



Fig. 1 Diagram of the chloroplast pump model with representative C_i concentrations. CO_2 and HCO_3^- are treated in four compartments (extracellular solution, cytoplasm, chloroplast stroma, and pyrenoid) subject to hydration and dehydration within each compartment (indicated with *dark blue arrows*), photosynthetic removal in the pyrenoid (*green arrow*), and fluxes between compartments. Diffusive fluxes are indicated with wavy *black arrows* and are parameterized using mass transfer coefficients (f_x), whereas active fluxes are indicated with straight *light-blue arrows* and are parameterized using Michaelis–Menten kinetics