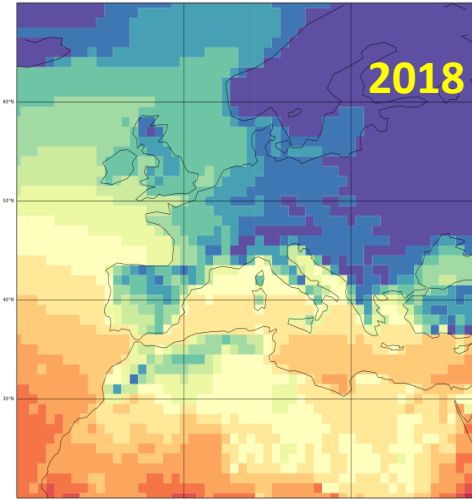
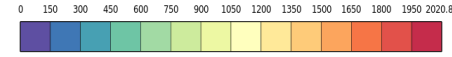
Growing Degree Days 1990 (above 0°C)



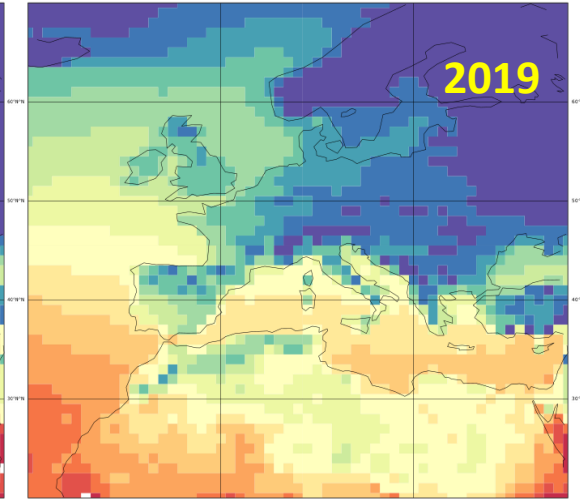
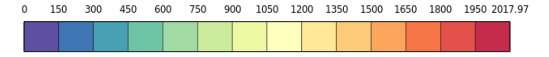
Growing Degree Days 2010 (above 0°C)



Growing Degree Days 2018 (above 0°C)

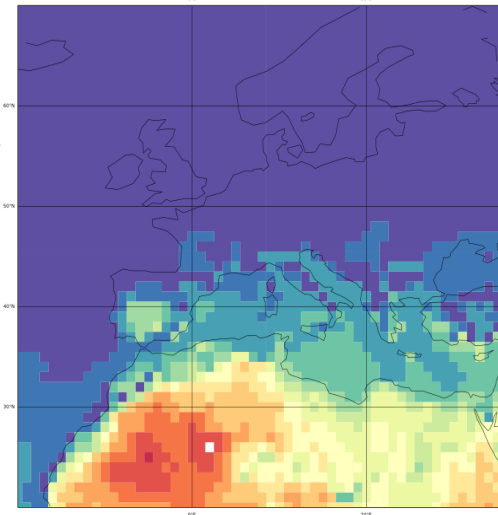
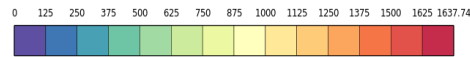


Growing Degree Days 2019 (above 0°C)

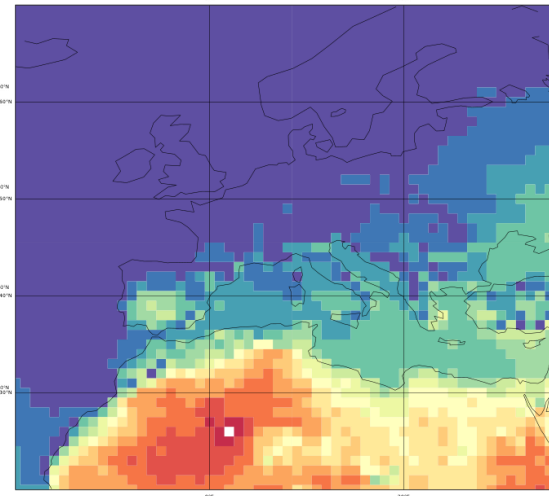
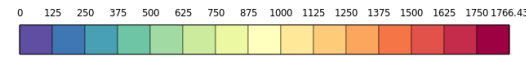


Calculate Growing Degree Days Index – Winter (Dec, Jan, Feb)

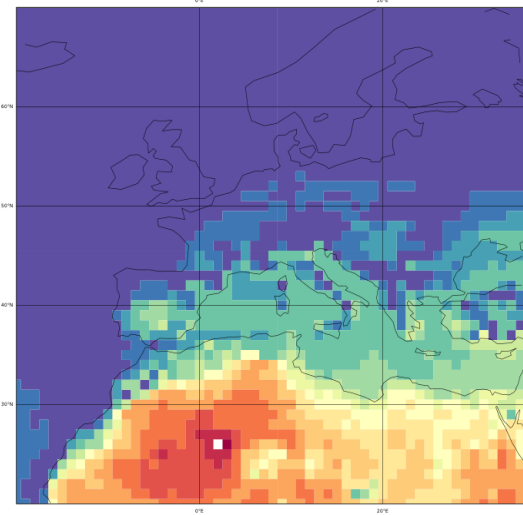
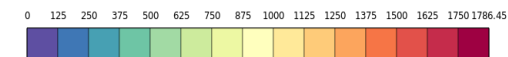
Growing Degree Days 1990 (above 20°C)



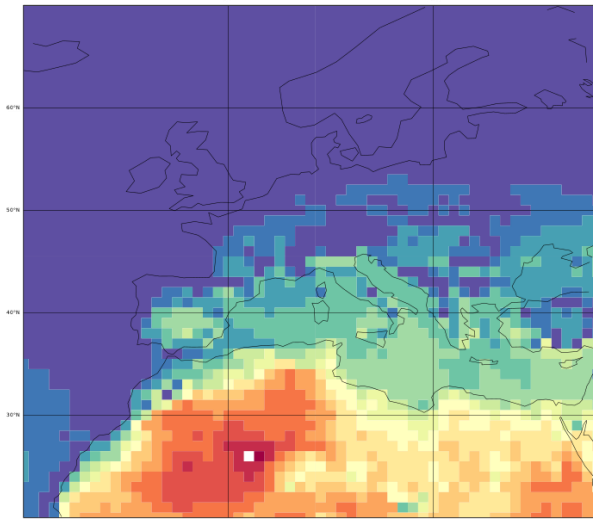
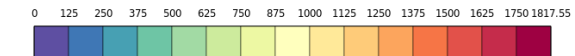
Growing Degree Days 2010 (above 20°C)



Growing Degree Days 2018 (above 20°C)

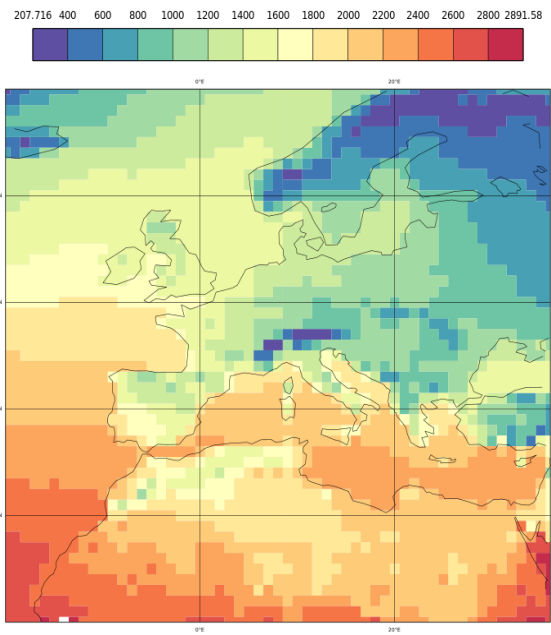


Growing Degree Days 2019 (above 20°C)

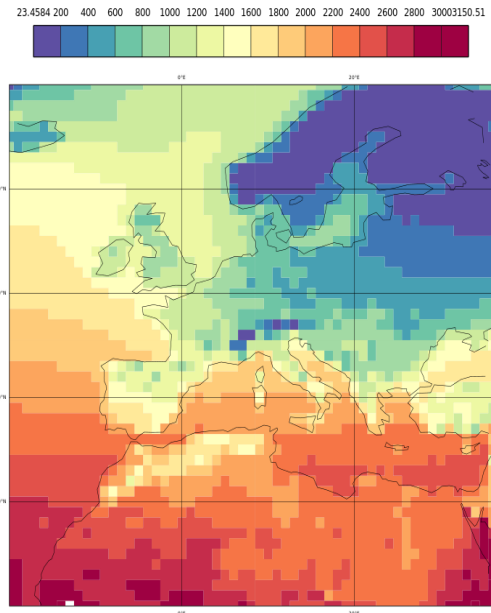


Calculate Growing Degree Days Index – Summer (Jun, Jul, Aug)

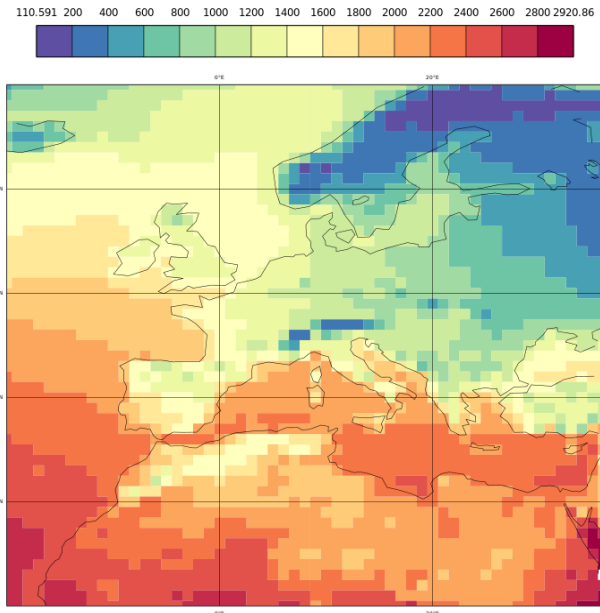
Growing Degree Days 1990 (above -10°C)



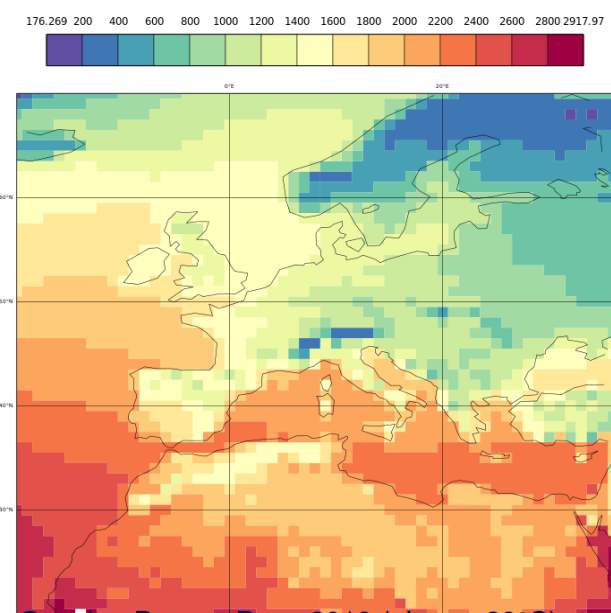
Growing Degree Days 2010 (above -10°C)



Growing Degree Days 2018 (above -10°C)

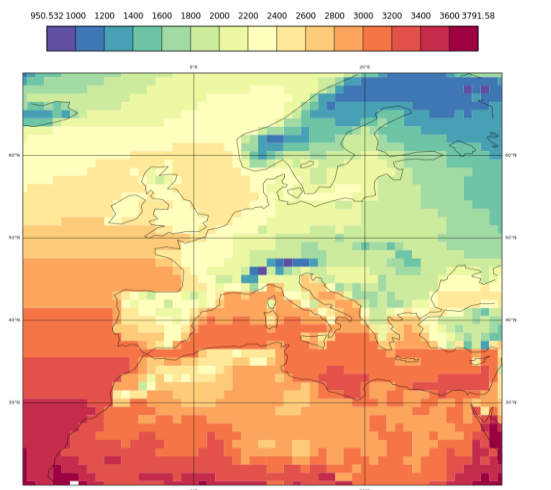


Growing Degree Days 2019 (above -10°C)

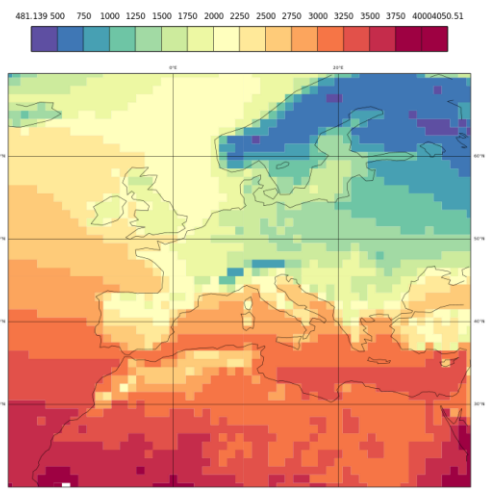


Growing Degree Days 2019 (above -20°C)

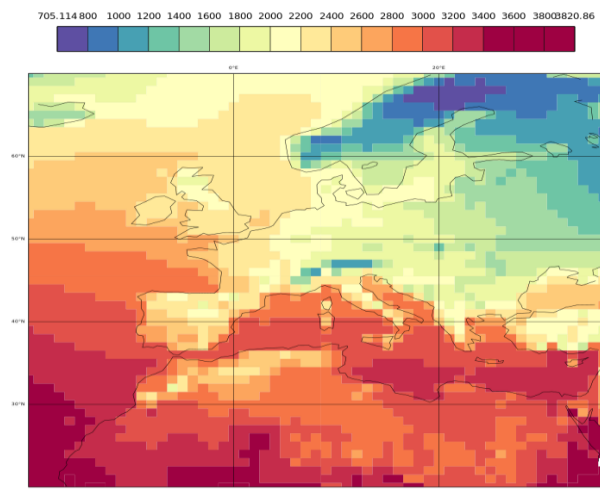
Growing Degree Days 1990 (above -20°C)



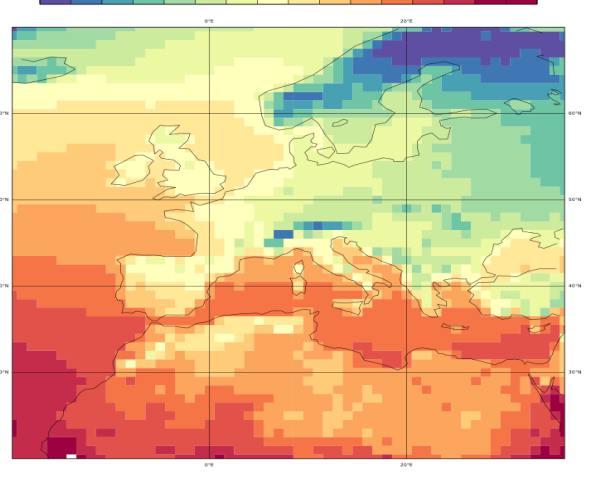
Growing Degree Days 2010 (above -20°C)



Growing Degree Days 2018 (above -20°C)

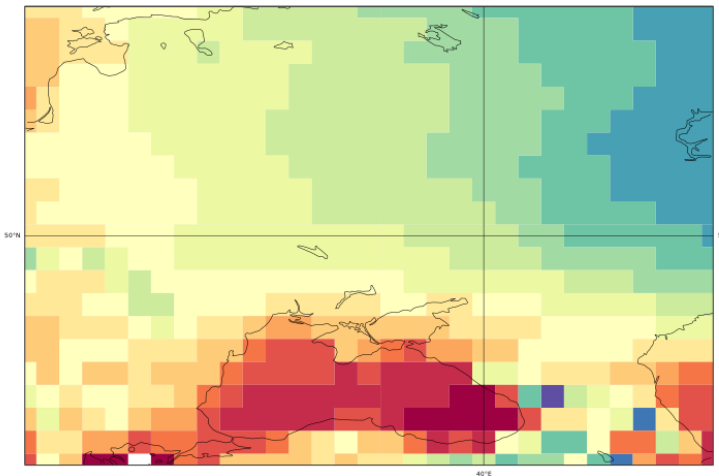
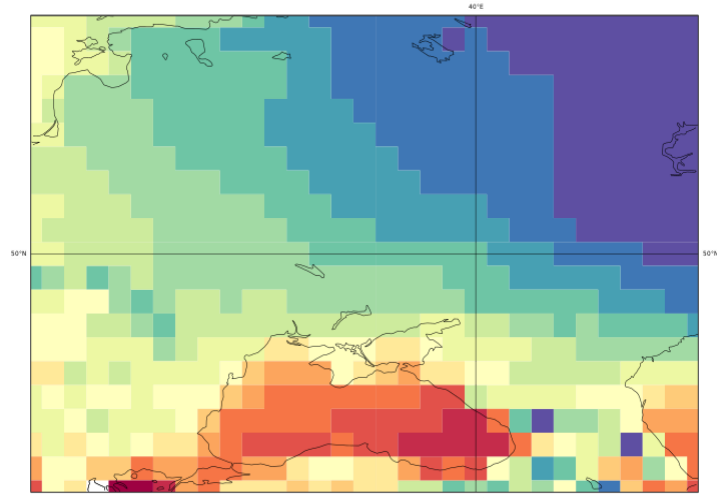
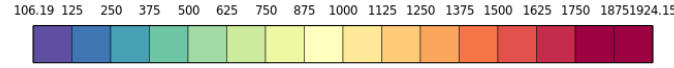
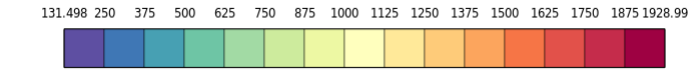


Growing Degree Days 2019 (above -20°C)



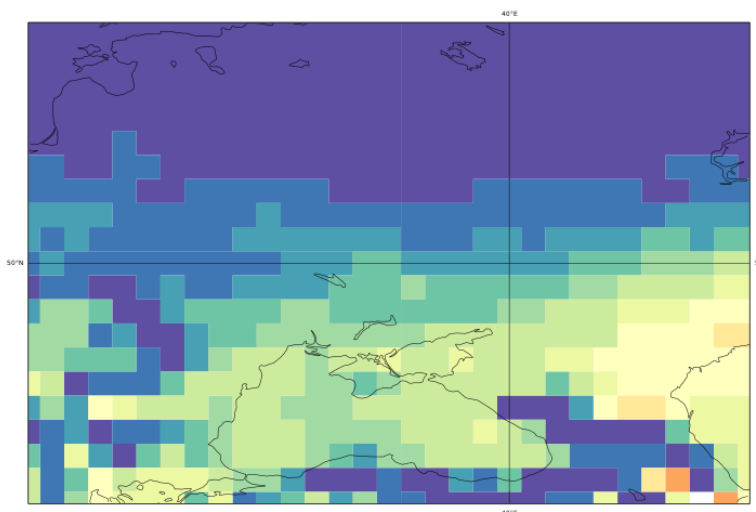
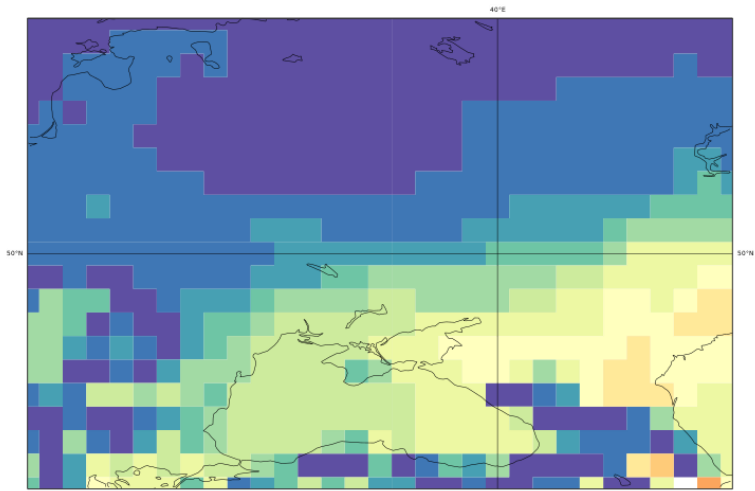
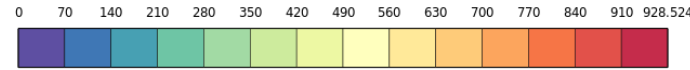
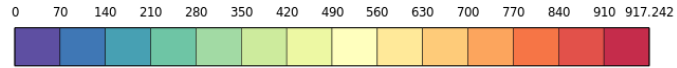
Growing Degree Days - Winter 2018 (above -10°C)

Growing Degree Days - Winter 2019 (above -10°C)



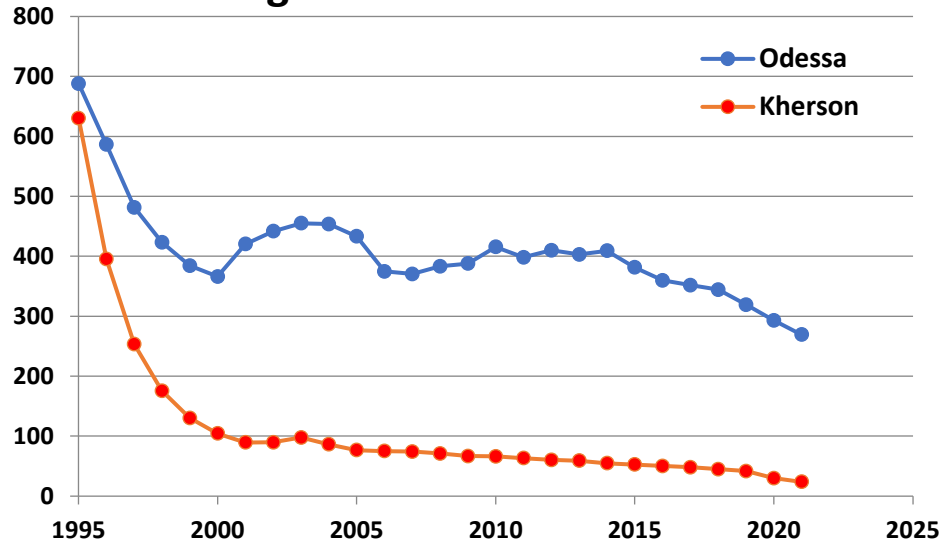
Growing Degree Days Summer 2018 (above 20°C)

Growing Degree Days Summer 2019 (above 20°C)



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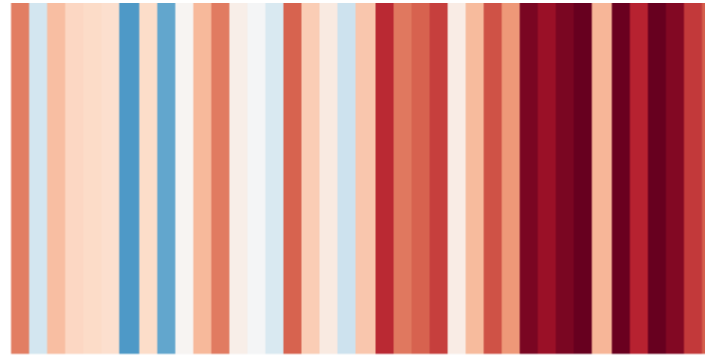
## Number of Sheep and Goats in Odessa and Kherson Region



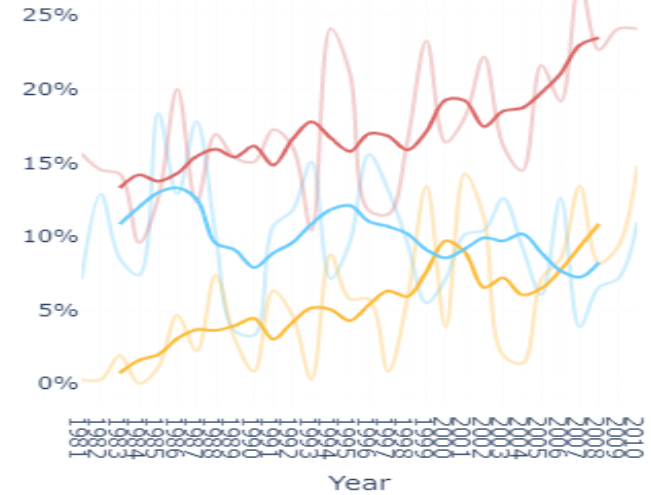
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<http://www.ks.ukrstat.gov.ua/ekonomichna-statistika/ekonomichna-diyalnist/silske-lisove-taribne-gospodarstvo/1754-2-1-8-1-silske-gospodarstvo/2031-tvarinnictvo-1995-2011-rr.html>

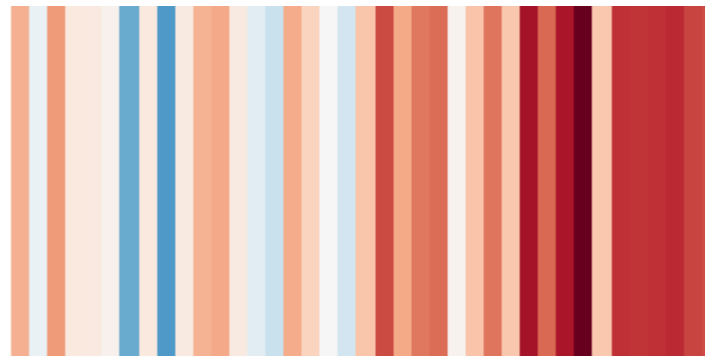
## Odessa – 1979-2018



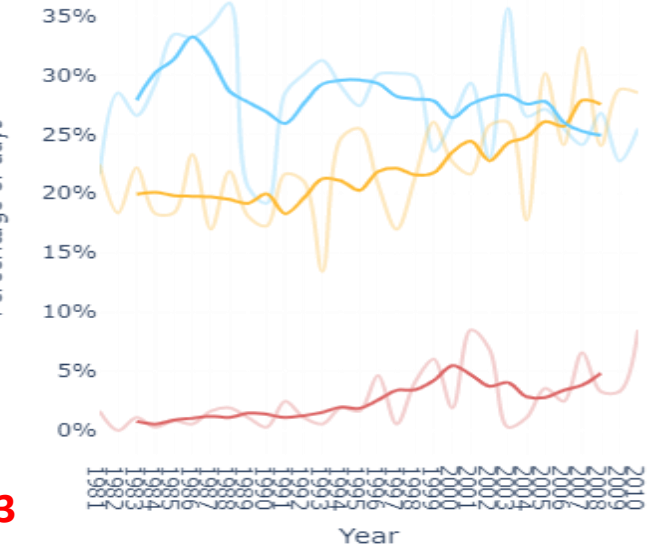
— Summer days (5 year average)  
 — Tropical nights (5 year average)  
 — Frost days (5 year average)



## Kherson - 1979-2018



— Summer days (5 year average)  
 — Tropical nights (5 year average)  
 — Frost days (5 year average)



# Conclusions

- 1. There is a tendency of an increase in air temperature and a decrease in precipitation on the territory of Ukraine, for the period from 1991 to 2020, especially in the southern regions, which in turn leads to the occurrence of drought .**
- 2. Relatively warm, snowless winters with temperature amplitudes from negative to positive temperatures, as well as abnormally hot summer months of 2018-2019, could become one of the reasons for the mass death of bees in Ukraine during this period.**
- 3. The number of goats and sheep according to official statistics in Odessa and Kherson regions has significantly decreased from 1995 to 2020. Perhaps, in addition to socio-economic factors, this is due to an increase in temperature and a decrease in precipitation.**



**Thank you for your attention**