

At Equilibrium

for EBM at  $2\times CO_2$  or greater  
there is no Ice

To Double  $CO_2$

We altered  $F_{out} = A + \beta T$   
by reducing  $A$  by  $2.1 \text{ W/m}^2$

$$\Delta Q = \Delta F_{out} = \Delta A = 2.1 \text{ W/m}^2$$

$$\Delta T = 1.00 \text{ C} \quad 2\times \rightarrow 4\times \text{ change}$$

$$\lambda_{2 \rightarrow 4 \text{ EBM}} = \frac{\Delta Q}{\Delta T} = 2.1 \text{ W/m}^2/\text{K}$$

$$\text{or } \lambda_{LW} = \frac{\partial F_{out}}{\partial T} = \beta \quad \text{it works!}$$

(since no  $\alpha$ -FB)

With Ice at  $1\times$

$$\Delta T = 2.44 \text{ C}$$

$$\lambda_{1 \rightarrow 2 \text{ EBM}} = \frac{\Delta Q}{\Delta T} = \frac{2.1}{2.44} = 0.86 \text{ W/m}^2/\text{K}$$

$$= \frac{\partial F_{out}}{\partial T} + \frac{\partial [S(1-\alpha)]}{\partial T}$$

$$= \lambda_{LW} + \lambda_{sw}$$

$$\lambda_{\alpha} = 0.86 - 2.1 = -1.24 \text{ W/m}^2$$

Recall signed FB  $\lambda = -\lambda$  for better intuition