Abstract title: The impact of climate change towards groundwater use and mitigation in The Upper Central Plain Basin of Thailand

Name authors: Long Thanh Tran, Sucharit Koontankulvong, Chokchai Suthidhummajit
Water Resources Engineering Department, Chulalongkorn University

30 October 2020
Content

I. Study area (the Upper Central Plain Basin of Thailand)

II. The bias correction rainfall (MRI and IPSL) in the study area

III. The impact of climate change towards groundwater levels

IV. The mitigation measures through recharge well field

V. Conclusions
I. Study area

The Upper Central Plain Basin of Thailand and hot spot areas

Hotspot 1 (Sukhothai)
GWL decrease from 46m. MSL -> 40m. MSL begin dry season

Hotspot 2 (Phitsanulok)
GWL decrease from 35m. MSL -> 25m. MSL begin dry season

Hotspot 3 (Nakhonsawan)
GWL decrease from 20m. MSL -> 24m. MSL begin dry season
II. The bias correction rainfalls (MRI and IPSL) in the study area

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Mean error(mm/year)</th>
<th>Utraradit</th>
<th>Sukhothai</th>
<th>Phitsanulok</th>
<th>Kampengphet</th>
<th>Pichit</th>
<th>Average regional</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPSL-CM5A-MR_rcp26adj_pr</td>
<td>134.48</td>
<td>141.74</td>
<td>-45.92</td>
<td>-22.46</td>
<td>2.3</td>
<td>42</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>IPSL-CM5A-MR_rcp45adj_pr</td>
<td>130.98</td>
<td>160.24</td>
<td>-12.17</td>
<td>-9.46</td>
<td>-2.2</td>
<td>53.5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>IPSL-CM5A-MR_rcp85adj_pr</td>
<td>102.73</td>
<td>139.49</td>
<td>-18.92</td>
<td>-10.96</td>
<td>19.8</td>
<td>46.4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>MRI-CGCM3_rcp26adj_pr</td>
<td>-208.27</td>
<td>-214.008</td>
<td>-393.665</td>
<td>-394.958</td>
<td>-336.703</td>
<td>-309.5</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>MRI-CGCM3_rcp45adj_pr</td>
<td>-110.27</td>
<td>-115.008</td>
<td>-298.415</td>
<td>-312.958</td>
<td>-263.953</td>
<td>-220.1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>MRI-CGCM3_rcp85adj_pr</td>
<td>-6.02</td>
<td>-5.51</td>
<td>-195.42</td>
<td>-212.96</td>
<td>-173.2</td>
<td>-118.6</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

The rainfalls of GCM MRI decrease 10% for whole region in next 20 years
The rainfalls of IPSL increase 10% in upstream (Utraradit, Sukhothai) and decrease 5% in downstream (Phitsanulok, Kampengphet, Phicit) in next 20 years
The projected groundwater levels keep going down under recent drought years based on 3 scenarios.
IV. The mitigation measures via recharge well field

Example: mitigation groundwater recharge trial run at hotspot 2 from 2020-2040

- Alternative 1 (inject 500 small wells during wet season)* recover 0.29 m with volume recharge 28.8MCM/ year
- Alternative 2 (natural recharge base in 3 wet months)* recover 0.33 m with volume recharge 15.18MCM/ year
- Alternative 3 (Artificial recharge ponds) recover 4.96 m with volume recharge 12.96MCM/ year

* Existing projects
V. Conclusions

• The rainfalls of GCM MRI decrease 10% for whole region in next 20 years.

• The rainfalls of IPSL increase 10% in upstream (Utraradit, Sukhothai) and decrease 5% in downstream (Phitsanulok, Kampengphet, Phicit) in next 20 years.

• The groundwater levels tend to decrease in next 20 years in 3 scenarios.

• The existing mitigation project are low effective on groundwater recharge since the coverage area are large. The artificial recharge ponds with high volume and focus area (hot spot area 2) can assist groundwater levels increase 0.17-5.0 meters which covered the area of 275 km$^2$ from the year 2020-2040.
References


• Koontanakulvong, S. and C. Suthidhummajit (2015). "The role of groundwater to mitigate the drought and as an adaptation to climate change in the Phitsanulok irrigation project, in the Nan basin, Thailand."


Thank you for your attention