# Supplement S3

October 25, 2021

## 1 Sensitivity of results for cost factor water transport

This supplement provides the full sensitivity analyses for the cost factor of water transport. We provide here more background and details for increased transparency of our results as presented in the main manuscript.

### 1.1 Relative errors mean annual fluxes

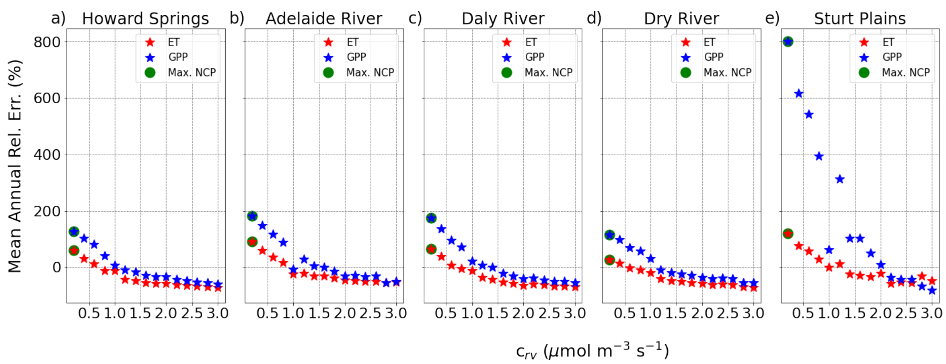


**Figure S3.1.** *Relative errors for mean annual fluxes, for different values of the cost factor for water transport and the different study sites of a) Howard Springs, b) Adelaide River, c) Daly Uncleared, d) Dry River and e) Sturt Plains. Assimilation is shown in blue, total evaporation in red, and the solution with the highest NCP is marked in green. The relative errors go down for higher values of the cost factor in most cases, and even change sign (positive errors to negative errors). Sturt Plains still shows a large errors for the assimilation for lower values of the cost factor.*

## 1.2 Timeseries

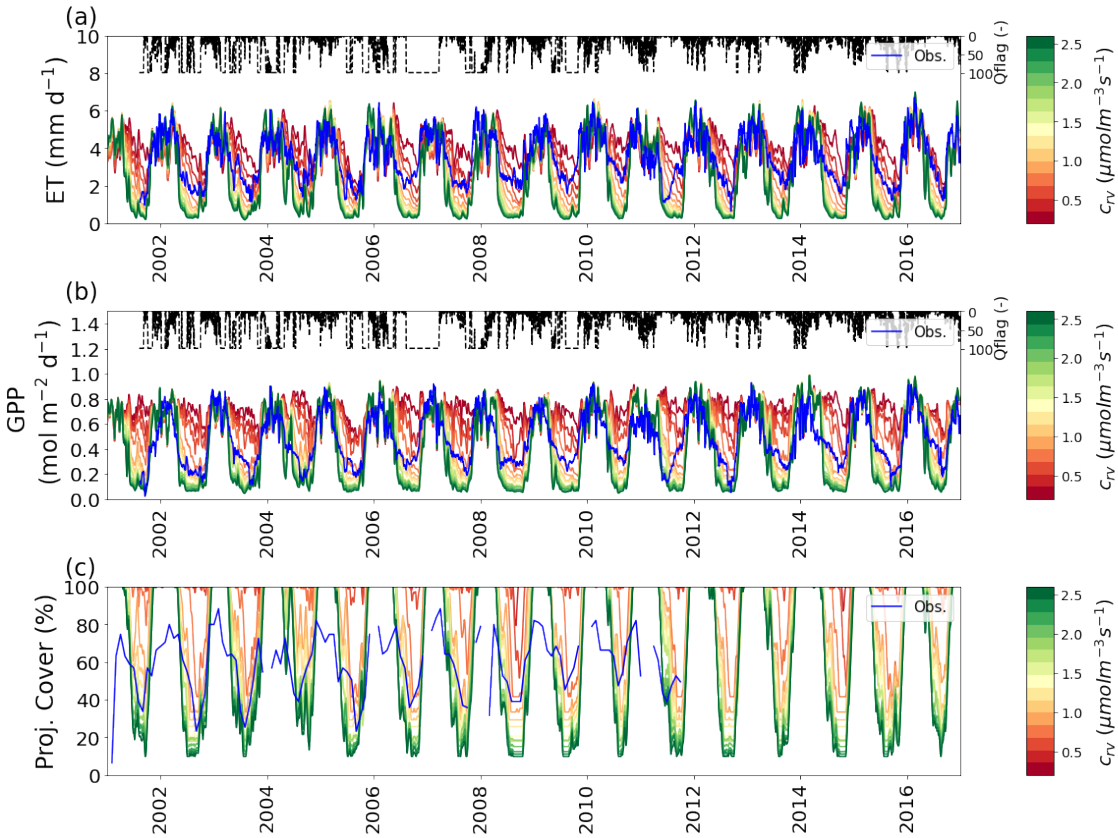


**Figure S3.2.** *VOM-results for different values of the cost factor $c_{rv}$ (color scale) for Howard Springs from 2001-2016 (subset from 1980-2016), with a) the evapo-transpiration (ET), with flux tower observations in blue b) gross primary productivity (GPP), with flux tower observations in blue and c) projective cover, with the observed fraction of vegetation cover based on fPAR-data (Donohue et al, 2008) in blue. Modelled ET and GPP are smoothed with a moving average of 7 days.*

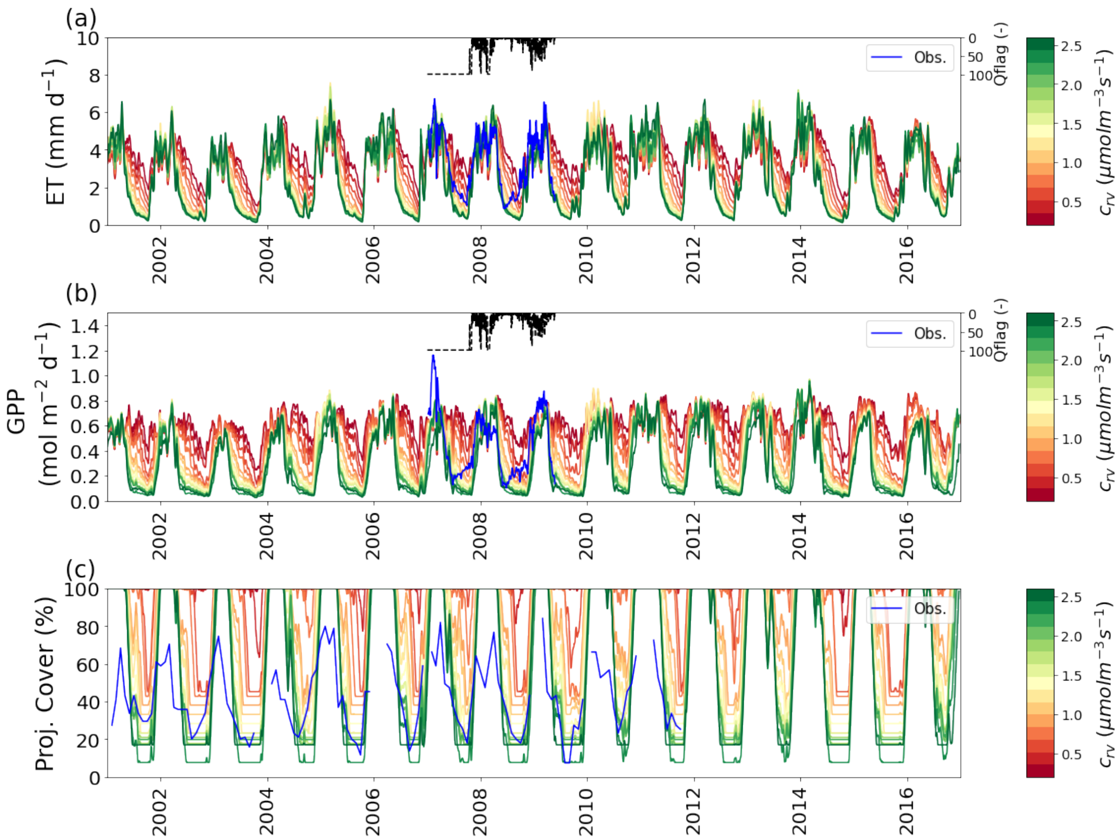


**Figure S3.3.** *VOM-results for different values of the cost factor $c_{rv}$ (color scale) for Adelaide River from 2001-2016 (subset from 1980-2016), with a) the evapo-transpiration (ET), with flux tower observations in blue b) gross primary productivity (GPP), with flux tower observations in blue and c) projective cover, with the observed fraction of vegetation cover based on fPAR-data (Donohue et al, 2008) in blue. Modelled ET and GPP are smoothed with a moving average of 7 days.*

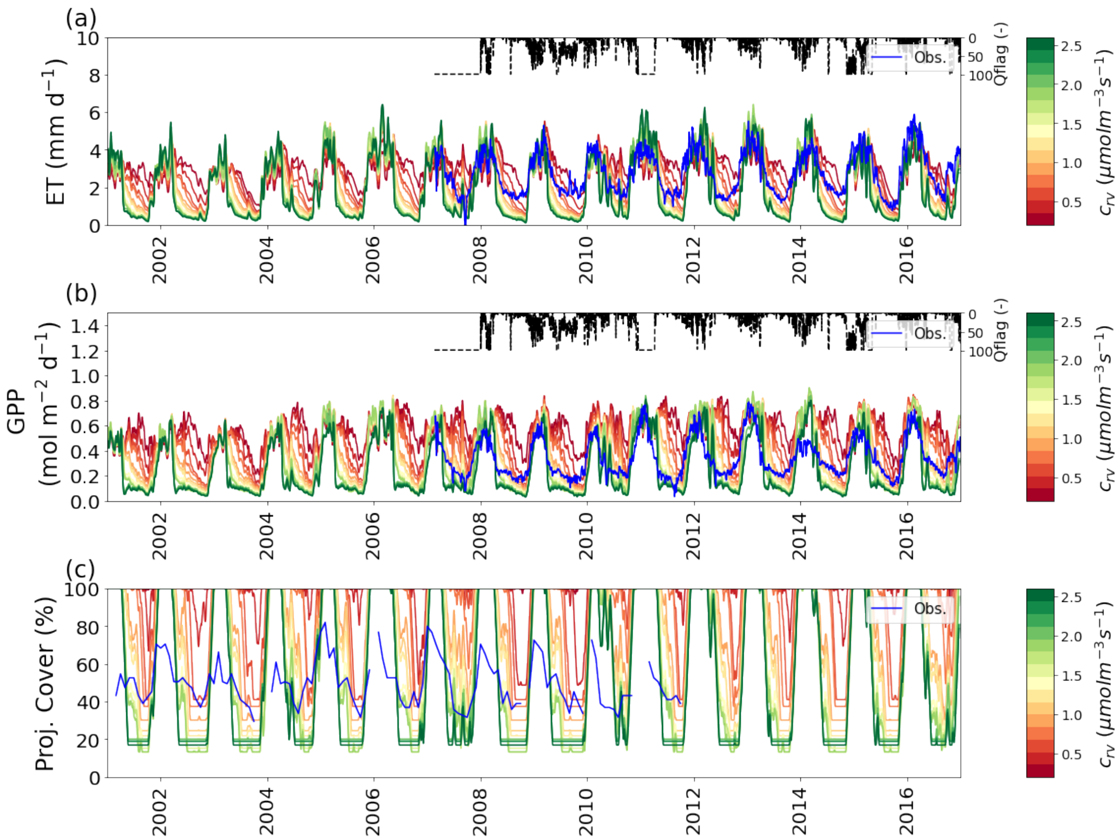


**Figure S3.4.** *VOM-results for different values of the cost factor $c_{rv}$ (color scale) for Daly River from 2001-2016 (subset from 1980-2016), with a) the evapo-transpiration (ET), with flux tower observations in blue b) gross primary productivity (GPP), with flux tower observations in blue and c) projective cover, with the observed fraction of vegetation cover based on fPAR-data (Donohue et al, 2008) in blue. Modelled ET and GPP are smoothed with a moving average of 7 days.*

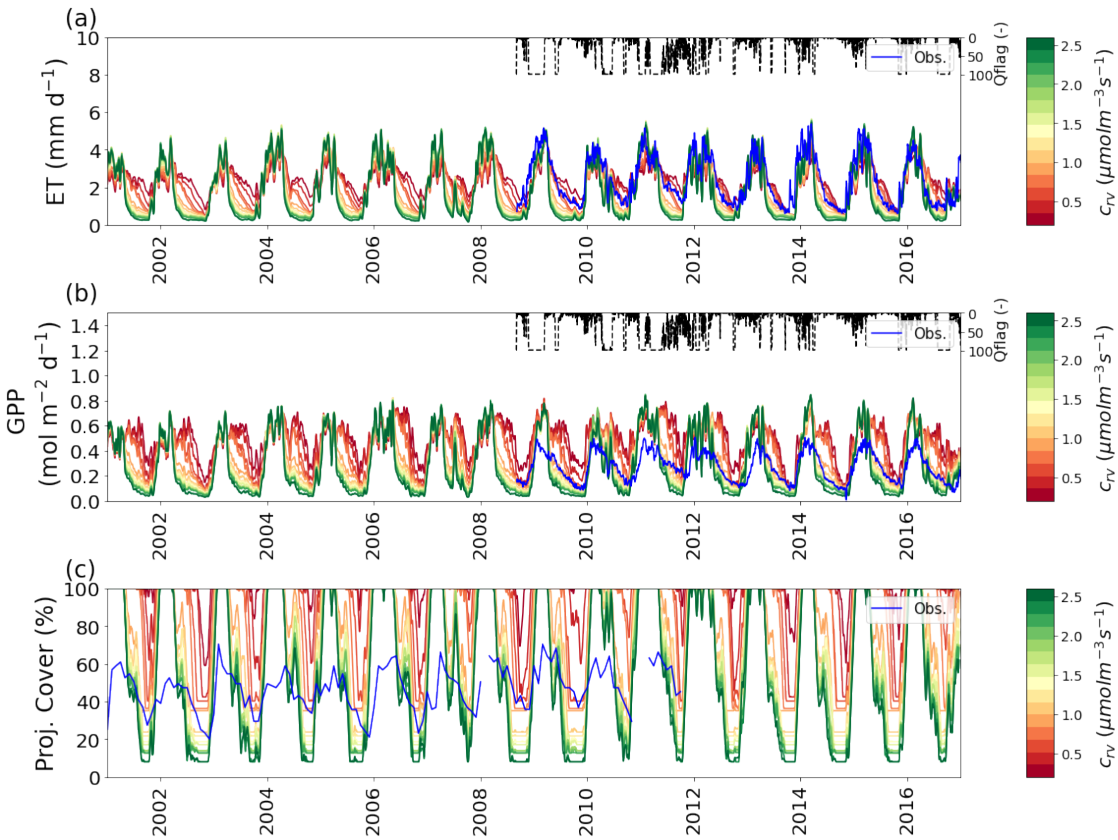


**Figure S3.5.** *VOM-results for different values of the cost factor* $c_{rv}$ *(color scale) for Dry River from 2001-2016 (subset from 1980-2016), with a) the evapo-transpiration (ET), with flux tower observations in blue b) gross primary productivity (GPP), with flux tower observations in blue and c) projective cover, with the observed fraction of vegetation cover based on fPAR-data (Donohue et al, 2008) in blue. Modelled ET and GPP are smoothed with a moving average of 7 days.*

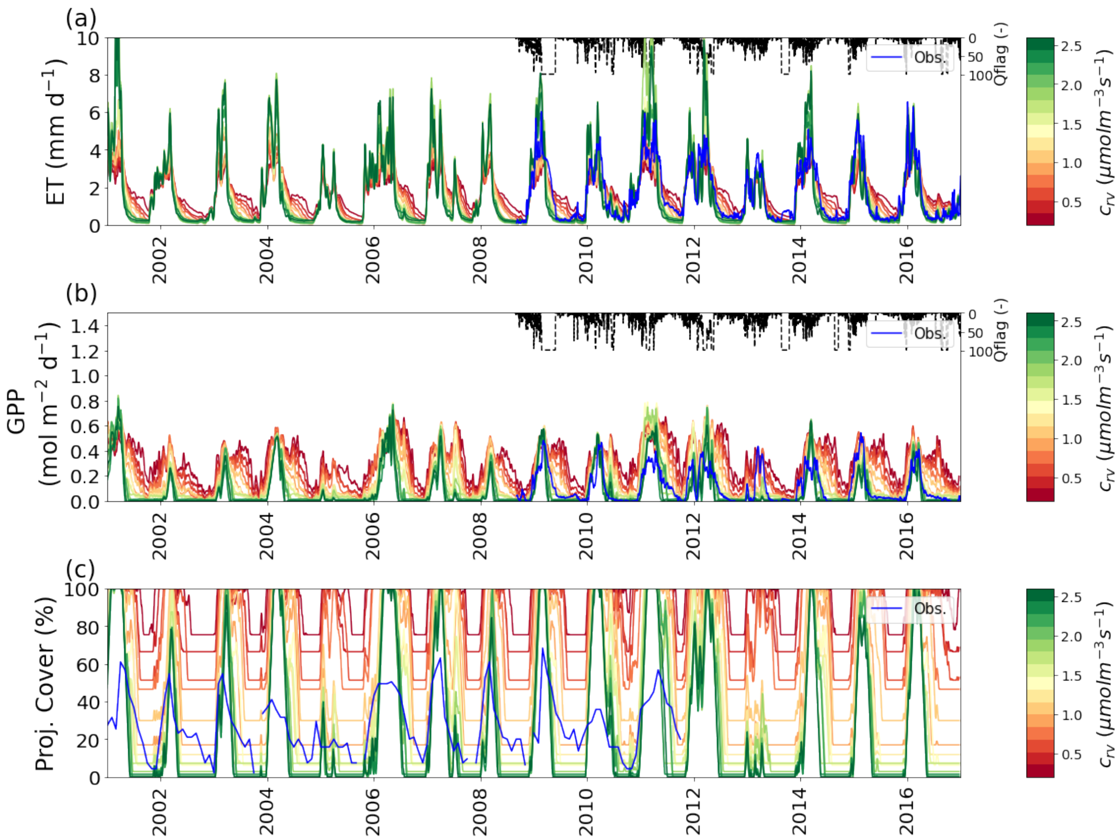


**Figure S3.6.** *VOM-results for different values of the cost factor $c_{rv}$ (color scale) for Sturt Plains from 2001-2016 (subset from 1980-2016), with a) the evapo-transpiration, with flux tower observations in blue b) gross primary productivity (GPP), with flux tower observations in blue and c) projective cover, with the observed fraction of vegetation cover based on fPAR-data (Donohue et al, 2008) in blue. Modelled ET and GPP are smoothed with a moving average of 7 days.*

## 1.3 Effect on parameter values

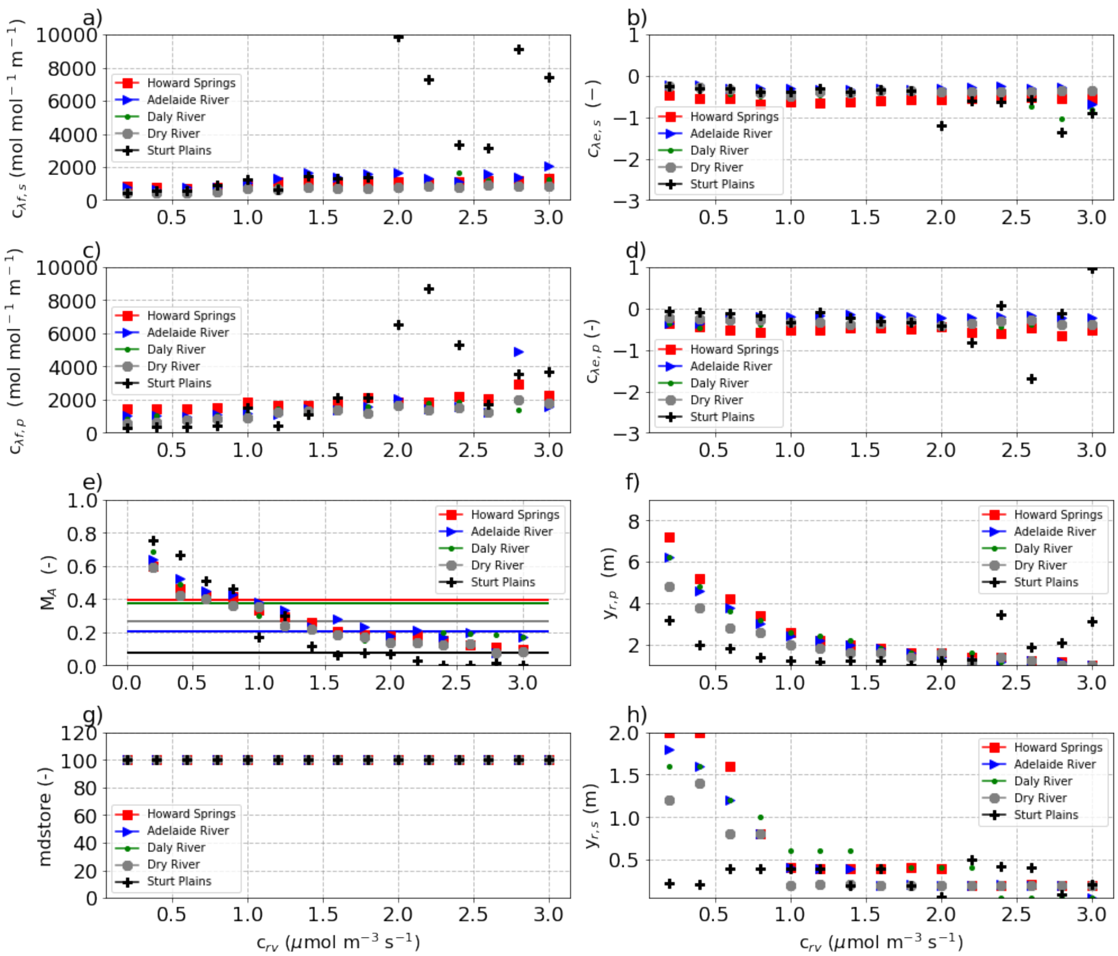


**Figure S3.7.** *Optimal vegetation parameters for the different values of the water transport cost-factor $c_{rv}$, for a) and b) the two parameters $c_{\lambda f,s}$ and $c_{\lambda e,s}$ effecting the water use for perennial vegetation, c) and d) the two parameters $c_{\lambda f,p}$ and $c_{\lambda e,p}$ effecting the water use for seasonal vegetation, e) vegetation cover of the perennial vegetation $M_{A,p}$, f) the rooting depth for the perennial vegetation $y_{r,p}$ and g) the plant water storage (fixed) and h) the rooting depth for the seasonal vegetation $y_{r,s}$. The lines for the parameter $M_{A,p}$ indicate the minimum vegetation cover during the dry season derived from fPar-values.*

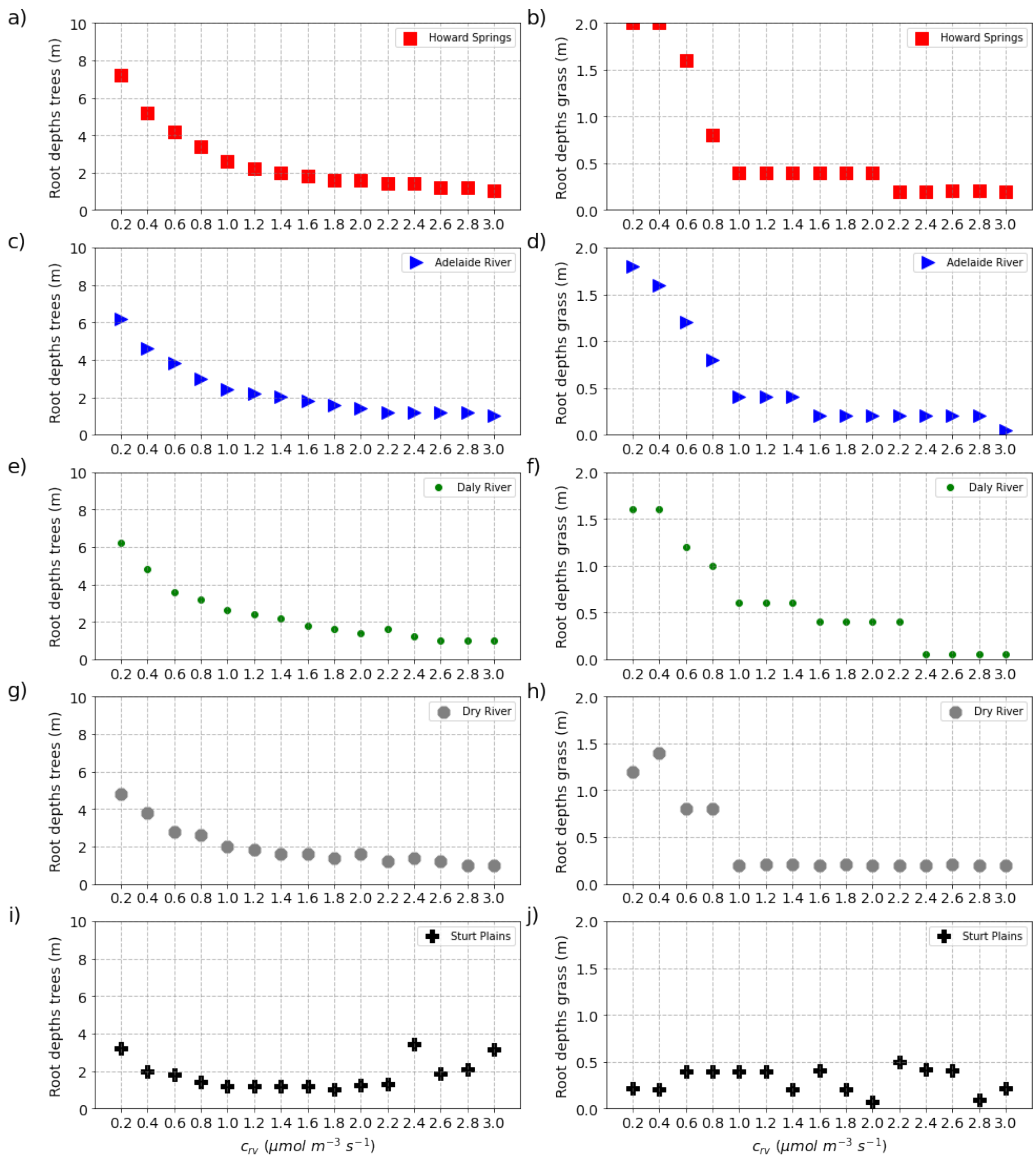


**Figure S3.8.** *Optimal vegetation parameters for the different values of the water transport cost-factor $c_{rv}$, for rooting depth trees (left column) and rooting depths grasses (right column), for a),b) Howard Springs, c),d) Adelaide River, e),f) Daly Uncleared, g), h) Dry River and i), j) Sturt Plains.*

## 1.4 Effect dry season vegetation cover

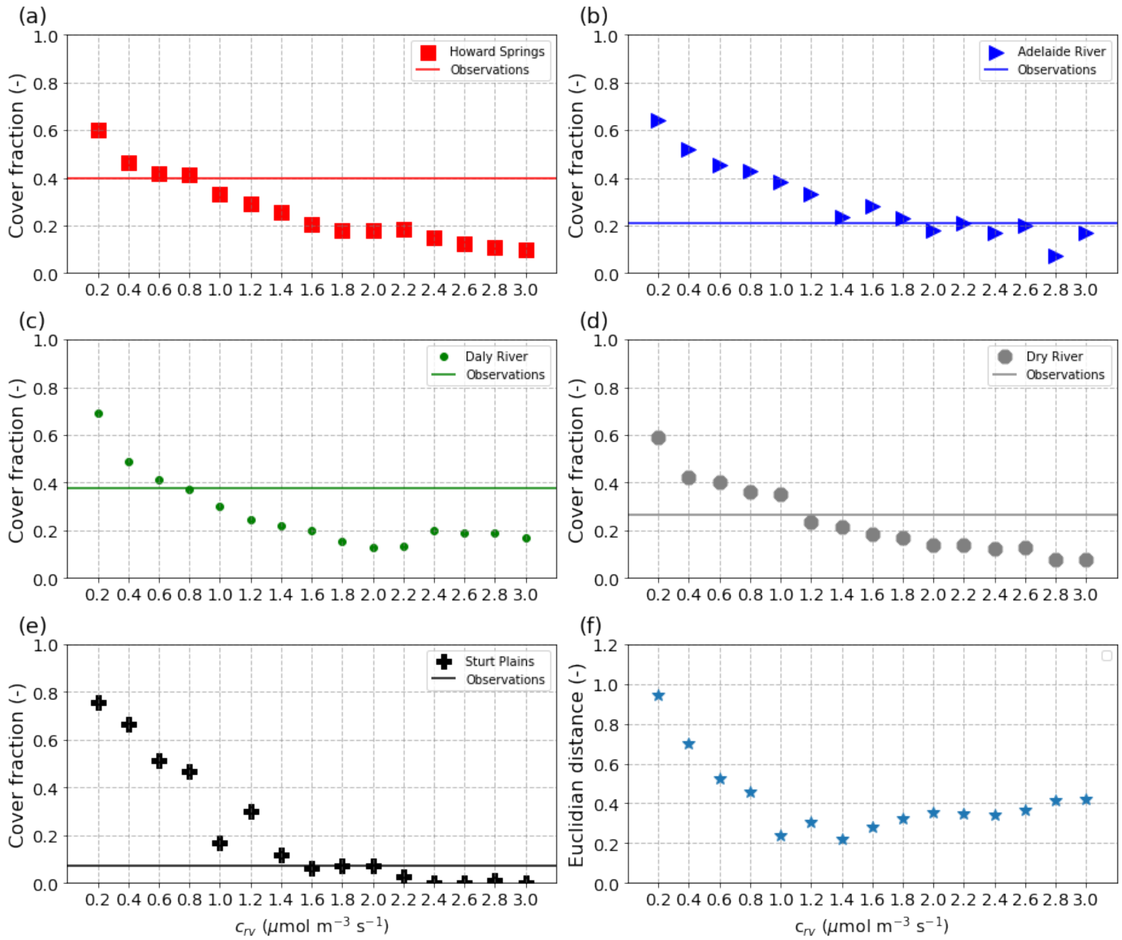


**Figure 3.9.** *Optimal vegetation parameters for the different values of the water transport costfactor $c_{rv}$. The lines indicate the minimum vegetation cover during the dry season derived from fPar-values (Donohue et al., 2008). Also here, it can be seen that values between 0.4 μmol $m^{-3}$ $s^{-1}$ and 1.8 μmol $m^{-3}$ $s^{-1}$ reproduce best the vegetation cover (Howard Springs = 0.8 μmol $m^{-3}$ $s^{-1}$, Adelaide River >= 1.4 μmol $m^{-3}$ $s^{-1}$, Daly Uncleared = 0.8 μmol $m^{-3}$ $s^{-1}$, Dry River = 1.2 μmol $m^{-3}$ $s^{-1}$, Sturt Plains >= 1.4 μmol $m^{-3}$ $s^{-1}$).*

### 1.5 Influence on NCP

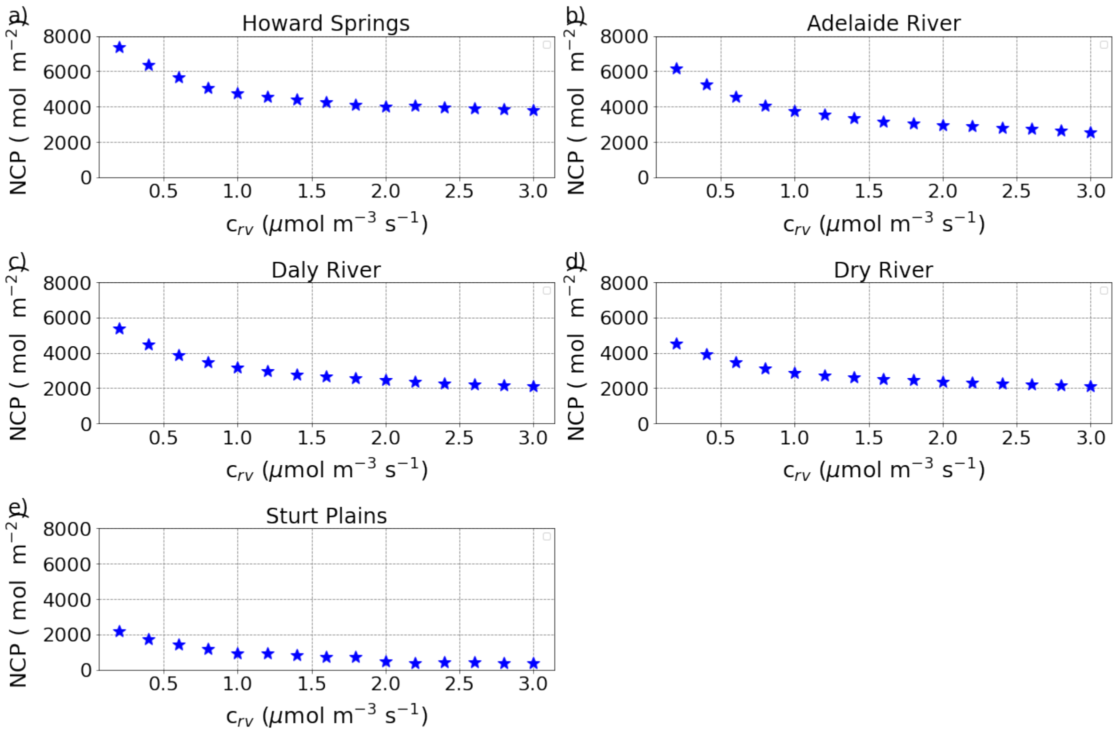


**Figure 3.10.** *Values of the costfactor $c_{rv}$ against the Net Carbon Profit (NCP) for with a) Howard Springs, b) Adelaide River, c) Daly Uncleared, d) Dry River, e) Sturt Plains. The NCP-values initially decrease strongly. For higher values, there decrease is less strong, but the NCP seems to keep going down.*

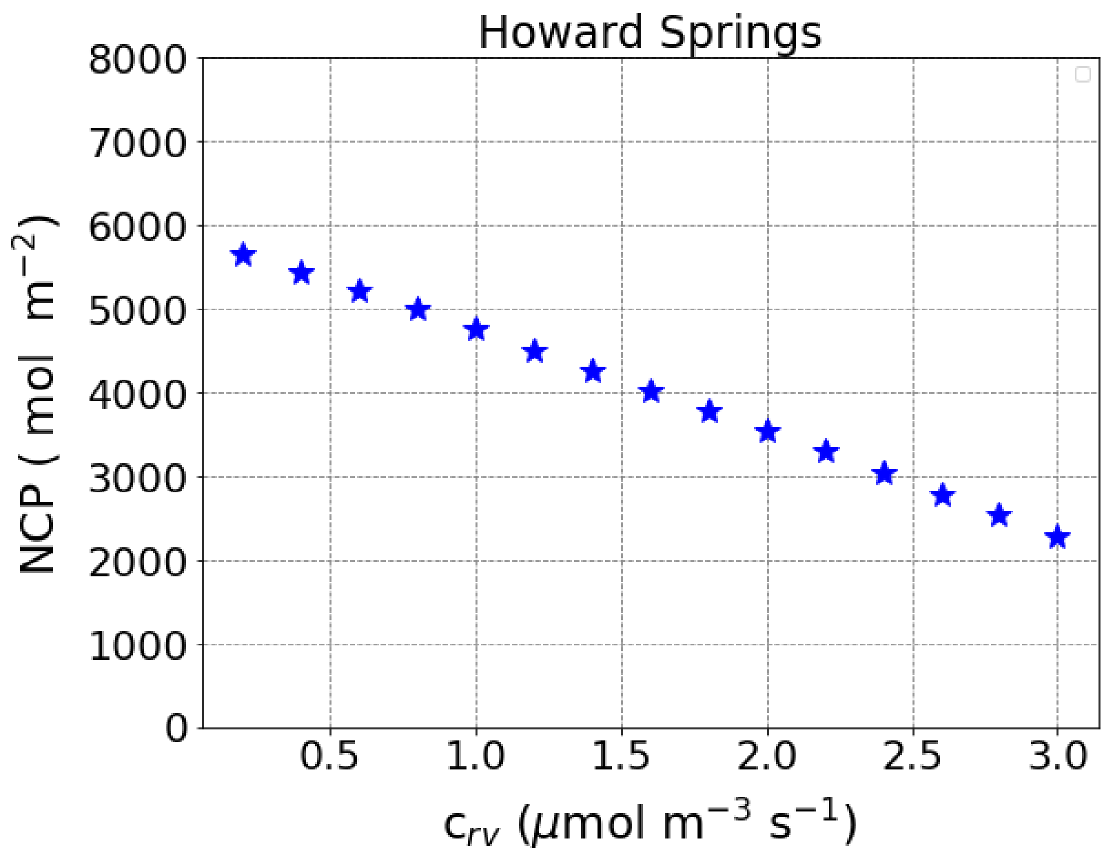


**Figure 3.11.** *Values of the costfactor $c_{rv}$ against the Net Carbon Profit (NCP) for Howard Springs with the same vegetation parameters. The NCP-values decrease linearly here.*

## 1.6 Influence on fluxes

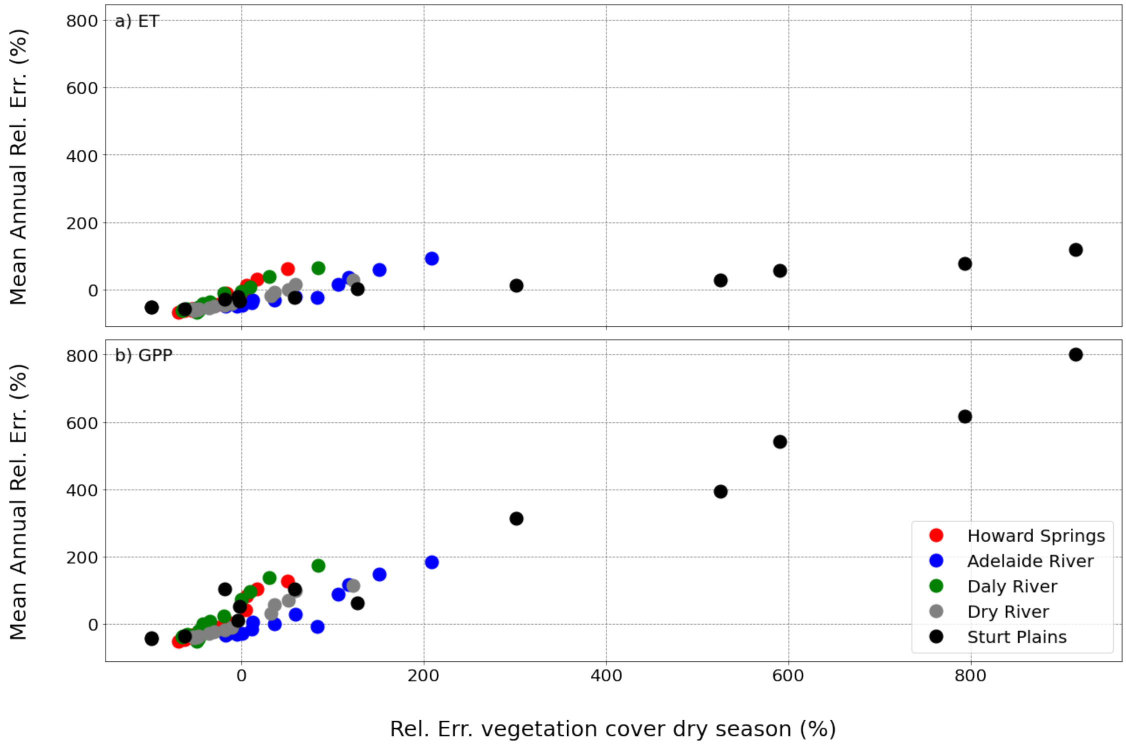


**Figure 3.12.** *The relative errors of the mean annual fluxes a) ET and b) GPP versus the relative errors for the projective cover, for the different values of the costfactor $c_{rv}$. It can be seen that a larger error in vegetation cover during the dry season also leads to a large error in the resulting fluxes.*

## 1.7 Extended range of cost factors

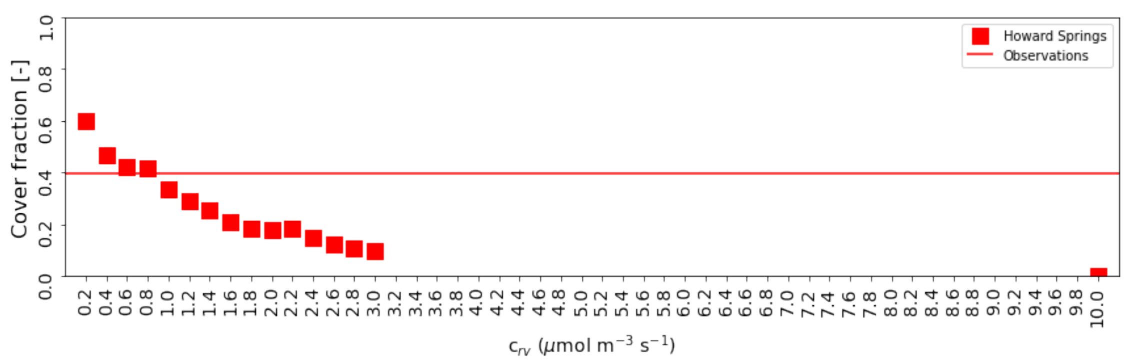


**Figure 3.13.** *Optimal vegetation parameters for an extended range (until 10.0 $\mu mol\ m^{-3}\ s^{-1}$) of the water transport costfactor $c_{rv}$ for Howard Springs. The lines indicate the minimum vegetation*

*cover during the dry season derived from fPar-values.*

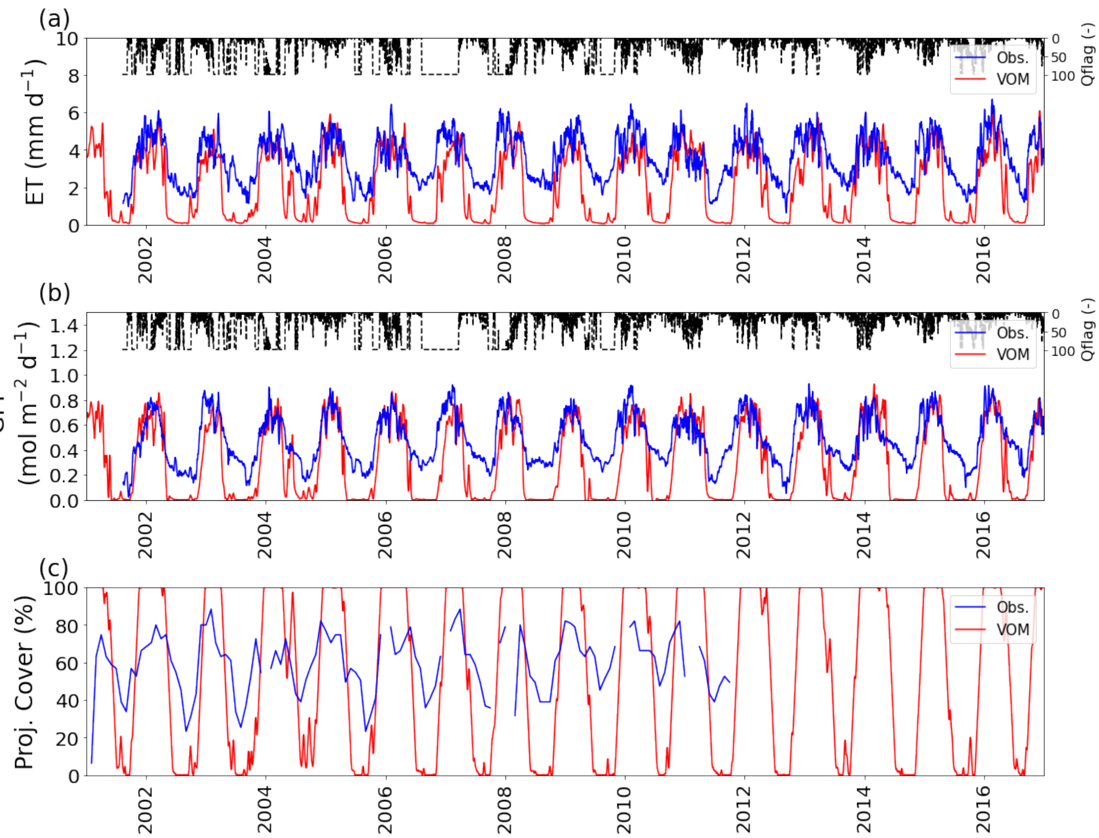


**Figure S3.14.** *VOM-results for a cost factor $c_{rv}$ of 10.0 $\mu molm^{-3}s^{-1}$) (red) for Howard Springs from 2001-2016 (subset from 1980-2016), with a) the evapo-transpiration (ET), with flux tower observations in blue b) gross primary productivity (GPP), with flux tower observations in blue and c) projective cover, with the observed fraction of vegetation cover based on fPAR-data (Donohue et al, 2008) in blue. Modelled ET and GPP are smoothed with a moving average of 7 days.*