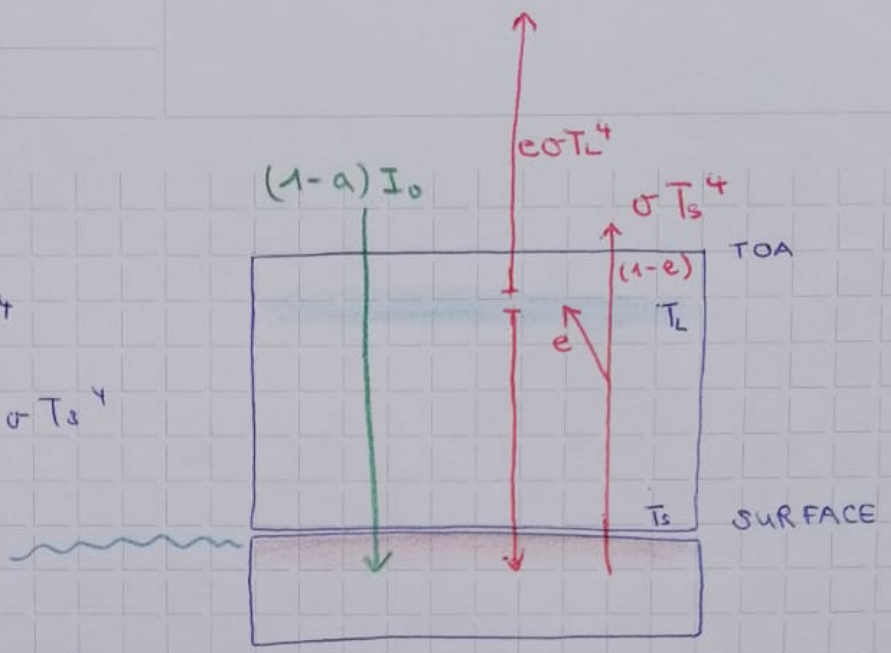
$$R = R_{TOA} - R_{SURFACE}$$

$$R_{TOA} = e\sigma T_s^4 - 2e\sigma T_L^4$$

$$R_{SURFACE} = (1-a)I_0 + e\sigma T_L^4 - \sigma T_s^4$$



$$\rightarrow R = e\sigma T_s^4 - 2e\sigma T_L^4 - (1-a)I_0 - e\sigma T_L^4 + \sigma T_s^4$$

$$= \sigma(e+1)T_s^4 - 3e\sigma T_L^4 - (1-a)I_0$$

longwave (thermal)

shortwave

$$a = a_0 + \Delta a$$

$$\rightarrow R = \sigma(e+1)T_s^4 - 3e\sigma T_L^4 - (1-a_0-\Delta a)I_0$$

$$= \underbrace{\sigma(e+1)T_s^4 - 3e\sigma T_L^4 + (a_0-1)I_0}_{R_0} + \Delta a I_0$$

Albedo	Vegetation	Desert
	≈ 0.1	0.3