# Climafruit: Transnational trial

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The James Hutton Institute

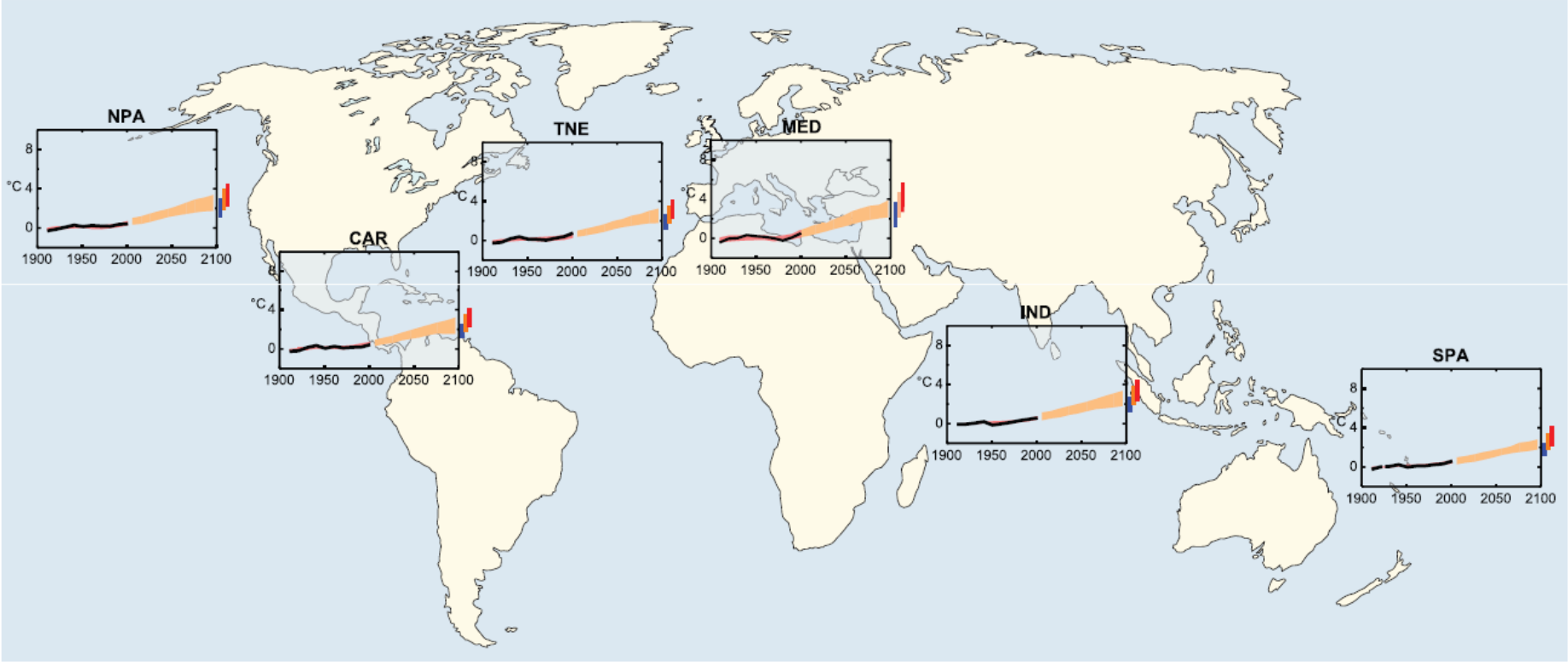
The Interreg IVB North Sea Region Programme

Future-proofing berryfruit
CLIMAFRUIT

Invergowrie 15.02.2012

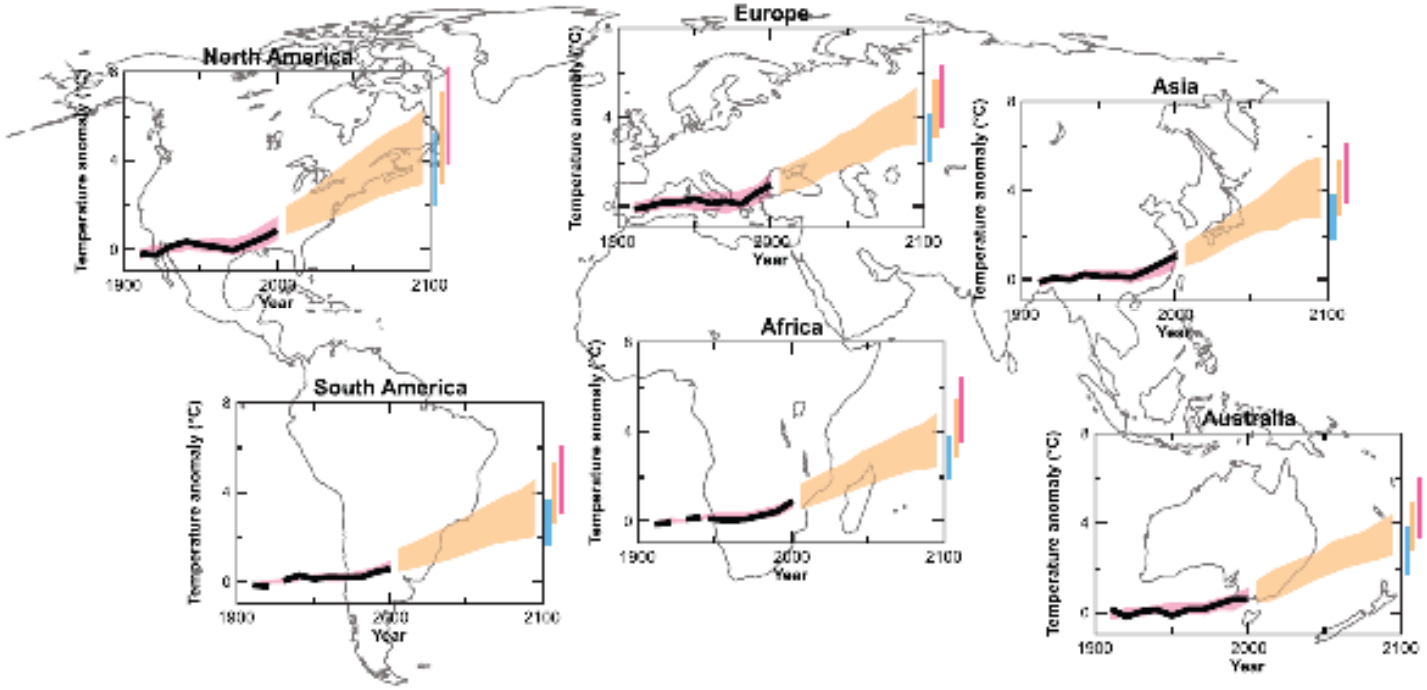
# Introduction

- Climate change projections



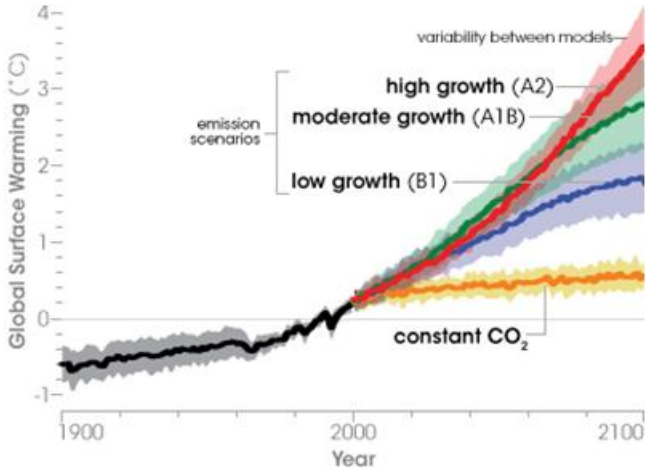

**Temperature anomalies for six oceanic regions (black line) and as simulated by multi-model data (MMD) models incorporating known forcings (red envelope); and as projected (orange envelope) for 2001 to 2100 by MMD models (IPCC, 2007)**

# Introduction



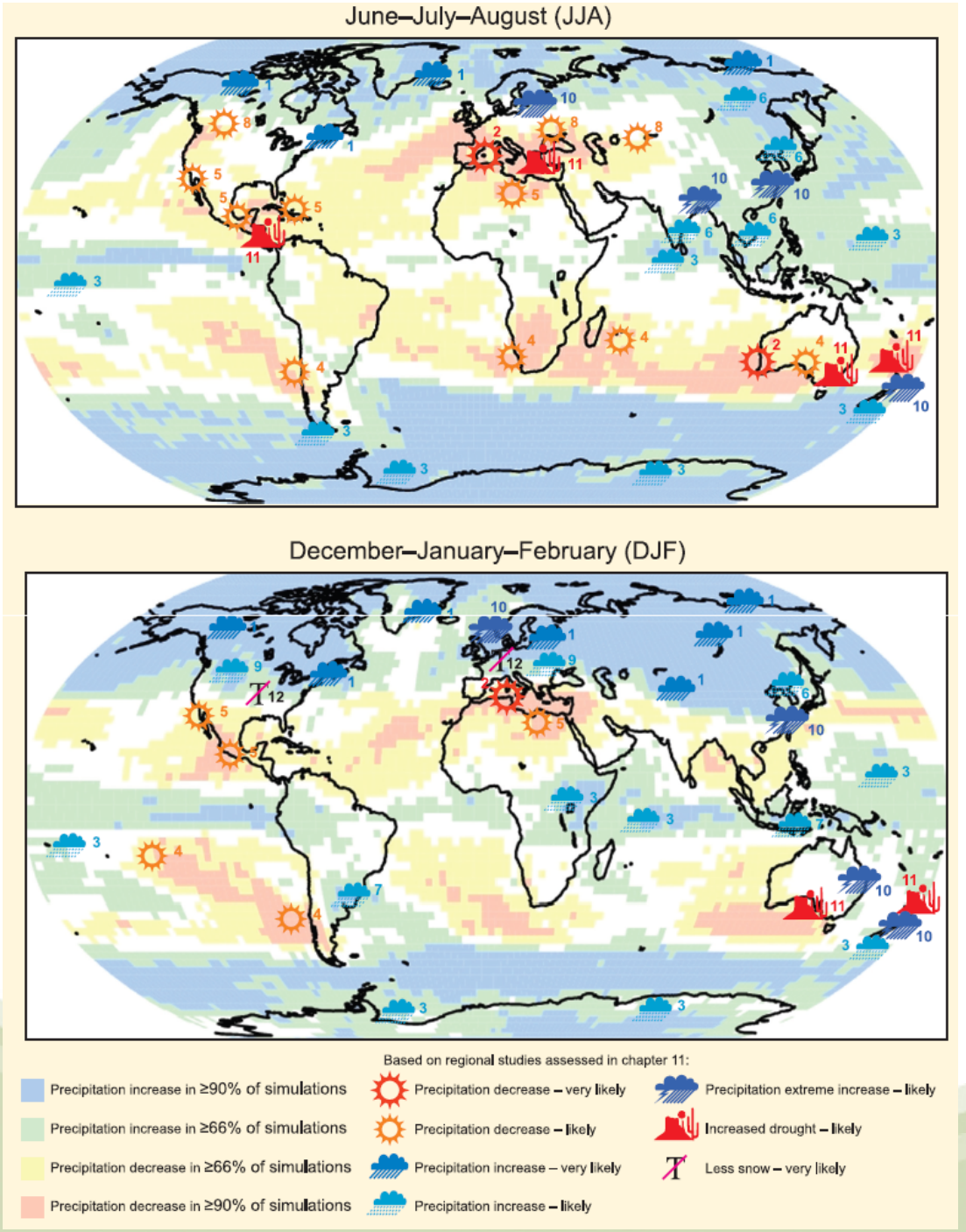

**Temperature anomalies for six continental-scale regions (black line) and as simulated by multi-model data (MMD) models incorporating known forcings (red envelope); and as projected (orange envelope)for 2001 to 2100 by MMD models (IPCC, 2007)**

# Introduction



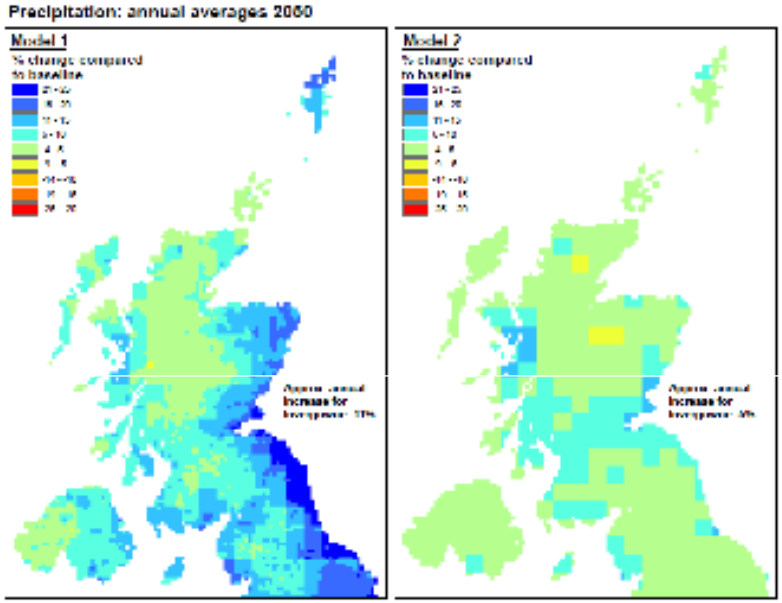

**Temperature projections to the year 2100, based on a range of emission scenarios and global climate models. Scenarios that assume the highest growth in greenhouse gas emissions provide estimations in the top end of the temperature range (IPCC, 2007).**

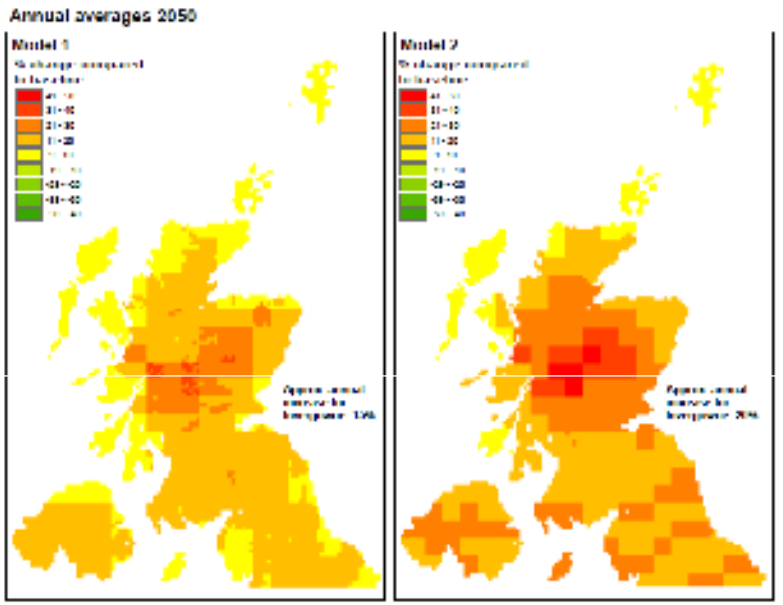
**Robust findings on regional climate change for mean and extreme precipitation, drought and snow. This regional assessment is based upon AOGCM based studies, regional climate models, statistical downscaling and process understanding.(IPCC, 2007)**



# Introduction

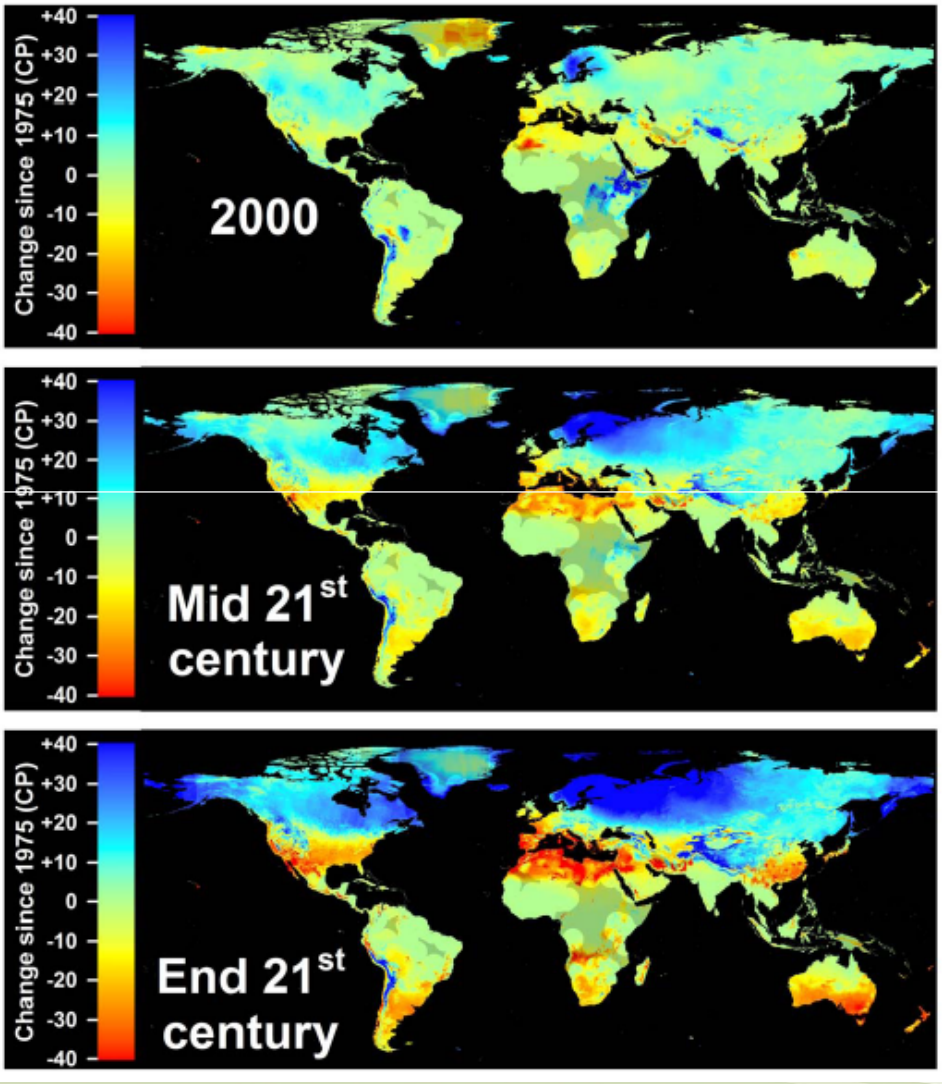
- Climate change in a local context




| Year | Annual precipitation (mm) | Annual evapotranspiration (mm) | Water balance (mm) | Water balance (mm) model 1 | Water balance (mm) model 2 |
|---|---|---|---|---|---|
| 2006 | 710.3 | 490.2 | 220.1 | 224.7 | 157.6 |
| 2007 | 741.5 | 453.7 | 287.8 | 301.3 | 234.1 |
| 2008 | 764.5 | 437.6 | 326.9 | 345.3 | 277.6 |
| 2009 | 845.8 | 447.5 | 398.3 | 424.2 | 351.1 |
| 2010 | 773.5 | 417.0 | 356.5 | 379.0 | 311.8 |

# Introduction




Modelled and projected losses in Safe Winter Chill compared to 1975 for the year 2000 (top), the middle of the 21st century (middle), and the end of the 21st century (bottom). For each point in time, results are averaged over three greenhouse gas emissions scenarios and three Global Climate Models. Areas that are more than 5u away from the closest weather station are shaded, because interpolated results are unreliable (Luedeling et al., 2011).

# Introduction

- Climate change is inevitable
- A range of robust global predictions
- There is a degree of variability in model predictions
- Weather variability
- There is a lack of information about the relationship of climate with quality traits

# Transnational trial

- *Ribes nigrum*
  - Ben Alder
  - Ben Gairn
  - Ben Vane
  - Ben Klibreck
  - Ben Hope

- *Rubus idaeus*
  - Glen Ample
  - Glen Fyne
  - Octavia
  - Tulameen
  - Autumn Treasure
  - Polka
  - Erika

- *Rubus fruticosus*
  - Karaka black
  - Loch Ness

# Transnational trial

- Invergowrie, UK
- Vechta, Germany
- Arhus, Denmark
- Ranna, Sweden
- Apelsvoll, Norway

# Transnational trial

- Average air temperature
- Maximum air temperature
- Minimum air temperature
- Soil temperature at 30 cm
- Precipitation
- Snow depth
- Relative humidity
- Evapotranspiration rate
- Wind direction
- Average wind speed
- Maximum wind speed
- Minimum wind speed
- Global radiation

# Transnational trial

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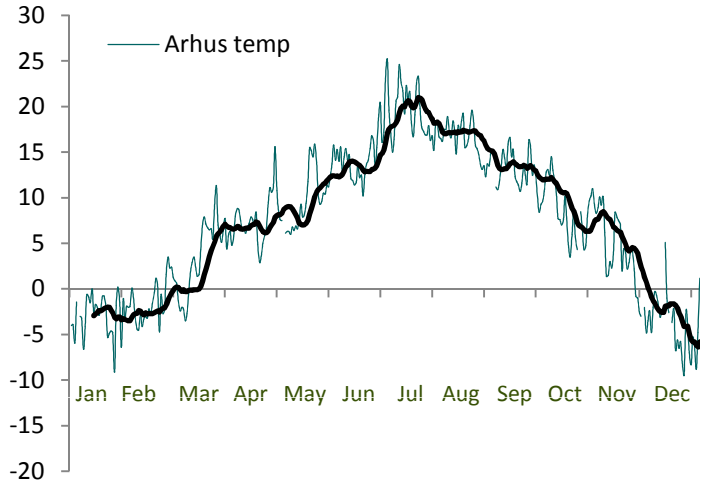
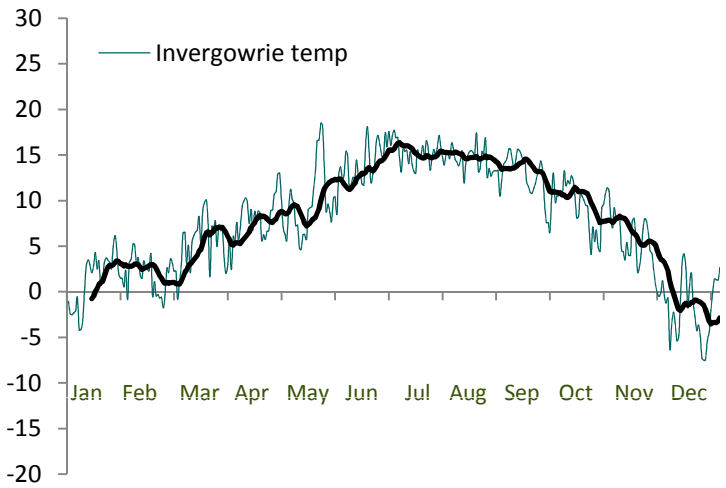
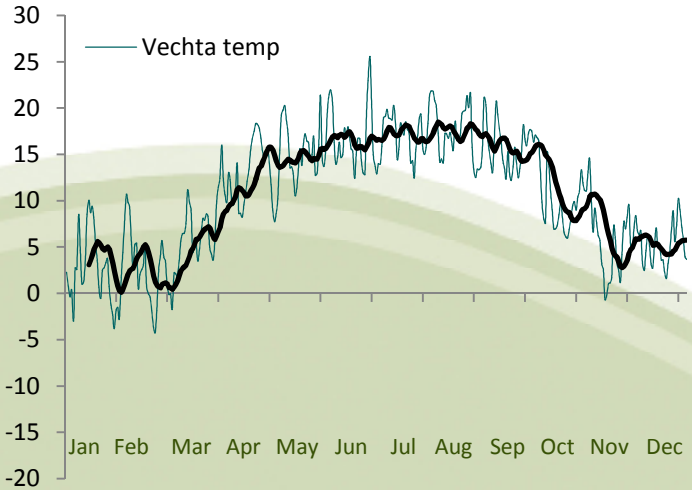
## Arhus temp 2010



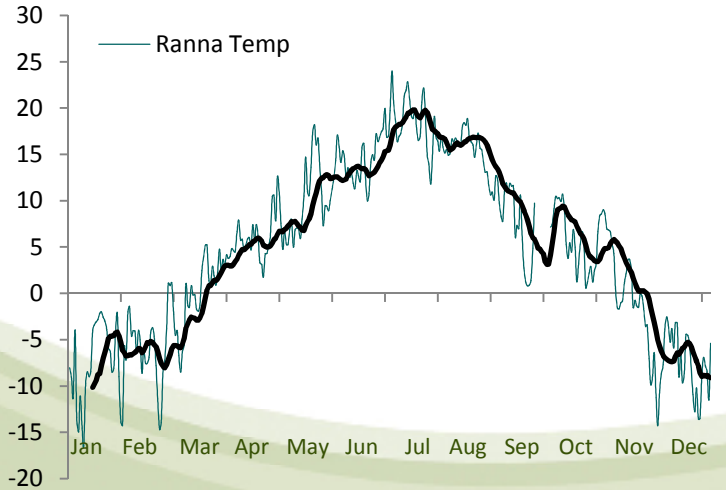

## Invergowrie temp 2010




## Vechta temp 2011




## Ranna Temp 2010



# Transnational trial

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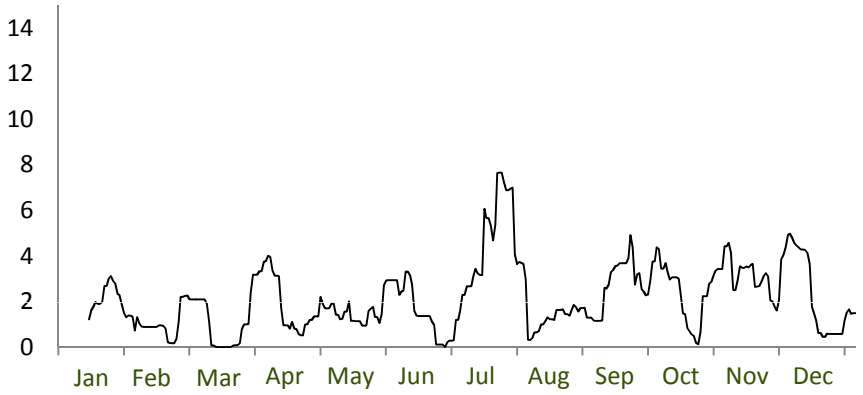
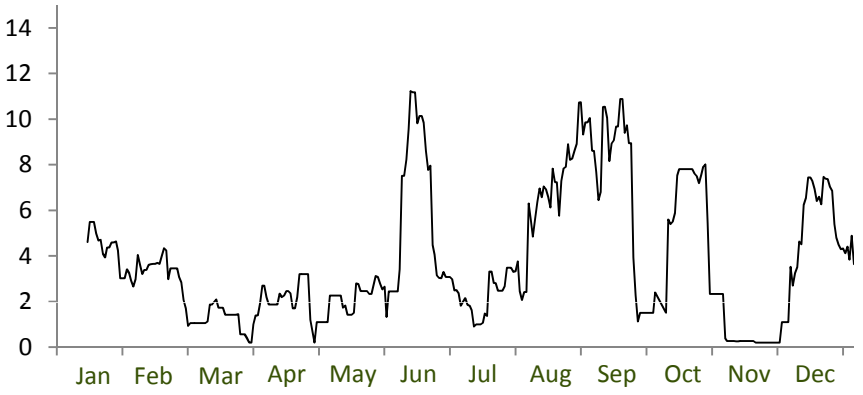
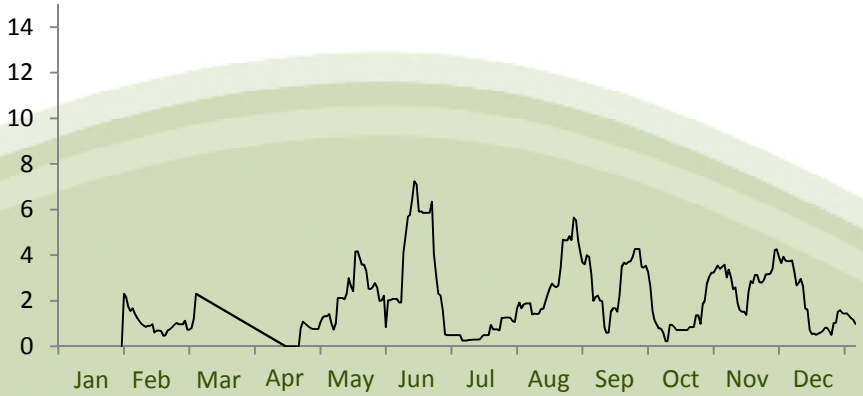
**Invergowrie 2010 precipitation averaged over 14 days (mm)**



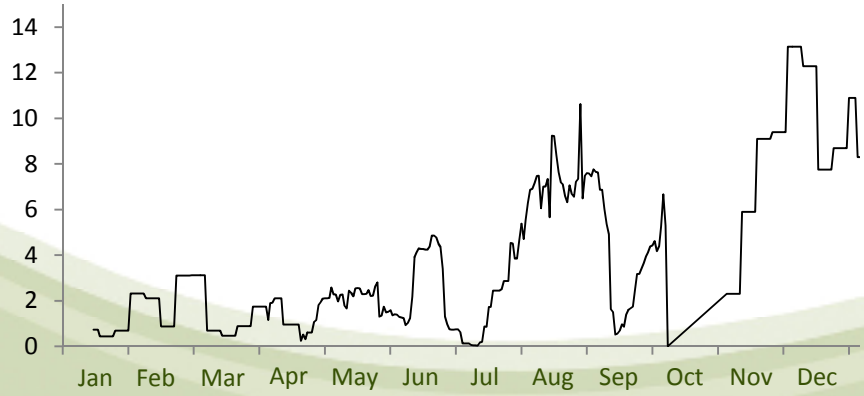

**Vechta 2011 precipitation averaged over 14 days (mm)**



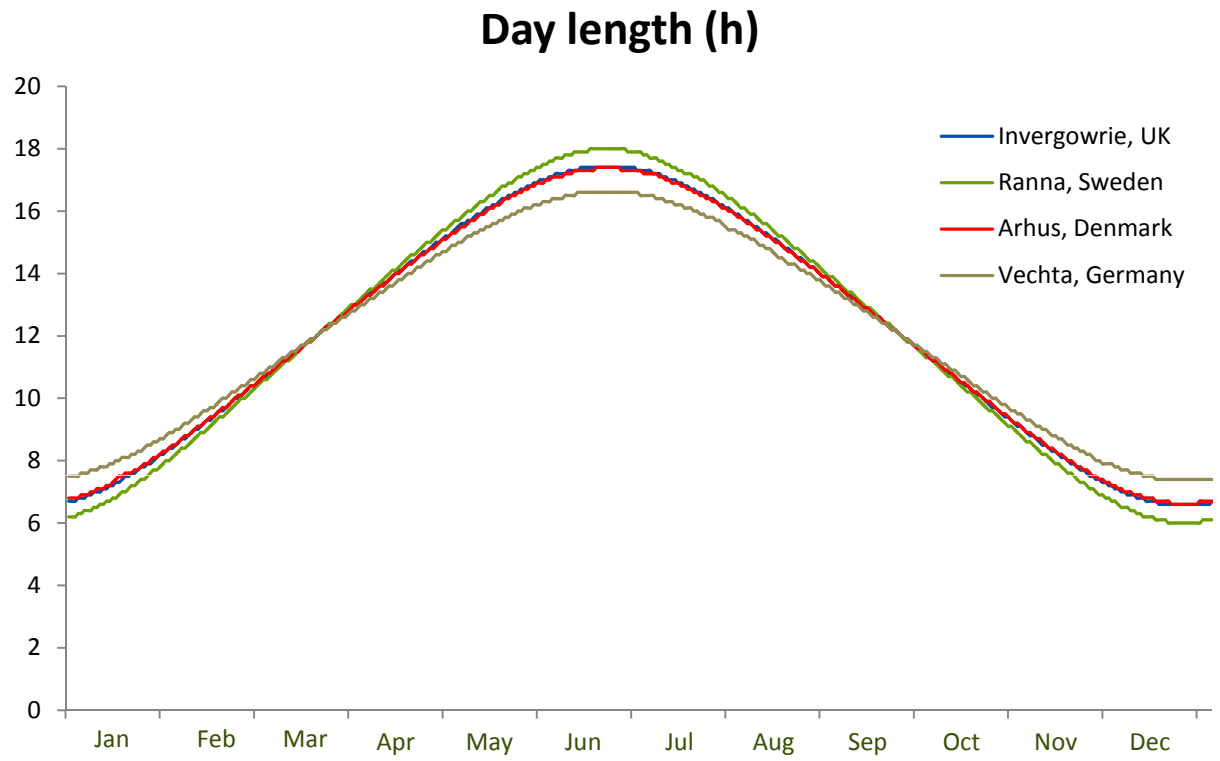

**Arhus 2010 precipitation averaged over 14 days (mm)**




**Ranna 2010 precipitation averaged over 14 days (mm)**



# Transnational trial



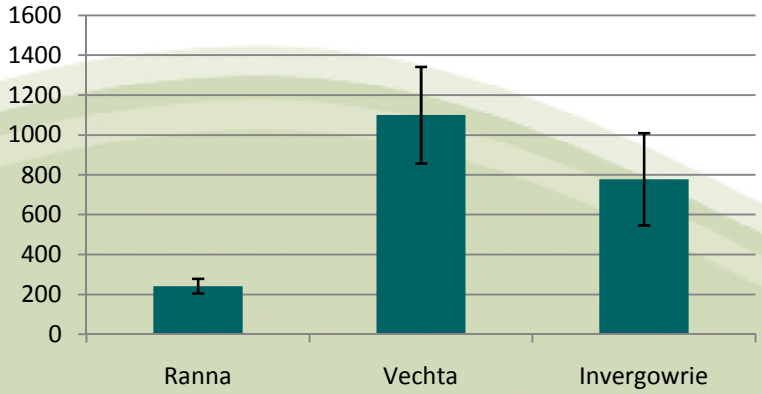

| Location | Maximum day length (h) | Minimum day length (h) |
|---|---|---|
| Invergowrie, UK | 17.4 | 6.6 |
| Arhus, Denmark | 17.4 | 6.6 |
| Ranna, Sweden | 18.0 | 6.0 |
| Vechta, Germany | 16.6 | 7.4 |

# Transnational Trial

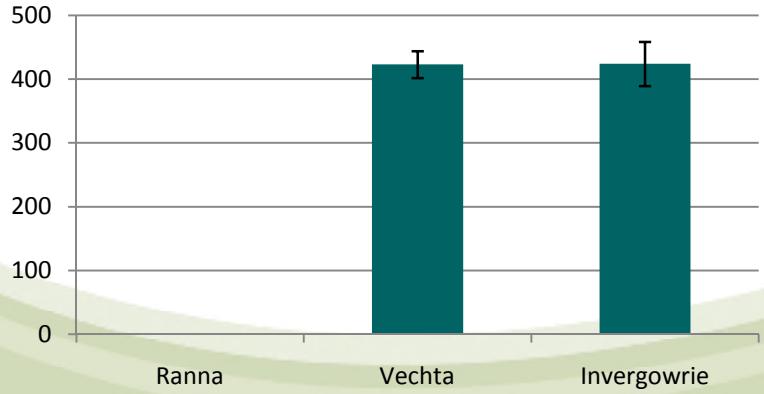
- Tulameen

| Location | Bud-burst date | First flower date |
|---|---|---|
| Ranna | - | - |
| Vechta | 13/03/2011 | 16/05/2011 |
| Invergowrie | 16/03/2011 | 19/05/2011 |

**Tulameen Yield per plant 2011 (g)**




**Tulameen weight per 100 fruits 2011 (g)**

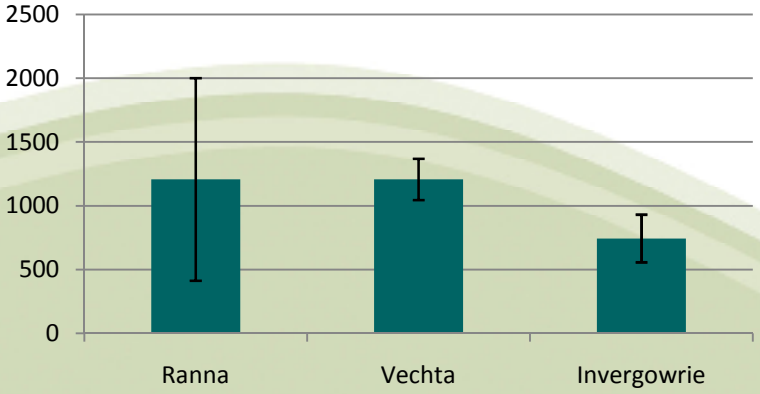


# Transnational Trial

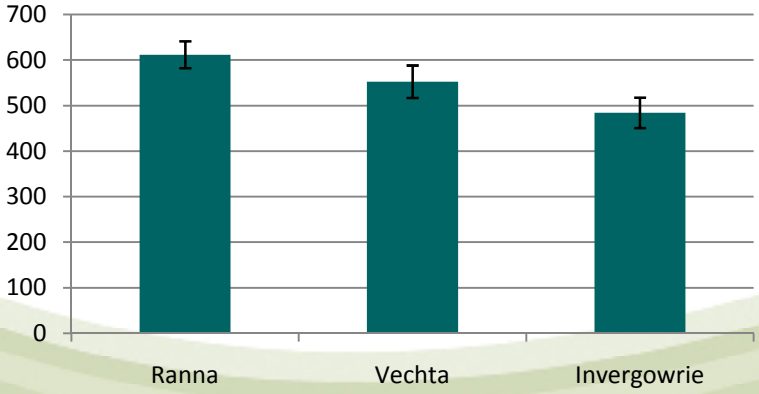
- Glen Ample

| Location | Bud-burst date | First flower date |
|---|---|---|
| Ranna | - | - |
| Vechta | 20/03/2011 | 14/05/2011 |
| Invergowrie | 18/03/2011 | 19/05/2011 |

**Glen Ample Yield per plant 2011 (g)**




**Glen Ample weight per 100 fruits 2011 (g)**

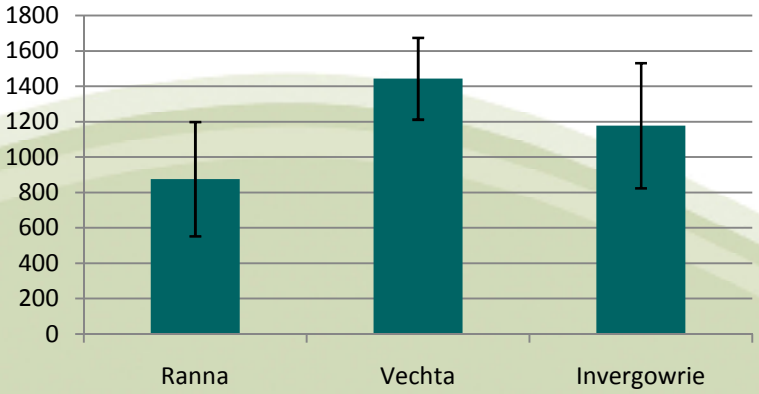


# Transnational Trial

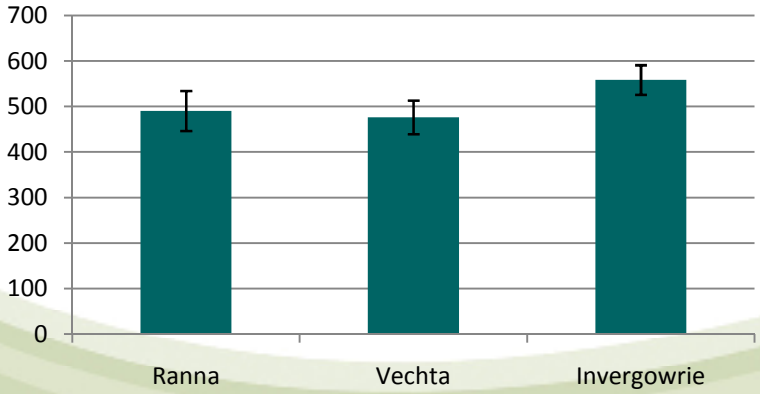
- Glen Fyne

| Location | Bud-burst date | First flower date |
|---|---|---|
| Ranna | - | - |
| Vechta | 20/03/2011 | 10/05/2011 |
| Invergowrie | 18/03/2011 | 10/05/2011 |

**Glen Fyne Yield per plant 2011 (g)**




**Glen Fyne weight per 100 fruits 2011 (g)**

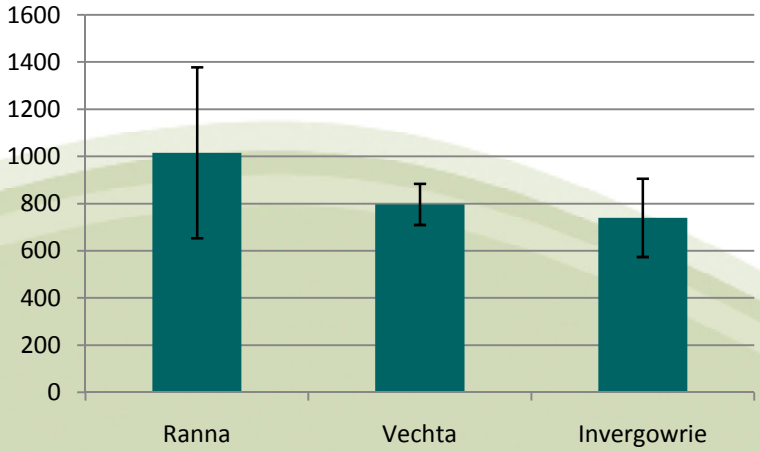


# Transnational Trial

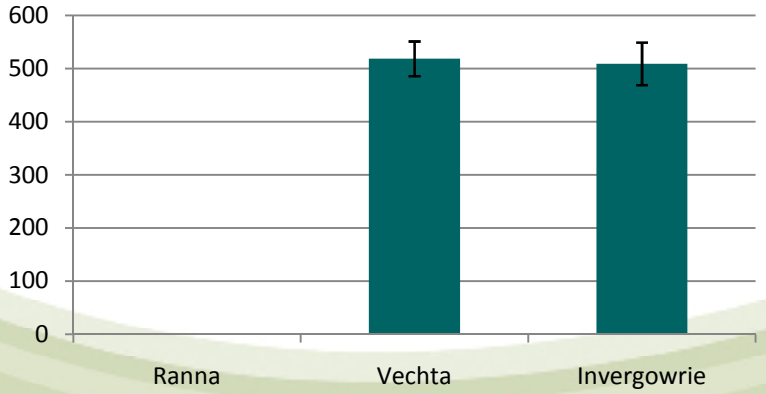
- Octavia

| Location | Bud-burst date | First flower date |
|---|---|---|
| Ranna | - | - |
| Vechta | 20/03/2011 | 20/05/2011 |
| Invergowrie | 12/04/2011 | 27/05/2011 |

**Octavia Yield per plant 2011 (g)**




**Octavia weight per 100 fruits 2011 (g)**



# Transnational trial

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- Fruits are freeze dried and sent to JHI
- Detailed biochemical analysis
  - Individual anthocyanins and flavonols
  - Individual organic acids
  - Individual sugars
- Correlate agronomical and biochemical data with meteorological data

| Anthocyanins | Flavonols |
|---|---|
| Delphinidin 3-galactoside | Myricetin 3-rutinoside |
| Delphinidin 3-glucoside | Myricetin 3-glucuronide |
| Delphinidin 3-rutinoside | Myricetin 3-glucoside |
| Cyanidin 3-glucoside | Myricetin 3-(6’’-malonyl)glucoside |
| Cyanidin 3-rutinoside | Aureusidin glucoside |
| Petunidin 3-rutinoside | Quercetin 3-rutinoside |
| Peonidin 3-galactoside | Quercetin 3-glucoside |
| Peonidin 3-rutinoside | Quecertin 3-(6’’-malonyl)glucoside |
| Peonidin 3-glucoside | Kampferol 3-rutinoside |
| Malvidin 3 galactoside | Kampferol 3-galactoside |
| Delphinidin 3-(6’’-coumaroyl)glucoside | Kampferol 3-glucoside |
| | Isohamnetin 3-rutinoside |

# Challenges and Limitations

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- Photoperiods are different between sites
- Standard management practices
- Different site-specific characteristics (soil types, altitude, orientation)
- Standardization of scoring systems
- Different experimental designs

- Year-to-year weather variability will provide further data which will be independent of site-specific conditions

# Acknowledgements


- Euan Caldwell (and his team)
- Nikki Jennings
- Dorota Jarret
- Mark Young
- Sara Jager
- Rob Stewart
- Rory McLeod







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