Desert Self Supporting Mechanism

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References

Geography and isobaths

Yellow River
Yangtze River

Legend
Main and sub-ditch
Raw ditch
Grassland
City and Town
Shrub
Dry land
Woodland
Barrel land
Desert
Irrigation land
Water area
Garden plot

Liberation village reservoir
Mandarin duck pool reservoir

QING ZANG PLATEAU

Urumqi
Lhasa
Dunhuang
Jiuquan
Zhangye
Qinghai Hu
Terim Basin

80° E 85° E 90° E 95° E 100° E 105° E 110° E 115° E

-500 0 500 1000 1500 2000 2500 3000 3500 4000
Chinese-Japan Joint
Heihe River Field Experiment (HEIFE)
1988-1993
Temperature

[Graph showing temperature profiles for Oasis and Desert on 23 June 1991, with temperature on the x-axis and height on the y-axis.]
Humidity
Heterogeneous Sensible Heat Flux ($H_s$) in HEIFE Region

- $H_s$ (Desert) – $H_s$ (Oasis) $\sim$ 400 W m$^{-2}$
Non-Classical Mesoscale Circulation
Oasis (cold-wet island)

Oasis Breeze Circulation (OBC)
MM5-LSM

(1) Triple Nesting grids

(2) USGS vegetation types:
   Desert (soil type 1)
   Oasis (Soil Type 6) mixed loam, shrubland, grassland
Numerical Experiment
Initial Conditions (Atmospheric Part)

- \( \mathbf{V} = 0 \)

- Horizontally uniform temperature and specific humidity soundings, at Zhangye at 00GMT (0700 LT) on July 24, 2000
## Initial Conditions (Soil Moisture)

<table>
<thead>
<tr>
<th>Layer</th>
<th>Thickness (m)</th>
<th>Soil Moisture</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Oasis</td>
<td>Desert</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.1</td>
<td>0.34</td>
<td>0.06</td>
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<tr>
<td>2</td>
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<tr>
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<td>0.28</td>
<td>0.04</td>
<td></td>
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<tr>
<td>4</td>
<td>1.0</td>
<td>0.24</td>
<td>0.04</td>
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</tr>
</tbody>
</table>
• Simulated temporal variation of total soil moisture (0 - 2 m) for oasis and desert, showing a stable soil-hydrologic environment.
T (850hPa): (a) 0600 GMT (1300 LT), (b) 0900 GMT (1600 LT), and (c) 1200 GMT (1900 LT)  

Cold Island
q (850hPa): (a) 0600 GMT (1300 LT), (b) 0900 GMT (1600 LT), and (c) 1200 GMT (1900 LT)  

Wet Island
Simulated Zonal Cross Section (39°N) Temperature and Circulation

1300 LT  1600 LT  1900 LT
Simulated Zonal Cross Section (39°N)
Humidity and Circulation

1300 LT
1600 LT
1900 LT
Oasis Scale Effect
• Large Oasis
  (30 km X 30 km)

• Medium Oasis
  (15 km X 15 km)

• Small Oasis
  (7.5 km X 7.5 km)
Oasis Land Surface Temperature
Solid: Medium-Large
Dashed: Small-Large
Oasis Surface Air Temperature
Solid: Medium-Large
Dashed: Small-Large
Conclusions

• Cooling at the oasis surface and warming at the desert surface drive OBC.
• The OBC provides a self-supporting mechanism.
• The oasis scale effect: the larger the scale, the larger the self supporting effect is.