HYMEX workshop
8-10 June 2010
Bologna

Land biogeophysical variables of the Mediterranean basin: to what extent can ERA-I be used to drive land surface models?

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Objectives

- Land surface monitoring (e.g. droughts)
  - Water cycle
  - Vegetation
  - Area: 25N-75N, 11W-62E (ECOCLIMAP2)

- TTM3b: a climatology of biogeophysical variables (e.g. LAI, soil moisture) is needed

- TTM2a (and TTM2b): NRT monitoring for HYMEX
Mediterranean basin: can ERA-I be used?

**Atmospheric forcing?**

- NRT monitoring: use ECMWF analyses (16km resolution) and/or ARPEGE

- Climatology: use ERA-Interim (resampled 50km product) and ALADIN 12km for hot-spot areas

- Quality of ERA-Interim?
  - Key variables: precipitation, incoming solar radiation (ISR)
  - Also: Ta, Qa, wind speed
  - Assessment over France (SAFRAN 8km)
  - Precipitation: comparison with GPCP and GPCC for the whole domain
Mediterranean basin: can ERA-I be used?

**Intercomparison**

- ERA-I rescaled (Balsamo et al. 2010): GPCP bias-corrected precipitation
- GPCP, GPCP: global monthly low resolution (2.5°) precipitation estimates
- SAFRAN
  - High resolution (8km) reanalysis
  - Precipitation is based on in situ observations
  - ISR: default product + BRION (based on in situ observations)
Mediterranean basin: can ERA-I be used?

Precipitation 2001
Mediterranean basin: can ERA-I be used?

Precipitation 2001: ERA-I vs. SAFRAN ($r^2$)

![Graph showing annual correlation between ERA-Interim and SAFRAN analysis data with daily time step (2001).]
Mediterranean basin: can ERA-I be used?

Precipitation 2001: ERA-I vs. SAFRAN (mean bias)
Mediterranean basin: can ERA-I be used?

Precipitation 2001-2003: all products

Mean Monthly Precipitation over France (2001)

Mean Monthly Precipitation over France (2003)
Mediterranean basin: can ERA-I be used?

Precipitation 2001-2003: seasonal variability scores

<table>
<thead>
<tr>
<th></th>
<th>ERA-Interim</th>
<th>ERA rescaled</th>
<th>GPCC</th>
<th>GPCP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R²</strong></td>
<td>0.955</td>
<td>0.991</td>
<td>0.995</td>
<td>0.972</td>
</tr>
<tr>
<td><strong>Bias (mm/month)</strong></td>
<td>-22.5</td>
<td>-11.2</td>
<td>-5.7</td>
<td>-1.7</td>
</tr>
<tr>
<td><strong>RMSE (mm/month)</strong></td>
<td>24.3</td>
<td>11.7</td>
<td>6.6</td>
<td>6.2</td>
</tr>
<tr>
<td><strong>Mean Precipitation Safran</strong></td>
<td></td>
<td></td>
<td>1032 mm for the year 2001</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.984</td>
<td>0.989</td>
<td>0.993</td>
<td>0.980</td>
</tr>
<tr>
<td><strong>Bias (mm/month)</strong></td>
<td>-18.1</td>
<td>-7.7</td>
<td>-2.7</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>RMSE (mm/month)</strong></td>
<td>19.4</td>
<td>8.7</td>
<td>3.7</td>
<td>5.3</td>
</tr>
<tr>
<td><strong>Mean Precipitation Safran</strong></td>
<td></td>
<td></td>
<td>810 mm for the year 2003</td>
<td></td>
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</tbody>
</table>
Mediterranean basin: can ERA-I be used?

Precipitation 2001-2003: daily and spatial variability

<table>
<thead>
<tr>
<th></th>
<th>ERA-Interim 2001</th>
<th>ERA rescaled 2001</th>
<th>ERA-Interim 2003</th>
<th>ERA rescaled 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temporal</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(365 days)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>$R^2$</td>
<td>0.89</td>
<td>0.89</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td>RMSE (mm/day)</td>
<td>1.26</td>
<td>1.09</td>
<td>1.12</td>
<td>0.94</td>
</tr>
<tr>
<td><strong>Spatial</strong></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>(308 grid cells)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>$R^2$</td>
<td>0.59</td>
<td>0.58</td>
<td>0.48</td>
<td>0.54</td>
</tr>
<tr>
<td>RMSE (mm/year)</td>
<td>326</td>
<td>235</td>
<td>274</td>
<td>179</td>
</tr>
</tbody>
</table>
Mediterranean basin: can ERA-I be used?

Precipitation 2001-2003: spatial variability

- January: $R^2 = 0.36$, $R^2 = 0.52$
  - Bias = -32 mm, Bias = -16 mm

- April: $R^2 = 0.63$, $R^2 = 0.65$
  - Bias = -33 mm, Bias = -13 mm

- July: $R^2 = 0.42$, $R^2 = 0.37$
  - Bias = -23 mm, Bias = -9 mm

- October: $R^2 = 0.40$, $R^2 = 0.52$
  - Bias = -33 mm, Bias = -10 mm
Mediterranean basin: can ERA-I be used?

Precipitation 2001: GPCP vs. GPCC ($r^2$)
Mediterranean basin: can ERA-I be used?

**ISR 2001**

**Mean Daily Incoming Solar Radiation over France (2001)**

- **Rg Era Interim**
- **Rg Brion/Safran**
- **Rg Safran**

**Mean Monthly Incoming Solar Radiation over France (2001)**

- **Rg Era Interim**
- **Rg Brion**
- **Rg Safran**
Mediterranean basin: can ERA-I be used?

Conclusions

- ERA-I correlates very well with SAFRAN/BRION
  - Daily precipitation: \( r^2 > 0.60 \) for 75% of France
  - Daily ISR: \( r^2 > 0.98 \) for 75% of France

- ERA-I underestimates precipitation (~20-25%)
  - Especially the most intense precipitation events
  - GPCP rescaling partially reduces the bias (by 50% over France)

- ERA-I overestimates ISR (~6%)

Next steps

- Precipitation: intercompare ERA-I rescaled, GPCP, GPCC over the whole ECOCLIMAP2 area
- ISR bias correction has to be implemented
- Assess the impact on land surface model simulations