AGRO-METEOROLOGICAL METRICS TO COMMUNICATE CLIMATE CHANGE

Impacts to Land Managers

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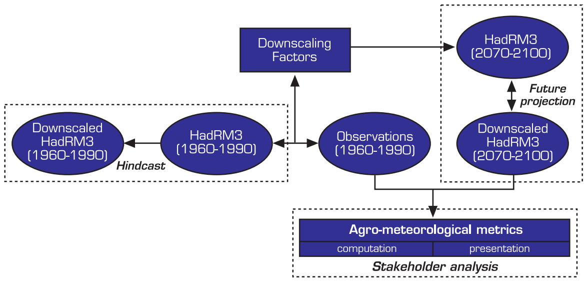
INTRODUCTION:

Agro-meteorological metrics and soil water balances are important indicators of conditions that influence farm scale decision making. Metrics derived from projected future climates provide an opportunity to characterise the impacts of climate change (CC) on agricultural practices. Such indications are vital for determining how changes in the biophysical environment can lead to adaptations to farming systems.

METHODOLOGY:

1. Compare HadRM3 Regional Climate Model (RCM) estimates for the 1960-90 period (hindcast) with observed data.
2. Use the differences to develop bias correction downscaling factors (DF).
3. Apply DF to hindcast data and re-compare with observed data.
4. Apply DF to future projections.
5. Compute agro-meteorological metrics using observed and downscaled future projection data.
6. Stakeholders determine the best form of representation of the metrics.



RESULTS:

(for A2 medium high greenhouse gas emissions scenario, 2070-2100)

- Average daily temperature may increase by ~3°C (Table 1).
- Annual rainfall total remains similar, but with greatly different seasonal distributions (Table 1 + Fig. 1).
- Growing season expands (starts earlier and finishes later) (Table 1).
- Temperature based start of field operations (i.e. Tsum200) projected to occur earlier (Fig. 2).
- End of FC (spring) and return to FC (autumn) remain the same, posing possible access restrictions at a time when growth conditions will be favourable (Figs. 3+4).
- Crop access to water will be restricted more severely and more often (Fig. 5).
- Warmer temperatures in winter and lack of frosts may result in increased pests and pathogens.

Fig. 1. Mean monthly precipitation (mm)

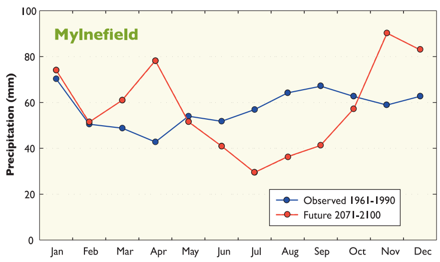


Fig. 2. Start of field operations (Tsum200)

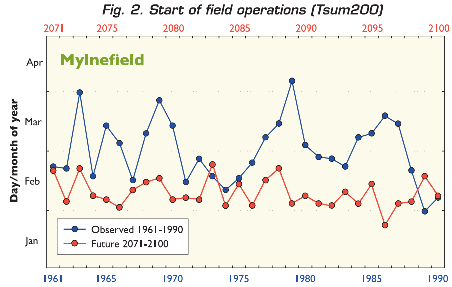


Fig. 3. Beginning and end of field capacity

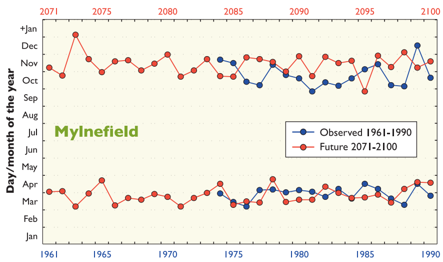


Fig. 4. Growth and Field Access

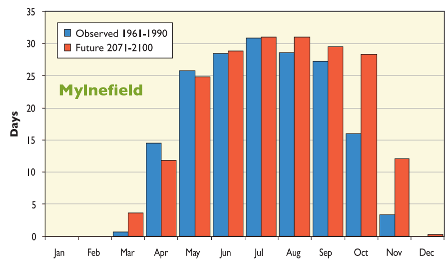
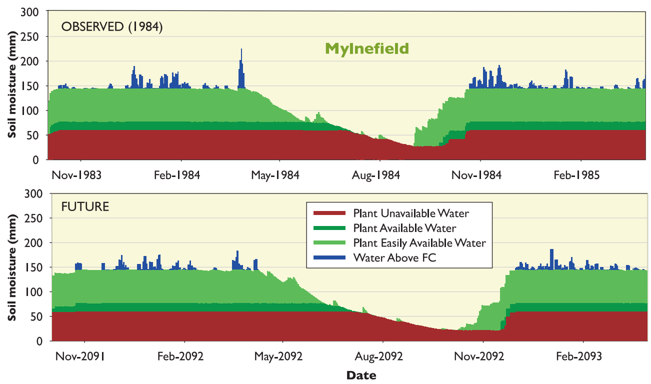


Table 1. Summary of Indicators

▶ increase/later ◀ decrease/earlier	Aberdeen	Mylnefield	Carnwath	Dumfries	Eskdalemuir	Auchincruive
Average Daily Temp (°C)	▶ 2.8	▶ 3.1	▶ 2.8	▶ 3.3	▶ 3.0	▶ 2.8
Average Annual Rainfall (mm)	▶ 36	▶ 26	▶ 35	▶ 100	▶ 20	▶ 70
Start of Growing Season (day)	◀ 48	◀ 35	◀ 37	◀ 27	◀ 50	◀ 14
Tsum200 (day)	◀ 22	◀ 22	◀ 21	◀ 22	◀ 26	◀ 16
End of Field Capacity (day)	◀ 3	◀ 2	na	◀ 2	◀ 7	◀ 3
Last Air Frost in Spring (day)	◀ 42	◀ 41	◀ 52	◀ 36	◀ 49	◀ 37
Return to Field Capacity (day)	▶ 14	▶ 18	na	▶ 23	▶ 11	▶ 18
End of Growing Season (day)	▶ 17	▶ 17	▶ 16	▶ 19	▶ 23	▶ 20
Dry Soil (days)	▶ 3	▶ 11	na	▶ 13	▶ 1	◀ 0 ▶
Growing Season Length (days)	▶ 64	▶ 63	▶ 58	▶ 60	▶ 66	▶ 55
Access Period Length (days)	▶ 11	▶ 19	na	▶ 47	▶ 22	▶ 30
Access in Growing Season (days)	▶ 20	▶ 26	na	▶ 51	▶ 30	▶ 33

Fig. 5. Soil Moisture (Dry Year)



CONCLUSIONS:

- Need to assess data quality from climate models before calculating agro-meteorological metrics.
- Downscaling greatly improves utility of RCM projections for site-specific application.
- Review by stakeholders improves the quality of representation of information.
- There will be both positive and negative impacts on farming from CC in Scotland.
- Substantial changes to management may be required to maximise potential and minimise risks.
- Site-specific agro-metrics aid farm management decision making on adaptation and mitigation strategies to cope with future climate change.

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