

HE Golden *et al.* Supporting Information

WebTable 3. Inventory of models for quantifying GIW connectivity or their downstream effects. The table is organized by model type. This table is not intended to be comprehensive but to provide examples of appropriate and relevant models. Most of the models presented here are process-based. Others, such as SWAT, are semi-processed based, which means they have a combination of physical processes and embedded empirical (eg statistical) relationships. Wetland parameterization means that model parameters or equations are specific to wetlands (eg wetland water depths).

Model type	Model name	Flowpath type	Structural connectivity information as model input?	Wetland parameterization available?	Required input data and/or calibration data	References
Fully distributed	Hydrogeosphere	SW and GW	No	Yes	Elevation, soil/surficial geology, stream discharge + weather data	Therrien <i>et al.</i> 2008
Fully distributed	Parflow	SW and GW	No	Yes	Elevation, soil/surficial geology, stream discharge + weather data	Ashby and Falgout 1996; Jones and Woodward 2001; Kollet and Maxwell 2006
Fully distributed	GSFlow	SW and GW	No	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Markstrom <i>et al.</i> 2008
Fully distributed	MIKESHE	SW and GW	No	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Refsgaard and Storm 1995

Model type	Model name	Flowpath type	Structural connectivity information as model input?	Wetland parameterization available?	Required input data and/or calibration data	References
Fully distributed	Hydrus	GW	No	Yes	Soil/surficial geology, water table depth or soil moisture + weather data	Simunek <i>et al.</i> 2006
Fully distributed	Series Solution	GW	No	Yes	Elevation, soil/surficial geology, stream discharge + weather data	Ameli and Craig 2014
Fully distributed	Puddle to puddle model (P2P)	SW	Yes	Yes	Elevation, soil/surficial geology + weather data	Chu <i>et al.</i> 2013
Fully distributed	Connectivity of runoff model (CRUM, agent-based version)	SW	No	No	Elevation, stream discharge + weather data	Reaney <i>et al.</i> 2007; Reaney 2008
Fully distributed	Connectivity of runoff model (versions CRUM2D and CRUM3 based on network index)	SW	Yes	No	Elevation, stream discharge + weather data	Lane <i>et al.</i> 2009

Model type	Model name	Flowpath type	Structural connectivity information as model input?	Wetland parameterization available?	Required input data and/or calibration data	References
Fully distributed	DRAINMOD for Watershed (DRAINWAT)	SW and GW	Yes	No	Land use/land cover, soil/surficial geology, stream discharge + weather data	Skaggs 1978; Amatya 1993; Amatya <i>et al.</i> 1997
Fully distributed	Visualizing Ecosystems for Land Management Assessment (VELMA)	SW and GW	No	Yes	Elevation, soil/surficial geology, stream discharge + weather data	Abdelnour <i>et al.</i> 2011; Golden <i>et al.</i> 2014
Fully distributed	VS2DI	GW	No	Yes	Elevation, soil/surficial geology, water table depth + weather data	Hsieh <i>et al.</i> 2000
Fully distributed	MODFLOW	GW	No	Yes	Elevation, soil/surficial geology, water table depth + weather data	Harbaugh 2005
Fully distributed	Basin-Scale Hydrologic Model (BSHM)	SW and GW	No	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Yu and Schwartz 1998
Fully distributed	WETLANDSCAPE (WLS) (successor to WETSIM)	SW and GW	No	Yes	Elevation (including wetland bathymetry), stream discharge + weather data	Johnson <i>et al.</i> 2010

Model type	Model name	Flowpath type	Structural connectivity information as model input?	Wetland parameterization available?	Required input data and/or calibration data	References
Fully distributed	TopoDrive	GW	No	Yes	Elevation, soil/surficial geology	Hsieh 2001
Fully distributed	Wetland Digital Elevation Ponding Model (WDPM)	SW	Yes	Yes	Elevation + weather data	Shook <i>et al.</i> 2013
Fully distributed	Pothole Cascade Model (PCM)	SW	Yes	Yes	Weather data (precipitation is forced onto synthetic wetlands)	Shook and Pomeroy 2011
Fully distributed	Catchment Connectivity Model (CCM)	GW	Yes	No	Elevation, stream discharge + weather data	Jencso <i>et al.</i> 2009; Smith <i>et al.</i> 2013
Semi-distributed	Prairie hydrological model-Cold Regions Hydrological Modelling (PHM-CRHM)	SW and GW	Yes	Yes	Elevation, land use/land cover + weather data	Pomeroy <i>et al.</i> 2010; Fang <i>et al.</i> 2010; Guo <i>et al.</i> 2012
Semi-distributed	Hydrologic Simulation Program-FORTRAN (HSPF)	SW and GW	Yes	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Bicknell <i>et al.</i> 2001; Golden <i>et al.</i> 2014

Model type	Model name	Flowpath type	Structural connectivity information as model input?	Wetland parameterization available?	Required input data and/or calibration data	References
Semi-distributed	Original SWAT model	SW and GW	Yes	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Neitsch <i>et al.</i> 2005
Semi-distributed	SWAT model with hydrologic equivalent wetland (HEW) concept	SW and GW	Yes	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Wang <i>et al.</i> 2008, 2010
Semi-distributed	SWAT with spatially distributed wetlands	SW and GW	Yes	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Evenson <i>et al.</i> 2015, 2016
Semi-distributed	SWAT with probability distributed landscape depressions (SWAT-PDLLD)	SW and GW	Yes	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Mekonnen <i>et al.</i> 2016
Semi-distributed	APEX (Agricultural Policy/Environmental eXtender)	SW and GW	Yes	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge and/or tile flow + weather data	Williams <i>et al.</i> 2005, 2006, 2008; Gassman <i>et al.</i> 2010
Semi-distributed	TOPMODEL	SW and GW	Yes	No	Elevation, stream discharge + weather data	Beven and Kirkby 1979

Model type	Model name	Flowpath type	Structural connectivity information as model input?	Wetland parameterization available?	Required input data and/or calibration data	References
Semi-distributed	SLURP (Semi-distributed Land Use-based Runoff Processes)	SW and GW	Yes	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Kite 1998; Su et al. 2000
Semi-distributed	Precipitation-Runoff Modeling System (PRMS)	SW and GW	Yes	Yes	Elevation, land use/land cover, soil/surficial geology, stream discharge + weather data	Vining 2002; Viger <i>et al.</i> 2010
Lumped	Wetland Hydrologic Capacitance (WHC) model	GW and SW	Typically yes but optional	Yes	Elevation, soil/surficial geology + weather data	McLaughlin <i>et al.</i> 2014
Lumped	Pothole Complex Hydrologic Model (PCHM)	SW and GW	No	Yes	Elevation (wetland bathymetry only), water table depth (i.e., wetland water levels) + weather data	Liu and Schwartz 2011

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