

# **Backgrounds**

moisture and precipitation.

based on Charney's desert instability theory.



# **Objectives**

- (2) To find the proof of desertification, specially caused by global warming

Köppen Classification of Climate	Hadley Circulation(Tanaka et
(1) Construction of the consecutive ten climates during 20 <sup>th</sup> century, defined by decadal means of global precipitation and surface air temperature	<ul> <li>(1) Horizontal winds can be exactly and divergent with and divergent with which streamfunction (ψ) are potential (χ) can be defined</li> </ul>
<ul> <li>(2) Classification of the global climatic regions into 13 regimes based on Köppen's classification of climate</li> <li>A B C D C D E E D E E S BW Cr Cw Cs Dr Dw Ds ET EF</li> <li>(3) Analyzing the decadal areal changes of 5 major climatic regions, and BS and BW regions during 20<sup>th</sup> (from observation and climate model output)</li> <li>(4) Construction of the models' ensemble mean</li> </ul>	$V = V_{\psi} + V_{\chi} = k \times \nabla \psi$ (2) If one takes divergence of h velocity potential ( $\chi$ ) can be solving the inverse Laplacia $\chi > 0$ ). $D = \nabla \cdot V = -\nabla^2 \chi$ (3) Divergent wind can be obta gradient of velocity potentia (4) Velocity potential is then de the linear combination of th spatial patterns: Hadley, Wa monsoon circulations $\chi(t, x, y) = [\chi(t, y)] + \chi^*(t, x)$ $= [\chi(t, y)] + \chi^*(x, y)$
<ul> <li>CRUTS2.1</li> <li>period : 1901~2000 (monthly)</li> <li>resolution : 0.5° x 0.5° (global land except Antarctica)</li> <li>variables : surface air temperature, precipitation</li> <li>ECMWF 40 years Reanalysis Data</li> <li>period : 1961~2000 (monthly)</li> <li>resolution : 2.5° x 2.5° (global land except Antarctica)</li> <li>variables : 200hPa u-wind &amp; v-wind</li> </ul>	<ul> <li>IPCC Coupled Model O</li> <li>period         <ul> <li>20C3M : 1950~1999 (mont</li> <li>models (21) : CCCMA-T47/0</li> </ul> </li> <li>T63/CNRM-CM3 / CSIRO-MKK</li> <li>MK3.5/ GFDL-CM2.0 / GFDL-</li> <li>AOM/ GISS-EH / GISS-ER/IAF</li> <li>IPSL-CM4 / MIROC-3.2(hires)/</li> <li>3.2(medres)/ MIRUB/ MPI-EC</li> <li>GCM2.3.2 / NCAR-CCSM3.0/1</li> <li>/UKMO-HadCM3 / UKMO-Hat</li> <li>resolution : 2.5° x 2.5° (Hadle with model resolution(Köppen ce)</li> </ul>

