An assessment of the Impact of Climate Changes on the Hydrological Budget over the Yellow River Domain

Akiyo Yatagai

Research Institute for Humanity and Nature,Japan

The YR domain is geographically sub-divided into the three sub-regions, namely over the Tibetan Plateau, the Loess Plateau and the lower reaches of the river. The climate system of the regions are affected by both mid-latitude and monsoon circulations. The mid and lower reaches of the river are located in the eastern most part of the mid-latitude arid zone, called Silk Road (Turkey/Central Asia/North China), where the arid climate was made by the existence of the gigantic mountain, the Tibetan Plateau (Yatagai, 2003). Therefore, in order to study the impact of climatic (natural) variabilities to the environment of the YR, we should remark the influences of the monsoon circulation, especially around the Tibetan Plateau, and also mid-latitude circulation to the regions. In fact, it has already pointed out that the summer precipitation over the Loess Plateau shows positive correlation with the Indian monsoon rainfall, and it tends to be dry (less precipitation) in EN/SO years (Wang and Li, 1992; Yatagai and Yasunari, 1995)

Investigating the hydrological budget estimated by the ECMWF reanalysis for the three sub-regions (see above) for 1979-1993 with the test product of precipitation (Xie, 2002), some points are shown at the workshop. We got consistent relationship in the time series for hydrological balance computed both by atmospheric water balance method of the ECMWF re-analysis and surface model flux by the ECMWF data, and precipitation data over the Loess Plateau. A sample composite pattern of the precipitation and the water vapor transport in the wet/dry years is given in Fig. 1. In the wet (relatively much rainfall) July for the Loess Plateau, more rainfall is also observed in the northeast India, and Taklimakan Desert, which implies stronger monsoon circulation around the Tibetan Plateau. It is also consistent with the result that in wet years Loess Plateau receives more water vapor flux from the south (Yatagai, 2003). In contrast, over the lower reach of the river and over the Tibetan Plateau, time series of moisture budget and forecasted fluxes do not show well consistent behavior each other. It should be investigated carefully with land surface modification, land surface processes including bio-physical effects, also change of input data.

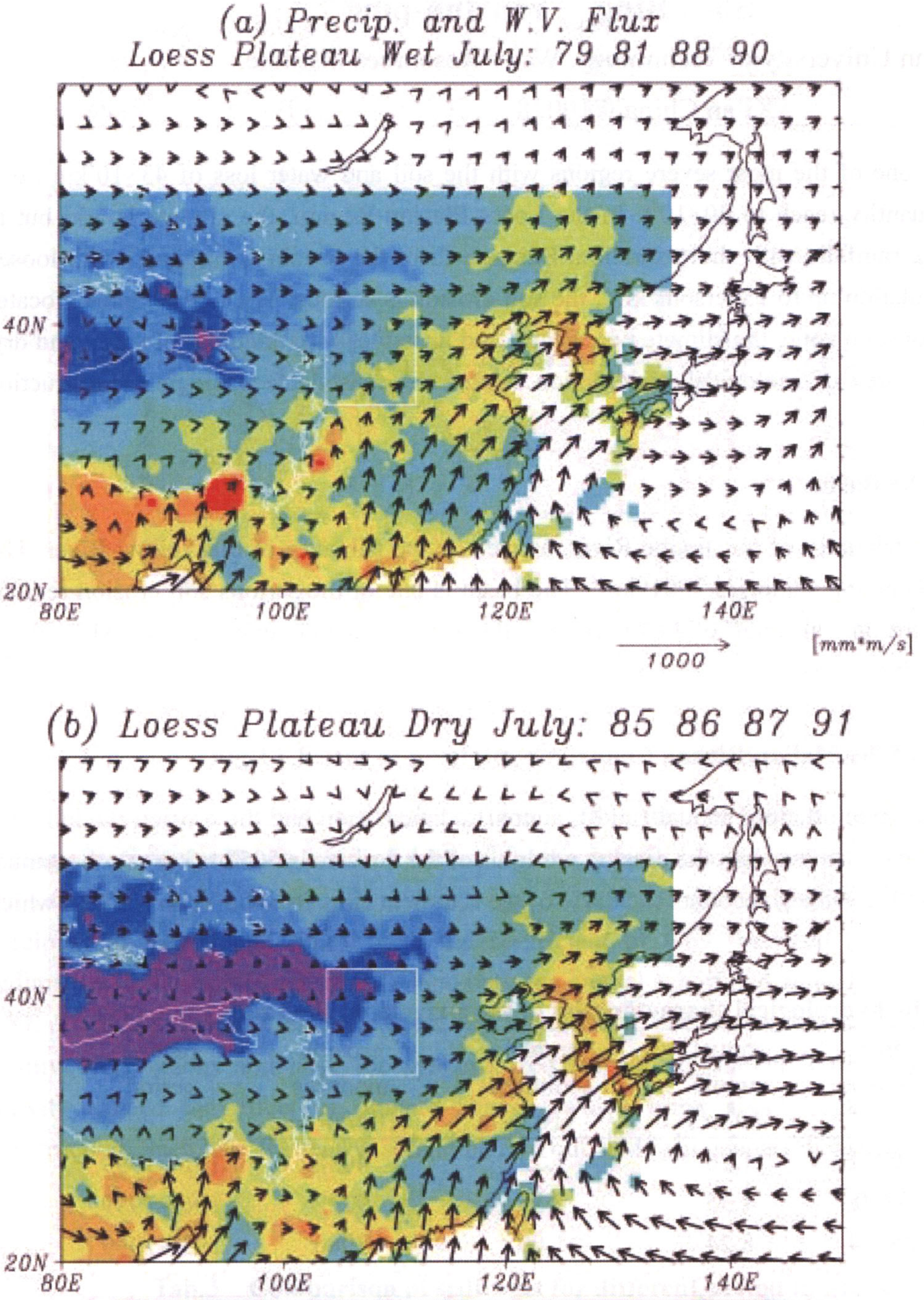

Figure 1 Water Vapor Transport of the Wet/Dry years for the Loess Plateau overlapped with the composit precipitation (Xie, 2002) for July. Selected years are given in the diagram. Vectors show vertically integrated moisture transport (unit: mm*m/s) computed using ECMWF reanalysis data, and color indicates precipitation in mm/month.