

## **A Partial List of Existing Numerical Models Dealing with Carbonate Accumulation**

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**CARB3D** - Paterson, RJ, Whitaker, FF, Smart, PL, Jones, DG & Oldham, D. 'Controls on early diagenetic overprinting in icehouse carbonates: insights from modeling hydrological zone residence times using CARB3D+', *Journal of Sedimentary Research*, 78 (4), (pp. 258-281), 2008. ISSN: 1527-1404 10.2110/jsr.2008.029

Whitaker, F.F., Smart, P.L., Hague, Y., Waltham, D.A. & Bosence, D.J.W. 1999. Structure and function of a coupled 2D sedimentological and diagenetic model for carbonate platform evolution. *Society of Economic Paleontologists and Mineralogists Special Publication*, 62, (pp. 337-355).

Bosence, D.W.J. & Waltham, D. 1990. Computer modeling the internal architecture of carbonate platforms. *Geology* 18(1):26-30. [DOI: 10.1130/0091-7613(1990)018<0026:CMTIAO>2.3.CO;2]

**CARBOCAT** - Burgess (unpubl) 2009. CarboCAT.  
“<http://csdms.colorado.edu/wiki/Model:CarboCAT>”.

Burgess P.M. 2013. CarboCAT: A cellular automata model of heterogeneous carbonate strata. *Computers & Geosciences* 53, 129–140.

**CARBPLAT** – Bosscher, H. & Southam, J. 1992. CARBPLAT - A computer model to simulate the development of carbonate platforms. *Geology* 20:3. [doi:10.1130/0091-7613(1992)020<0235:CACMTS>2.3.CO;2]

**DYNACARB** –Li Y.Y., Lerche I. & Perlmutter M.A. 1993. Global cyclostratigraphy: a model of carbonate growth patterns. *Marine and Petroleum Geology*, 10, 620–631.

**PHIL** – Bowman, S.A. 1997. PHILx Stratigraphic Simulators and PHLuxx Hydrocarbon Generation Modeller: Using Objects and Relationships with nearest neighbours to Model Stratigraphy and Fluid Flow. In: Watney, W.L., Rankey, E.C., Franseen, E.K. and Goldstein, R.H. (eds), Numerical experiments in stratigraphy-an international workshop. *Kansas Geological Survey, Open-File Report* 96–27, 69.

Bowman, S. A. , and Vail, P.R. 1999. Interpreting the Stratigraphy of the Baltimore Canyon Section, Offshore New Jersey with PHIL, a Stratigraphic Simulator. In: Harbaugh, J.W., Rankey, E.C., Slingerland, R., Goldstein, R.H. and Franseen, E.K. (eds), Numerical Experiments in Stratigraphy: Recent Advances in Stratigraphic and Sedimentologic Computer Simulations. *SEPM Special Publication*, 62, 117–138.

**Carbonate GPM** - Hill, J., Tetzlaff, D., Curtis, A., & Wood R. Modeling shallow marine carbonate depositional systems. *Computers & Geosciences* 35 (2009) 1862–1874

**CYCLOPATH** - Burgess, P.M. and Wright, V.P, 2003. Numerical forward modelling of carbonate platform dynamics: An evaluation of complexity and completeness, *Journal of Sedimentary research*, v.73, p.637-652.

Demicco, R.V., 1998. CYCOPATH 2D - A Two-Dimensional, Forward Model of Cyclic Sedimentation on Carbonate Platforms. *Computers & Geosciences* 24(5), 405-423.

**DIONISOS** - J. Borgomano, C. Lanteaume, O. Ridet, M. Rousseau, & N. Vilasi-Marmier. 2014. 3D Stratigraphic Forward Modelling for the Prediction of Carbonate Platform Architectures: Evaluation of Stratigraphic Trap Potential in Middle East Mesozoic Carbonate Sequences. *Search and Discovery*, Article #41328, 7pp.

Sear, C., Borgomano, J. Granjeon, D. and Camoin, G. 2013, Impact of environmental parameters on coral reef development and drowning: Forward modeling of the last deglacial reefs from Tahiti (French Polynesia;IODP Expedition #310): *Sedimentology*, doi: 10.1111/sed.12030.

Granjeon D. & Joseph P. 1999. Concepts and applications of a 3D multiple lithology, diffusive model in stratigraphic modeling. In: Harbaugh, J. W., Watney W. L., Rankey, E. C., Slingerland, R., Goldstein, R. H. & Franseen, E. K. eds. *Numerical Experiments in Stratigraphy: Recent Advances in Stratigraphic and Sedimentological Computer Simulations*, Vol. 62, SEPM Special Publication, Tulsa Ok, pp. 197-210.

**FUZZIM** – Nordlund, U. 1996. Formalizing geological knowledge, with an example of modeling stratigraphy using FUZZY logic. *Journal of Sedimentary Research*, 66, 4, 689–698.

Nordlund, U. 1999. Stratigraphy Modelling Using Common Sense Rules. In: Harbaugh J.W., Rankey E.C., Slingerland R., Goldstein R.H. and Franseen E.K.(eds), *Numerical Experiments in Stratigraphy: Recent Advances in Stratigraphic and Sedimentologic Computer Simulations*. SEPM Special Publication, 62, 245–252.

**FUZZYREEF** - Parcell, W.C., 2003, Evaluating the development of Upper Jurassic reefs in the Smackover Formation, Eastern Gulf Coast, U.S.A. through fuzzy logic computer modeling. *Journal of Sedimentary Research*, 73, 498-515.

Parcell, W.C., 2000, 3D computer simulation of carbonate depositional facies distribution and productivity rates using continuous set theory to mimic geologists' reasoning. *Gulf Coast Association of Geological Societies Transactions*, 50, 439-450.

**REEFHAB** - Kleypas, J. A. 1997. Modeled estimates of global reef habitat and carbonate production since the Last Glacial Maximum. *Paleoceanography*, 12(4), 533-545.

**ReefSAM** - Barrett, S.J. & Webster J.M. 2017. Reef Sedimentary Accretion Model (ReefSAM): Understanding coral reef evolution on Holocene time scales using 3D stratigraphic forward modelling. *Marine Geology* 391, 108–126.  
[<https://doi.org/10.1016/j.margeo.2017.07.007>]

**STRATA** - *STRATA: Freeware for analyzing classic stratigraphic problems*. P.B. Flemings & J.P. Grotzinger [http://hydro.geosc.psu.edu/Papers/Gsa\\_strata/gsa.html](http://hydro.geosc.psu.edu/Papers/Gsa_strata/gsa.html)

Read, J.F., Grotzinger, J.P., Bova, J.P. & Koerschner, W.F., 1986, Models for generation of carbonate cycles: *Geology*, v. 14, p. 107-110.

**SEDSIM** - Griffiths, C. *SEDSIM Stratigraphic Forward Modeling*.

<http://sepmstrata.org/PDF-Files/Simulations/SedsimBackgroundGriffiths03.pdf>. CSIRO Petroleum 2003.

Huang, X. Griffiths C.M. & Liu, J. 2015. Recent development in stratigraphic forward modelling and its application in petroleum exploration, *Australian Journal of Earth Sciences*, 62:8, 903-919, [DOI: 10.1080/08120099.2015.1125389]

**SEDPACK** - Strobel, S., Cannon, R., Kendall, G.St. C. C.St., Biswas, G. & Bezdek, J. 1989. Interactive (SEDPACK) simulation of clastic and carbonate sediments in shelf to basin settings. *Computers & Geosciences*, 15(8), 1279-1290.

Kendall, C.G.St.C., Strobel, J., Cannon, R., Bezdek, J. & Biswas, G. 1991. The simulation of the sedimentary fill of basins. *Journal of Geophysical Research*, 96, B4, 6911–6929.

**SIMSAFADIM** - Bitzer, K., Salas, R., 2002. SIMSAFADIM: three-dimensional simulation of stratigraphic architecture and facies distribution modeling of carbonate sediments. *Computers and Geosciences*, 28, 1177-1192.

**SEALEX** - Koelling, M., Webster, J.M., Camoin, G., Iryu, Y., Bard, E., Seard, C. (in press): SEALEX - Internal reef chronology and virtual drill logs from a spreadsheet-based reef growth model. *Global and Planetary Change*. [doi: 10.1016/j.gloplacha.2008.07.011]

### **(Other Unnamed Models)**

**1** - Bosscher H. and Schlager W., 1992. Computer simulation of reef growth. *Sedimentology* 39, 503–512.

**2** - Demicco R.V. and Klir G.J. 2001. Stratigraphic simulations using fuzzy logic to model sediment dispersal. *Journal of Petroleum Science and Engineering* 31, 135–155.

**3** - Graus R.R., Macintyre I.G. and Herchenroder B.E. (1984) Computer simulation of the Reef Zonation at Discovery Bay, Jamaica: Hurricane Disruption and Long-Term Physical Oceanographic Controls. *Coral Reefs*, 3, 59–68.

Graus R.R. and Macintyre I.G. (1989) The zonation patterns of Caribbean coral reefs as controlled by wave and light energy input, bathymetric sanding and reef morphology: computer simulation experiments. *Coral Reefs*, 8, 9–18.

**4** - Hüssner H. and Roessler J. 1996. Modeling of Reef Growth in a 3-Dimensional Space. Global and Regional Controls on Biogenic Sedimentation. I. Reef Evolution, *Göttinger Arb. Geol. Paläont., Sb2*, 397–404.

Hüssner H. and Roessler J. 1997. Mathematical modelling and numerical simulation of reefs. *Cour. Forsch.-Inst. Senckenberg*, 201, 225–235.

5 - Li, X. Wang, H. Zhang, Z. & Hastings, A. 2014. Mathematical analysis of coral reef models. *J. Math. Anal. Appl.* 416 (2014) 352–373  
[<http://dx.doi.org/10.1016/j.jmaa.2014.02.053>]

6 - Jordan-Cooley, W.C. Lipcius, R.N., Shaw, L.B., Shen, J. & Shi, J. 2011. Bistability in a differential equation model of oyster reef height and sediment accumulation. *Journal of Theoretical Biology* 289, 1–11.

7 - D. Lirman, 2003. A simulation model of the population dynamics of the branching coral *Acropora* palmate: Effects of storm intensity and frequency. *Ecological modelling.* 161, 169-182.

8 - Paulay G. & McEdward L.R. 1990. A simulation model of island reef morphology: the effects of sea level fluctuations, growth, subsidence and erosion. *Coral Reefs*, 9, 51–62.

**(Model Comparisons)** - Dalmasso, H., Montaggioni, L. F., Bosence, D., & Floquet, M. 2001. Numerical Modelling of Carbonate Platforms and Reefs: Approaches and Opportunities. *Energy Exploration & Exploitation*, 19(4), 315–345.  
[<https://doi.org/10.1260/0144598011492318>]

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