Predictions of Future Model Improvements

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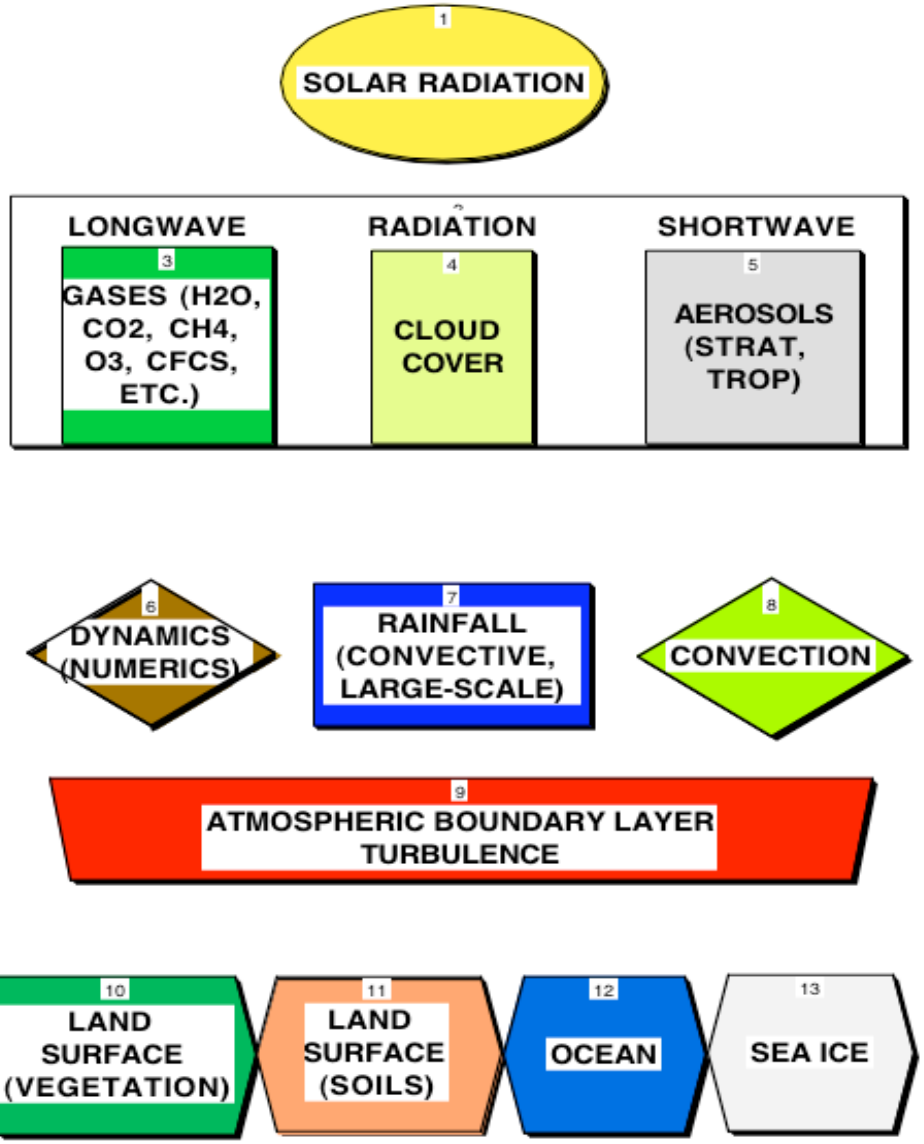
Configuration of Future ESMs (GISS perspective)

FEATURE	SIMULATIONS FOR 2010-2050		SIMULATIONS FOR 2050-2100	
	Standard	Supplementary	Standard	Supplementary
Finer horizontal resolution	X		X	
Finer vertical resolution	X		X	
Higher top (mesopause)		X		X
Dynamic Vegetation	X (hourly, seasonal interannual)		X (hourly, seasonal, interannual)	Y (succession) Z (movement)
Carbon Cycle		X		X
Atmospheric Chemistry		X		X
Aerosols (complex)		Y		Y
Clouds (complex)	Z		Z	
Ice Sheets		Z		Z
Ocean Biogeochemistry (complex)		Z		Z
Ground Water Hydrology		Z		Z
Resolved Convection	Z		Z	
Gravity Wave Generation	Z		Z	

X In use with some confidence by 2009
Y In use with some confidence by 2015
Z In use with some confidence by 2021

GCM MODEL PROCESSES



When wlll the different Subroutines get significantly more accurate in AOGCMs?

	2009	2015	2021
Solar radiation variations		X (assuming continuing observations)	
Atmospheric Radiation		X (line by line codes)	
Cloud Cover		X (cloud resolving mod)	X (droplet size)
Aerosols			X (particle size)
Convection			X (resolved)
Large-scale Rainfall			X
Numerics (dynamics)			X (effect of finer resolution)
Atmospheric Boundary Layer		X (LES processes)	
Atmospheric Surface Layer			X
Land Surface: Vegetation	X (for interannual)	X (for succession)	X (for migration)
Land Surface: Soils			X (structure issues)
Sea Ice	X (brine, thickness dist.)		
Oceans			X (eddy resolving)

Note: improvements may well be ready earlier but computer power limitations will delay their implementation in coupled AOGCMs.
Also: "significantly more accurate" does not necessarily mean we will have the ability to make accurate predictions.

What Degree of Complexity Is Needed and How to Determine That?

1. Off-line models: show local impacts - how good are they in determining complexity given the non-interaction with rest of model
2. Single-column models: what about the impact geographically (can't assess all diverse regions)
3. Global impact - who does the evaluation?

   -run with specified SSTs, Q-flux or coupled models? How do we understand the equilibrium response in coupled models?
4. Assessment should also be made in terms of impact on variability and climate change

Degree of Complexity (cont)

5. Alternate approach: put in the degree of complexity really needed, then reduce it until stabilization is reached - will always get changes - how to decide what is 'good enough'?

   -goes against human nature to accept 'less than the best'.

   -same evaluation problems.

6. Practical approach - decide that one can't use more than a certain amount of time for the parameterization and force the 'subgroup' to stick to that.

   -in the end, this is often used (quality not completely dismissed...)

   -decision really needs to be re-evaluated as computing power increases.