**2.1 Surface O3 chemical budget**

Chemical budget of surface O3 considers production and loss, denoted as P(O3) and L(O3), excluding the deposition (both dry and wet) and atmospheric dynamic-driven fluxes. Production rate of O3 can be equivalent to the instant photolysis of NO2 under radiation of wavelength <330 nm. Production of NO2 originates from NO oxidation by HO2, CH3O2, and RO2 peroxide radicals, leading to the formula of O3 production as Equation 1. Photolysis under radiation of wavelength <330 nm, reactions with HOX radicals and unsaturated VOCs (such as alkenes) lead to destructions of O3, as indicated in Equation 2. The temperature-dependent

NO2 + *hv* → NO + O(3P) (R1)

O(3P) + O2 + M → O3 + M (R2)

NO + HO2 → NO2 + OH (R3)

NO + CH3O2 → NO2 + CH3O (R4)

NO + RO2 → NO2 + RO (R5)

P(O3) = *k*1[NO][HO2] + *k*2[NO][CH3O2] + ∑*ki*[NO][RO2] (Equation 1)

, preferred value as 8.5×10–12 cm3 molecule-1 s-1 at 298 K.

, preferred value as 7.7×10–12 cm3 molecule-1 s-1 at 298 K.

O3 → O2 + O(1D) (R6)

O(1D) + H2O → 2OH (R7)

O3 + OH → O2 + HO2 (R8)

O3 + HO2 → 2O2 + OH (R9)

L(O3) = *k*3[O(1D)][H2O] + *k*4[O3][OH] + *k*5[O3][HO2] + ∑*kj*[O3][alkenes] (Equation 2)

, preferred value as 2.14×10–10 cm3 molecule-1 s-1 independent of temperature over the range 200–350 K.

, preferred value as 7.3×10–14 cm3 molecule-1 s-1 at 298 K.

, preferred value as 2.0×10–15 cm3 molecule-1 s-1 at 298 K.