### **Evaluation and uncertainties in ocean biogeochemistry** (from the French climate community to CMIP5)

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# How can we deal with uncertainties in Marine biogeochemistry ?

Between January 1, 2000 and March 31, 2007: **~142 peer-reviewed papers** (e.g., Journal of Geophysical Research — Oceans, Deep Sea Research I and II, Journal of Marine Systems, Journal of Oceanography, and Ocean Modeling):

- 68.3% present a visual comparison !
- 9.3% quantify model-data misfits
- 11.3% data assimilation, cost function etc...
- remaining employ complex methodology

Nowadays, multi-models skill assessment in CMIP5 perspective...

- model ranking (Anav et al., submitted)
- Model-data modern state (Séférian et al., 2012)
- feedback metrics comparison (Vivek et al., 2012)
- and so on...

 $\Rightarrow$ Can we compare one Earth System Model to each other ?



#### IPSL & CNRM as CMIP5 test tube for Marine biogeochemistry

=> same model (PISCES) + same spin-up strategy (long & multi-step)









Basic evaluation & skill assessment in Clim Dyn Special Edition
Extension to other configurations (Medium resolution, new physics...)

#### IPSL & CNRM as CMIP5 test tube for Marine biogeochemistry



#### Uncertainties of Marine biogeochemistry in a CMIP5 perspective

Several quantification of uncertainties have been proposed in both biogeochemical and physical community:

•Multi-score approach e.g. Stow et al., 2009, Rose et al., 2009, Doney et al., 2009

•Fraction of explained variance (Hawkins and Sutton, 2009)

•Trends assessment (McKinley et al., 2010)

•Detection and Attribution (Allen et al., 2003, Andrew et al., 2012, BGD)

	Explained Variance	Trends assessment	D&A
	Observational need		
	Multi-score approach		

## Uncertainties of Marine biogeochemistry in a CMIP5 perspective

Incertitude totale = Incert. Modèle + Incert. Scénario + Variabilité Interne



Time [year]

#### Uncertainties of Marine biogeochemistry in a CMIP5 perspective

Incertitude totale = Incert. Mod + Incert. Scé non-C + Var Int non-C + Incert. Scé C + Var Int C



Time [year]

# Uncertainties of Marine biogeochemistry in a CMIP5/6 perspective

Some ideas to better constrain uncertainties before moving towards more cycles in ESM (meaning more degree of freedom):

- Systematic skill-assessment within a common framework
- Converge or recommendations for spin-up strategy
- Ensemble approach (only IPSL has performed more than 1 members with BGC)
- •Cross-assessment of Earth System components (Impact of various sea ice model on MBG) -> simulations are processing... [Martin ?]

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