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Level of hydrometeorological processes simulation in global climate models

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Text of Abstract
In order to quantify the impacts of global warming on catchment hydrology from the outputs of Glo
mate Models (GCMs), a realistic representation of water and energy cycles' characteristics is vital. C
soil-vegetation-atmosphere transfer schemes are now commonly being coupled with GCMs. Howev
schemes have typically focused on ever more complex representations of vertical structure while mai
a simple representation of the 2-dimension horizontal variability of near-surface hydro-meteorologic
within each GCM grid cell. Consequently, the key hydrometeorological processes are over simplified
often contributes to biased estimates of surface fluxes.
A comparative study of GCM-based and observed meteorological fields that drive catchment response
and energy balance was undertaken using outputs from four GCMs. Surface water and energy flu
the Murray-Darling Basin (MDB) in Australia were modelled using GCM-based and observed temp
humidity, incoming radiation and precipitation for 1971-2000. For the GCM data two sets are used c
one is raw data and the second set is the data after offline bias correction against observations. T
correction scheme is based on *quantile-quantile* comparison, which unifies distributions of GCM data s
observations.
Multivariate statistical analyses were subsequently carried out to quantify putative differences between
and observation-based evaporation indices (point potential, wet areal potential and actual evaporatio
moisture and runoff over Murrumbidgee and Upper Murray catchments within the broader MDB. Co
significant differences between GCMs' raw data-based results show the existence of catchment speci
acteristics both in magnitude and sign. These differences are more pronounced in moisture related flux
seasonal scale than in thermometric related fluxes and annual scale, respectively. The application of the
rection scheme significantly narrows down the differences between the GCM- and observation-based ca
responses simulations. While the current GCMs cannot resolve sub-grid scale near-surface hydromete
cal characteristics an offline bias correction has a potential to improve GCMs' outputs for inputs to tr
hydrological models commonly used in the impacts studies on surface hydrometeorological processes