Spatial assessment of atmosphere-ecosystem exchanges via micrometeorological measurements and footprint modeling

Atmospheric turbulent energy flux measurements in South Korea 2010

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Objectives

- To understand the sensible and latent heat fluxes in such a complex terrain as Haean Basin, South Korea

- To better understand the energy exchange above farmlands (rice fields and dry crops) during the whole growing period including monsoon seasons in Korea

- To determine reliable evapotranspiration and net ecosystem exchange (NEE) of carbon above farmlands

- To determine reliable information about near surface atmospheric stratification conditions, including convective events in Haean Basin
Plant production studies in Haean in 2009

Steve Lindner

CO₂ flux [µmol m⁻² s⁻¹]

Day of year

Rice

Potato
SITE SELECTION

Schedule 2010:

Monsoon

|-----|------|------|------|-------|------|


Monsoon

Panorama of rice field

Dry field

Rice field
Eddy covariance complex

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Instrument</th>
<th>Sampling frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind vector</td>
<td>Ultrasonic anemometer (USA-1)</td>
<td>20 Hz</td>
</tr>
<tr>
<td>Sonic temperature</td>
<td>Sonic temperature (METEK Box)</td>
<td></td>
</tr>
<tr>
<td>Humidity (H₂O concentration)</td>
<td>open path CO₂/H₂O analyzer (LiCOR 7500)</td>
<td></td>
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<tr>
<td>CO₂ concentration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net radiation</td>
<td>Net radiometer (NR lite)</td>
<td></td>
</tr>
</tbody>
</table>
Data processing and QA/QC

Flux corrections

- Coordinate rotation: Planar fit, double rotation
- Buoyancy correction (Schotanus/Liu)
  \[ w'T' = w'T_s' - 0.51T w'q' \]
- WPL correction
  \[ F_c = \bar{w} \rho_c + \bar{q}_c \cdot \frac{H}{c_p \cdot \bar{R}} \cdot \left[ 1 + 1.61 \cdot \frac{c_p \cdot \bar{T}}{\lambda} \cdot \left(1 - 0.61 \cdot \bar{q}\right)\cdot \frac{1}{Bo_{turb}} \right] \]
- Spectral correction (Moore)
  \[ \frac{\Delta F}{F} = 1 - \frac{\int_0^{\infty} T_{wz}(f) \cdot S_{wz}(f) df}{\int_0^{\infty} S_{wz}(f) df} \]
Footprints with TerraFex

TK2 output → TerraFex → FOOTPRINT

- Raw Covariances
- QA/QC (flags 1-5)
- Resultfile (flags 1-5)

Matrix Landuse
Matrix Roughness Length

Footprint – data quality
Footprint – land use

[Diagrams and data visualizations related to footprints and land use classification]
Automatic Weather Stations
KMA Weather information as supporting data

AWS of KMA

Satellite image

Synoptic weather chart
Thank You