Yield gap analysis for irrigated wheat in Egypt

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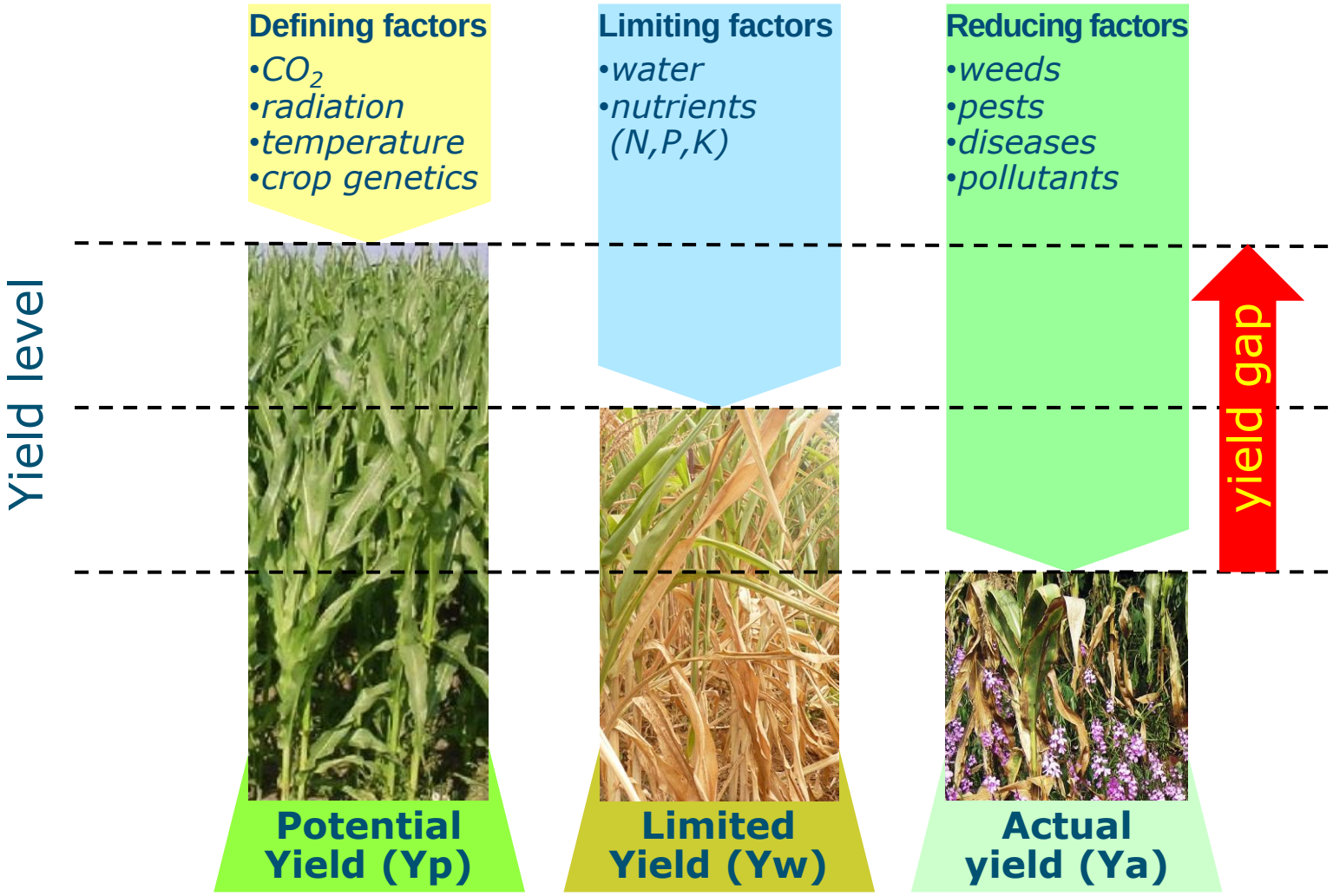
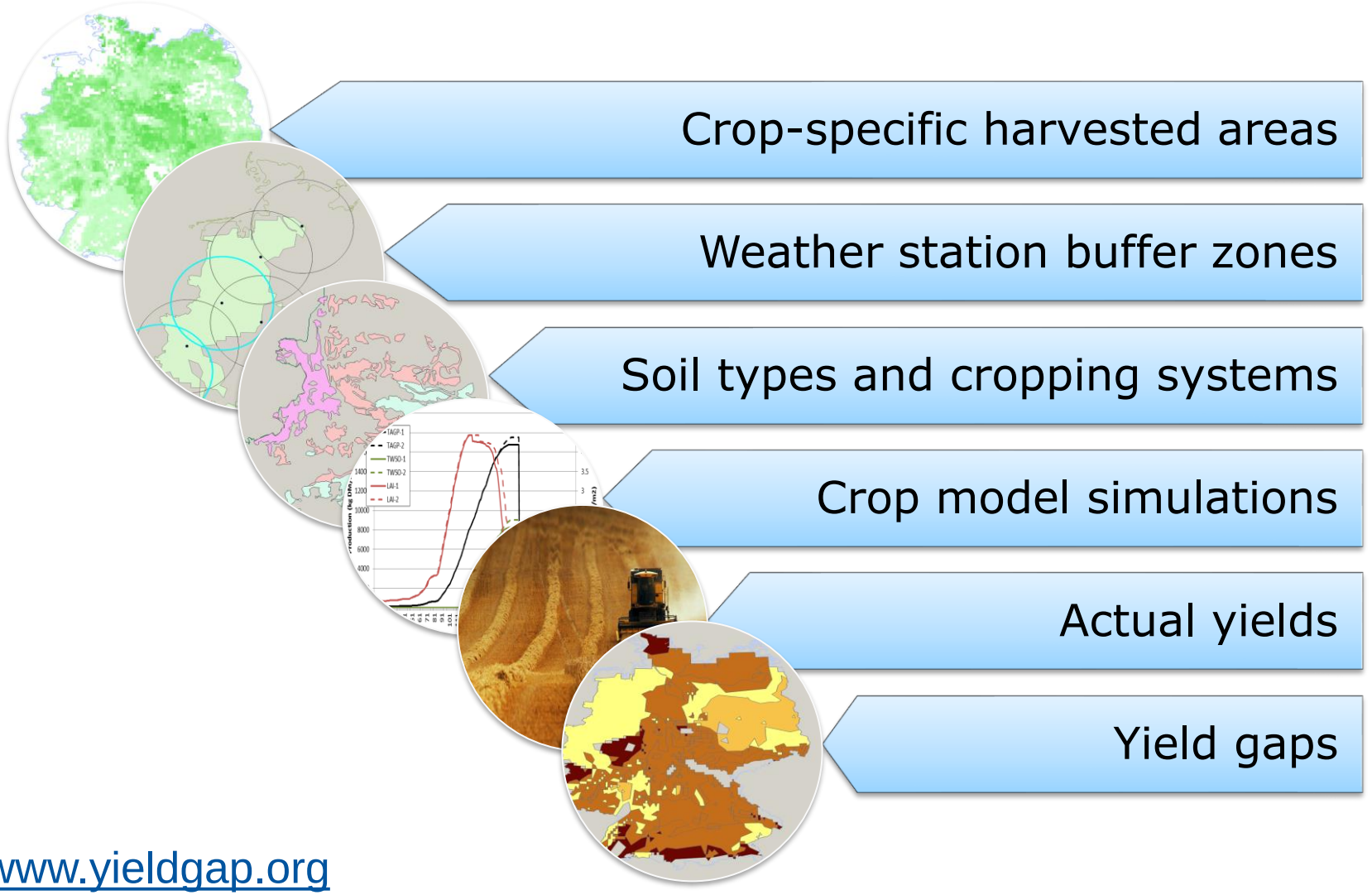
Concepts for yield gap analysis



van Ittersum & Rabbinge (1997, FCR)

Protocol Global Yield Gap Atlas



Crop-specific harvested areas

Weather station buffer zones

Soil types and cropping systems

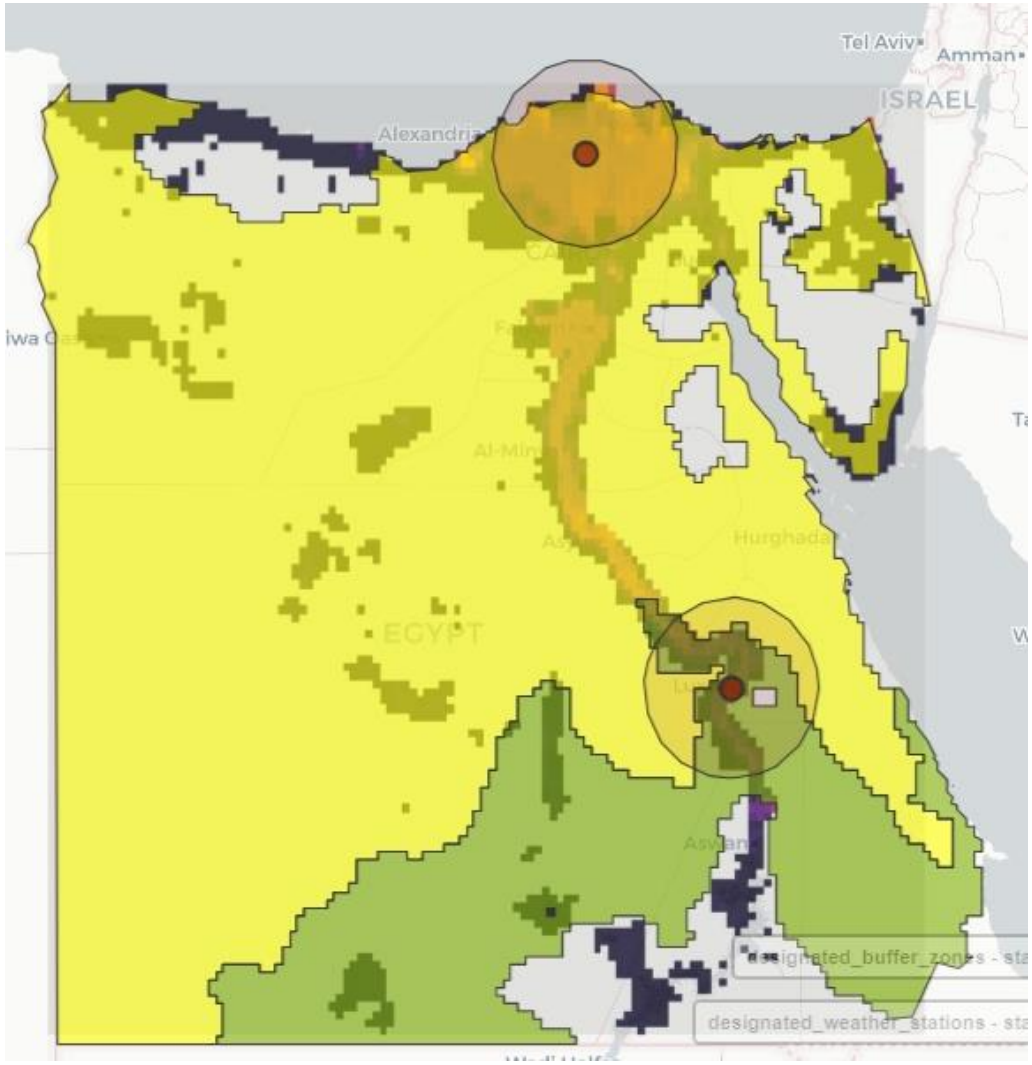
Crop model simulations

Actual yields

Yield gaps

www.yieldgap.org

Climate zone selection and weather stations



- Wheat production along the Nile valley and in the Nile delta
- Most country covered by one climate zone one, except southern part
- 2 buffer zones centered by weather stations in Kafr-El-Sheikh and Luxor
- Each buffer zone covers >50% of the wheat area in each climate zone

Cropping system characteristics – Nile delta

station_name	Sakha	Nile Delta
cropping_system	Mainly field crops with about 10-15% orchards	There is mix with vegetables
per_rainfed	(20% in north Nile delta to 0% south delta)	the maximum rainfall in north delta is 80 mm/year (winter)
per_irrigated	almost 100% (5 irrigation events)	
irrigation_type	flood irrigation	
main_soil_type	clay soil (with clay content 39-42%)	
per_main_soil_type	100%	
main_crop_rotation	Wheat-Sugarbeet-Barseem/Maize-Rice-Cotton	There is no followed crop rotation or system, but these are the most common crops
sowing_window_start	October, 25	
sowing_window_end	December, 15	
harvest_period_start	April, 15	
harvest_period_end	May, 15	
main_cultivar	Giza 171	
ndays_emergence_flowering	90-105	
ndays_flowering_maturity	40-60	
harvest_index	0.33-0.38	

November 15

May 1

ca. 165 days

ca. 150 days

Cropping system characteristics – Upper Egypt

station_name	Luxor	Upper Egypt
cropping_system	Field crops and about 20% sugarcan	There is mix with vegetables
per_rainfed	0%	There is no rainfall in upper Egypt
per_irrigated	100% (7 irrigation events)	
irrigation_type	flood irrigation/sprinkler	
main_soil_type	clay soil, loamy soil, sandy soil	
per_main_soil_type	60%, 25%, 15%	
main_crop_rotation	Wheat-Barseem/Sugar cane-Maiz-Sorgum	There is no followed crop rotation or system, but these are the most common crops
sowing_window_start	November, 15	
sowing_window_end	December, 15	
harvest_period_start	April, 20	
harvest_period_end	May, 15	
main_cultivar	Giza 168	
ndays_emergence_flowering	80-90	
ndays_flowering_maturity	35-50	
harvest_index	0.29-0.38	

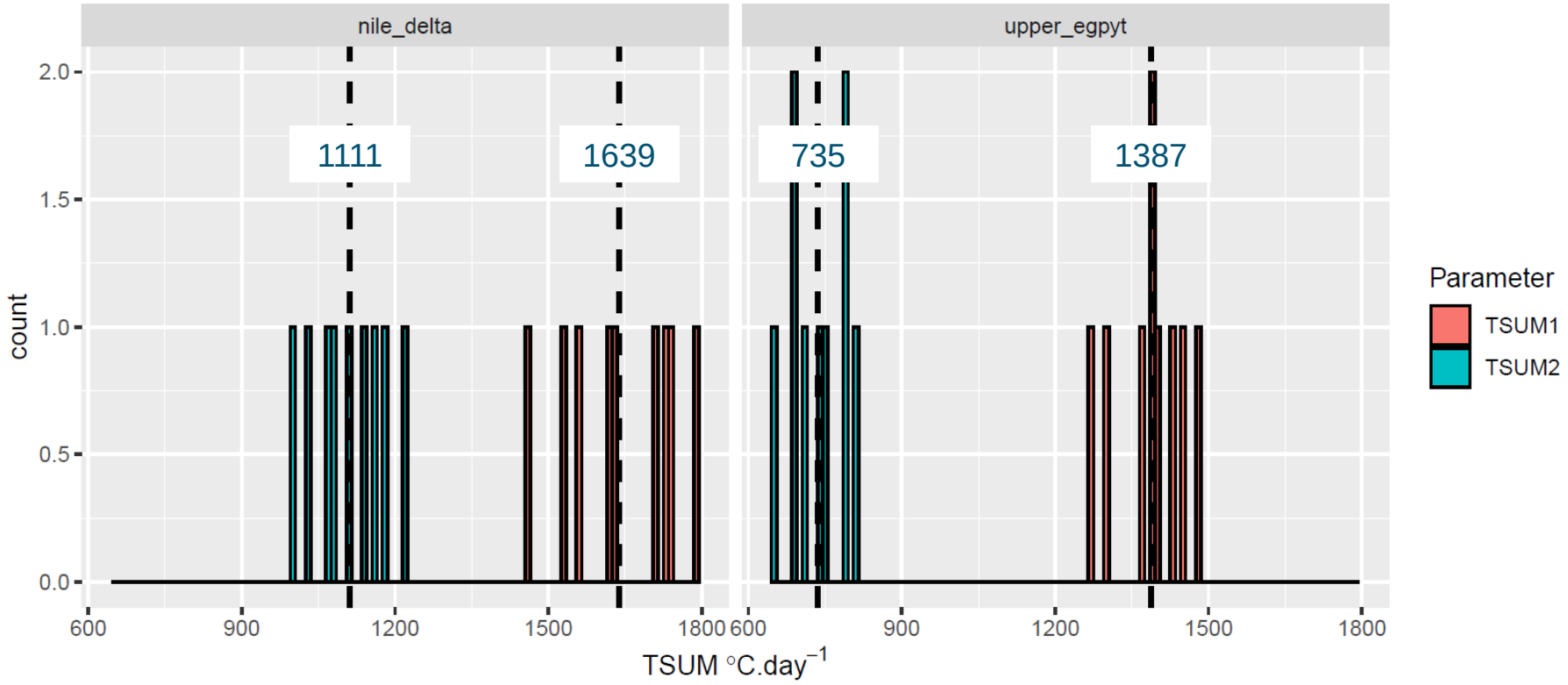
November 15

May 1

ca. 165 days

ca. 130 days

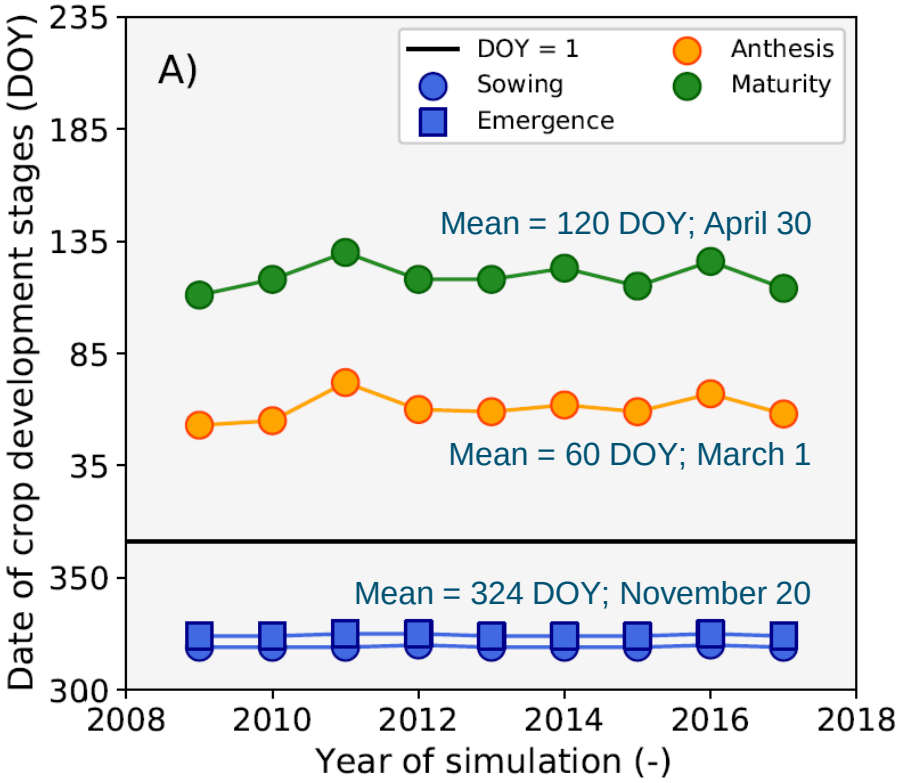
Calibrated crop parameters

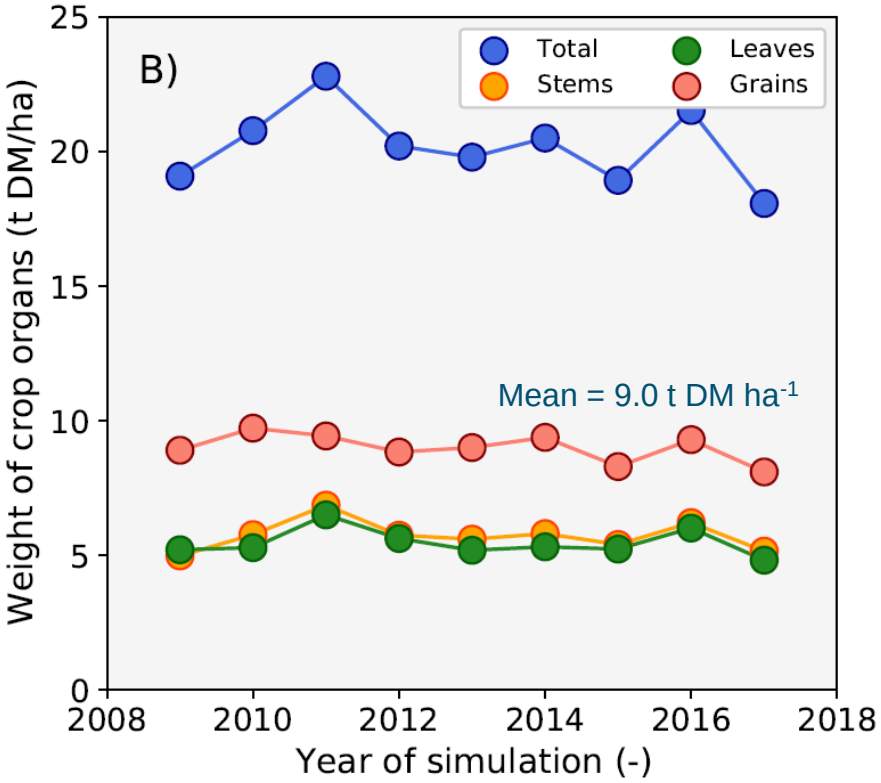


Other parameters:

SLATB = 0.0037 ha/kg	**--** specific leaf area as a function of DVS
SPAN = 35 days	**--** life span of leaves growing at 35 Celsius
AMAXTB = 45; 7.5 kg/ha/hr	**--** max. CO2 assimilation rate as a function of DVS

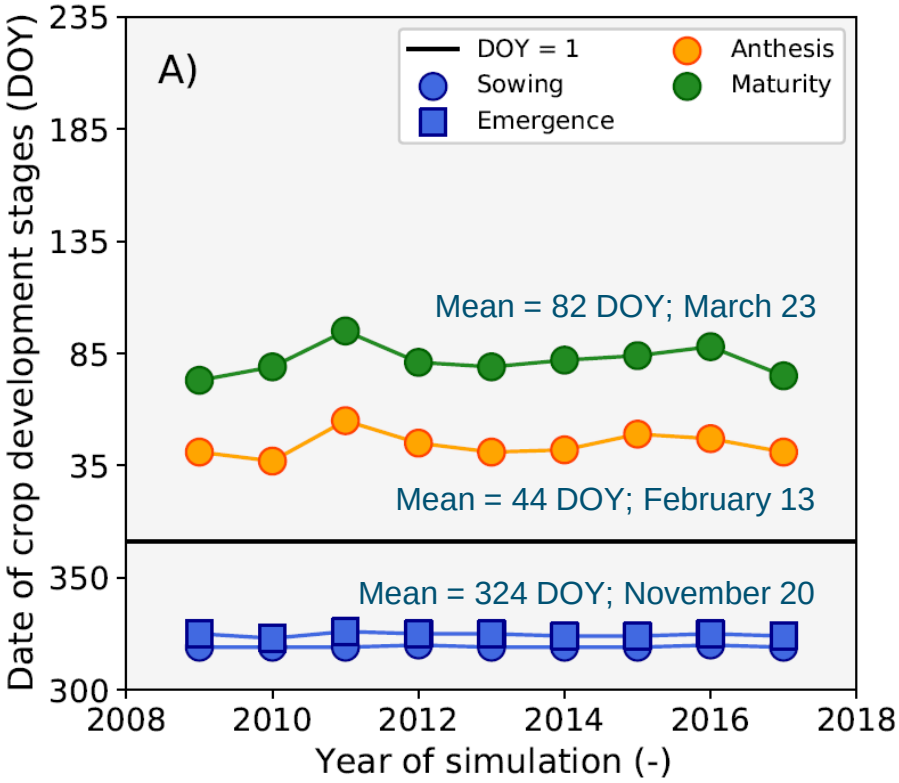
Simulated Yp – Nile delta

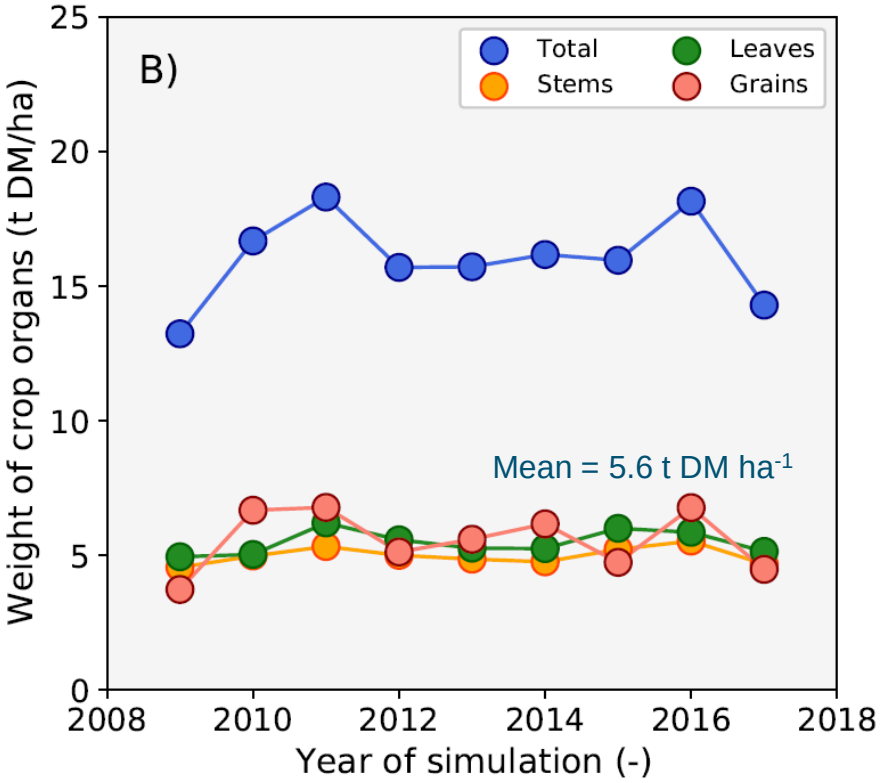




Maturity – Emergence = 161 days

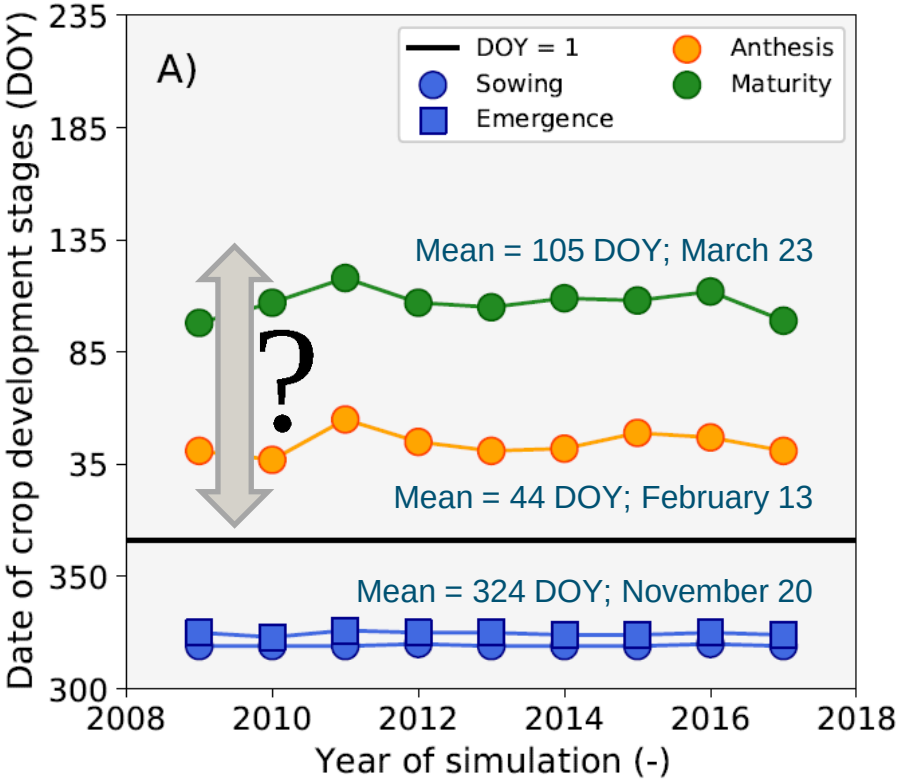
Simulated Yp – Upper Egypt

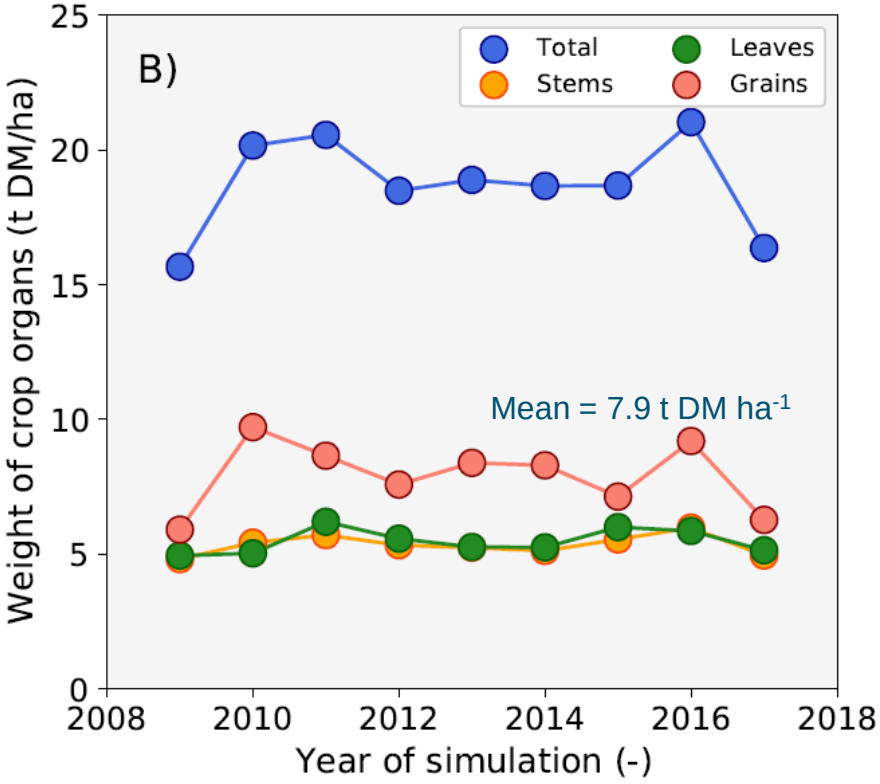




Maturity – Emergence = 123 days

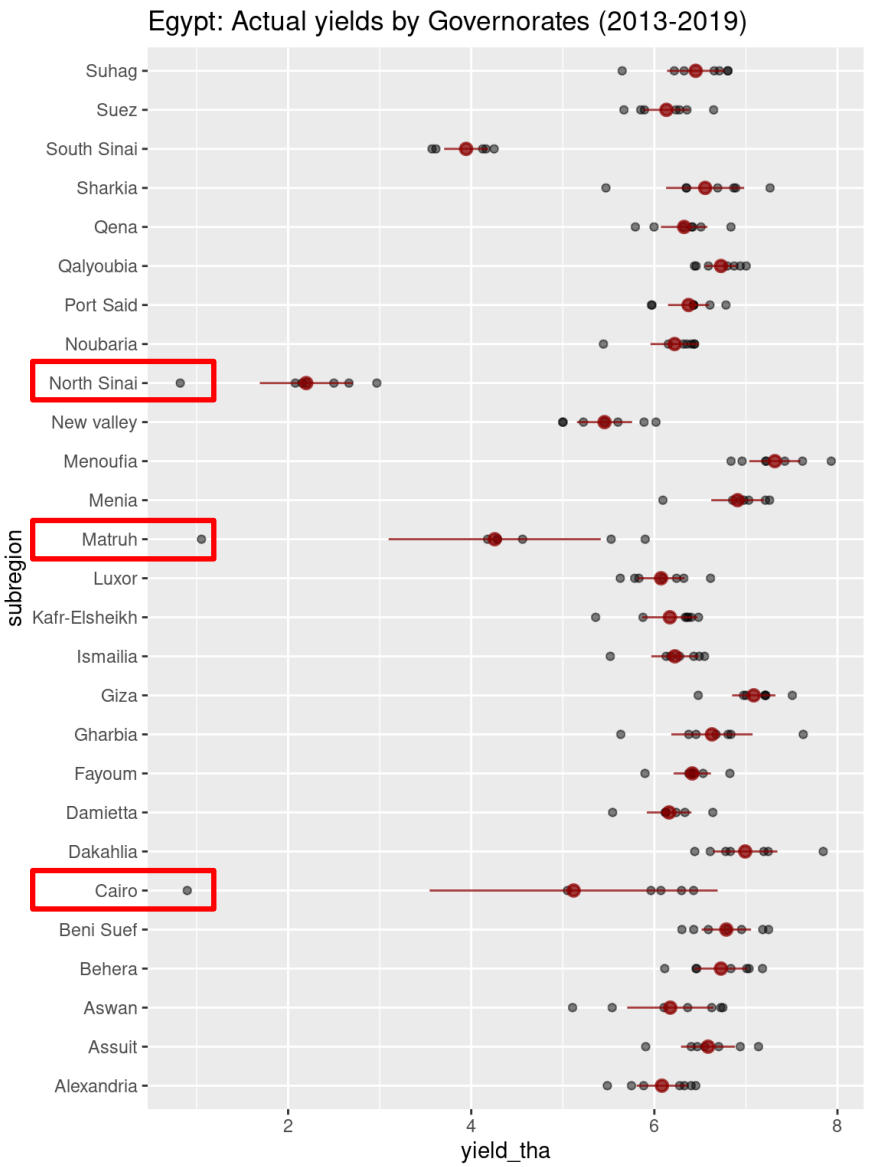
Simulated Yp – Upper Egypt – **TSUM2+600**





Maturity – Emergence = 146 days

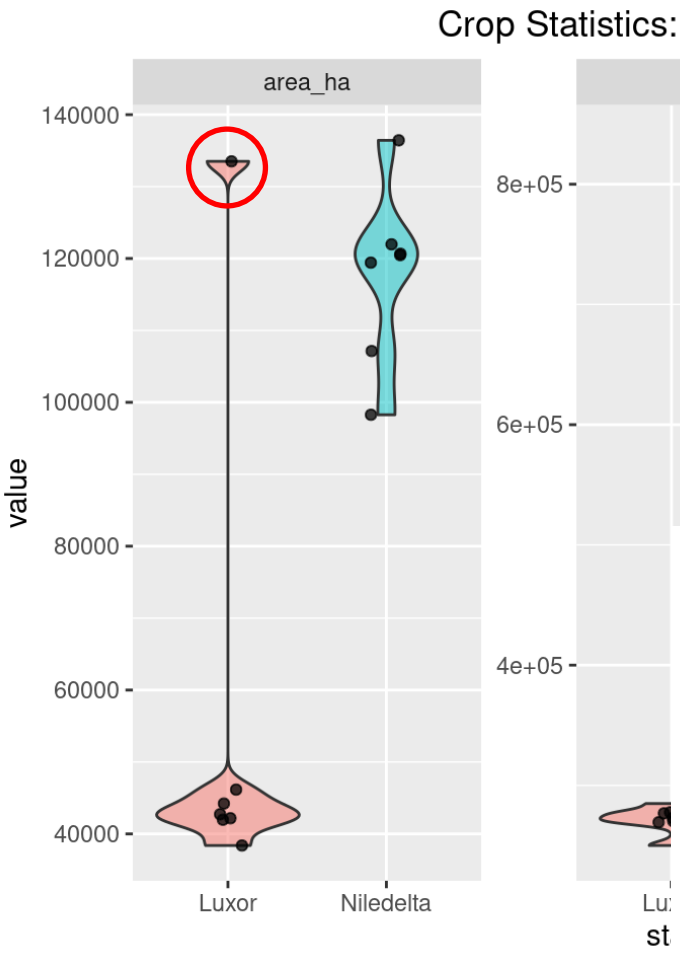
Actual yields at governorate level



Outliers

crop	yearsubregion	area_ha	production_t	yield_tha
Irrigated wheat	2014North Sinai	578.34000	475.20	0.821662
Irrigated wheat	2018Cairo	38.09524	34.20	0.897750
Irrigated wheat	2018Matruh	42611.90476	44912.55	1.053991

Actual yields at buffer zone level



station_name	station_id	crop	year	area_ha	production_t	yield_tha
Luxor	1	Irrigated wheat	2013	41970.83	277619.6	6.439513
Luxor	1	Irrigated wheat	2014	46154.59	284899.3	6.358293
Luxor	1	Irrigated wheat	2015	44219.81	272776.1	6.238067
Luxor	1	Irrigated wheat	2016	42729.12	269333.3	6.263148
Luxor	1	Irrigated wheat	2017	38386.20	250007.9	6.519983
Luxor	**1**	**Irrigated wheat**	**2018**	**133507.19**	**270290.1**	**5.715091**
Luxor	1	Irrigated wheat	2019	42174.21	276771.4	6.543393
Niledelta	818005001	Irrigated wheat	2013	121970.86	836501.0	7.204606
Niledelta	818005001	Irrigated wheat	2014	120468.43	813283.8	6.819561
Niledelta	818005001	Irrigated wheat	2015	119422.83	823772.4	6.929822
Niledelta	818005001	Irrigated wheat	2016	120658.69	822847.1	6.732421
Niledelta	818005001	Irrigated wheat	2017	98274.86	700792.2	7.172009
Niledelta	818005001	Irrigated wheat	2018	136430.18	709090.3	6.059324
Niledelta	818005001	Irrigated wheat	2019	107131.72	693570.8	6.527569

Yield gap closure for wheat in Egypt