

Porting a climate-air quality modelling system to the EGEE Grid

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The central task facing atmospheric scientists is to unite sufficiently **powerful science** and sufficiently **powerful computers** to create a numerical counterpart of Earth and its atmosphere in order to **manage climate and environmental risk with confidence in the years ahead.**

- The main objective of this work is to study **climate change** in the 21st century and its impact on air quality on a **regional scale**.
- General Circulation Models cannot provide information at scales finer than their computational grid (typically of the order of 200 km) and processes at the unresolved scales are important.
- Providing information at finer scales can be achieved through using high resolution in dynamical models.

- **RegCM3**

Regional Climate Model (<http://users.ictp.it/~pubregcm/>)

- Resolution: 50 km x 50 km
- Vertical Layers: 18 (up to 50hPa)
- Driven by GCM ECHAM5

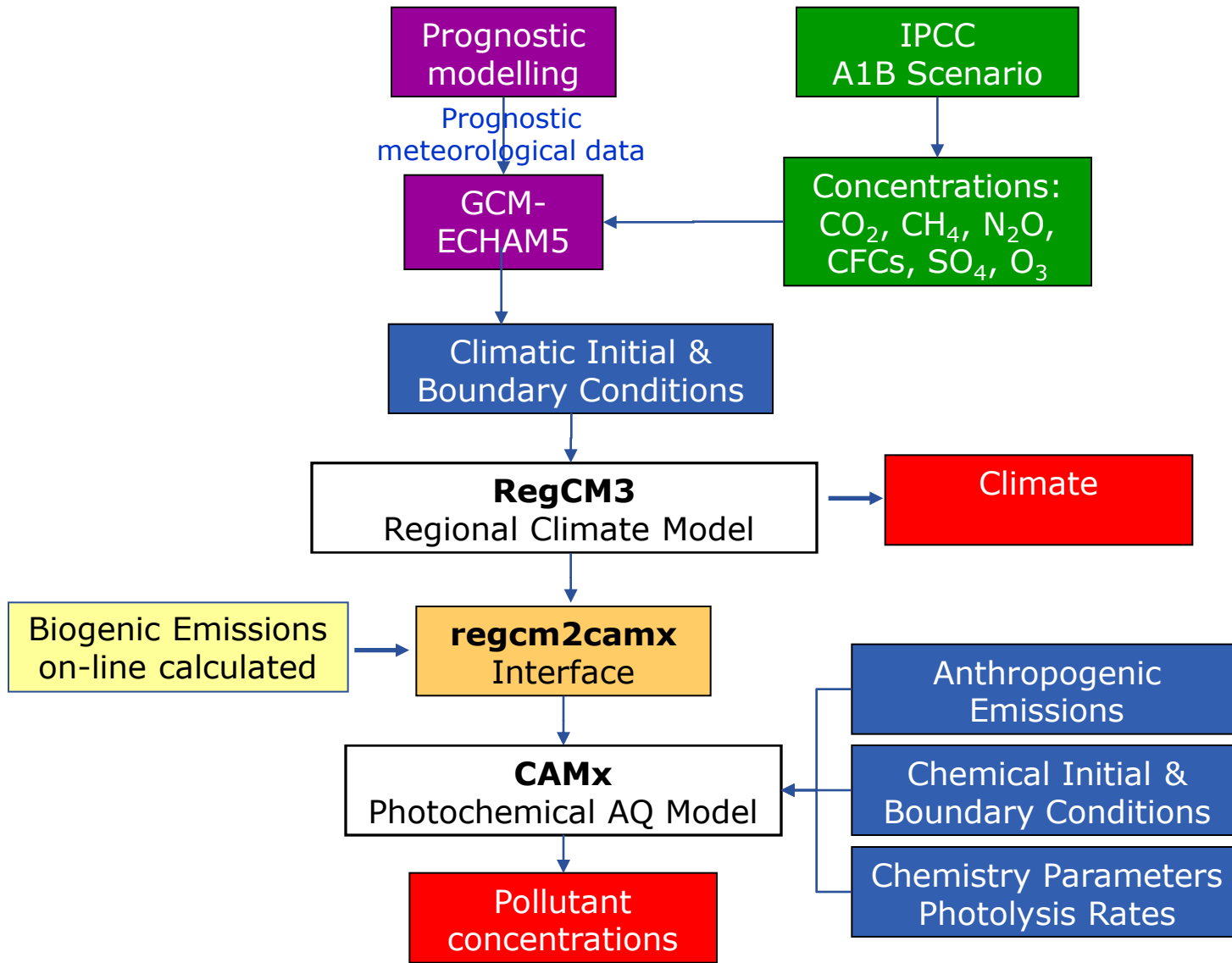
- **CAMx 4.40 (<http://www.camx.com>)**

Air quality chemistry model

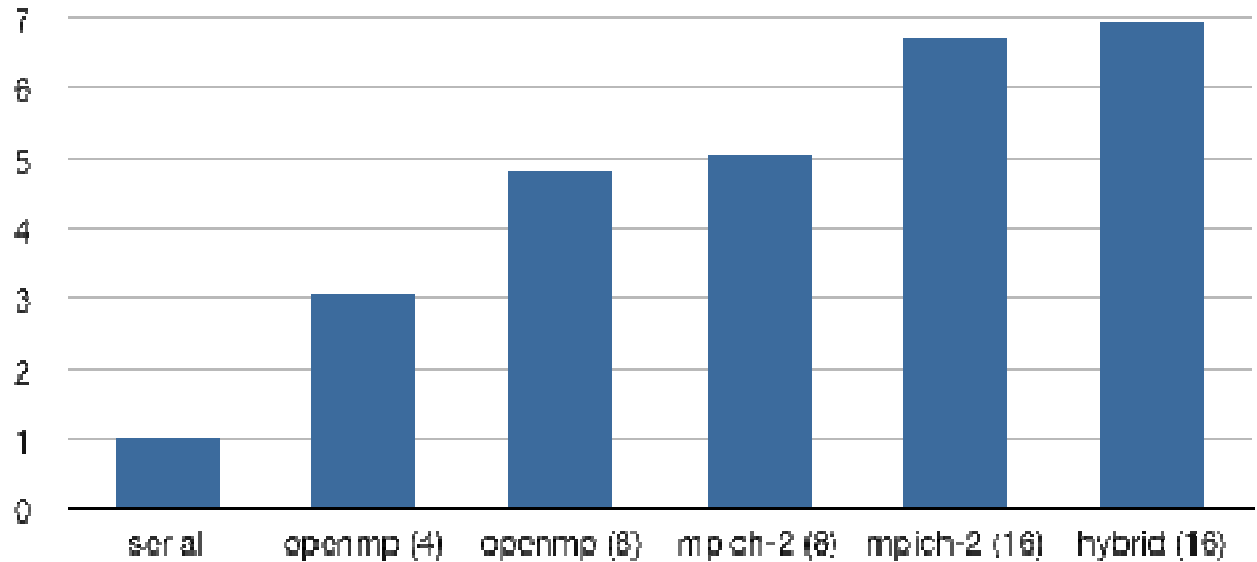
- Resolution: 50 km x 50 km
- Vertical Layers: 12 (up to 6.5 km)
- Chemistry Mechanism: CB(IV)

- **Emissions**

- Anthropogenic: EMEP database
- Biogenic: On-line calculated (temp. + rad. dependent)

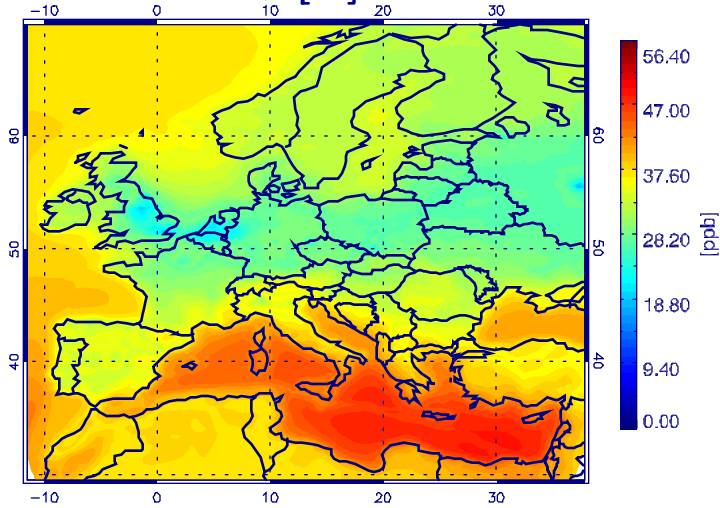


- Parallel (MPI) version of RegCM3 has been used
- Developed a modified version of the Gram module for Icg-CE to allow WN reservations for OpenMP jobs
 - <http://tinyurl.com/job-manager-pbs-fix>
 - Environment = {"OPENMP=true"};
- CAMx 5.10 supports MPI, OpenMP and Hybrid execution

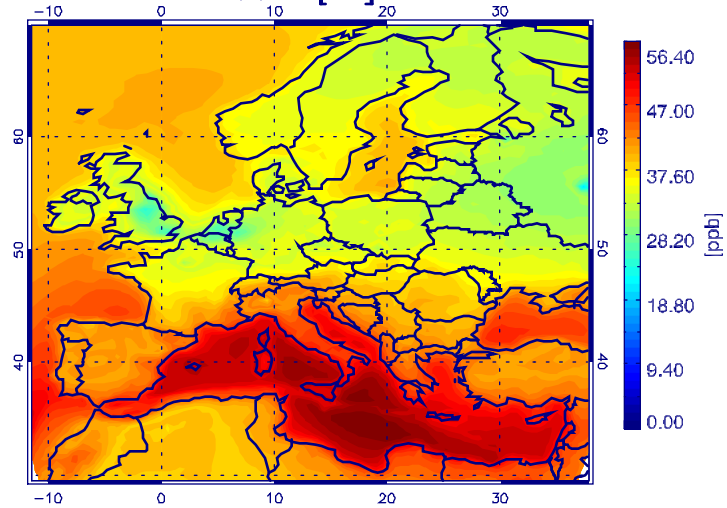


- ECHAM control run : 1991-2000
RegCM3 forced by GCM ECHAM5
- FUT1 run: 2041-2050
RegCM3 forced by GCM ECHAM5 using IPCC A1B scenario
- FUT2 run: 2091-2100
RegCM3 forced by GCM ECHAM5 using IPCC A1B scenario

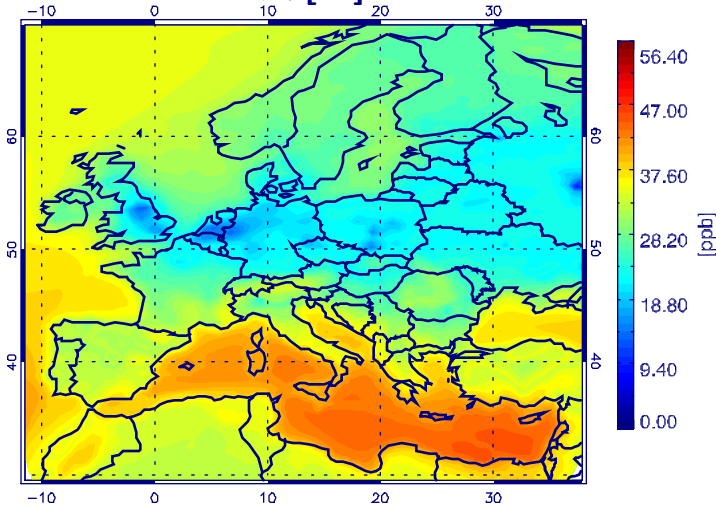
Season: SPRING [O3] echam 1991_2000



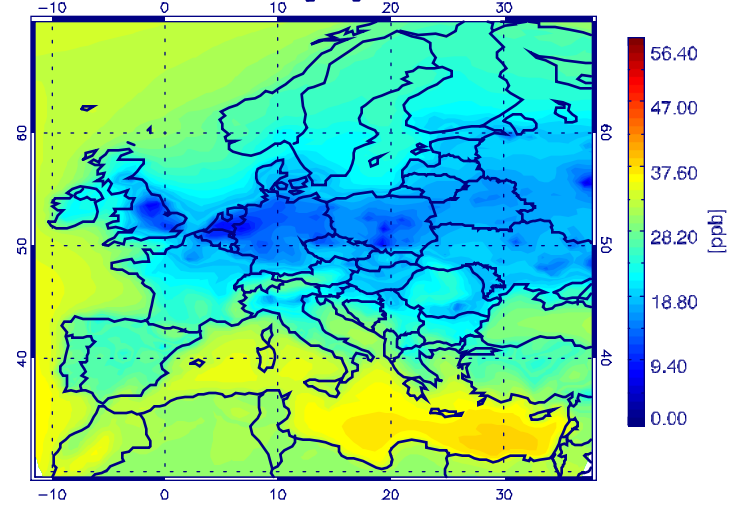
Season: SUMMER [O3] echam 1991_2000

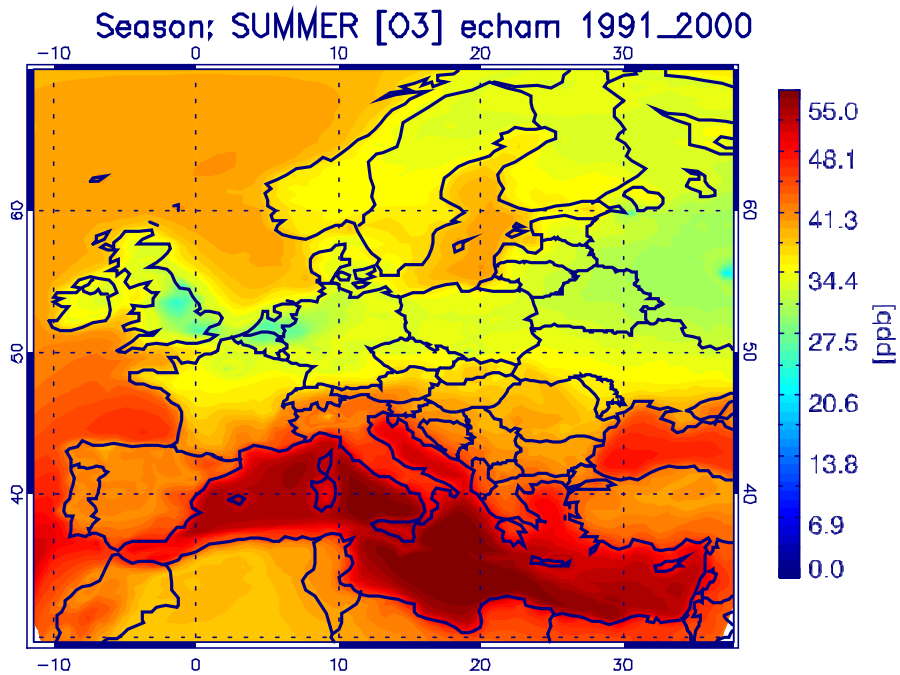


Season: AUTUMN [O3] echam 1991_2000

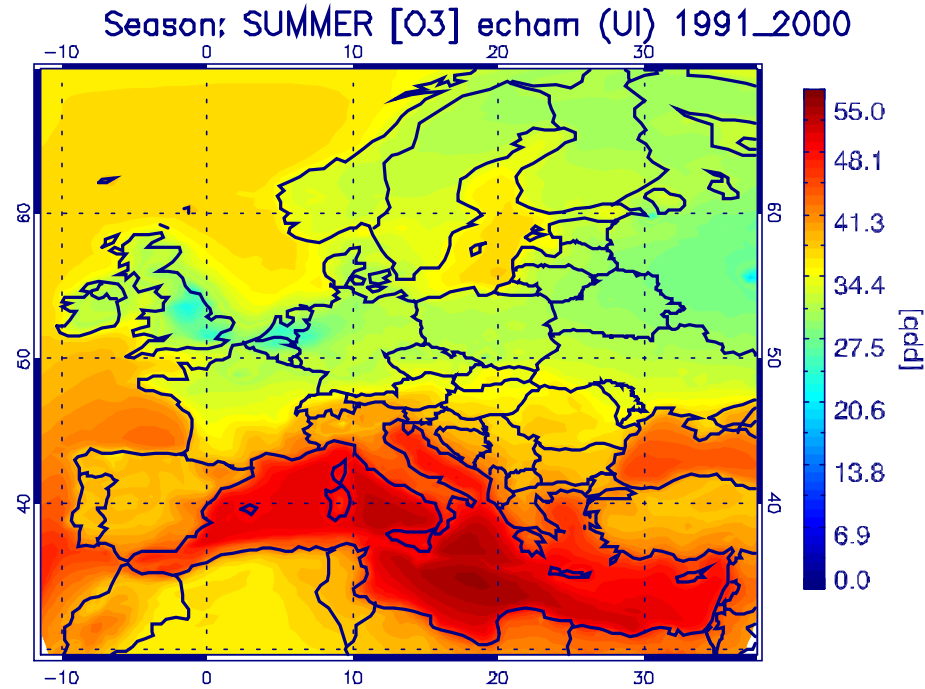


Season: WINTER [O3] echam 1991_2000



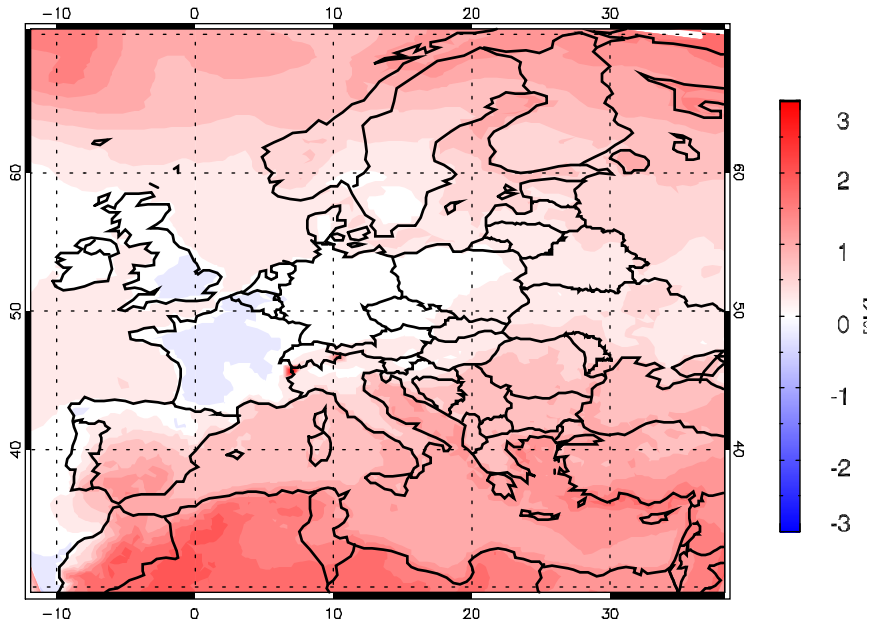


V9.1

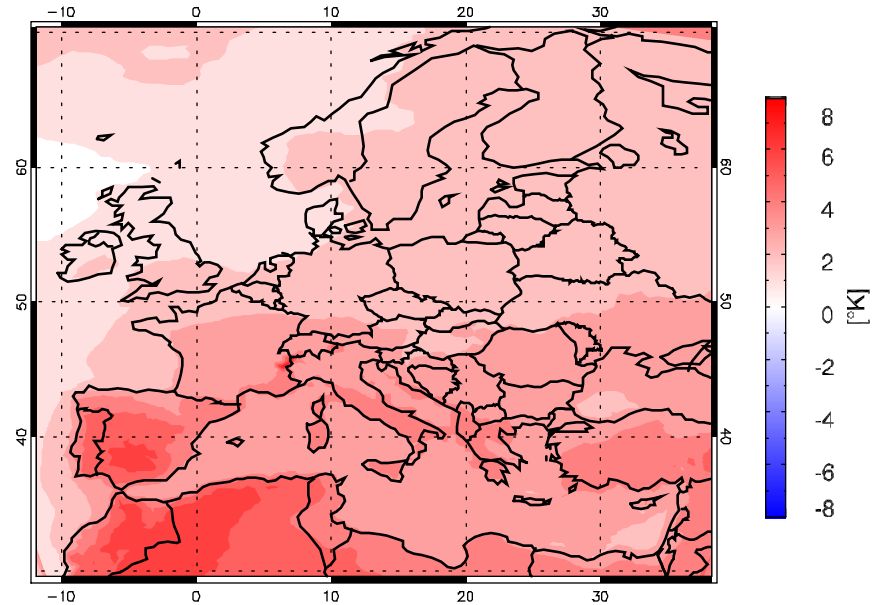


V10.1

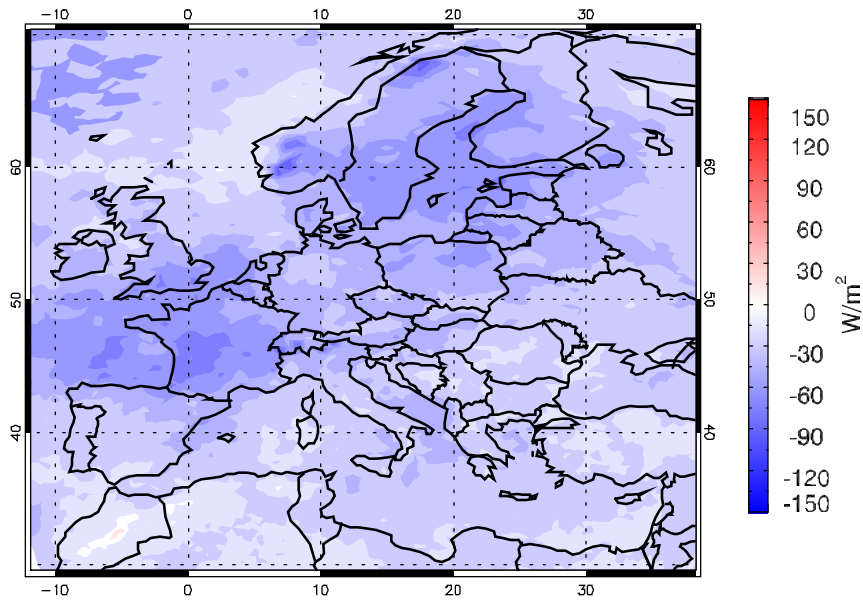
Season: SUMMER [TEMP] (2041_2050) – (1991_2000)



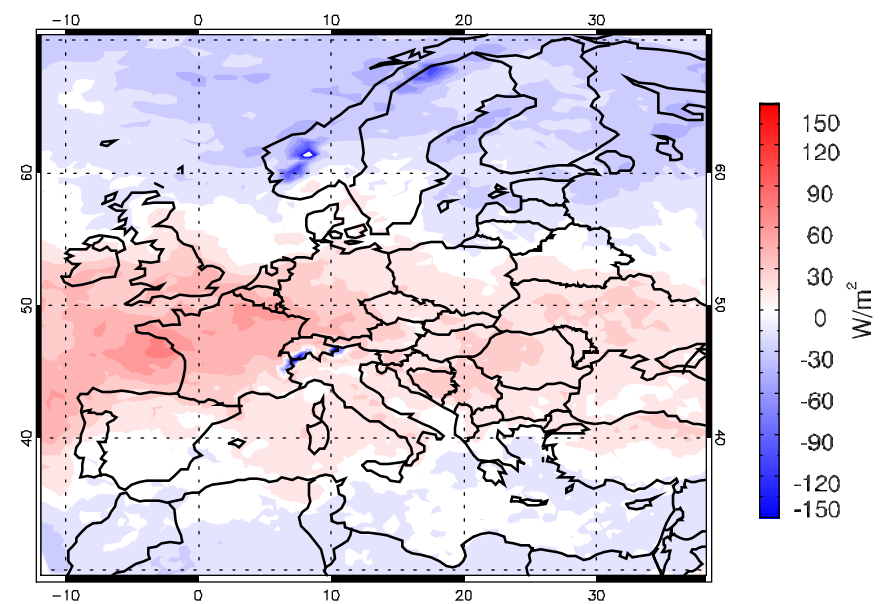
Season: SUMMER [TEMP] (2091_2100) – (1991_2000)



Season: SUMMER [SOLRAD] (2041_2050) – (1991_2000)

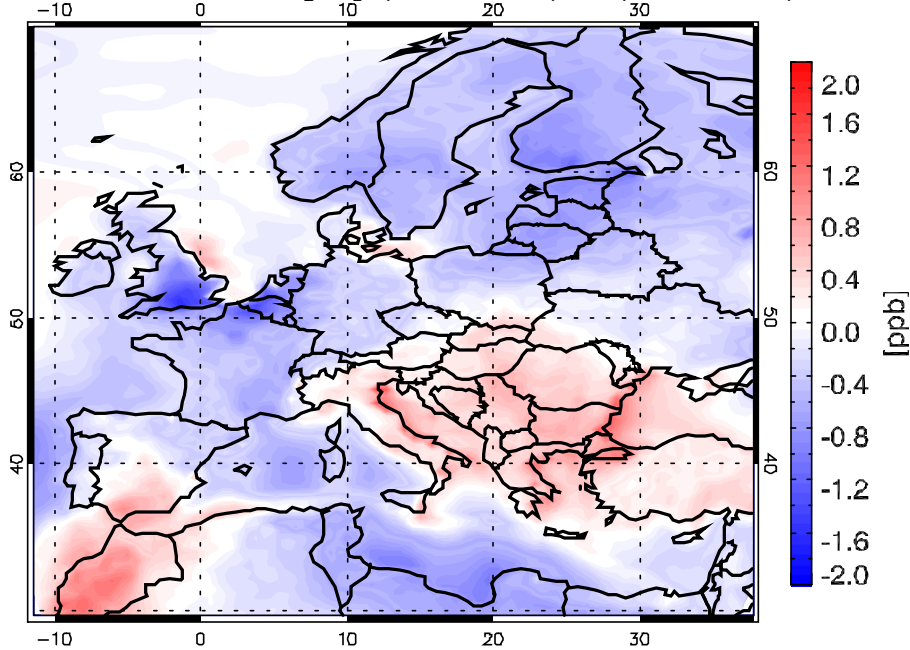


Season: SUMMER [SOLRAD] (2091_2100) – (1991_2000)

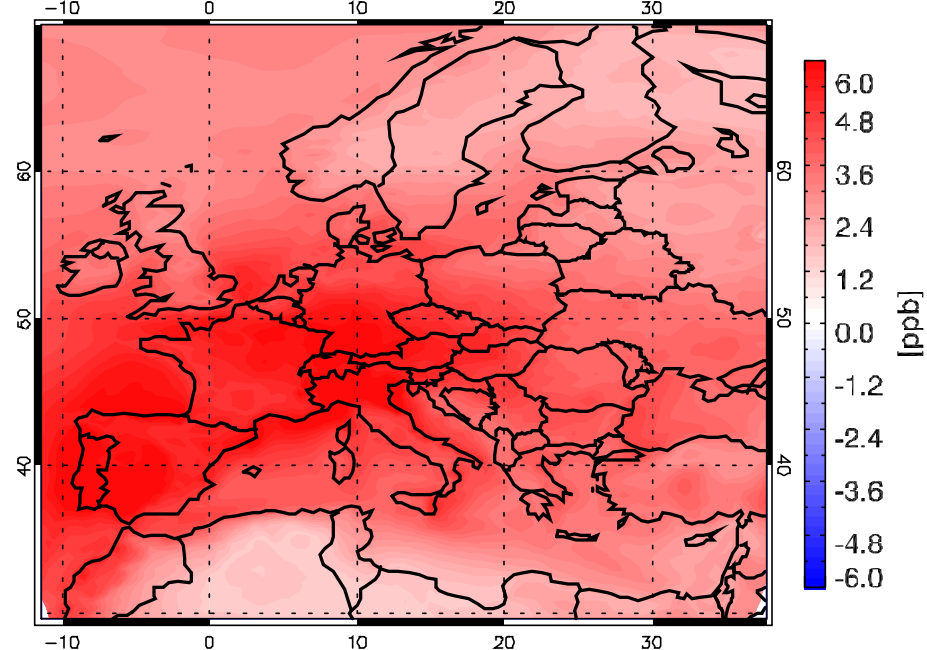


Projected changes in surface Ozone

Season: SUMMER [O3] (2041_2050) - (1991_2000)



Season: SUMMER [O3] (2091_2100) - (1991_2000)



- Average decadal seasonal surface ozone variation well captured.
- Temperature and solar radiation increases considerable by the end of the century
- Changes in circulation patterns trigger multiple changes in meteorological parameters including clouds, solar radiation, temperature and winds which all impact on surface ozone.
- The change of average ozone due to climate change is less than 1ppb in the first half of the century
- The increase of surface ozone may reach up to 6 ppb at the end of the century, depending on the region.