How does the crop model work (Nitrogen limitation - Reid 2002)?

1. Calculate steady state soil carbon accounting for impacts of soil water and nitrogen.
2. Calculate soil nitrogen supply for this month (Sheet A2a, column AE).
3. This gives soil nitrate and ammonium at the start of the next month (Sheet A2, columns E and Q).
4. Use soil nitrate and ammonium **at the start of the month** to calculate plant available N from the soil (Sheet B1c, column K).
5. Add fertiliser supply (Sheet B1c, column L).
6. Calculate the proportion of the optimum yield achieved (Sheet B1c, column N).
7. Obtain the nitrogen demand without other losses needed to achieve that yield (Sheet A2b, column G)
8. Adjust the nitrogen demand to account for other losses (eg leaching and denitrification) (Sheet A2b, column H).
9. Translate the nitrogen demand into a revised estimate of the proportion of the optimum yield achieved (Sheet A2b, column I).
10. Use this to calculate the N limited yield for this month (Sheet B1c, column P).
11. Compare forward run value in 10. to steady state run value to give Production compared to steady state (Sheet B1c, column Q).
12. Use this value to multiply the plant inputs for this month and feed plant inputs into the carbon model.

How does the crop model work (Water stress – Zaks et al. 2007)?

1. Calculate steady state soil carbon accounting for impacts of soil water and nitrogen.
2. Use the percent soil carbon **in the last timestep** to calculate lower limit for water extraction (sheet A3, column I) and field capacity in the rooting zone (sheet A3, column J).
3. Use rainfall, PET, field capacity and lower limit for water extraction to calculate soil water content in the rooting zone before irrigation (sheet A3, column K), which gives AET before irrigation (cant be higher than the water content (sheet A3, column L).
4. Add any irrigation and repeat (3) – not quite sure why we do both - maybe in case want to report without irrigation? (sheet A3, columns O and P).
5. Take the AET after irrigation in months during the growing season (Sheet B1b – column I).
6. Calculate the growing degree days this month (Sheet B1b – column H).
7. Use the growing degree days and the ratio of AET to PET (water stress index) in Zaks’ formula to calculate the NPP (Sheet B1b, column M).
8. Calculate the ratio of NPP in this year to NPP in the same crop in the steady state run (Sheet B1b, column N).
9. Use this value to multiply the plant inputs for this month and feed plant inputs into the carbon model.

PET : potential evapotranspiration

AET: actual evapotranspiration