



National Snow and Ice Data Center  
*Supporting Cryospheric Research Since 1976*

# Model Evaluation

*Andrew G. Slater*

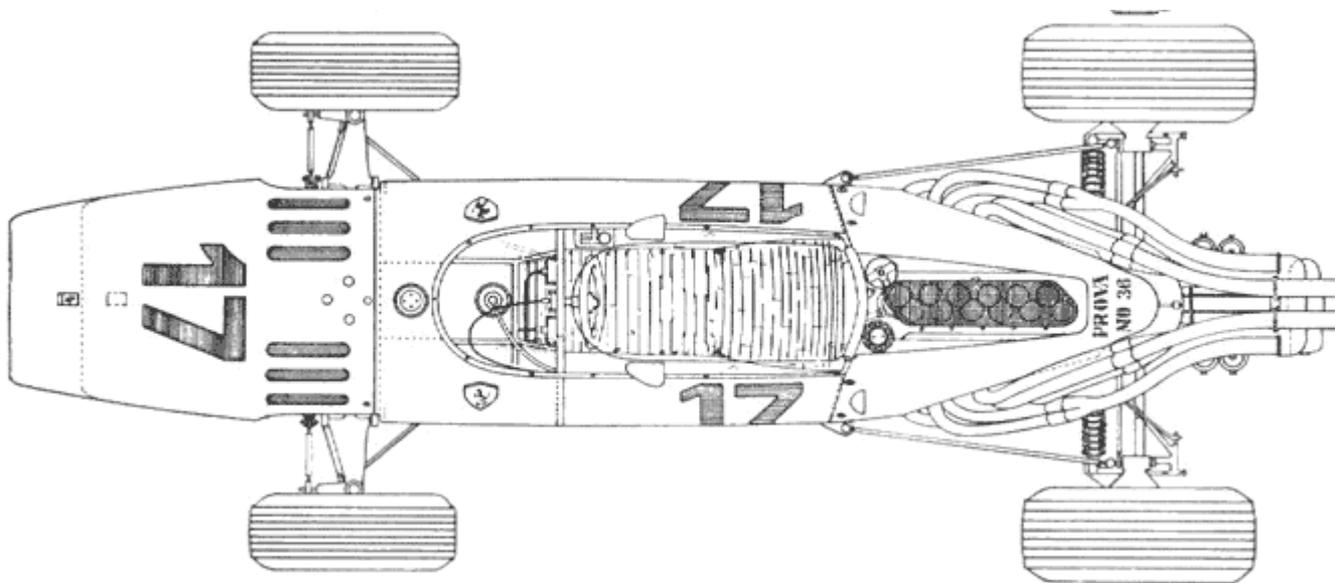


# *The Four Wheels of Uncertainty in Modeling*

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**Inputs/Forcing**

**Model Structure**

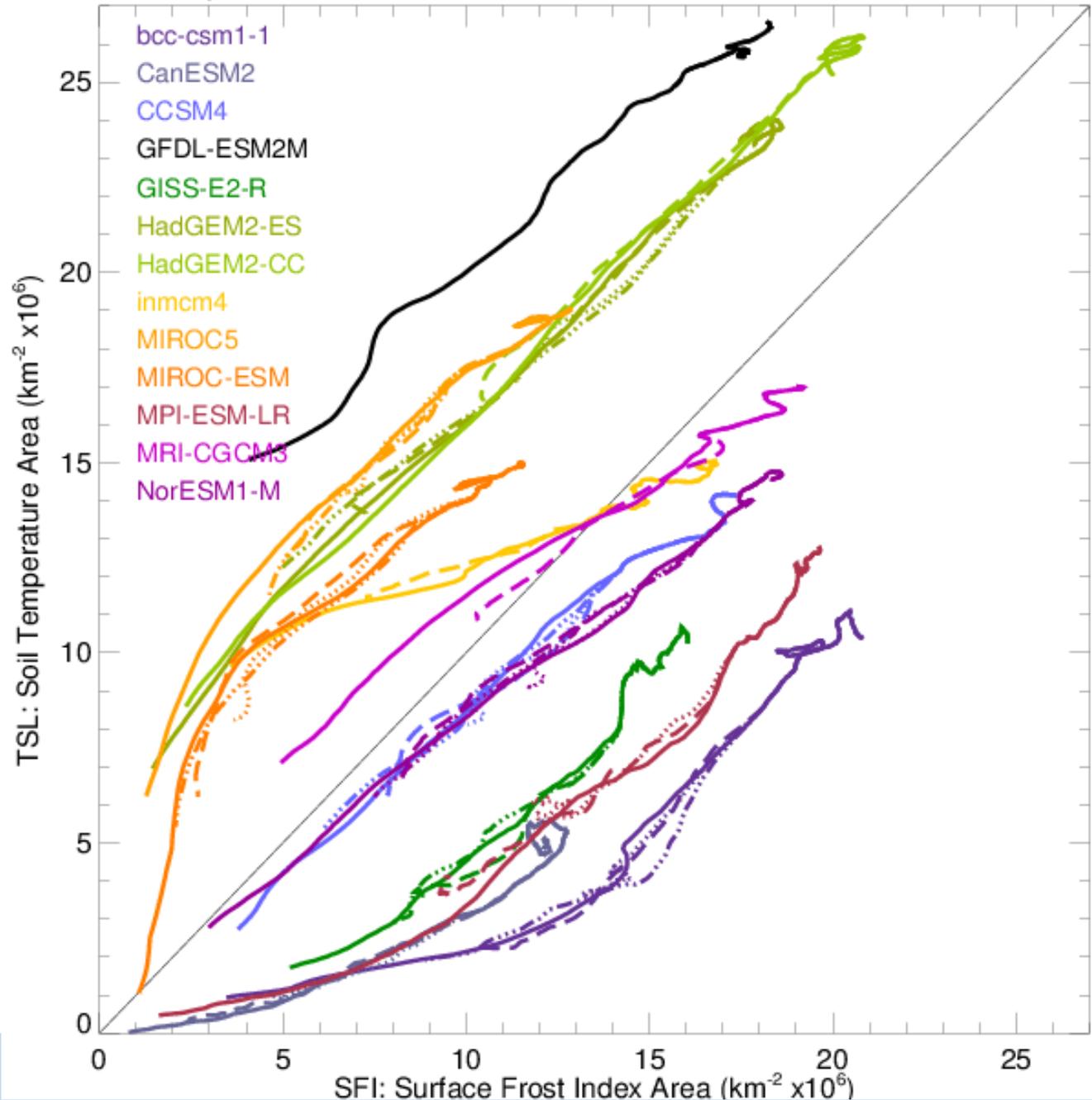


**Parameters**

**Initial/Boundary  
Conditions**

*Direct*  
*vs*  
*Indirect*  
*Diagnosis*

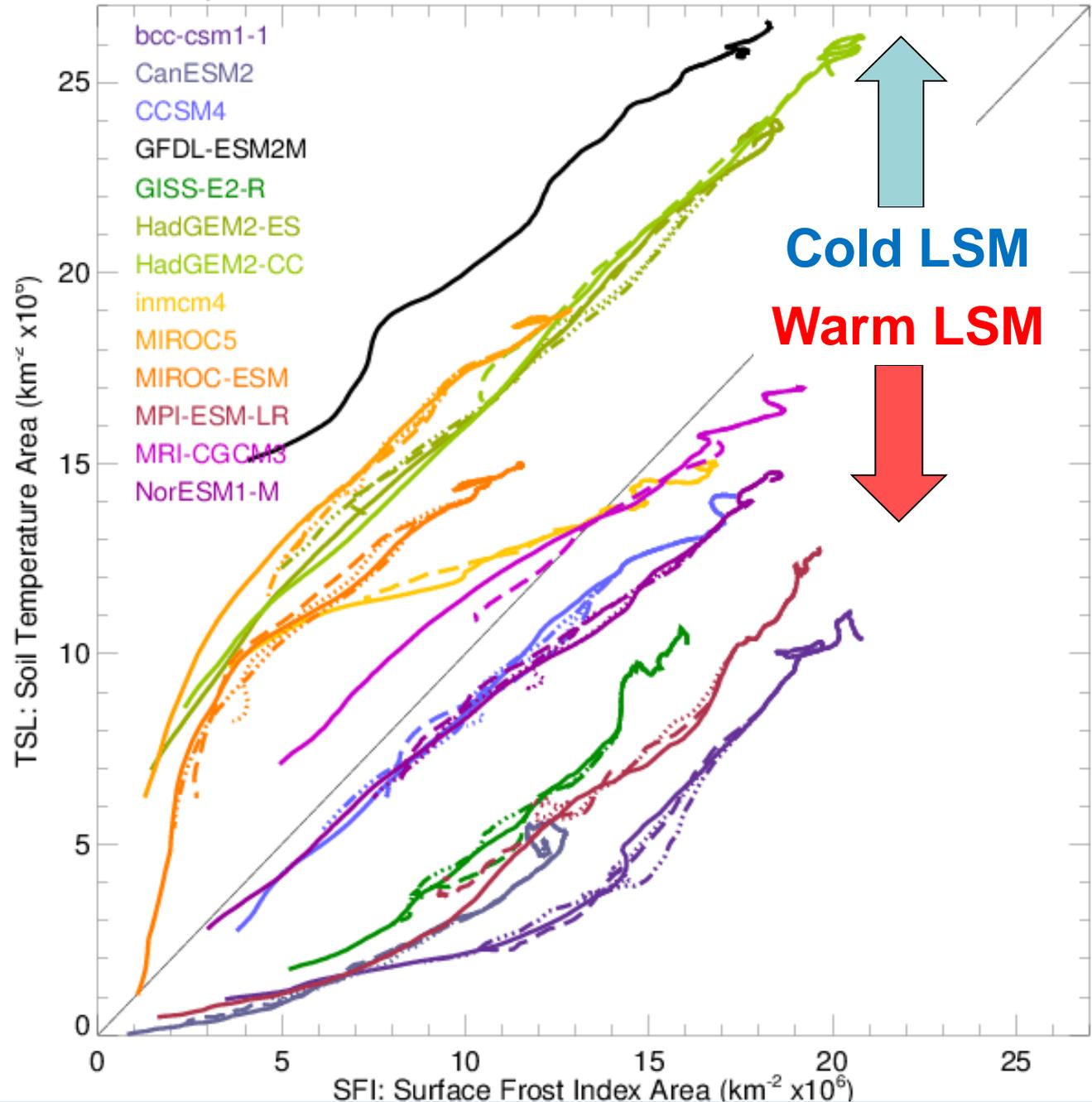
Comparison of Near-Surface Permafrost Area (1900-2099)



Land Model  
vs.  
Surface Climate

*Direct*  
*vs*  
*Indirect*  
*Diagnosis*

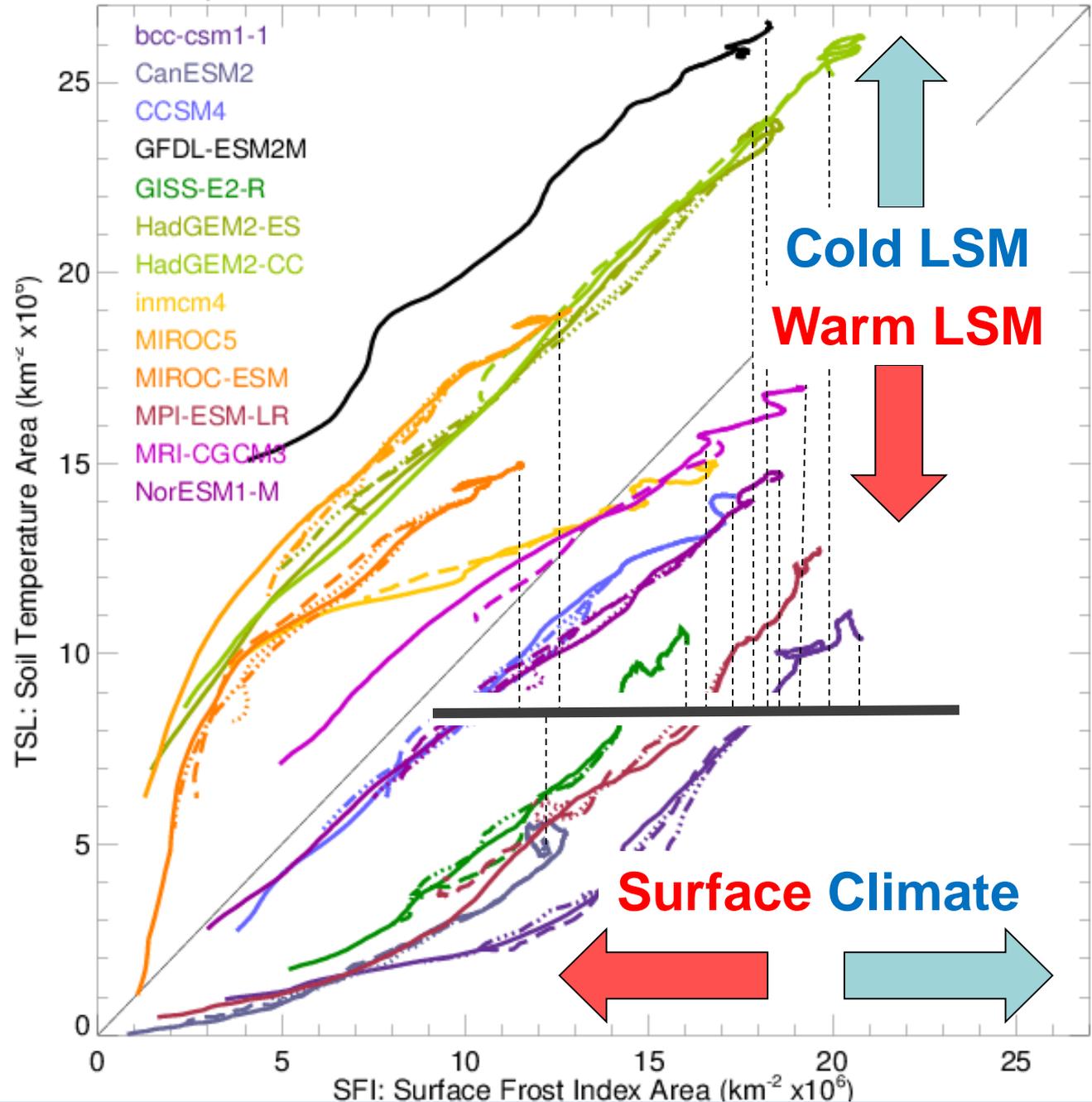
Comparison of Near-Surface Permafrost Area (1900-2099)



Land Model  
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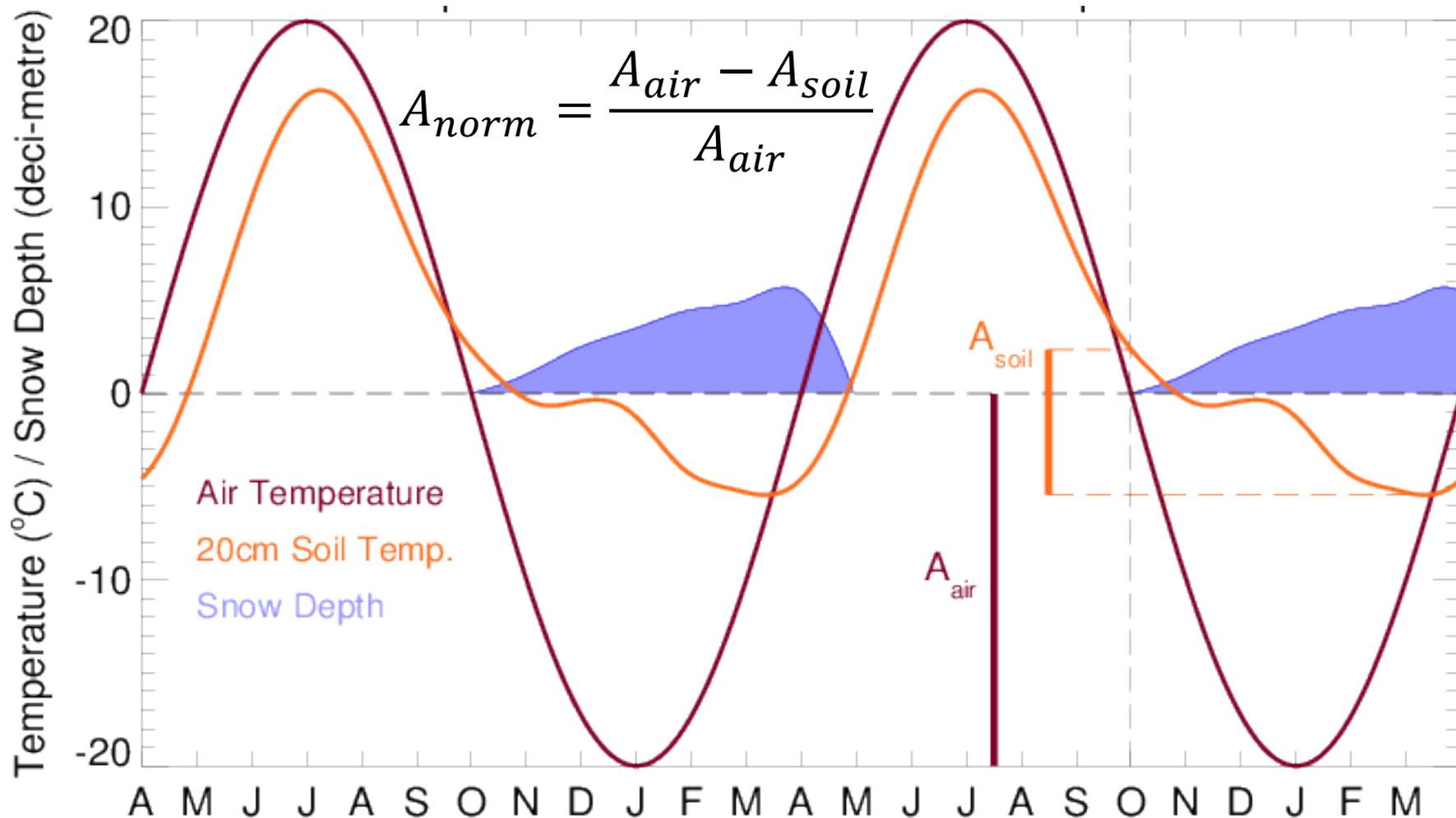
*Direct*  
*vs*  
*Indirect*  
*Diagnosis*

Comparison of Near-Surface Permafrost Area (1900-2099)

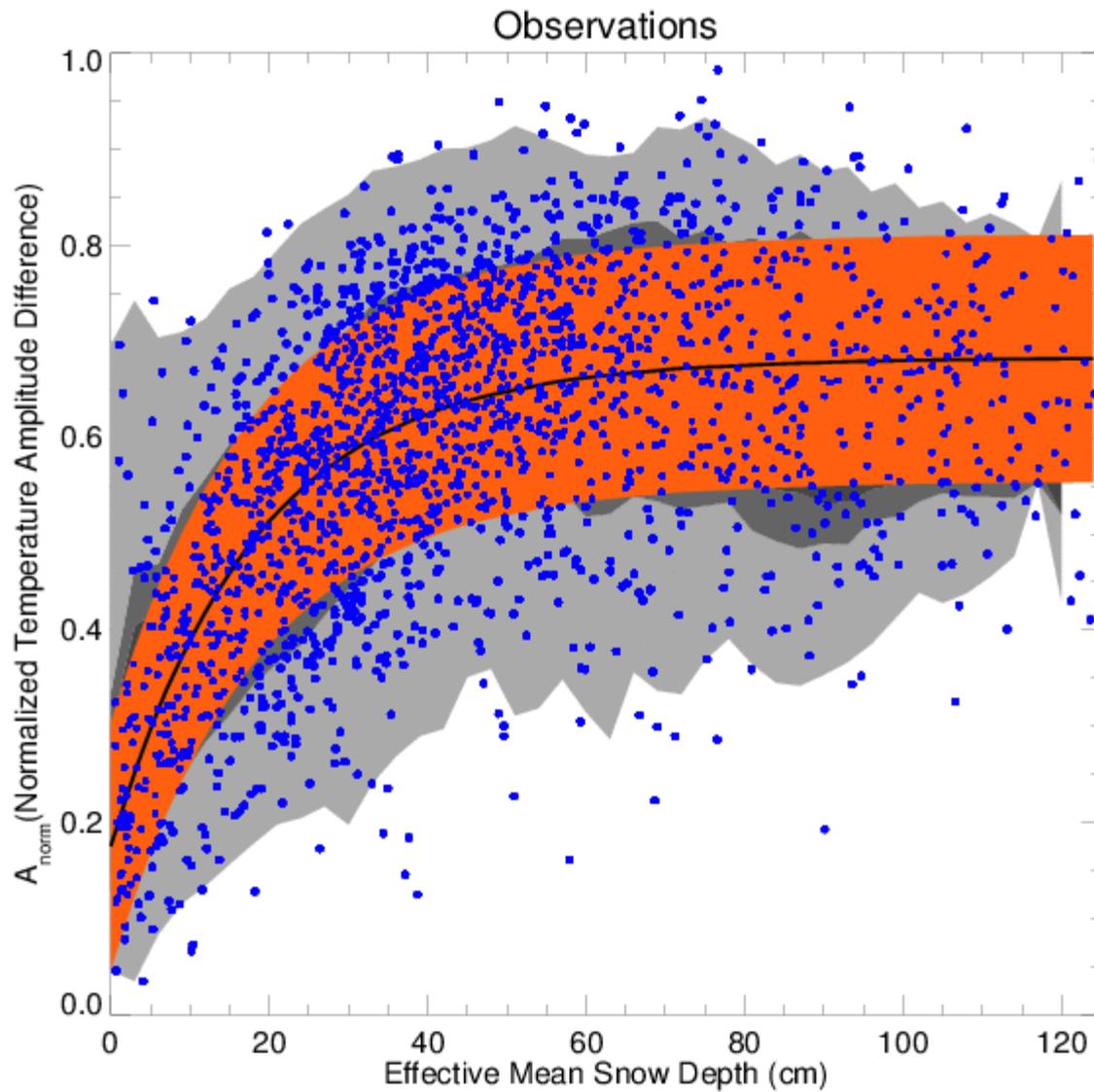


Land Model  
vs.  
Surface Climate

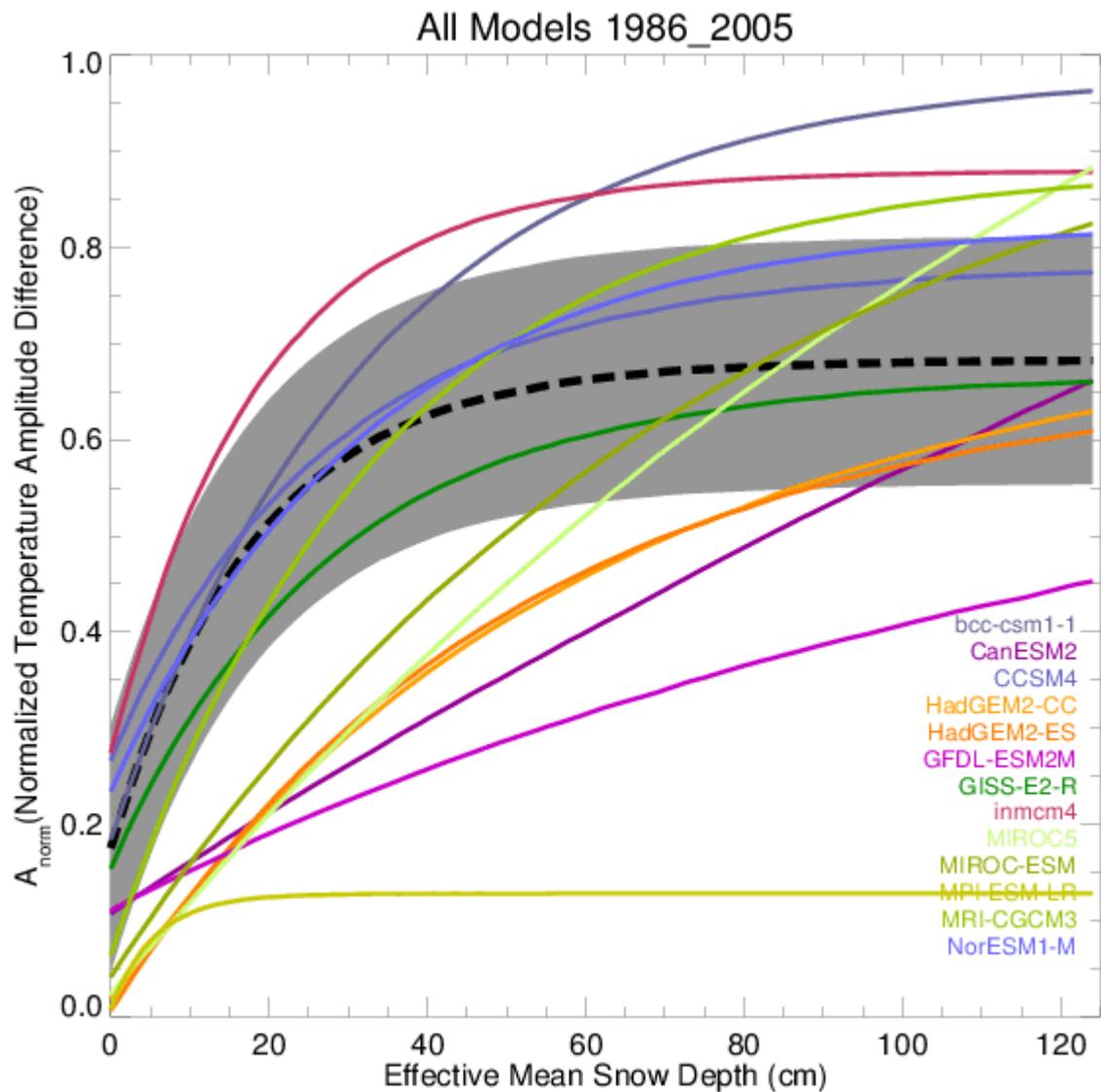
# Process: Atmosphere-Land Heat Transfer



# Observations Match Theory



# Models Compared

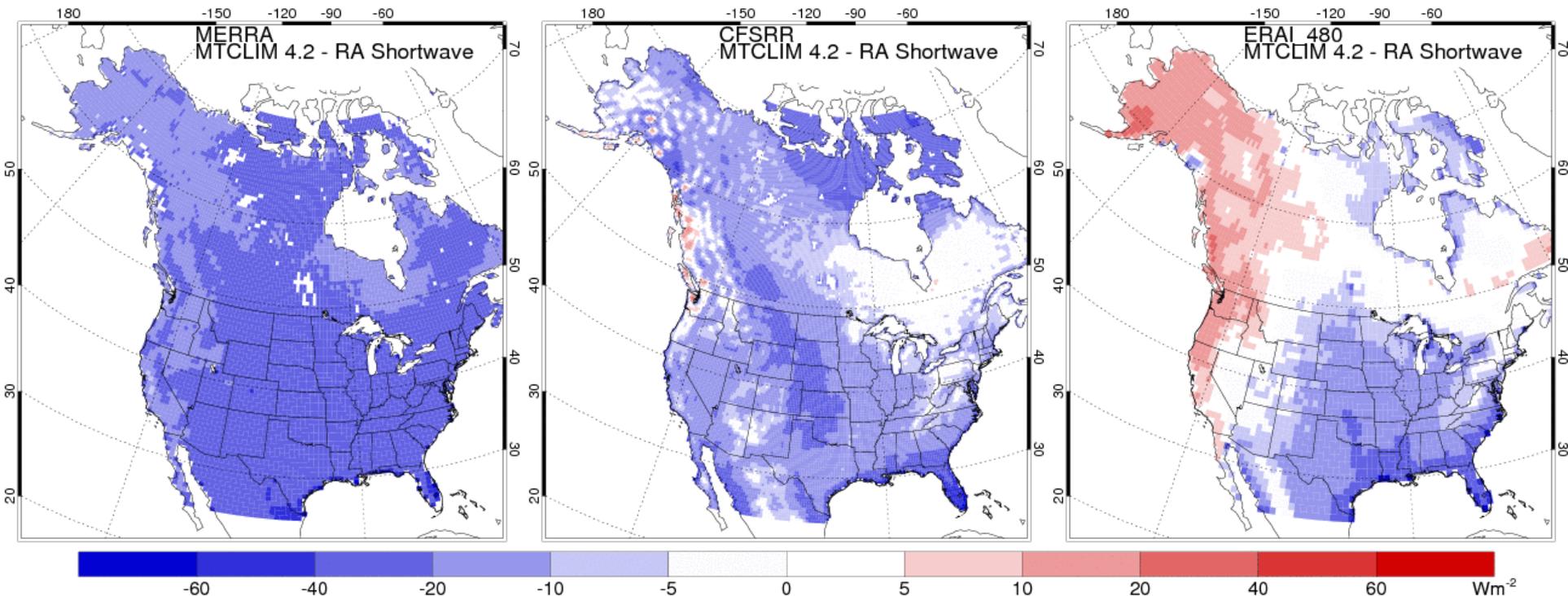


# Consistency Across Variables: Solar Radiation

**MERRA**

**CFSR**

**ERA-I**



**MTCLIM:** Empirical algorithm,  
*f* (Diurnal Temp. Range, Precip, Humidity)

# International LAnd Model Benchmarking (ILAMB)

scores for RMSE, interannual variability, pattern correlation, variable-to-variable comparisons, +



