

Carbonate & Biogenic Sediments Models

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Note: This list is incomplete in many important ways.
If you have more information to add please contact chris.jenkins@colorado.edu in the CSDMS.

Name	Reference	Release Year	Authors / Institution	Materials	Chemistry	Physics / Oceanography	Biology	Spatial Scale	Stratigraphy	Method/s	Time Scale	Code Availability	Code Type	Other Refs
SEDPAK		2005-13; Sedpak 5.4 (final)	Department of Earth and Ocean Sciences, University of South Carolina	All sediment types	-	Water Depth	None	Basin / platform	Litho- and chronostratigraphy	spatial/temporal accumulation	10 ⁷ yr	http://sedpak.geol.sc.edu/	Executable: Redhat Linux Version 8.0 or 9.0 (Not a Windows or Mac application)	
Cyclopath		2005	Shell International E&P	Carbonates	-		None	Platform	2D/3D model of cyclicity	spatial/temporal mosaic of production & transport	10 ⁶ yr	https://github.com/cs-dms-contrib/cyclopath	C	
CarboCAT	Burgess, P.M., 2013. CarboCAT: A cellular automata model of heterogeneous carbonate strata, Computers & Geosciences, Volume 53, 129-140	2008	Shell International E&P	Carbonates	-	Simple sediment transport; depth-dependent sediment production; subsidence; eustatic oscillations	None	Platform interiors	horizontal and vertical distributions of carbonate lithofacies	cellular automaton	10 ⁶ yr	https://github.com/cs-dms-contrib/cyclopath	Matlab	
Boscher & Schlager Model	BOSCHER, H. & SCHLAGER, W. 1992. Computer simulation of reef growth. Sedimentology, 39, 503-512.	1992	Boscher & Schlager / Institute for Earth Sciences, Vrije Universiteit, The Netherlands	Coral Reefs	-	Depth, Light (Beer-Lambert Law) & Temperature	Hermtatypc corals	Reef						
FUZZIM	Nordlund, U. 1990. FUZZIM: forward stratigraphic modeling made simple, Computers & Geosciences v. 25, p 449-456	1990	Nordlund / Department of Earth Sciences, Historical Geology and Paleontology,	All sediment types	-	Depth		Basin / platform		Fuzzy Set Theory				
SEDSIM	CSIRO, (2004), Promotional brochure on the use of Sedsim. Predictive Geoscience Group, CSIRO Petroleum, pp. 22 [Brochure]	2004	Griffiths / CSIRO, Australia	All sediment types	-		Biofacies		3D lithofacies	Fuzzy Set Theory (in part)		Commercial		
Dionisos	Bassant, P. & Harris, P.M. 2008. Analyzing Sequence Architecture and Reservoir Quality of Isolated Carbonate Platforms with Forward Stratigraphic Modeling. In: SEPM Special Publication Volume 89. DOI: 10.2110/pec.08.89.0343	2008		All sediment types; E&P oriented		Diffusional transport	-	Platform	Spatial 3D; Processes 1-2D			Commercial		Bassant and Harris, 2008; Williams, 2010, unpubl. PhD thesis
carb3D+	Paeterson et al 2006; Paterson et al 2008; Granjeon and Joseph, 1999	2008	Smart and Whitaker; Bristol Carbonates Consortium, UK			waves (shoaling) and currents; diagenetic processes		Platform	Spatial 3D; Processes 1-2D?			Commercial		
carboCELL and carboLOT			Jenkins, Burgess, Potts; INSTAAR/CU & etc	Carbonate environments	-	World Ocean Atlas; MODIS irradiances	Carbonate skeletal	local representations of broad facies; sealevel changes	1D on 3D terrain, etc	carboCELL - cellular automaton; carboLOT - calculus population ecology; ground conditions	months to 10,000 yrs	On request	Python 2.7	
ReefHab	Kleyvas JA (1997) Modeled estimates of global reef habitat and carbonate production since the last glacial maximum. Paleogeography 12: 533-545. http://onlinelibrary.wiley.com/doi/10.1029/2006GC001415/full	1997	Kleyvas / UCAR	Coral Reefs	Nutrient and Dissolution	Temperature, Light	Hermtatypc Corals	85km2 cellsizes; global oceans	No	Box Model	Present	No		Guan Y, Hohn S, Merico A (2015) Suitable Environmental Ranges for Potential Coral Reef Habitats in the Tropical Ocean. PLoS ONE 10(6): e0128831.
ReefSAM		2006	Webster Univ. Sydney; ##											

Source: Miscellaneous References and Citations

Intermediate Complexity Marine Model	http://usjgofs.whoi.edu/mzweb/syn-mod.htm https://sourceforge.net/projects/combocoralreef/	US JGOFs										Matlab	http://usjgofs.whoi.edu/mzweb/smp
COMBO Biogeochemical Elemental Cycling (BEC) model	http://www.cesm.ucar.edu/models/cesm1.1/pop2/doc/sci/ecosys_placehold.html	2012 Keith Lindsay; NCAR	Plankton	Ocea nutrient & saturation	Ocean Circulation inputs	Plankton	Global; 0.25 dg	No	Intermediate Complexity	Present	NCAR		Moore, J. K., S. Doney, J. Kleyapas, D. Glover, and I. Fung, An intermediate complexity marine ecosystem model for the global domain, Deep-Sea Res Pt II 48: 403-452, 2003
(Coral Competition Model)	Maguire, L.A. and Porter, J.W., 1977. A spatial model of growth and competition strategies in coral communities. Ecol. Modelling, 3: 249--271.	1977 Maguire, Oak Ridge National Laboratory; Porter, University of Michigan	Hermatypic corals	No	No	Hermatypic corals	Metres	No	Cellular model; spatial simulation	Present	Unpublished		
Ecosim with Ecopath	http://www.ecopath.org/ ; Christensen and Pauly, 1992; Pauly et al., 2000	1992, 2000 Christensen NOAA; Pauly UBC	Living actors	Nutrients		Trophic webs; predator-prey; mortalities	An ecosystem	No		Present	NOAA; http://www.ecopath.org/	Windows Executable (based on Java)	Arias-González, J.E., Nuñez-Lara, E., González-Salas, C. & Galzin, R., 2004. Trophic models for investigation of fishing effect on coral reef ecosystems. Ecological Modelling 172,197-212.

Source:

CSM Carbsim	Taizhong Duan, 2000				Sedimentology		Basin / platform						
REPRO	Hussner et al, 2001				Sedimentology								
SedTec 2000	Boylan et al, 2002				Sedimentology								
CARBONATE 3D	Warrlich et al, 2002				Sedimentology								
SIMSAFADIM	Bitzer and Salas, 2002				Sedimentology	Biofacies compete							
FUZZYREEF	Parcell, 2003				Sedimentology								
TAWIC+?	Quinquerez et al, 2004				Sedimentology								
CARBONATE GPM	Hill et al in prep				Sedimentology								
PHAST	Parkhurst et al, 2004				Diagenesis								
TOUGHREACT	Xu et al, 2004				Diagenesis								
GEOCHEMISTS	Bethke, 2007				Diagenesis								
WORKBENCH													
FACIES 3D	Matsuda et al, 2004												Facies templates by environment
BASIN 2	Bethke et al, 2007												

Source: <http://pft.ees.hokudai.ac.jp/maremp/models/index.shtml>

Model	Author	PFTs	Main focus	<<	<<	<<	<<	<<	<<	<<
BEC	S. Doney & K. Lindsey	plankton: pico/nano, diatoms; diazotrophs; adaptive zooplankton	production, carbon cycle, other biogeochemical cycles.							Climate-biogeochemical feedbacks.
NOBM	Watson Gregg	plankton: diatoms; chlorophytes; cyanobacteria; coccolithophores; zooplankton								Phytoplankton phenology, primary production, carbon cycle
AusCom	R. Matear	plankton: silicifiers; calcifiers; N2-fixers; microzoo; mesozoo	Interactions between the high-resolution ocean physics and biogeochemistry							Use of parameter optimisations and size-based parameters.
TOPAZ	J. Dunne	plankton: small phytoplankton; large phyto; protists; filter feeders								Phytoplankton physiology, such as development of optimal allocation theory & N:P cellular quotas.

MEM-MRI.com	http://www.jamstec.go.jp/frcg/eng/program/ecrp/group03.html ; 2003; 2 versions: MEM-COCO; NPZD	H. Nakano FRCGC/JAMSTEC, JP	Interactions between the high-resolution ocean physics and biogeochemistry	1 x 1 degrees	30yr +			
PISCES	"Pelagic Interaction Scheme for Carbon and Ecosystem Studies"; 2004; http://www.lodyc.jussieu.fr/~aumont/OPA_model.html	L. Bopp; Laboratoire d'Océanographie Dynamique et de Climatologie (LODYC), FR	plankton: diatoms; nanophyto; microzoo; mesozoo	Currently interfaced with the OPA model, an Ocean General Circulation Model also developed at LODYC. beta-version of PISCES coupled to the regional ocean model ROMS	Primary production, carbon cycle, other biogeochemical cycles.	Adjoint version and high resolution physics.	Climate-biogeochemical feedbacks.	
PlankTOM	Global Change Biology (2005) 11, 2016–2040, doi: 10.1111/j.1365-2486.2005.01004.x;	E. Buitenhuis & C. Le Quéré; University of East Anglia, UK	plankton: silicifiers; calcifiers; Phaeocystis; nanophyto; pico-autotrophs; N2-fixers; pico-heterotrophs; protozoo; mesozoo; macrozoo	Carbon cycle, other biogeochemical cycles. 22-39 prognostic variables describing the C, O, N, Si, P and Fe cycles and phytoplankton chlorophyll.	Embedded in the NEMO general circulation model (GCM); Stokes' law particle settling. The vertical eddy diffusivity and viscosity coefficients are calculated using a 1.5 order turbulent closure scheme which explicitly calculates mixed layer depth and produces a minimum of diffusion in the thermocline.	Ecosystem-climate interactions, particularly those involving zooplankton. microzooplankton physiology and biomass; iron-light colimitation photosynthesis model	Acclimation. Climate-biogeochemical feedbacks.	http://lgmacweb.env.uea.ac.uk/green_ocean/model/model.shtml?1
ERSEM		I. Allen	diatoms; dinoflagellates; flagellates; picophyto; bacteria; heterotrophs; microzoo; mesozoo	Biogeochemical interactions in the coastal ocean (upcoming global version).	Phytoplankton physiology (quota model). Interactions with fish. Complex interactions with sediment and microbial processes.			
BFM-PELAGOS		M. Vichi	plankton: diatoms; flagellates; picophyto; large phyto; bacteria; heterotrophic nanof; heterotrophs; microzoo; carnivores; omnivores	Carbon cycle, biological pump.			climate-biogeochemical feedbacks.	
MEM-COCO		Y. Yamanaka & T. Hashioka	plankton: diatoms; small phyto; small zoo; copepods; euphausiids; fish		Ecosystem interactions with coral reefs and fisheries.		Climate-biogeochemical feedbacks.	
DARWIN		S. Dutkiewicz & M. Follows	plankton: 78 phytoplankton; zooplankton			Flexible community structure and emergent properties.	Ecosystem - climate interactions.	
REcoM2		Judith Hauck & Christoph Völker	plankton: diatoms; small phyto; zooplankton	Primary production, biogeochemical cycles, CO2 uptake, dynamic stoichiometry, Si-cycle		Southern Ocean.		