Historical and Future Typical Meteorological Years for 33 locations in Greece: A handy tool for various applications

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The concept of the Typical Meteorological Year (TMY) was firstly introduced in the late 1970s in USA (Crow 1970; 1980; 1983), as a design tool for approximating expected climate conditions at specific locations, at a time when computers were much slower and had less memory than today.

A TMY is a collation of selected weather data (meteorological and solar radiation elements) for a specific location, for one-year period, generated from a data bank of at least 10 years in duration, using a statistical methodology (Danish method, Festa-Ratto, Modified Sandia National Laboratories).

It is specially selected so that it presents the range of weather phenomena for the location in question, while still giving annual averages that are consistent with the long-term averages for the specific location.

TMY is NOT the Average Meteorological Year.

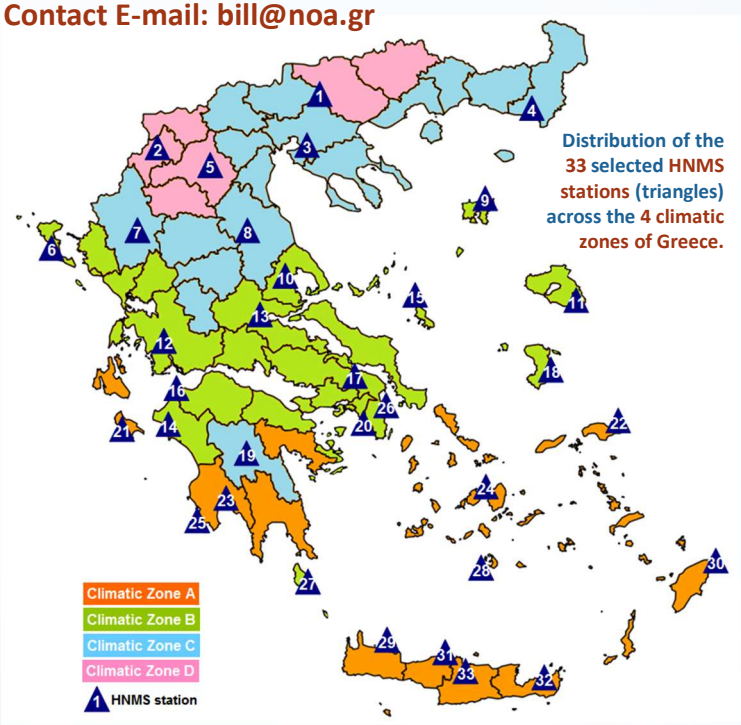
TMY sets remain in popular use until today consisting a handy tool between building designers and renewable energy systems engineers, providing them with a relatively concise set of data for system performance estimates, without the need of incorporating large amounts of data into simulation models (commercial packages that use TMYs: TRNSYS, Energy+, PV*SOL, PVscout, Pvsystand).

TMY sets for 33 locations in Greece distributed all over the country were developed, covering for the first time all four climatic zones, and for both HISTORIC and FUTURE periods.

Historical TMY sets generation was based on meteorological data collected from the Hellenic National Meteorological Service network in Greece in the period 1985-2014 (30 years), while the corresponding total solar radiation values have been derived through the Meteorological Radiation Model (MRM).

Future TMY sets generation was based on bias-adjusted daily data for the closest grid point from the RCA4 Regional Climate Model (Swedish Meteor. & Hydrological Inst.) driven by the Earth system model of the Max Planck Institute for Meteorology (MPI-M).

With 30 years of data, all of the shorter-term weather variations are included, such as those caused by El Niño and La Niña episodes, or even the 11- or 22-year sunspot cycle. The short-cycle events that can last several years definitely influence the resulting means or persistence measures.



Examined periods for TMYs generation
HISTORIC : 1985-2014
FUTURE : 2021-2050, 2046-2070, 2071-2100
for two IPCC scenarios, RCP4.5 and RCP8.5 .

Horizontal RCA4 model resolution:
0.11° (~12 x 12 km)

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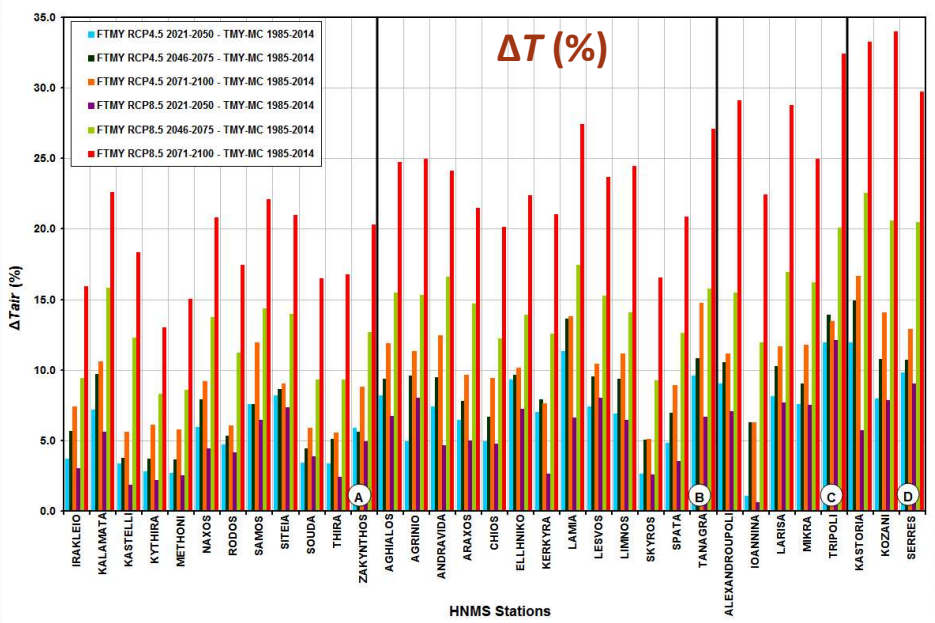

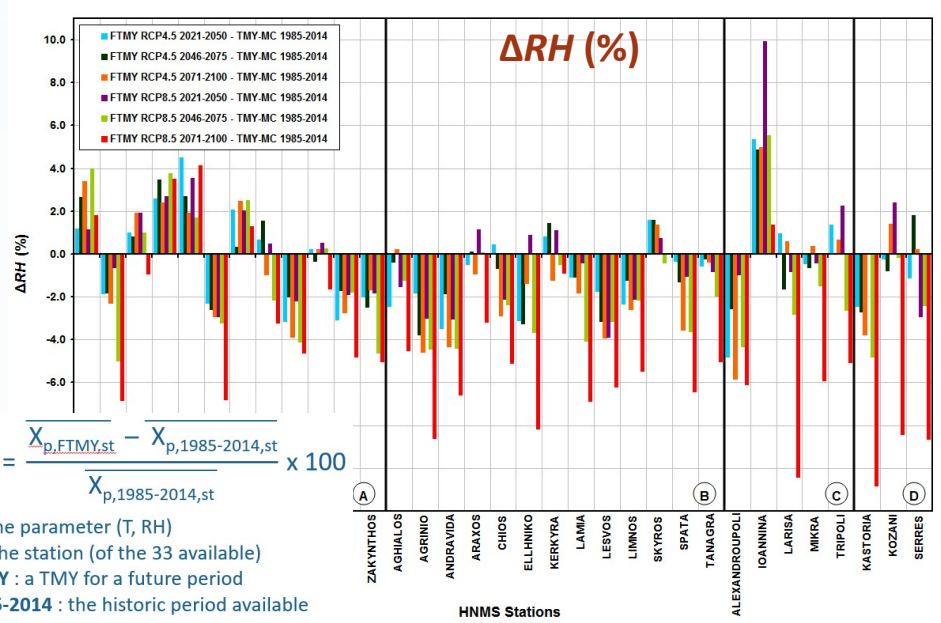

$$\Delta x_p = \frac{\overline{X_{p,FTMY,st}} - \overline{X_{p,1985\text{-}2014,st}}}{\overline{X_{p,1985\text{-}2014,st}}} \times 100$$

p : the parameter (T, RH)
st : the station (of the 33 available)
FTMY : a TMY for a future period
1985-2014 : the historic period available

SCREEN CAPTURE NOT ALLOWED

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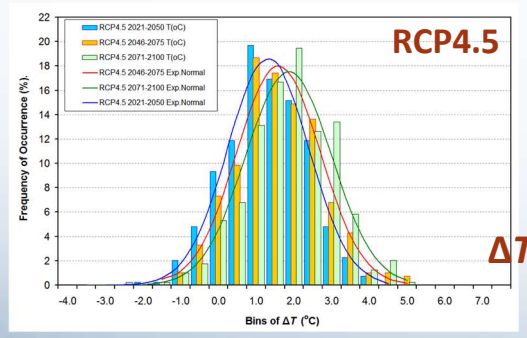
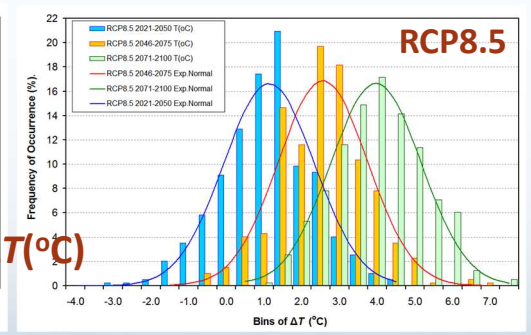
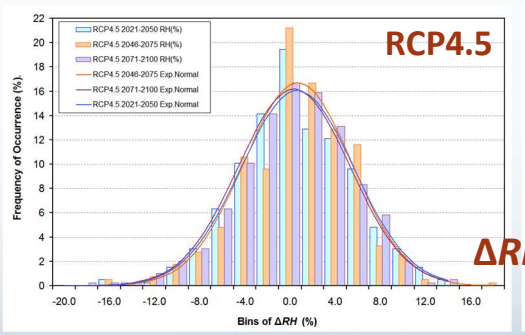
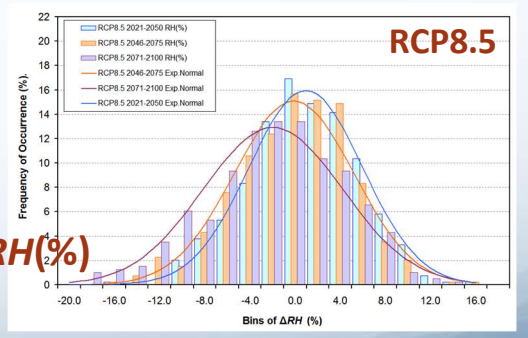
Percentage changes of air temperature (*T*) and relative humidity *(RH*) between Future TMYs (3 future periods with 2 climatic scenarios each) and the Historical one (1985-2014), as calculated for each from the 33 HNMS stations under study (ratio equation above).





ΔT(°C)





ΔRH(%)

Distribution histograms of the differences ΔT(°C) and ΔRH(%) of the parameters *T* and *RH*, between the historical 1985-2014 and respective Future TMYs, for all 33 HNMS stations, for the three study future periods and for both IPCC scenarios. Colored curves represent the expected Normal distribution.

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"Development of synergistic and integrated methods and tools for monitoring, management and forecasting of environmental parameters and pressures"