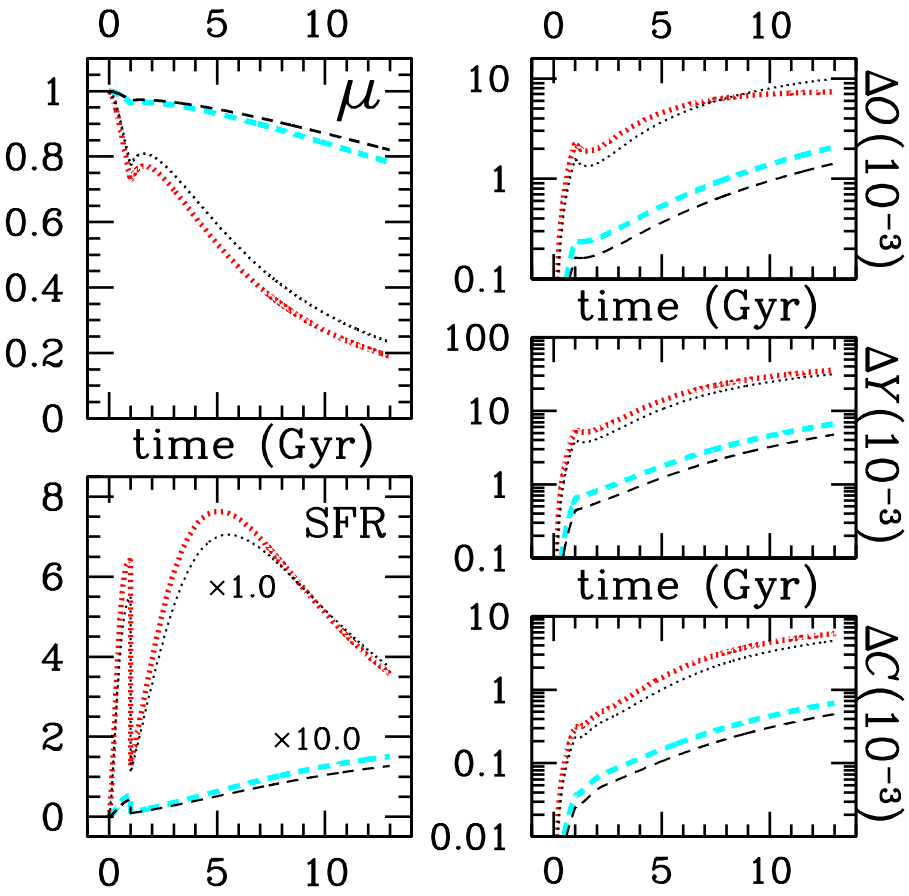

Fig. 6. Evolution of $M_{\rm gas}/M_{\rm tot} = \mu$, star formation rate, ΔO, ΔY, and ΔC for $r = 7$ kpc (dotted lines) and $r = 17$ kpc (dashed lines), assuming HWY (thick tracks) or LWY (thin tracks). Star formation history is in $M_\odot$ pc^{-2} Gyr^{-1} units and the SFR for $r = 17$ kpc has been multiplied by 10.

smaller then the values derived from the F-G dwarf stars and the average of NGC 3576 and the Orion nebula. Maybe part of the reason for the smaller C abundance in the B stars can be due to rotational mixing (e.g., Meynet & Maeder 2000; Fierro & Georgiev 2008). The B stars ΔO value is about 1.5σ and about 4.5σ smaller than the predicted HWY and LWY model values, respectively. Furthermore, the B stars ΔO value is in fair agreement with the F-G dwarf value and about 1.5σ smaller than the the average value of NGC 3576 and Orion. These differences between the B stars and the other objects of the solar vicinity should be studied further.

For $r = 7$ kpc and $t = 13$ Gyr we took the average of the abundances of the M17 and M20 H II regions as the observational constraint; the C/H and O/H gaseous values were obtained from García-Rojas & Esteban (2007) and Paper I, using recombination lines of C and O. We have adopted the M17 X value obtained in Paper I to convert the abundances by number of M17 and M20 to abundances by mass. Unfortunately, there are no observational data representative of the chemical past at $r = 7$ kpc.

The HWY model fits very well the current C and O values for $r = 7$ kpc and marginally the present-day O for $r = 8$ kpc, but does not explain the current C value for $r = 8$ kpc. Alternatively the LWY model fits quite well both the C and O values for the solar vicinity, but predicts a higher O abundance for $r = 7$ kpc.

In Figures 4 and 5 the evolutionary tracks partially overlap: for a given ΔO value the ΔY and ΔC values of the two different tracks are almost the same, but the time is very different. In Figure 6 we present the evolution of ΔO, ΔY, and ΔC as a function of time to appreciate the differences between the 7 kpc and the 17 kpc tracks. It is important to present the behavior of $\mu = M_{\rm gas}/M_{\rm tot}$ because it drives the O evolution. For example, the 17 kpc track reaches a ΔO value of about 2×10^{-3}