

CMIP5 activities at CMCC (Italy)

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CMIP5 simulations at CMCC

The simulations refer to the CMIP5 experiment description as detailed by Taylor et al. 2008

Numbers (#) correspond to the document:

http://cmip-pcmdi.llnl.gov/cmip5/docs/Taylor_CMIP5_design.pdf

#	Simulation	CMCC-CESM	CMCC-CMS	CMCC-CM
3.1	Pre-industrial control	X	X	X
3.2	Historical (1850-2005, coupled model)	X	X	X
3.3	AMIP (1979-2008, atmosphere model)		X	X
4.1	RCP4.5 2006-2100		X	X
4.2	RCP8.5 2006-2100	X	X	X
6.1	Idealized +1%CO2/yr			X
1.2	Decadal Predictions		ongoing	X

CMCC-CM : **Standard** AOGCM : T159L31

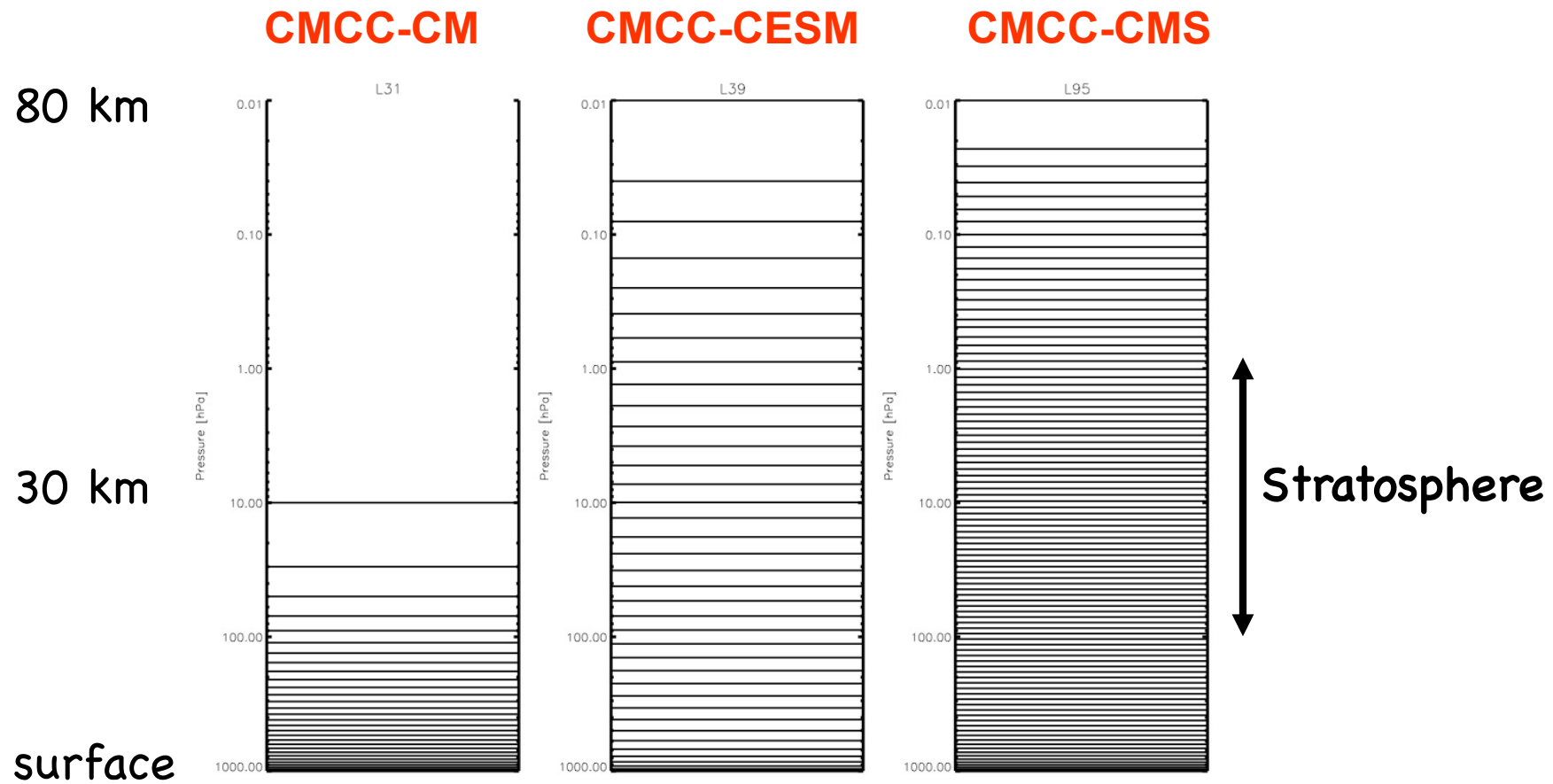
CMCC-CMS :AOGCM + well resolved **stratosphere** : T63L95

CMCC-CESM: **Earth System Model** T31L39

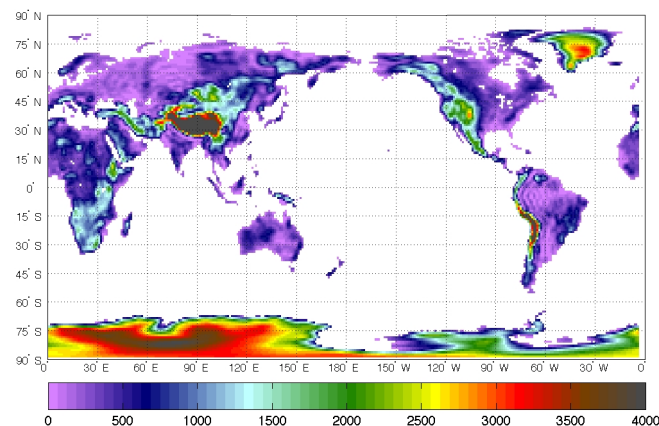
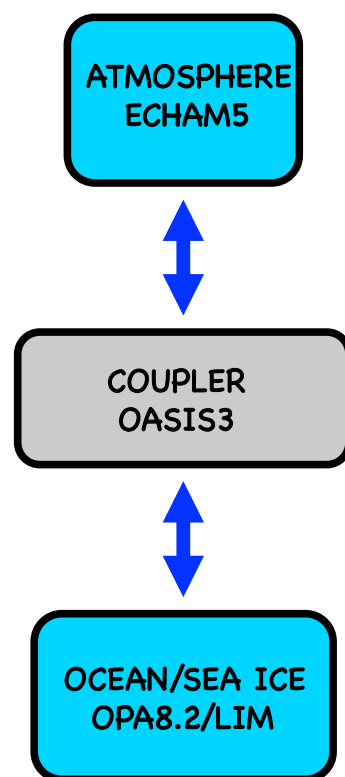
All AGCMs coupled to OPA8.2 (ORCA2) + LIM

CMCC-CMS: stratosphere-resolving CGCM

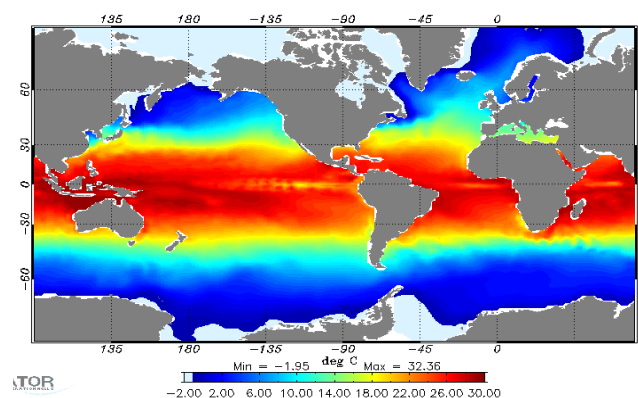
- T63L95 MAECHAM5 (Manzini et al 2006, Giorgetta et 2006)
- Updated shortwave radiation Scheme (Cagnazzo et al 2007)



CMCC-CM : AOGCM CMCC Climate Model



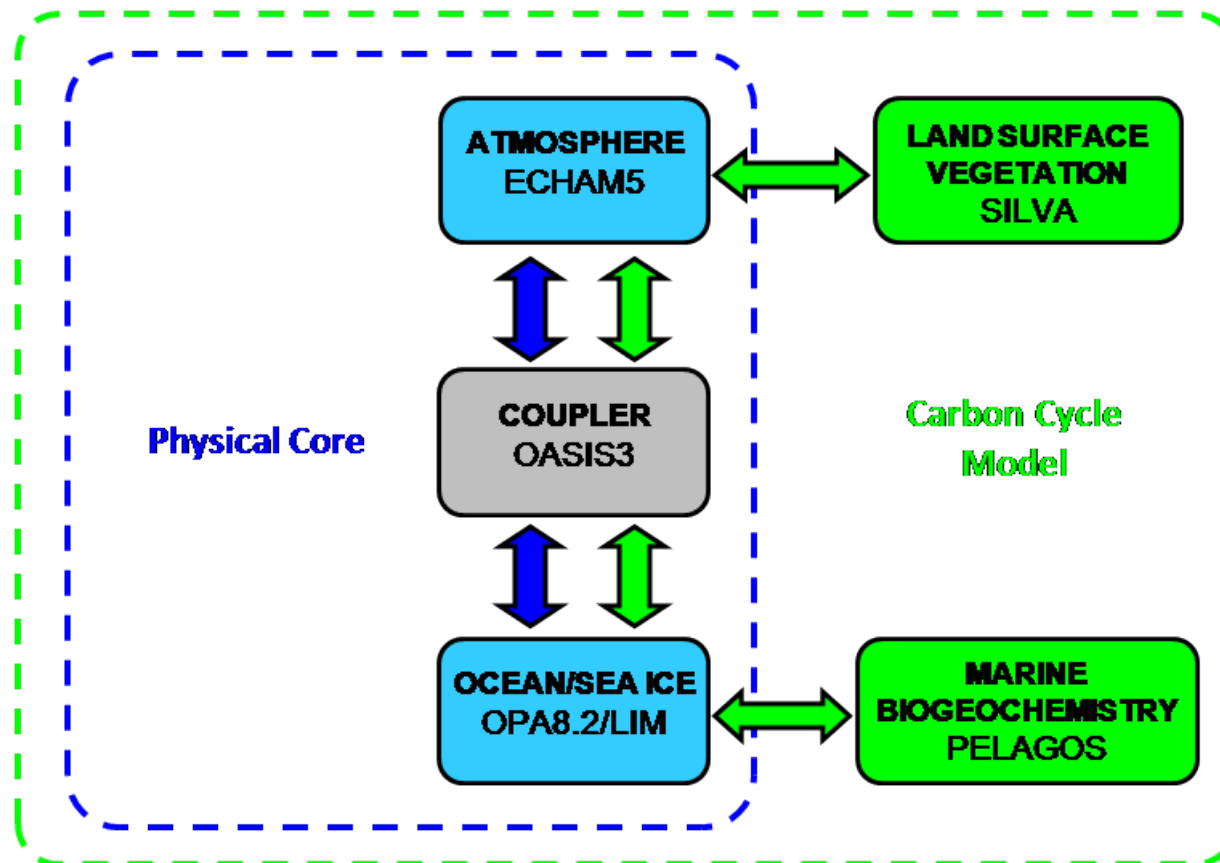
*ATMOSPHERE Resolution
ECHAM5 T159 L31*



*OCEAN Resolution
OPA/ORCA2 2°x2° L31
(0.5° in the tropical belt)
SEA-ICE: LIM*

- High resolution global atmosphere (~80 Km) : improved representation of regional scale features, with respect to previous (AR4) SXG AOGCM.

CMCC-CESM Carbon Cycle Earth System Model



ECHAM5 (Roeckner et al. 2003, 2006); SILVA (Alessandri 2006);

OASIS3 (Valcke 2006);

OPA8.2 (Madec et al. 1999);

PELAGOS (Vichi et al. 2007)

Resolution: T31L39

Stratospheric Component.

Top at 80 km, **39 vertical levels**

Momentum conserving orographic and non-orographic gravity wave scheme [Manzini et al., 2006]

CMCC-CMS Climate Model with the Stratospheric Component

Physical Core. **ATMOSPHERE : ECHAM5** (Roeckner et al. 2003, 2006); Coupler: OASIS3 (Valcke 2006); **Ocean: OPA8.2** (Ocean Parallelise Madec et al. 1999), Resolution ORCA2L31;
LIM (Louvain-la-Neuve sea Ice Model, Fichefet and Morales-Maqueda 1997) is a thermodynamic sea ice model directly coupled with OPA8.2.
Fogli et al. 2009 (for the coupling)

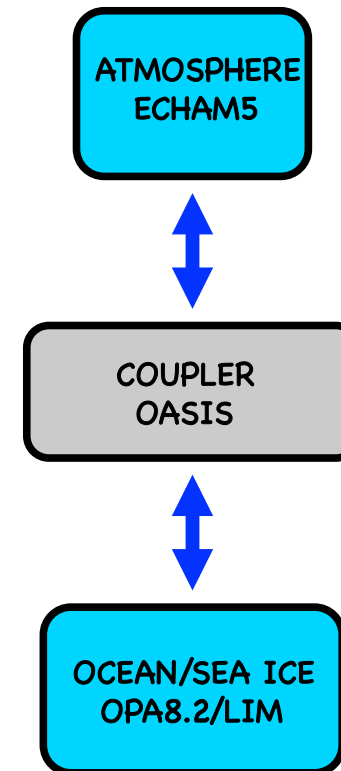
Resolution: T63L95

Stratospheric Component.

Top at 80 km, **95 Vertical Levels**, High vertical resolution: 44 levels between 100 and 1 hPa

Momentum conserving orographic and non-orographic gravity wave scheme [Manzini et al., 2006]

The Model has a spontaneous QBO



Publications

- Bellucci , A., S. Gualdi, S. Masina, A. Storto, E. Scoccimarro, C. Cagnazzo, P. Fogli, E. Manzini and A. Navarra, **(2012)**: Decadal climate predictions with a coupled OAGCM initialized with oceanic reanalyses, *Climate Dynamics*, doi:10.1007/s00382-012-1468-z.
- Alessandri, A., Fogli, P. G., Vichi, M., and Zeng, N. **(2012)**. "Strengthening of the hydrological cycle in future scenarios: atmospheric energy and water balance perspective". *Earth Syst. Dynam. Discuss.*, 3, 523-560, doi:10.5194/esdd-3-523-2012, 2012.
- Cagnazzo, C., Manzini E., Fogli, P. G., Vichi, M. and Davini P. **(2012)**. "Role of Stratospheric Dynamics in the Ozone-Carbon connection in the Southern Hemisphere". Submitted to *Climate Dynamics*
- Davini P, Cagnazzo C., P. G. Fogli, E. Manzini, S. Gualdi, and A.Navarra, European Blocking and Atlantic Jet Stream Variability in theNCEP/NCAR Reanalysis and the CMCC climate model, **submitted to J Climate,under revision**
- Manzini, E., C. Cagnazzo, P. G. Fogli, A. Bellucci, and W. A. Muller **(2012)**. "Stratosphere -troposphere coupling at inter-decadal time scales: Implications for the North Atlantic Ocean". *Geophys. Res. Lett.*, 39, L05801, doi:10.1029/2011GL050771.
- Scoccimarro, E., S. Gualdi, A. Bellucci, A. Sanna , P.G. Fogli,E. Manzini, M. Vichi, P. Oddo, A. Navarra **(2011)**. " Effects of Tropical Cyclones on Ocean Heat Transport in a High Resolution Coupled General Circulation Model". *J. Clim.*, 24, 4368-4384. doi: 10.1175
- Vichi, M., E. Manzini, P. Fogli, A. Alessandri, L. Patara, E. Scoccimarro, S. Masina, A. Navarra **(2011)**. "Global and regional ocean carbon uptake and climate change: sensitivity to a substantial mitigation scenario". *Climate Dynamics*, 37, 1929-1947 doi:10.1007/s00382-011-1079-0

Successes,difficulties,plans,recommendations,
science gaps and new questions that have emerged
related to how formulate a possible CMIP6

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To produce a **statistics of downloaded variables** from
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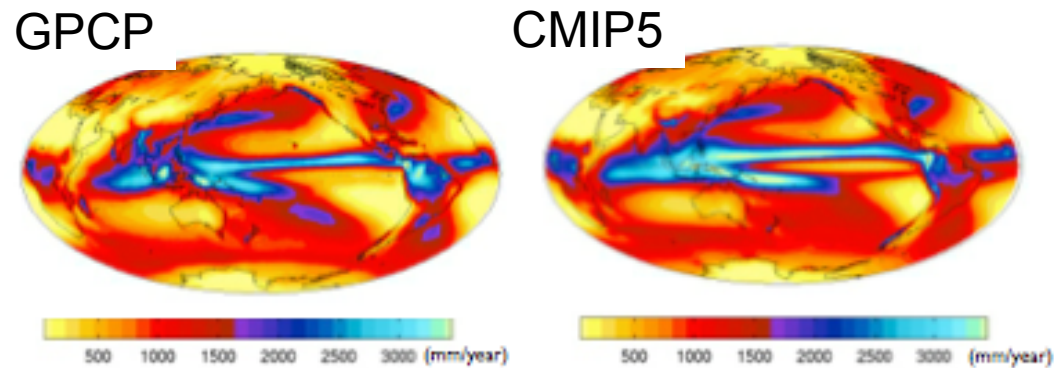
- To produce a **statistics of downloaded** variables from CMIP5 archive may help in assessing the real demand of climate models data from users
- To promote **CMOR as a standard protocol** for climate data format (i.e., GCM output directly saved into CMOR format): it would facilitate the (very time-consuming) post-processing stage

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- To produce a **statistics of downloaded** variables from CMIP5 archive may help in assessing the real demand of climate models data from users
- To promote **CMOR as a standard protocol** for climate data format (i.e., GCM output directly saved into CMOR format): it would facilitate the (very time-consuming) post-processing stage
- **Facilitate download of data** from CMIP5 archive! (CMIP3 was much easier...)

Recommendations/Suggestions for CMIP6 (Priority Actions)

- 1) To use the CMIP5-CMIP6 interval to tackle the **models' systematic error reduction**....in a (more) systematic way!
Some “historical” biases particularly reluctant to go away...
(double ITCZ?) : **GRAND CHALLENGE #7?**



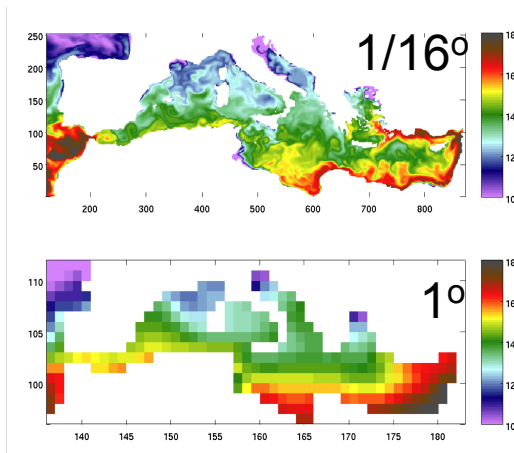
Put bias reduction at the top of the agenda.

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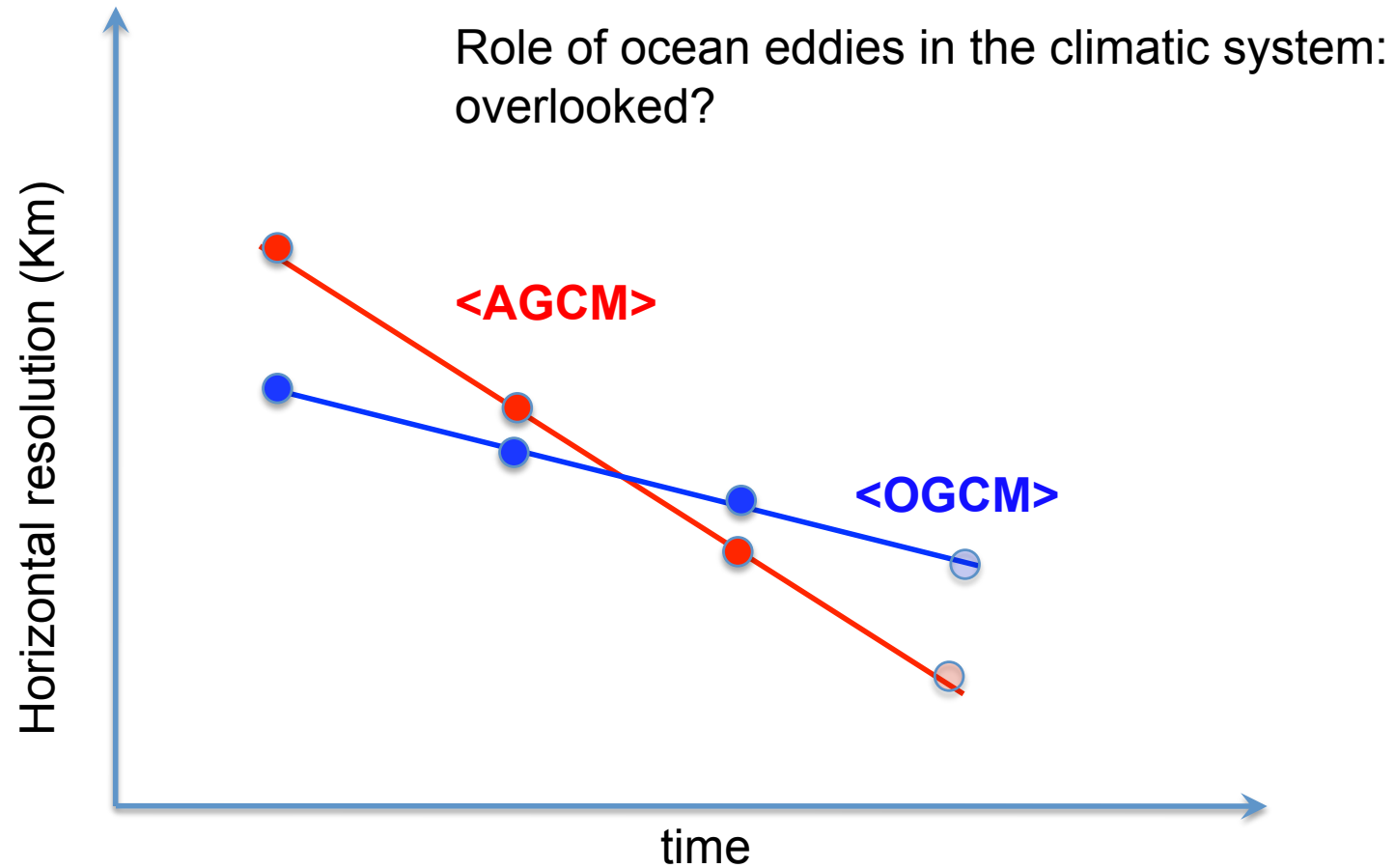
2) (Mesoscale) **Turbulence in the ocean.**

Current generation of OGCMs in CMIP coupled models
do still provide a “**laminar**” **representation of the ocean state.**



turbulent ocean (7 Km)

smooth, laminar flow (100 Km)



The **rate of spatial resolution refinement in AGCMs was faster than in OGCMs?**

The inclusion of mesoscale turbulence in the oceanic component of global CGCMs may have a dramatic impact on our current vision of climatic processes (THC, energy transfer at the air-sea interface, interaction with marine biogeochemical cycles..)

Thanks!

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