**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.

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.

Photolysis under radiation of wavelength <330 nm, reactions with HOX radicals and unsaturated VOCs (such as alkenes) lead to destructions of O3.

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.