

Yer sistem biliminde karmaşıklık ve veri yönetimi sorunları

H. N. Dalfes

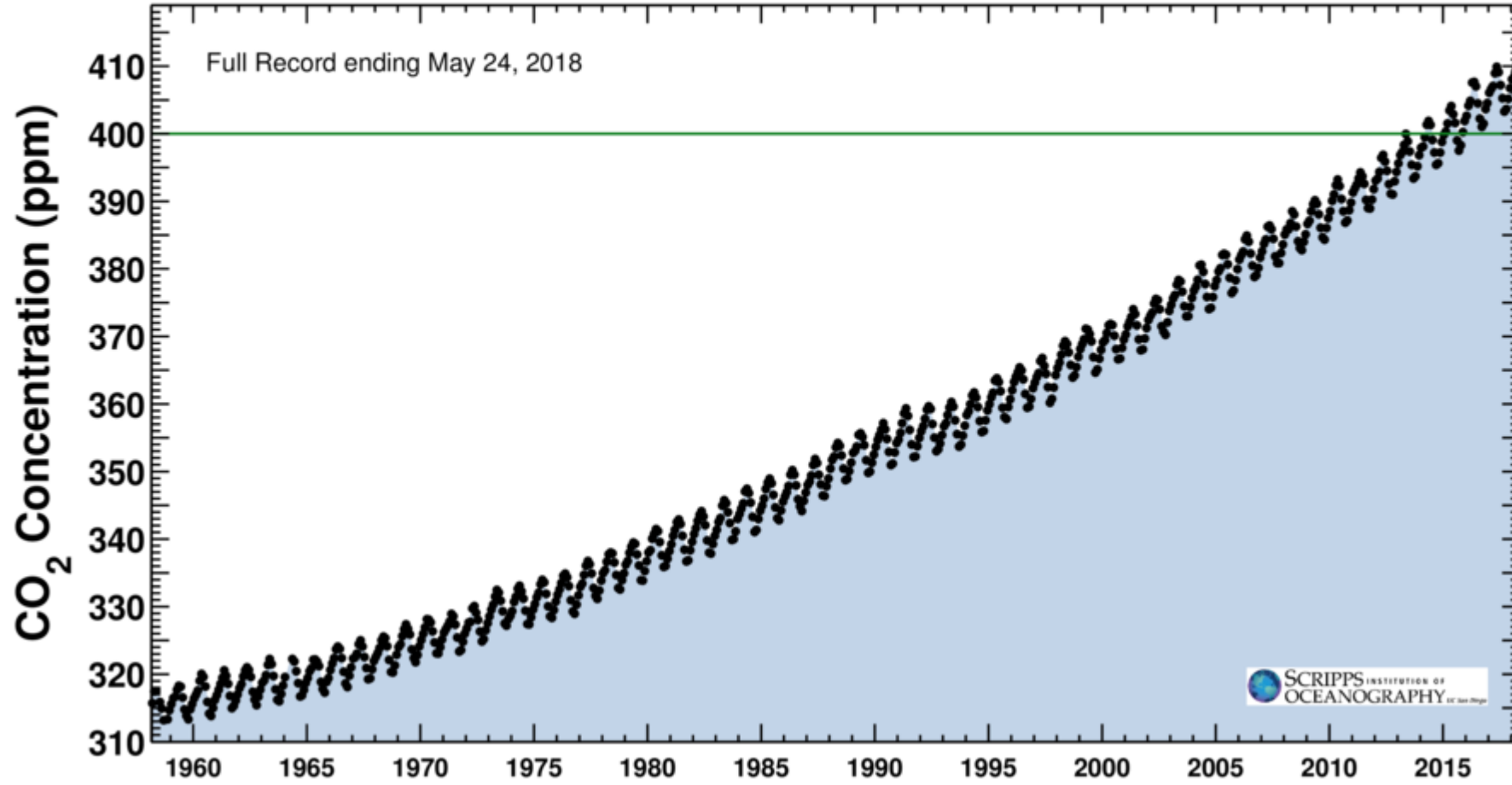
İTÜ Avrasya Yer Bilimleri Enstitüsü

- Yer sistem modellerinde karmaşıklık
- Veriye ulaşım ve yönetimi

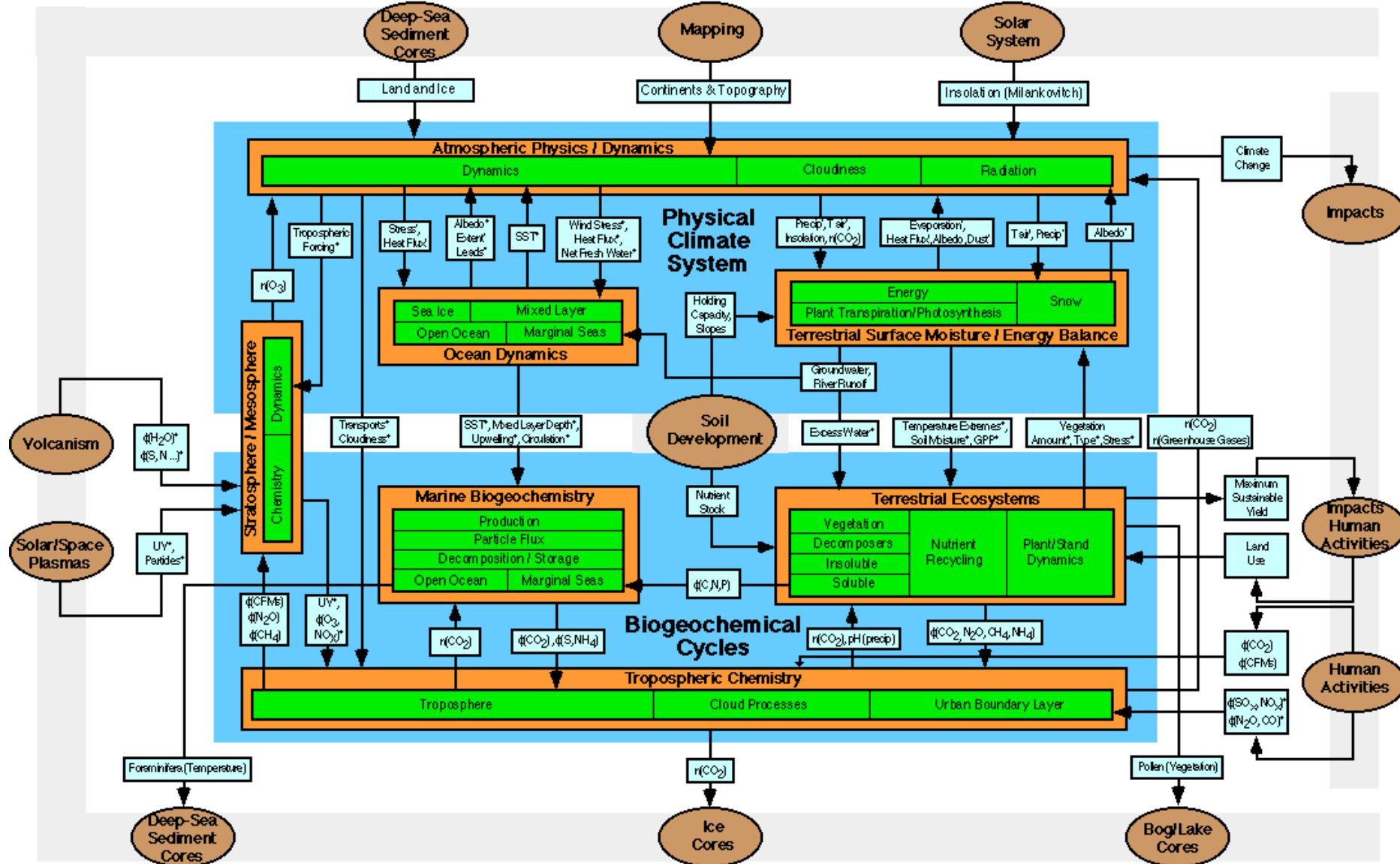
Latest CO₂ reading
May 24, 2018

411.62 ppm

Carbon dioxide concentration at Mauna Loa Observatory



CONCEPTUAL MODEL of Earth System process operating on timescales of decades to centuries

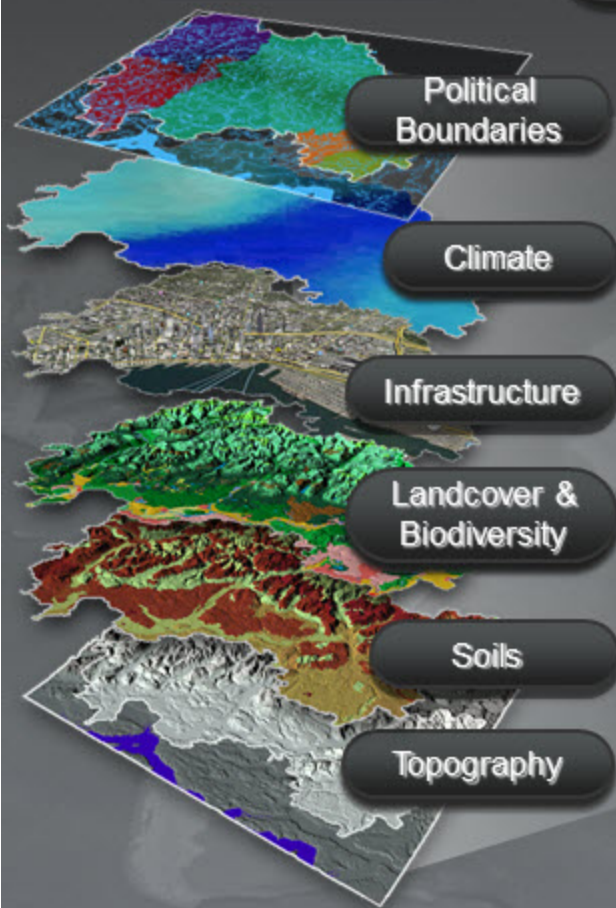


* = on timescale of hours to days * = on timescale of months to seasons ϕ = flux n = concentration

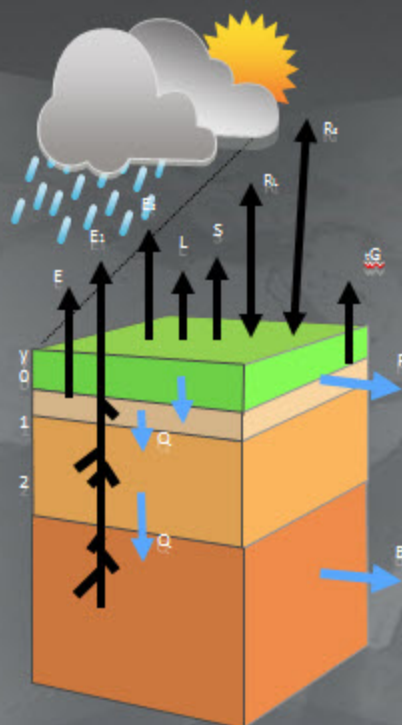
Earth System Modeling

“geospatially-explicit, process-based, & coupled”

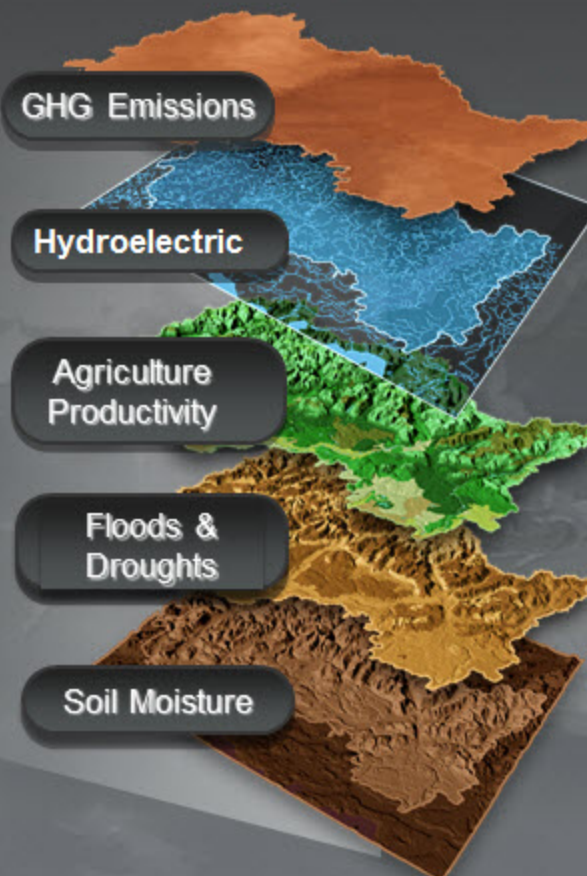
THE DATA MODULES

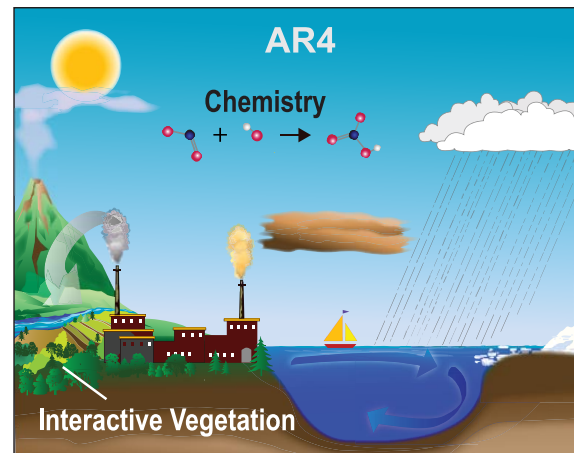
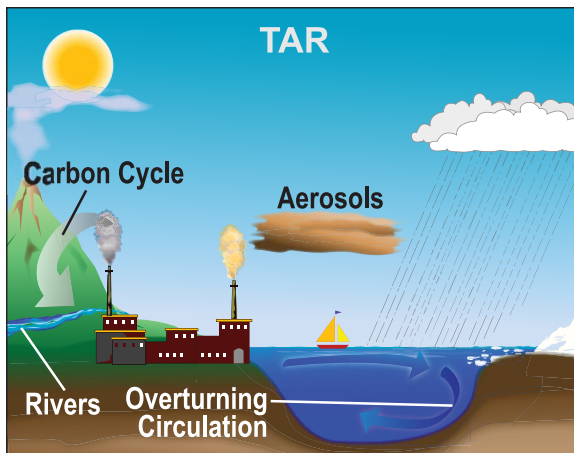
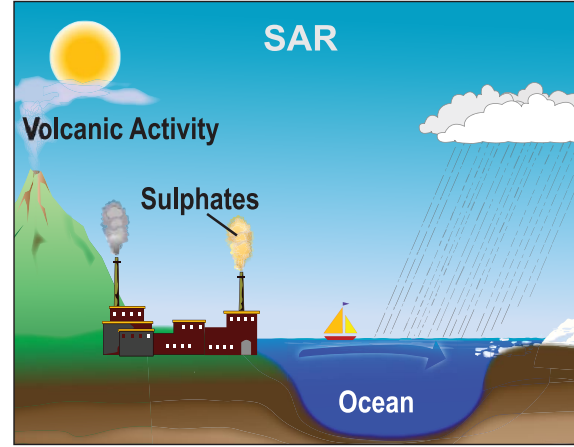
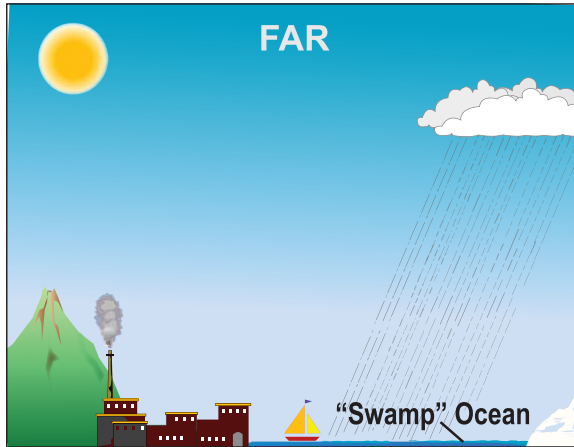
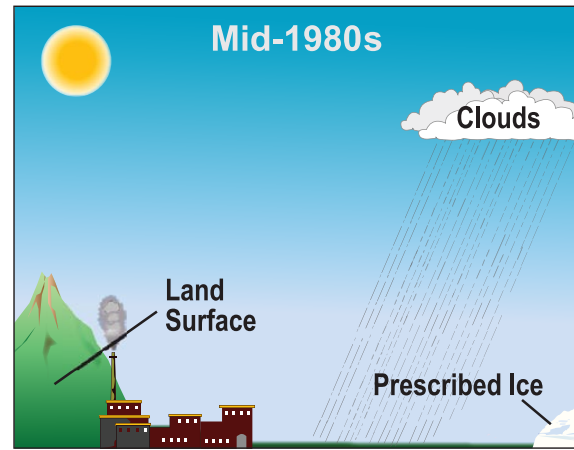
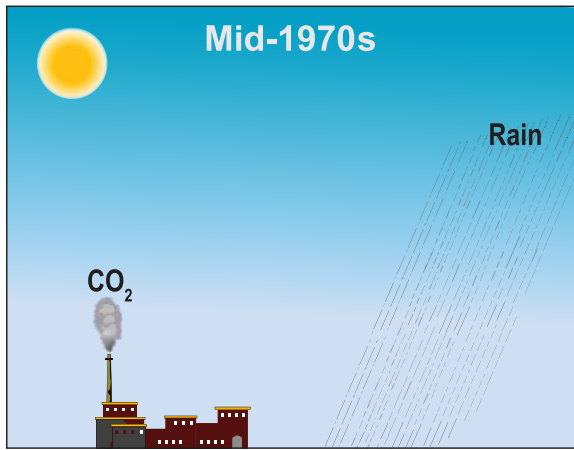


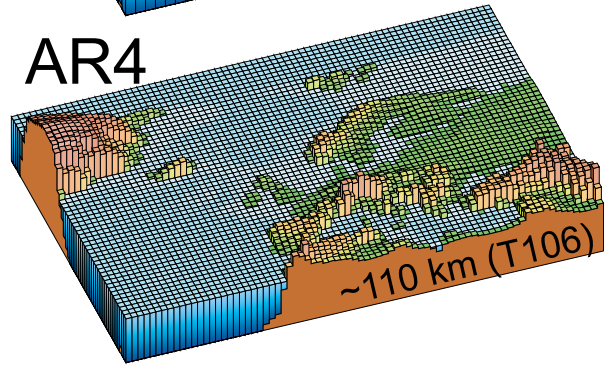
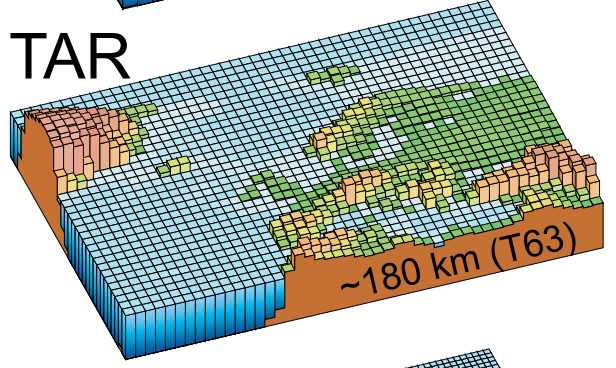
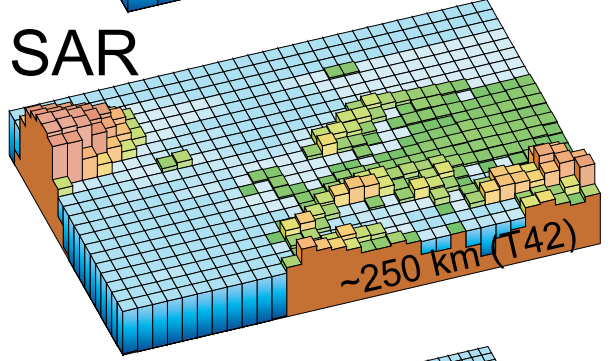
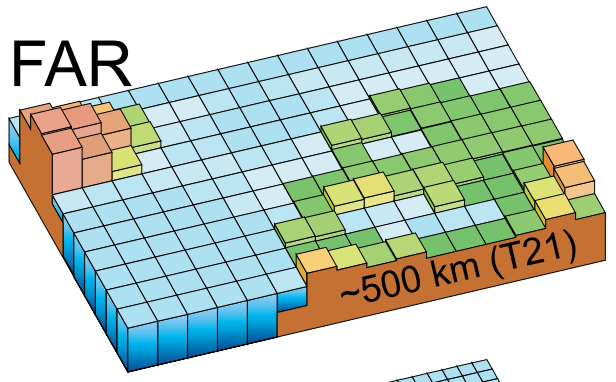
COMPUTATION ENGINE
THE MODELS AND CALCULATIONS

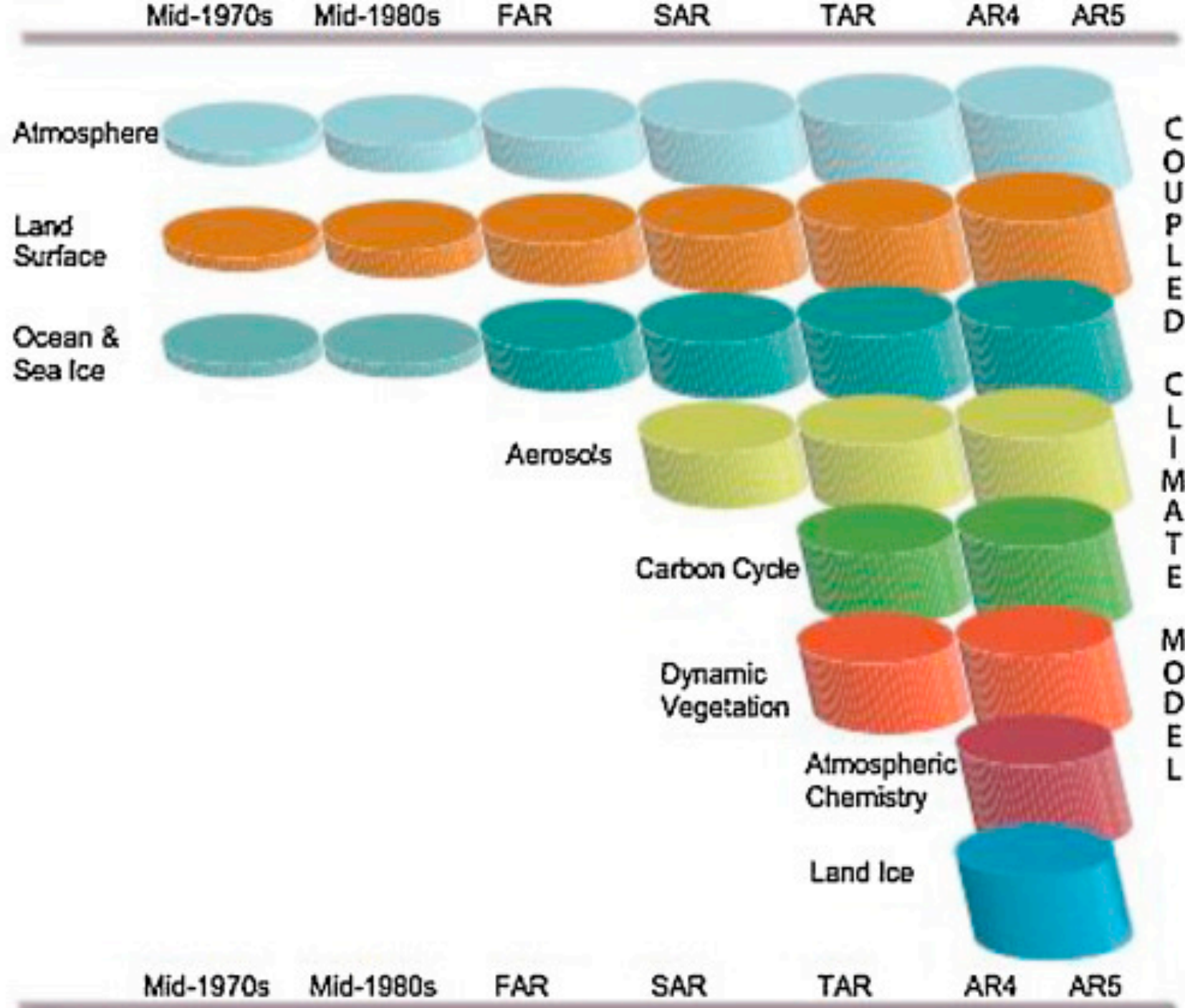


THE OUTPUT VARIABLES

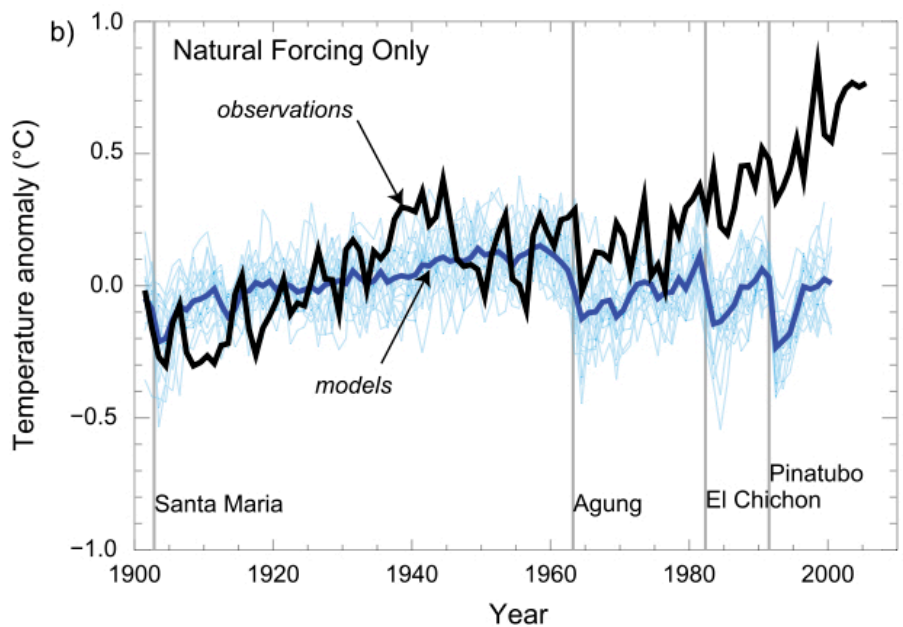
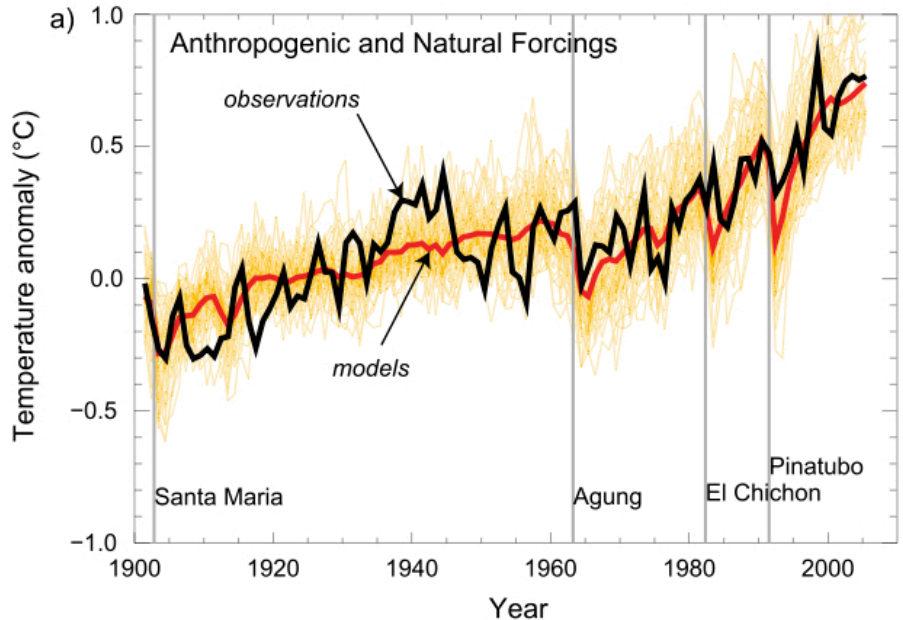






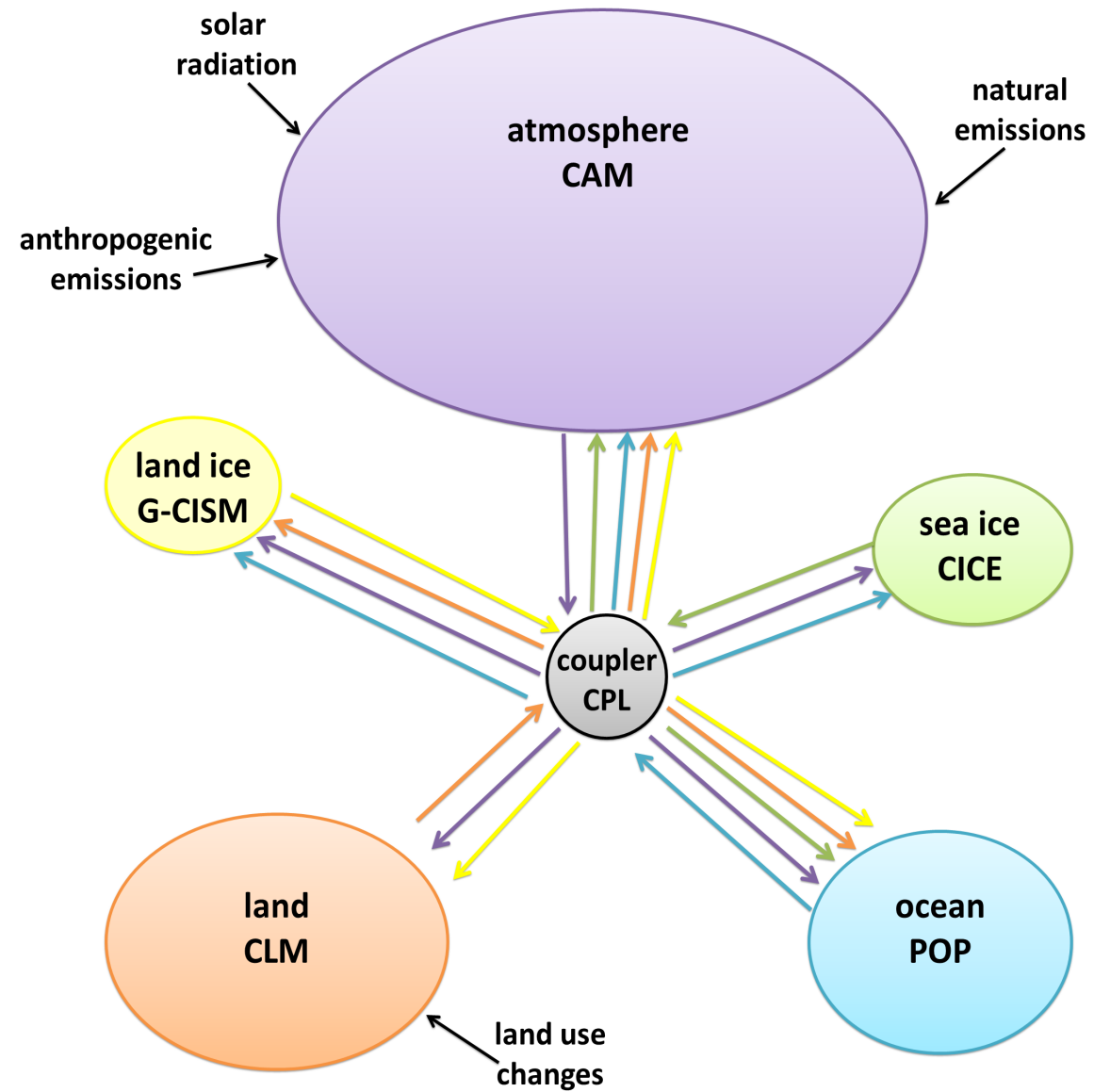


GLOBAL MEAN SURFACE TEMPERATURE ANOMALIES



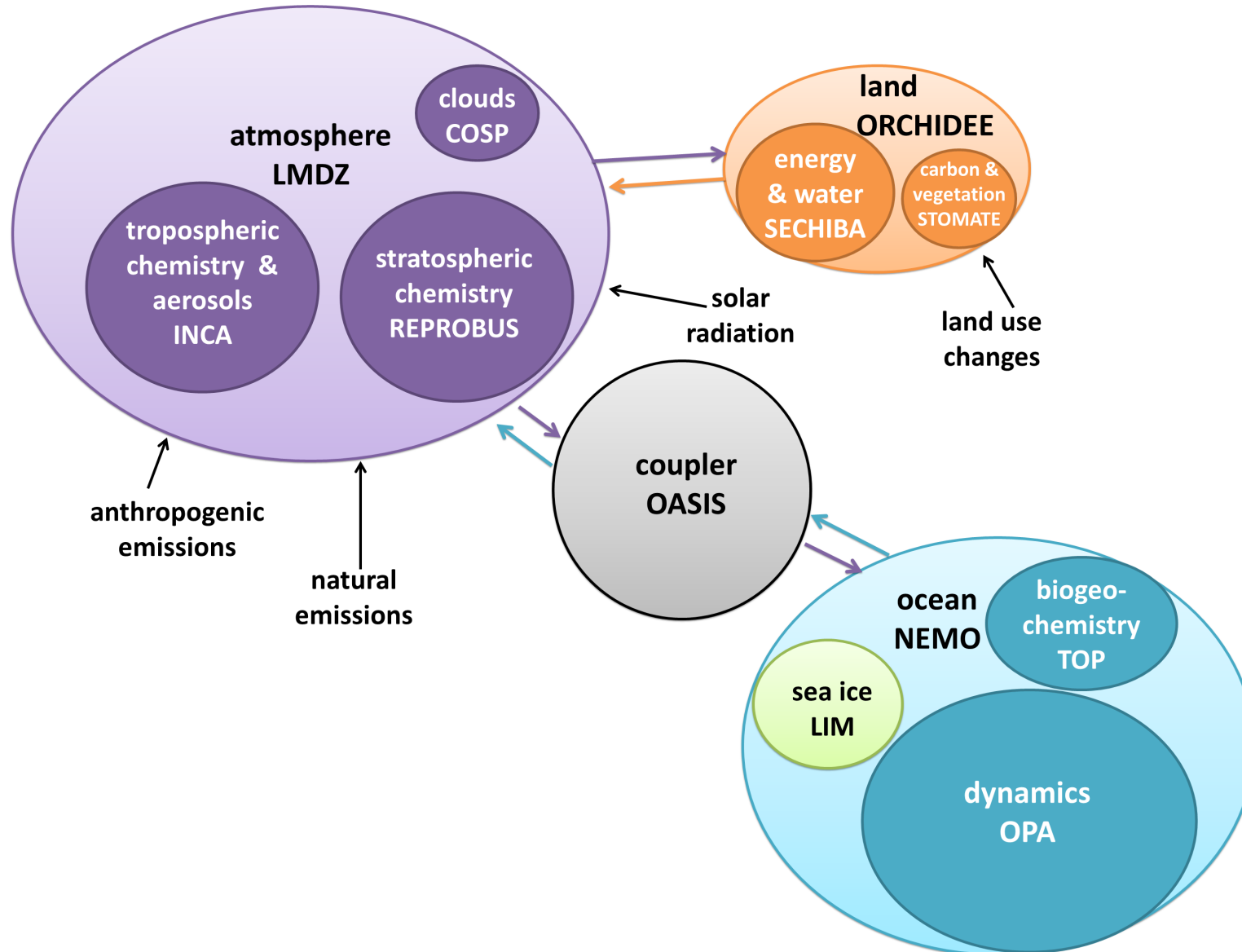
CESM 1.0.3

National Center for Atmospheric Research, USA

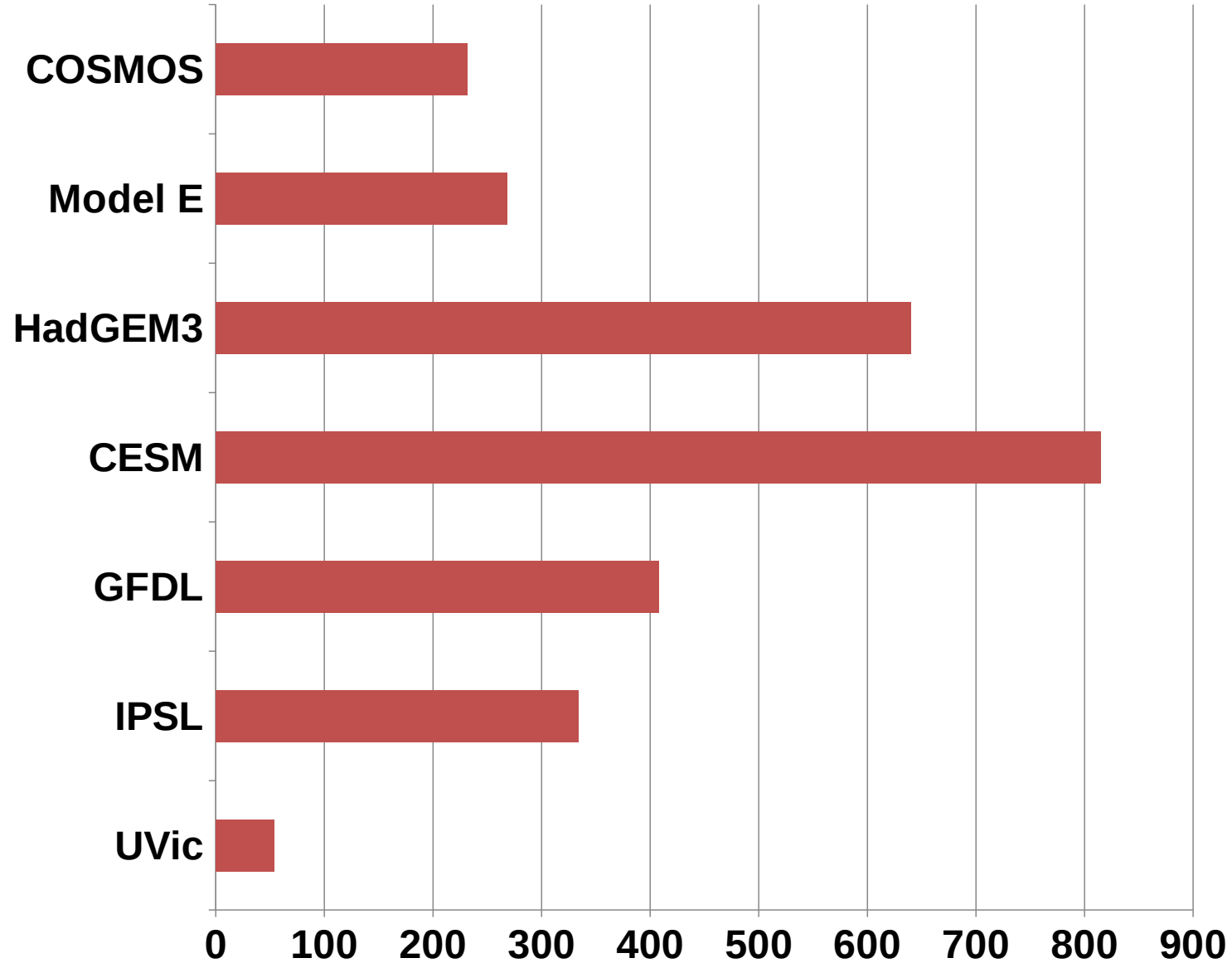


IPSL Climate Model 5A

Institut Pierre Simon Laplace, France



Size (thousands of lines of code)



iklimin karmaşıklığı?

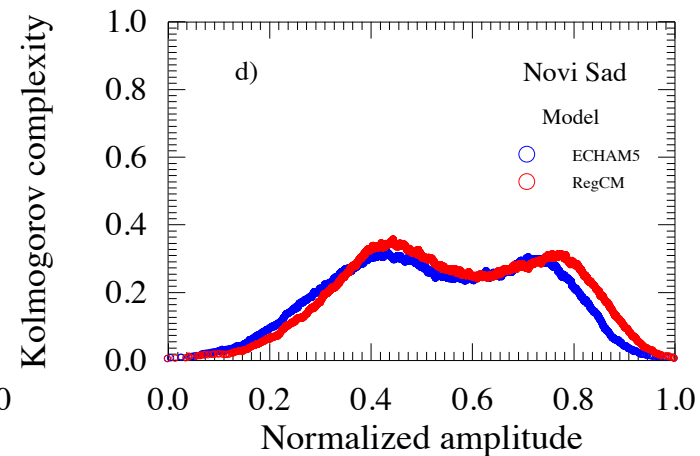
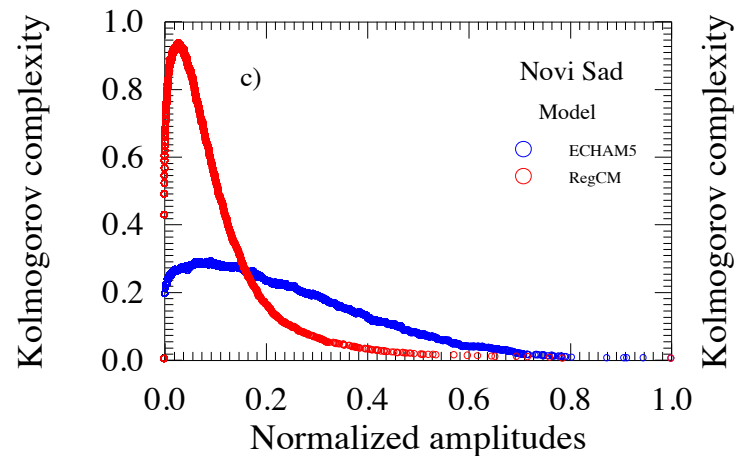
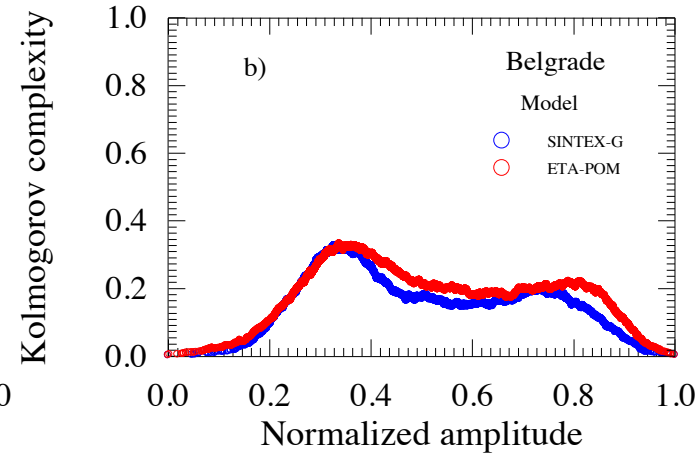
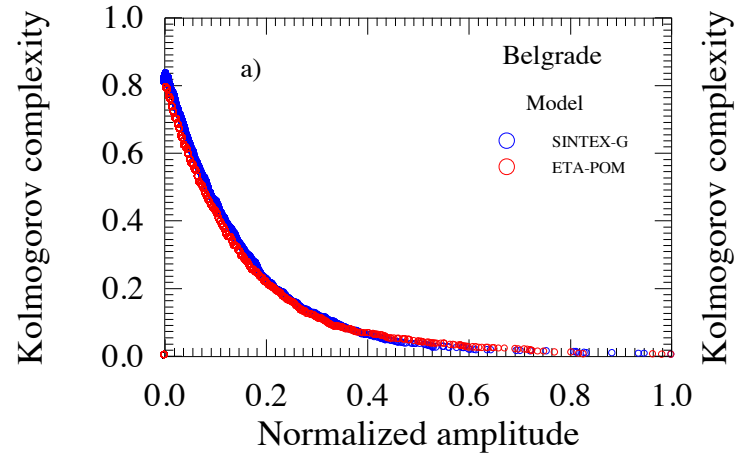
/

iklim modellerinin karmaşıklığı?

karmaşıklığın ölçütü?

- karmaşıklık / öngörülebilirlik
- öngörülebilirlik:
 - Liapunov üssü [exponent]
- karmaşıklık:
 - Kolmogorov karmaşıklığı

bir örnek: Mihailovic et al., 2014



veri yönetimi...

veri yönetimi: sorunlar ve çözümler

- gözlemsel veri:
 - büyük hacim
 - her zaman, her yerde veriye ulaşma(ma)!
 - ✓ aylık ortalama atmosfer verileri
 - su verisi: çok zor
 - toprak, bitki örtüsü, v.s.: standardizasyon sorunları

21. Yüzyıl:
açık/özgür veri!



FREEDOM TO DATA!

veri yönetimi: sorunlar ve çözümler

- model çıktıları:
 - büyük hacim
 - herşeyi saklamak teknolojik olarak mümkün değil!
 - metaveri yönetimi
 - 'kendini tanımlayan' veri formatları
 - netCDF
 - veri, modelleme sürecinin bilgisini de [provenance] içermeli
 - modelleme zinciri, yani 'iş akışı' belgelenmeli ve model çıktılarıyla birlikte 'dolaşmalı'
 - her analiz aşaması/aracı çıktıya 'imzasını' atmalı
- dağıtım: bilgisayar ağları hala bir kısıt

CMIP

(coupled model intercomparison project)

	CMIP (1996 onwards)	CMIP2 (1997 onwards)	CMIP3 (2005-2006)	CMIP5 (2010-2011)
Number of Experiments	1	2	12	110
Centres Participating	16	18	15	24
# of Distinct Models	19	24	21	45
# of Runs (Models X Expts)	19	48	211	841
Total Dataset Size	1 Gigabyte	500 Gigabyte	36 TeraByte	3.3 PetaByte
Total Downloads from archive	??	??	1.2 PetaByte	
Number of Papers Published	47		595	
Users	??	??	6700	

teşekkürler!

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