Evaluation of Optimal Hourly Stomatal Control using Dynamic Programming

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Abstract. Leaves control the rate of assimilation through adjustments of stomatal apertures, which regulates the flow of CO_2 into the leaf. An inevitable consequence of opening stoma to allow CO_2 into the leaf is the loss of water vapor out of the leaf to the atmosphere (*i.e.* transpiration). Therefore, there is a tradeoff between carbon assimilation and water loss through transpiration. These tradeoffs have been considered for decades through the use of optimal stomatal control theories. Here, we consider a new approach to modeling the daily variation of stomatal control by using Dynamic Programming. The temporal movements and control of stoma are evaluated over the course of 24-hours, including variable light and vapor pressure deficits. The optimal stomatal movement is then compared to available data, demonstrating on the one hand that vegetation responds in a manner consistent with the optimality hypothesis and on the other hand that Dynamic Programming is a viable means of determining stomatal control.