Comment 3: Model and forecast of global climate (Rain and temperature) based on multidecada lagged responses to SST-epac changes.

In order to complement the ESD-2021-84 paper in discussion with shorter temporal scales, the present comment is associated to the global and monsoon rainfalls and its lagged influences of Eastern Pacific (EPac).

Although the atmosphere-ocean connection between the EEPac and the hydroclimate of the rest of the world is not as slow as the oceanic transports mentioned in the ESD-2021-84 paper in discussion, however the "trade winds" and the associated surface currents, transport the heat and water vapor to the western regions in a "faster way" that influence rainfalls several decades later.

The three largest continents, Asia, America and Africa, are affected by monsoon rains (Wang et al., 2012; 2020). As part of the ESD-2021-84 work, delayed solar influence are analyzed on rainfall for four countries, located in those continents, and for global scales. The annual accumulated rainfalls, coming from CRU/UEA(2022), in four countries: India, China, Nigeria and Mexico (IN, CH, NG & MX) over the period 1901-2020 are analyzed. The rains mentioned are shown in Figure 3.1.

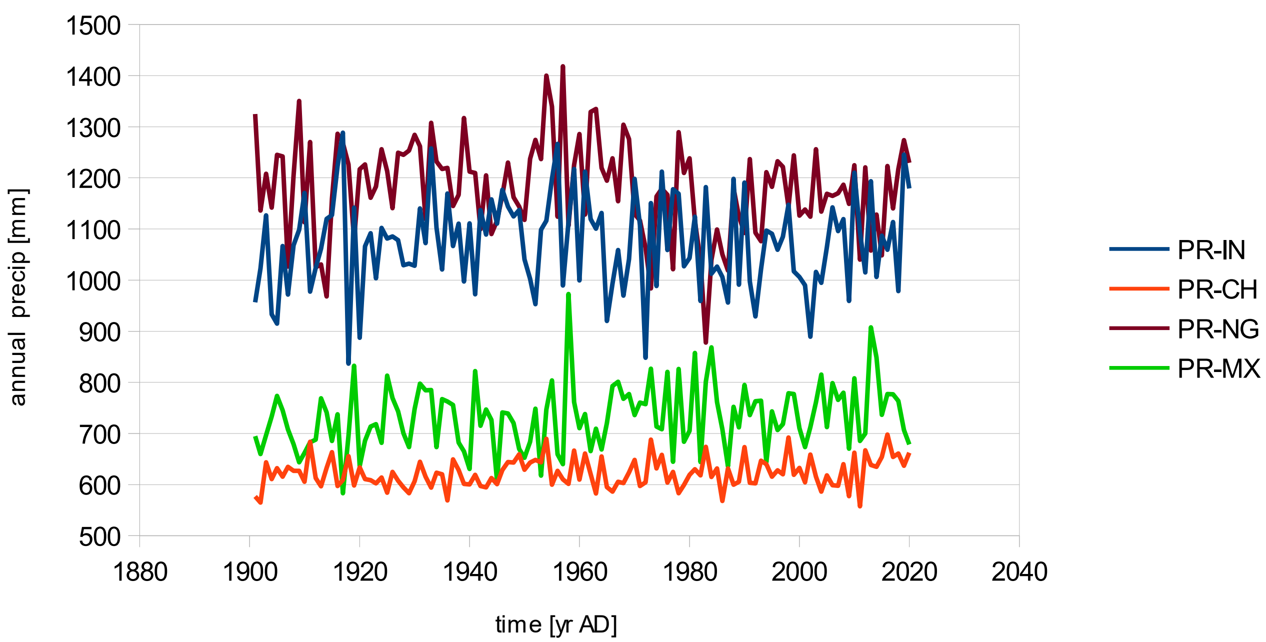

Figure 3.1 Annual accumulated rainfalls, coming from CRU/UEA(2022), in four countries: India, China, Nigeria and Mexico (PR-IN, PR-CH, PR-NG & PR-MX) over the period 1901-2020.

The annual accumulated rainfalls in IN, CH, NG and MX, are analyzed with respect to the SSTepac, record. Figures 3.2-3.5 shows the explanation of four national accumulated rainfalls based on solar influence (expressed through the SSTepac). The delays of those national rainfall records of India (IN), China (CH), Nigeria (NG) and Mexico (MX), respect the SSTepac, are 40, 35, 51 and 41 years, respectively.

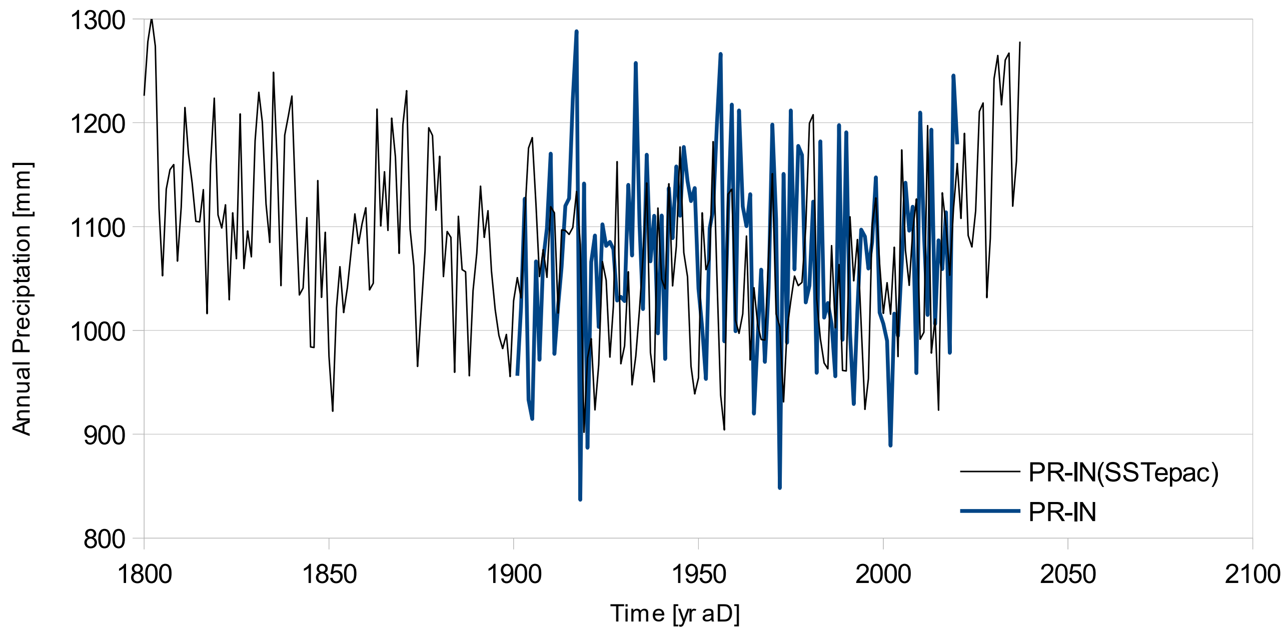

Figure 3.2 Annual accumulated rainfalls, coming from CRU/UEA(2022) for India (PR-IN) over the period 1901-2020 and extended thanks to the SSTepac records, and its lagged influences.

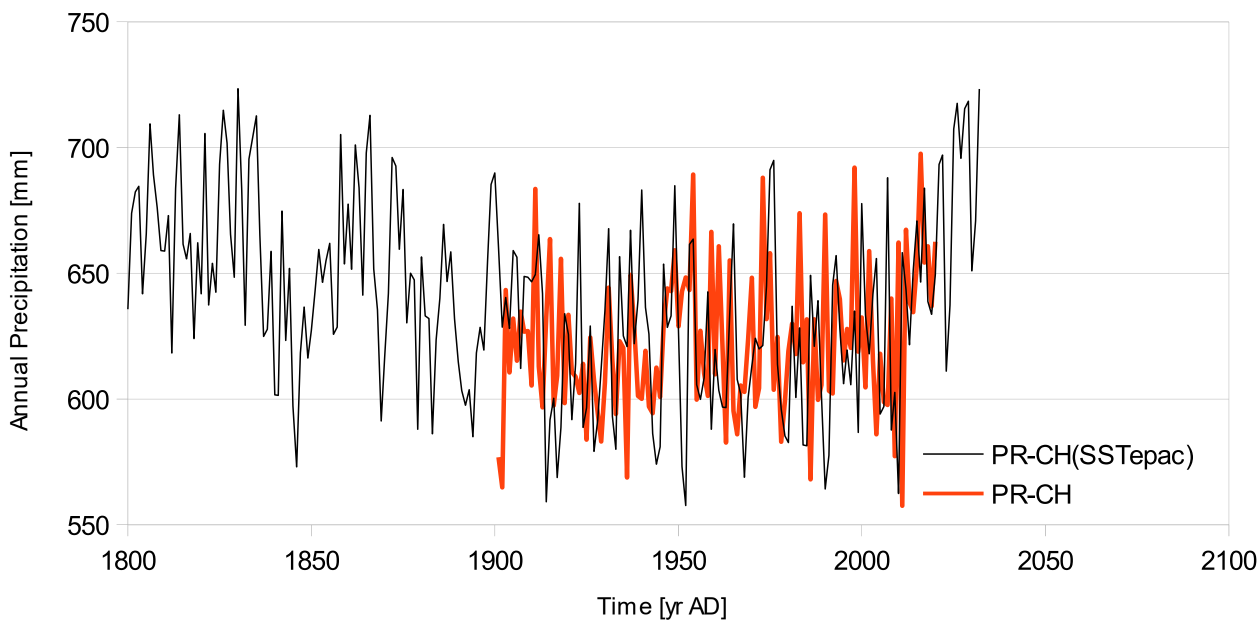

Figure 3.3 Annual accumulated rainfalls, coming from CRU/UEA(2022) for China (PR-CH) over the period 1901-2020 and extended thanks to the SSTepac records, and its lagged influences.

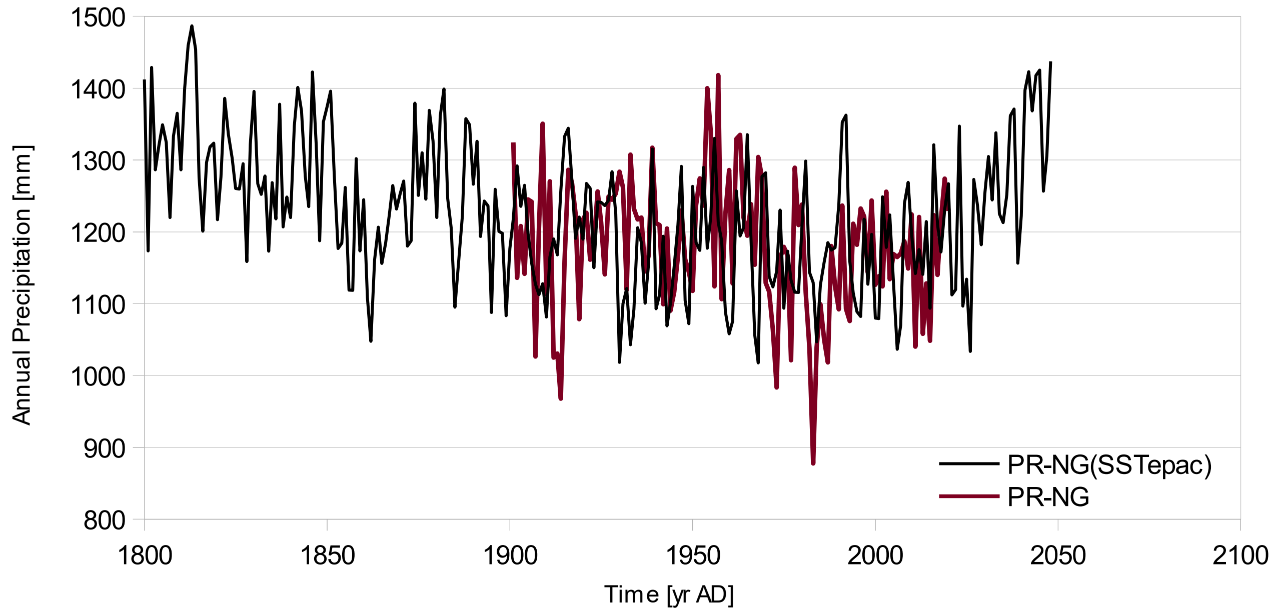

Figure 3.4 Annual accumulated rainfalls, coming from CRU/UEA(2022) for Nigeria (PR-NG) over the period 1901-2020 and extended thanks to the SSTepac records, and its lagged influences.

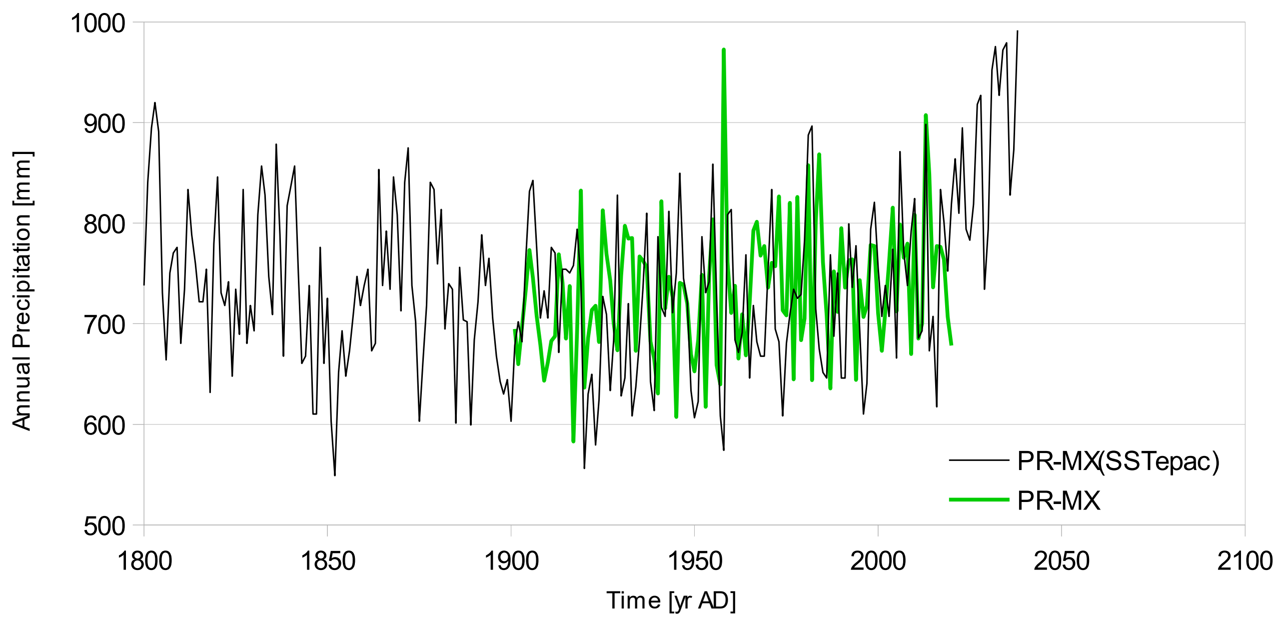

Figure 3.5 Annual accumulated rainfalls, coming from CRU/UEA(2022) for Mexico (PR-MX) over the period 1901-2020 and extended thanks to the SSTepac records, and its lagged influences.

The importance of delayed SSTepac influences shoud be evaluated not only in the four analyzed country records associated with the global monsoon, but in the global rainfall.

To better develop this global anaylsis it is convenient to extent the SSTepac record considering the ENSO EN12 SST record. It is displayed in Figure 3.6 where SSTepac values are extrapolated, thanks to N12 SST values, after to be calibrated over the period 1856-2000.

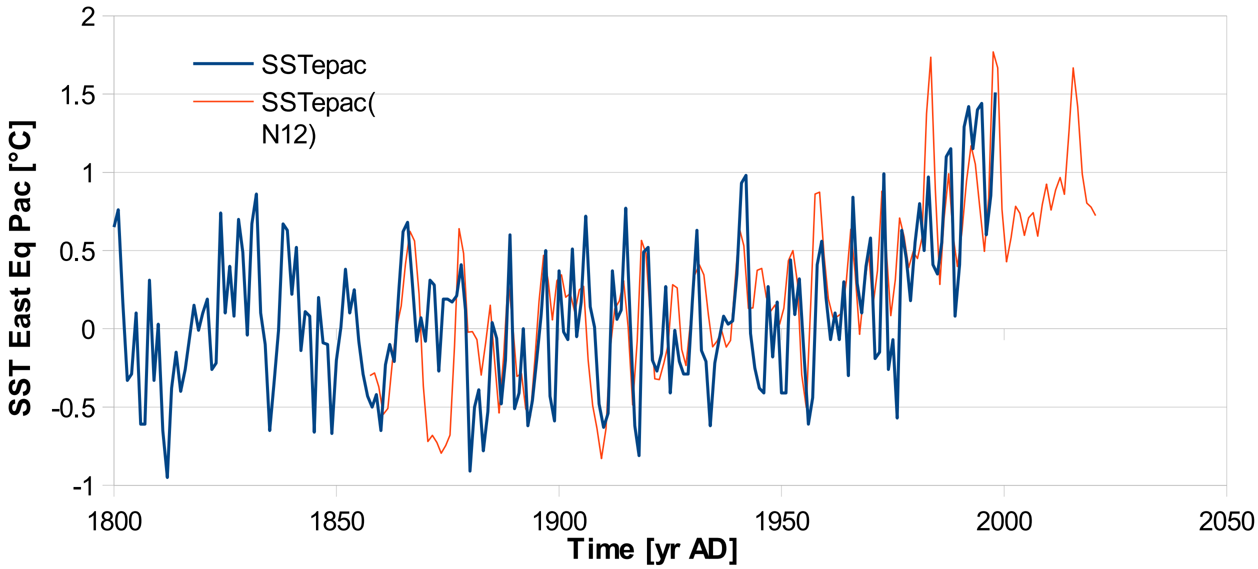

Figure 3.6 SSTepac compared with Niño12 SST. The annual mean N12-SST values help to extend the SSTepac record over the period 2000-2021.

We have employed the KNMI Climate Explorer (KNMI, 2022) provides a Spatial statistic of NOAA/NCDC gridded GHCN v2 for global land precipitation anomalies. The global average values were estimated through the same database (KNMI, 2022) but using the CRU/UEA precipitation data over land. In Figure 3.7, the global precipitation PG, is expressed as a linear function of the lagged eastern Pacific sea surface temperature [SSTepac]. The lag employed is 43 years, that minimize the error between PrecGLO and its model.

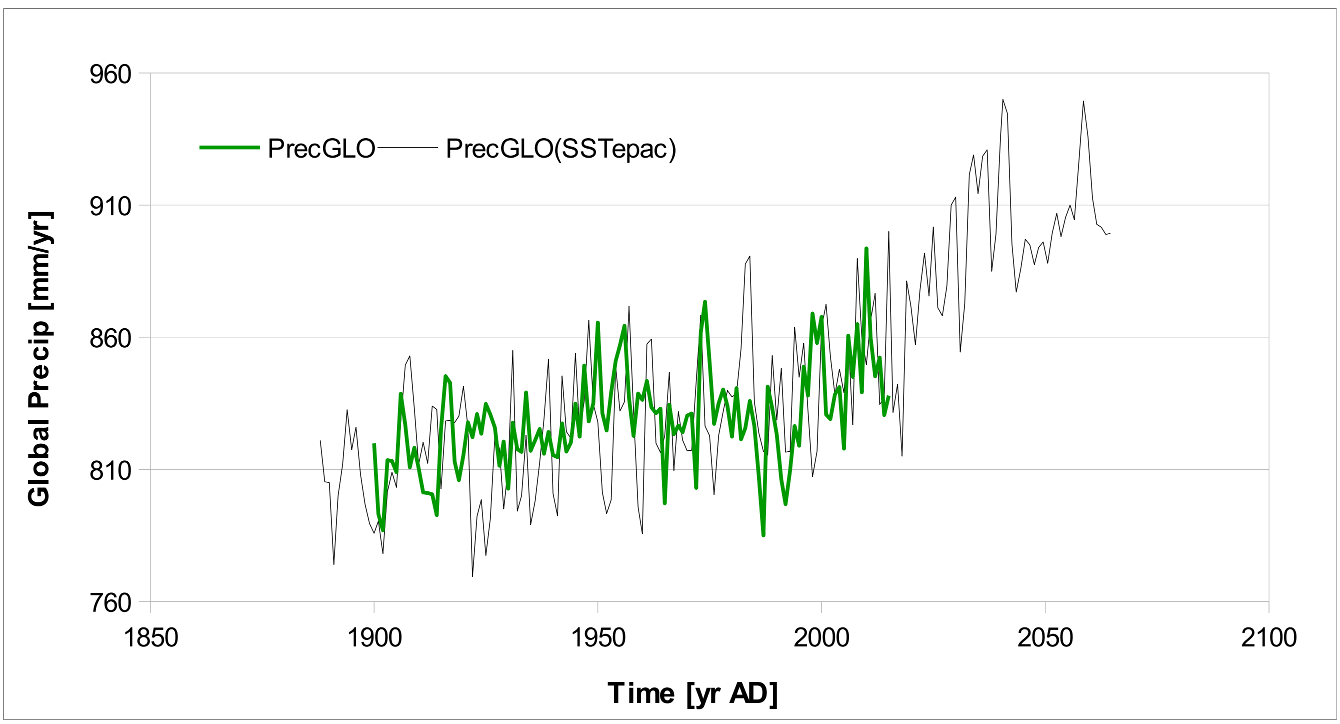

Figure 3.7 Annual accumulated global rainfalls, coming from WMO(2022) over the period 1901-2020 and extended thanks to the SSTepac record (this record was also extended based on N12 record) and its lagged influences.

The extended SSTepac record provides more than 40 years of global rainfall forecast.

In Figure 3.8, the global temperature (GT), is expressed as a linear function of the lagged eastern Pacific sea surface temperature [SSTepac]. The lag employed is 23 years, that minimize the error between TG and its model.

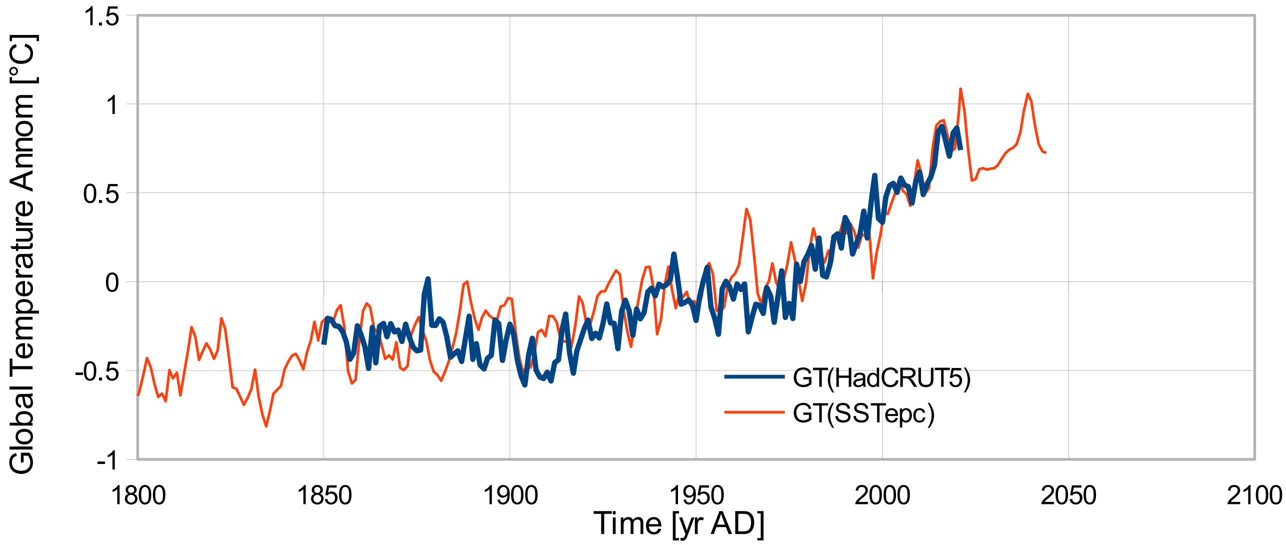

Figure 3.8   Global temperature coming from HadCRUT5 (2022) over the period 1856-2021, is modelled and forecast thanks to the extended SSTepac record (See Figure 3.6). The lag imposed to the model [GT(SSTepac)] is 23 years lagged influences.

The extended SSTepac record provides more than 20 years of global temperature forecast.

The two presented global forecasts, for rainfall and temperature, provide further elements to accept ocean and atmosphere circulations where the SST anomalies are transported, toward the West, to all the rest of the world.

As a final comment, considering the numerous lagged responses analyzed, I would like to expose a capacity of the IPCC scenarios that has not been considered. I present the linearly extrapolated and averaged version of the rcp2.6, rcp4.5 and rcp8.5 scenarios to estimate the rcp0.0 scenario.

Using this two simple formulas:

rcp0.0a(t)=rcp2.6(t)-2.6*(rcp4.5(t)-rcp2.6(t))/(4.5-2.6)
rcp0.0b(t)=rcp2.6(t)-2.6*(rcp8.5(t)-rcp2.6(t))/(8.5-2.6)

and after averaging these each pair of values (1850-2100), is posible to estimate an approximated official scenario for rcp0.0.

This scenario, that shows a modelling toward conditions associated with “zero GHG emissions”, is shown in Figure 3.9 and compared with the initial estimated scenario from Figure 11b.

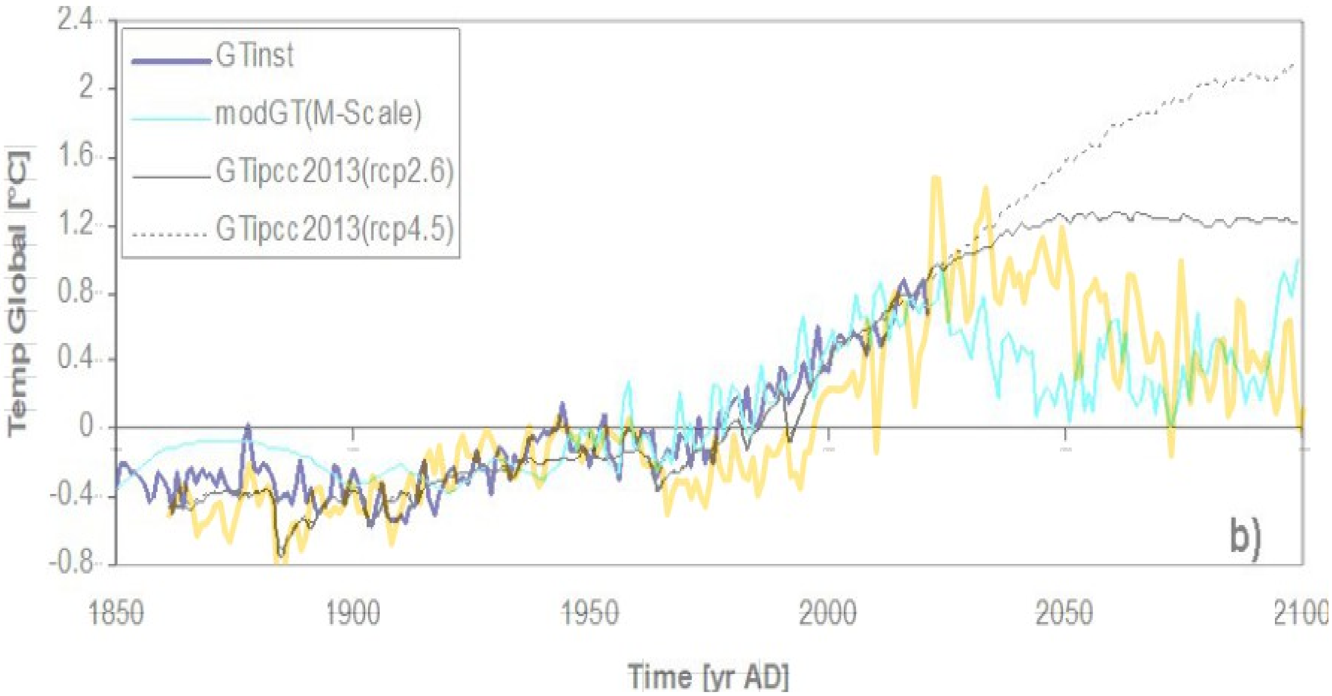

Figure 3.9 Global temperature scenarios 1850-2100. An adapted Figure 11b from the paper ESD-2021-84 in discussion with the Average rcp0.0 values (in yellow line).

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