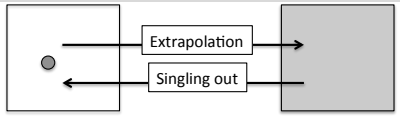
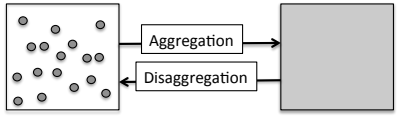
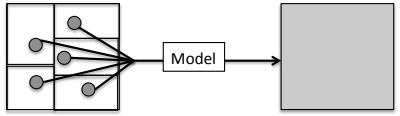
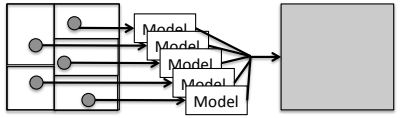
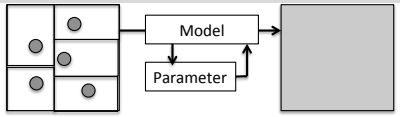
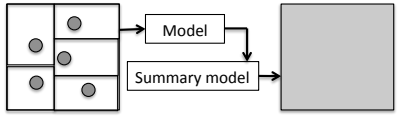
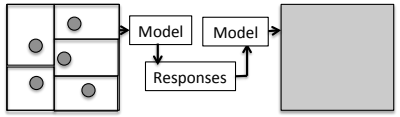
Table 1. Conceptual framework of select scaling methods. Based on Ewert et al. (2011)

Scaling method	Graphical representation	Opportunities	Challenges	GHG example
MANIPUTLATION OF DATA				
Extrapolation and singling out		Simple	Heterogeneity in inputs are neglected	Tully et al. in prep
Aggregation and disaggregation		Spatial heterogeneity is considered	Need to have hypotheses about underlying drivers of input data heterogeneity	Rufino et al. Chapter 2
Aggregation/averaging (Stratified input data)		Less computationally intensive because of averaged input data	Averaging input data may compromise modeling efforts	Bryan et al. 2013, Li et al. 2005
Aggregation/averaging (Stratified output data)		More accurate representation of heterogeneity	Data and simulation intensive which limits applicability at scale	De Gryze et al. 2010
MANIPULATION OF MODELS				
Modification of model parameters		Uses existing models	Fine scale model parameters may be inappropriate for larger scales	
Simplification of model structure		Relies on understanding of known fundamental relationships	Subject to availability of data and understanding of processes	Perlman et al. 2013, Spencer et al. 2011
Derivation of response function or coefficients		Simplifies process-based model output to summary function	Output based on	