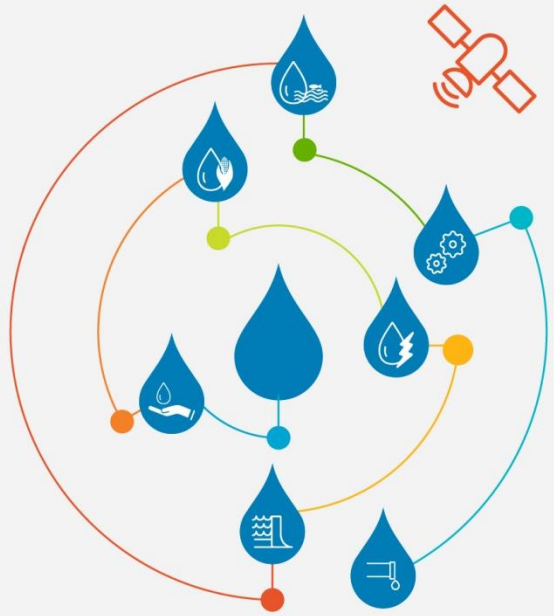
SIMULATION OF RAINFED RICE YIELDS UNDER CLIMATE CHANGE IN PUOK DISTRICT, SIEM REAP PROVINCE, CAMBODIA



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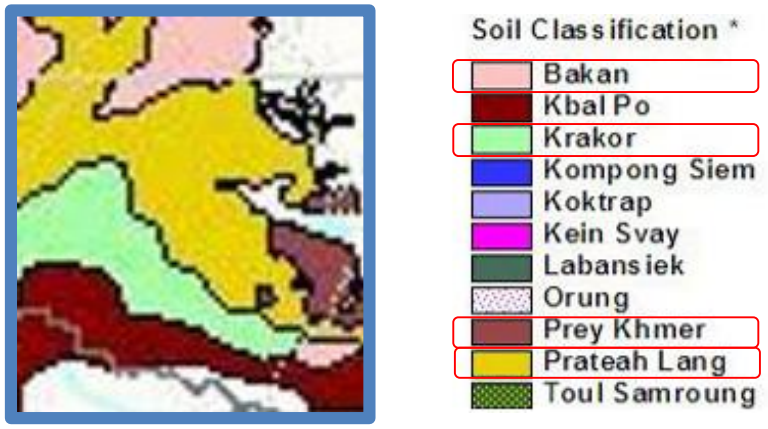
Background

- In Cambodia, the majority of flooded areas are also experiencing drought in the dry season due to the lack of sufficient irrigation systems.
- Puok district is located on lowland, Western part of West Baray and Tonle Sab lake in Siem Reap province of Cambodia.
- Total area of the district is 1,279 square kilometer, divided into 16 communes with population of 126,110 forming 22,936 households within which 22,471 (97.97%) involves in agricultural farming.
- Rice is cultivated in a vast area of 30,980 ha of the district. At the end of 2007, the total rice cultivated area was up to 26,420 ha within which 23,980 ha is cultivated only once a year in rainy season starting from May due to the lack of water for irrigation.
- The other crops grown by the communities in 2007 are maize, cassava, sweet potato, sugar cane and vegetables. 2008 (Field survey, 2009).

Study area map and identification of agricultural soil type



Rationale and problem statement

- Cambodia suffered a prolonged civil wars and peace has just brought to this country from 1993 onwards. It lacks ability to invest in any other resources.
- About 70% of the population is farmers occupying 30% of the land along lowland Tonle Sab, Mekong Krom and Basak rivers, which lie from the Northwest to the Southeast.
- Flood hitting Cambodia in 2000 was recorded as the worst flood during the last 70 years (NCDM, 2002).
- Cambodia lost 20% of its rice production in 1998 and 2002 due to drought in addition to a loss of 70% due to flooding of agricultural fields.
- The result of floods occurred from 2000 to 2002 were 438 casualties and damages to national economy amounting to US$205 million (NCDM, 2002).

Crop data files and selection of file based on sowing/transplanting dates

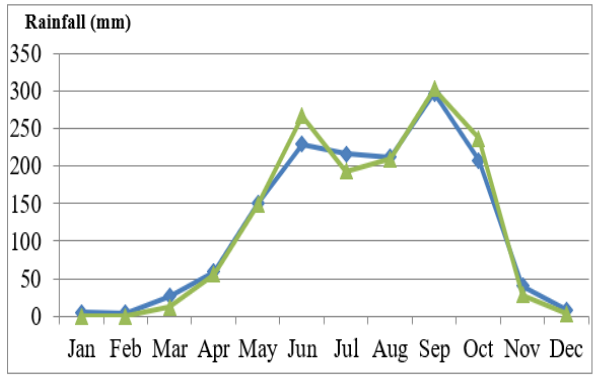
- In the base case, one file fits all for IR66. For CAR1 and CAR4:

Cultivar	Sowing date	Transplanting date & (transplanting window)	Time from transplanting to recover	Time from transplanting to max canopy	Flowering date	Time from sowing to flowering	Time from transplanting to flowering	Length of flowering stage	Time from transplanting to senescence	Length of canopy decline	Length of building up of HI	Time from transplanting to maturation
CAR1	01 May	28 May (20 May - 14Jun)	4	54	26 Oct	178	151	17	156	31	35	187
	04 Jun	01 Jul (15 Jun - 16 Jul)	4	54	01 Nov	150	123	17	129	31	35	160
	08 Jul	04 Aug (17 Jul - 12Aug)	4	54	05 Nov	120	93	18	95	31	31	126
	23 Jul	19 Aug (13 Aug - 27 Aug)	4	54	12 Nov	112	85	17	87	31	31	117
	09 Aug	05 Sep (28 Aug - 15 Sep)	4	54	20 Nov	103	76	17	78	31	31	108
CAR4	14 May	10 Jun (01 Jun - 20 Jun)	4	54	05 Nov	175	148	18	150	31	32	181
	03 Jun	30 Jun (21 Jun - 18 Jul)	4	54	10 Nov	160	133	17	134	31	31	165
	10 Jul	06 Aug (19 Jul - 12 Aug)	4	54	14 Nov	127	100	17	102	31	32	133
	23 Jul	19 Aug (13 Aug - 27 Aug)	4	54	18 Nov	118	91	17	93	31	31	123
	09 Aug	05 Sep (28 Aug - 15 Sep)	4	54	25 Nov	108	81	17	83	31	31	113

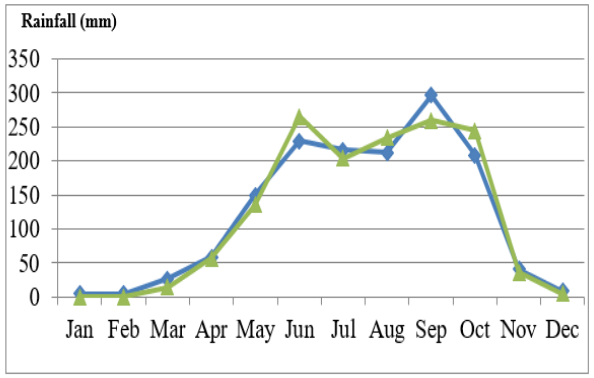
Bias correction - climate data from SRES A2 and B2 scenarios

The following shows is the demonstrations of each result of bias correction from the two tables above.

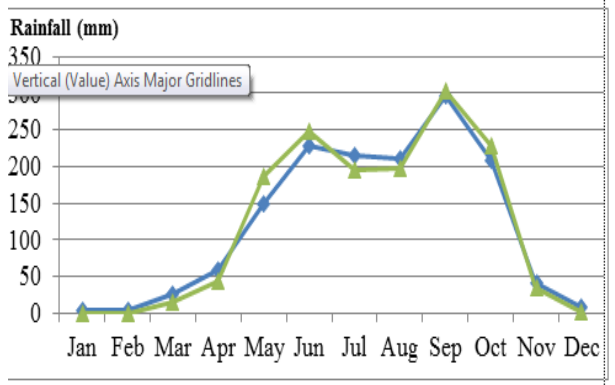
Observed data — P_{cor} – 2nd bias correction – corrected P



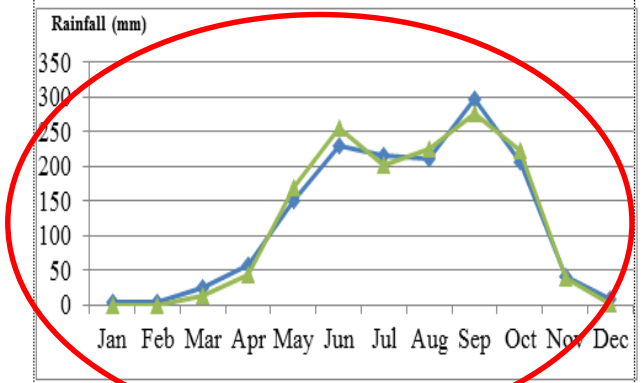
35-day window



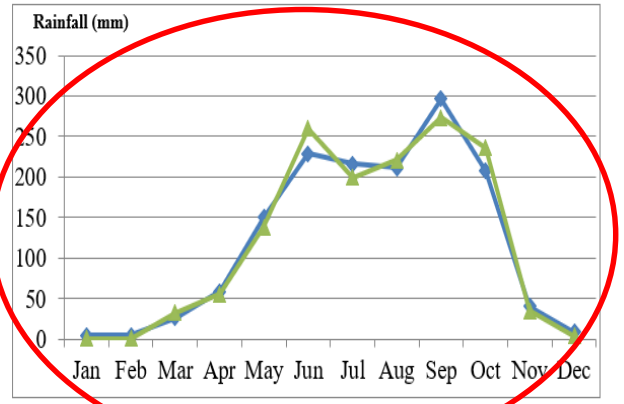
55-day window



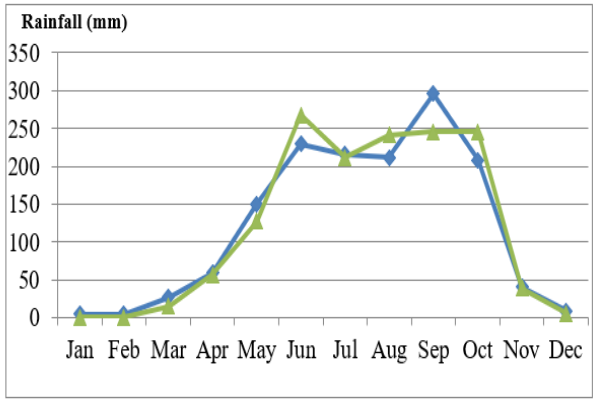
35-day window



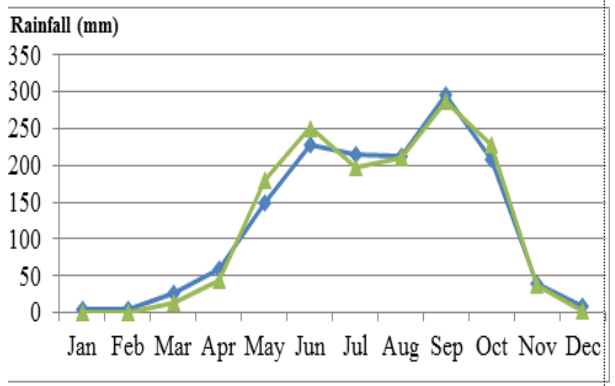
55-day window



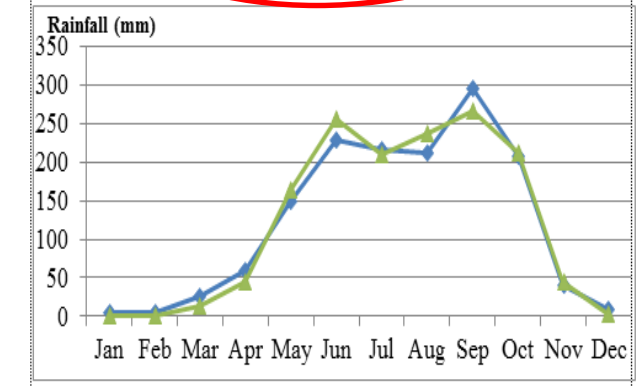
45-day window



65-day window



45-day window

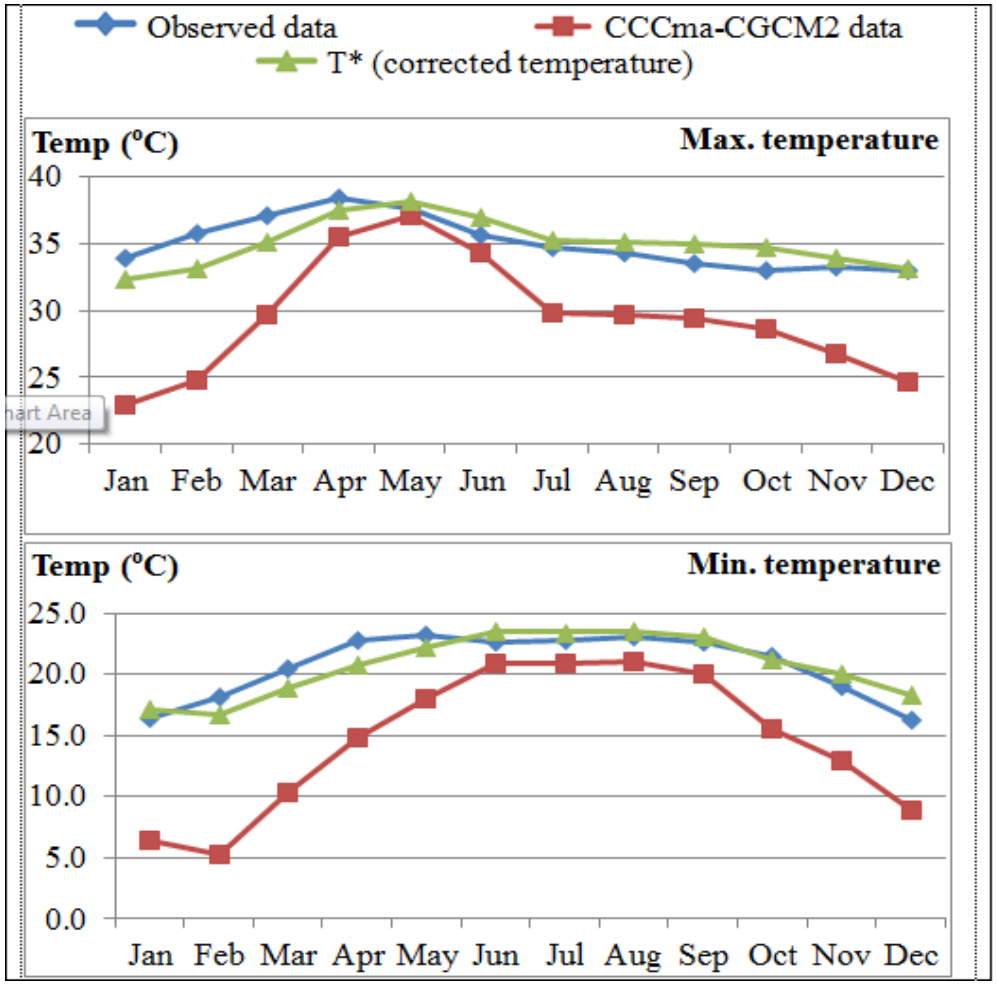


65-day window

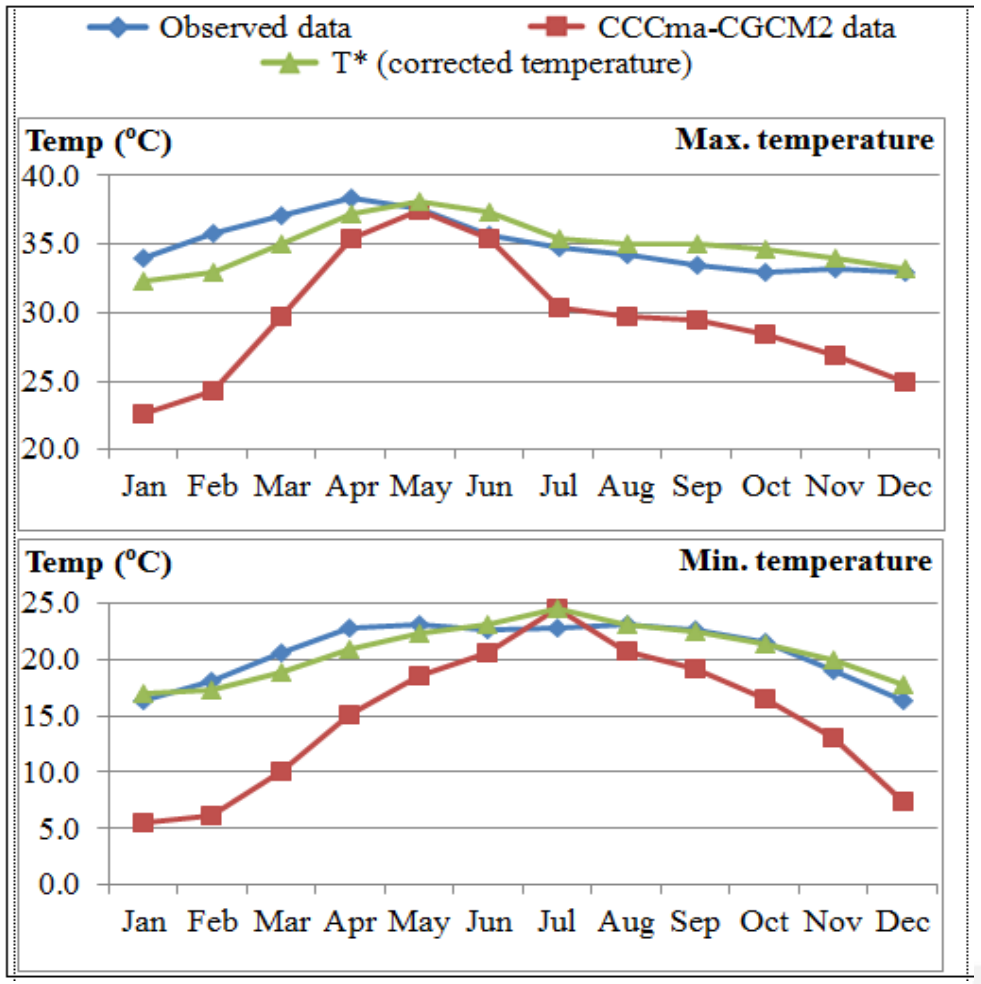
Graphical demonstration of corrected CCCma SRES A2's rainfall

Graphical demonstration of corrected CCCma SRES B2's rainfall

Future climate predictions for temperatures

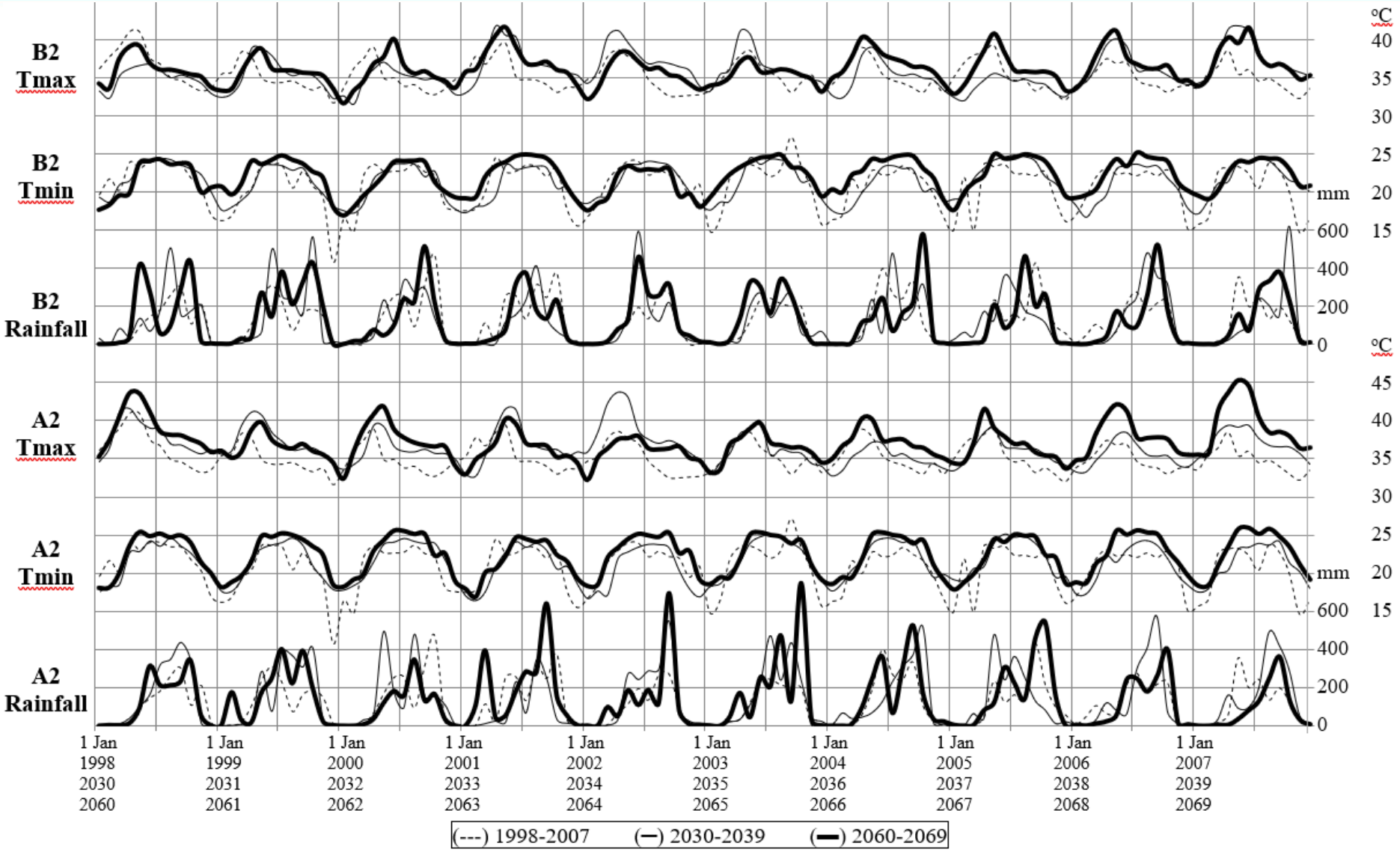


Graphical demonstration of corrected CCCma SRES A2's temperature



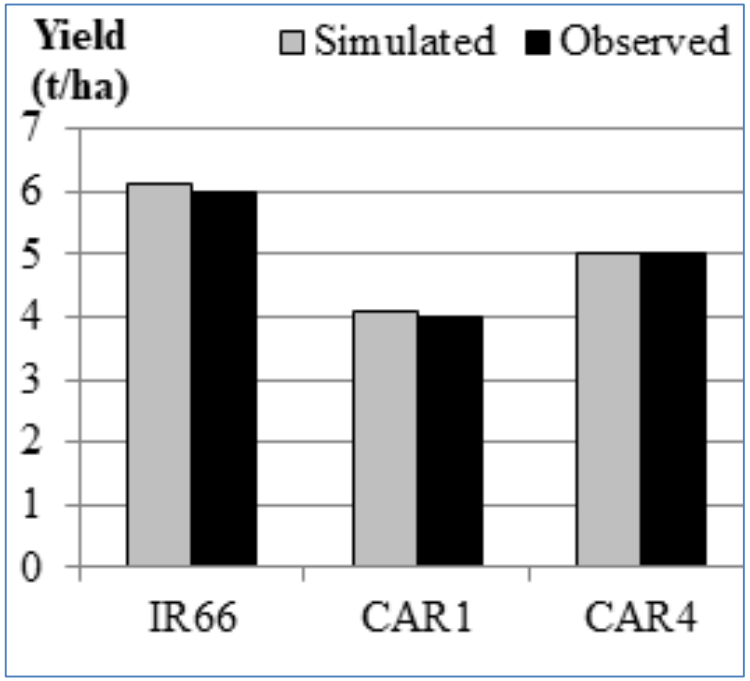
Graphical demonstration of corrected CCCma SRES B2's temperature

Graphical illustrations of different climate parameters under three periods

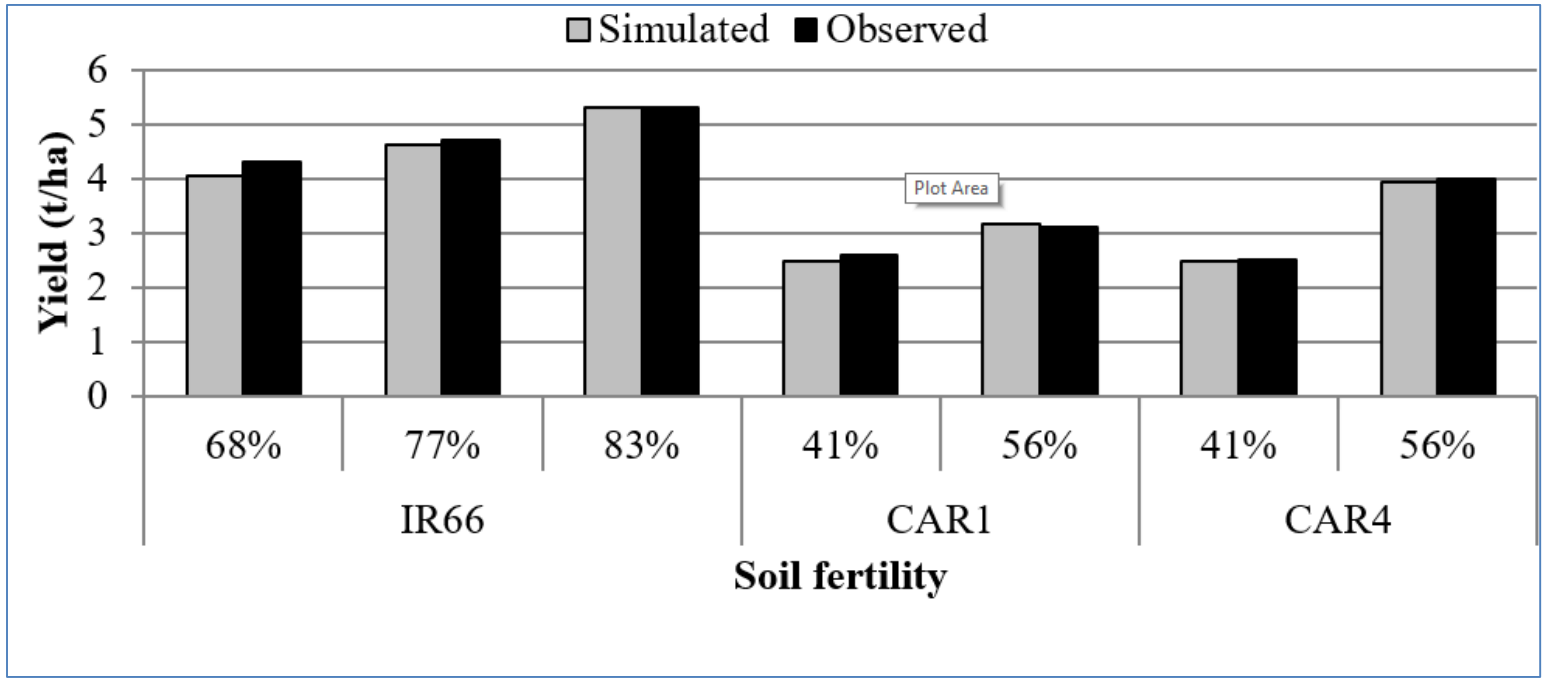


Simulation of yields using AquaCrop

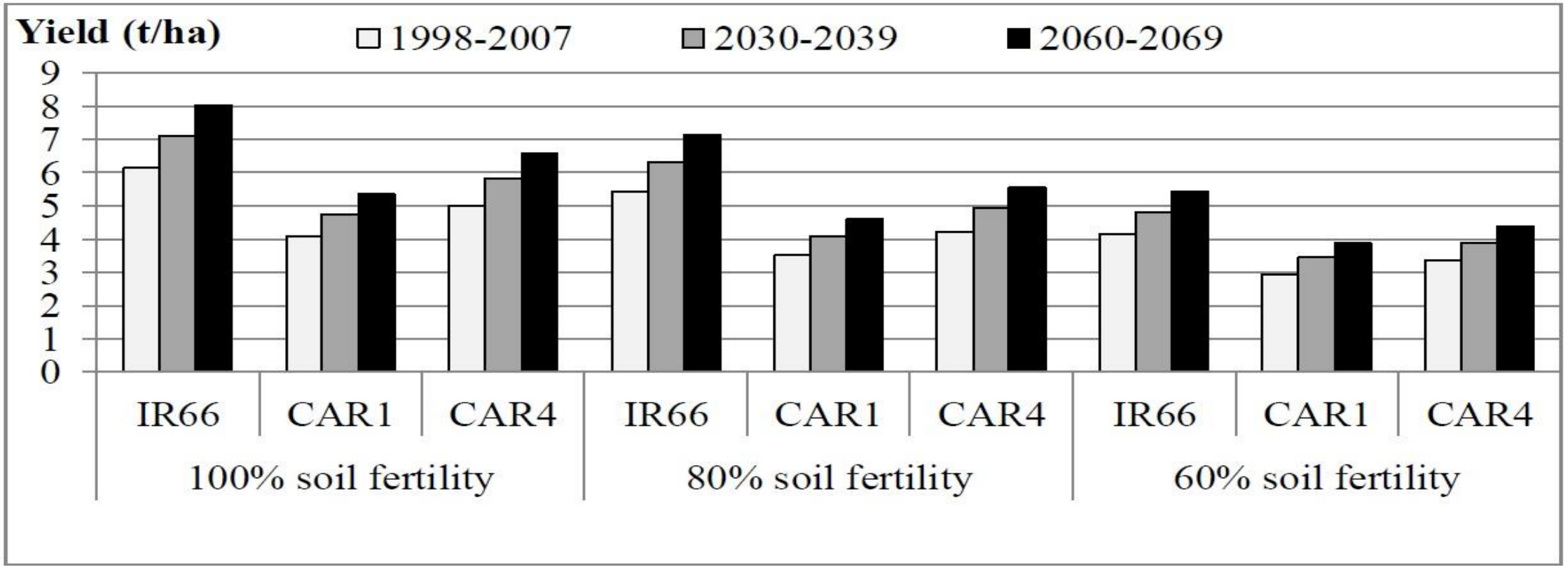
Comparison of observed and simulated yields



Baseline yields of three rice post-calibration varieties



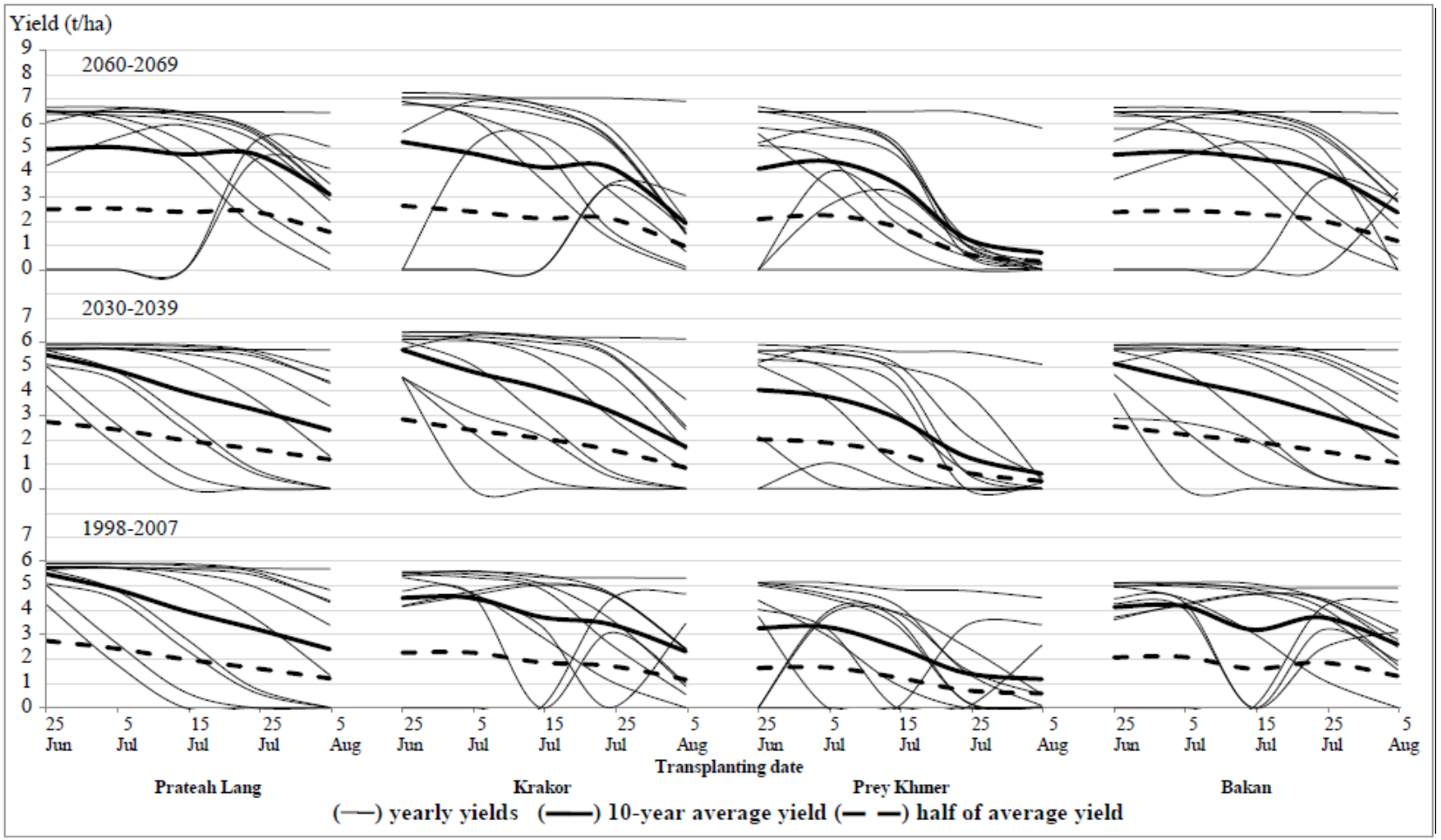
Simulated future yields



Comparison of optimum yields under SRES A2 scenario during different periods in the case of irrigated rice land

Simulated yields on 100% soil fertility on 4 different soil types under 3 periods

CAR4



Under SRES B2 scenario

Conclusion

- Precipitations significantly increase in early of 2030s' rainy season and mid season of 2060s.
- Min and max temperatures significantly increase in the growing cycles.
- Yields are forecast with a good agreement with observation data.
- Yields vary according to precipitation and temperature patterns.
- Rainfall is the more important factor in planning transplanting dates.
- Higher temperatures contribute less in date shifting but more in yield decrease.
- Yields reductions are caused by rising temperatures; the reductions are, however, outweighed by positive effects from rising rainfall and [CO_2].

Recommendations for future research

- Research focusing on other rice growing area along Mekong river of Cambodia should be considered to cover a full range adaptation
- Future research on reliability level for meteorological data and weather forecast practiced by future trained farmers
- Research focusing on more improvised data downscaling for other/future climate change models
- Financial studies should be done on rice variety and transplanting date selections.
- Microeconomics of rice should be studied in order to facilitate the plantation and mitigate risks due to the changing climate.
- Further research on AquaCrop are necessary to better simulate not only rice but also other crops

Thank You!