Release Notes – OverseerFM version 6.4.0

Contents

Changes to climate data in release 6.4.0

The update of OverseerFM to version 6.4.0 includes the release of new climate data from the National Institute of Water and Atmospheric Research (NIWA). This data includes GIS data grids (500m spatial resolution, NZMG projection, all NZ extent) of monthly climate variables (derived by interpolation of climate observations over the 30-year period 1991-2020) for air temperature, total rainfall, Penman PET and sunshine hours.

Previous NIWA climate data used was annual variables from 1981-2010.

While this release does not make any changes to the way the climate data is used in the Overseer model, it does change how farms define their climate and as such will give a more accurate representation for each farm. In summary the changes are as follows:

- Moved from annual to monthly data. (Within the model climate was previously defined as annual values that were converted to monthly values (based on region/town seasonality). It now uses monthly values provided by NIWA, thus giving a more accurate representation for each farm.
- Required farms to be located to find the most accurate data for the farm. (Previously a farm's region or town could be used to derive the data which was not always a good representation of climate for the farm).
- Where possible a farm's location will be set using the address. Where this is not possible and blocks are not drawn, the analyses for that farm will be in error until the farm's location is set.
- Farm data imported from Legacy contained their own definitions of climate. This will be replaced by location based NIWA data for the location, so all farms are consistent.

Even though the actual modelling has not changed, we are changing the model version number to 6.4.0 because these changes will affect the nutrient loss and greenhouse gas results (GHG) results.

While a vast majority of farms/analyses will have small changes in results, there are some farms that will have significant changes. This is because the climate used previously had come from legacy and is completely different to NIWA's average climate for that location. It is important that all farms in OverseerFM are treated consistently.

These release notes set out the new approach we have implemented and the impact of this new approach and updated climate dataset will have for users.

How OverseerFM uses climate data

Climate is an important input in generating a nutrient budget. The following describes how OverseerFM uses the different climate variables; temperature, potential evapotranspiration (PET), sunshine hours and rainfall.

Temperature is used extensively throughout the model, it affects pasture/crop growth and many of the biological processes such as decomposition, fixation, volatilisation etc. Temperature is used to calculate monthly soil temperature at 5 and 10 cm below the surface. These influence soil processes such as mineralisation and denitrification.

PET is used in the hydrology model to calculate daily soil water balance. PET is the amount of evaporation that occurs if sufficient water source is available. It is influenced by the surface air temperature, the sun and the wind. Daily PET values are calculated based on the annual value and a classification in seasonality. Seasonality is based on the farm's region. Monthly sunshine hours come from the town or region and are used when calculating pasture growth.

Rainfall is an important input to the hydrology model, having significant effects on monthly drainage, runoff and hence N leaching numbers. Daily rainfall values are calculated based on the annual value and a classification in seasonality. Seasonality is based on the farm's region.

Why we are changing from annual to monthly data.

While OverseerFM has used a monthly timestep and a daily timestep for some components for many years, the old data base built into the model provided long-term annual data that was then converted using region/town proportions to derive seasonally sensible monthly and daily data. In updating the long-term data base, we have taken the step to use direct monthly averages, rather than using annual averages. This means we have simplified the approach as better data is available, making the data entered more accurately reflect the location, and therefore, the results more accurate to the farm.

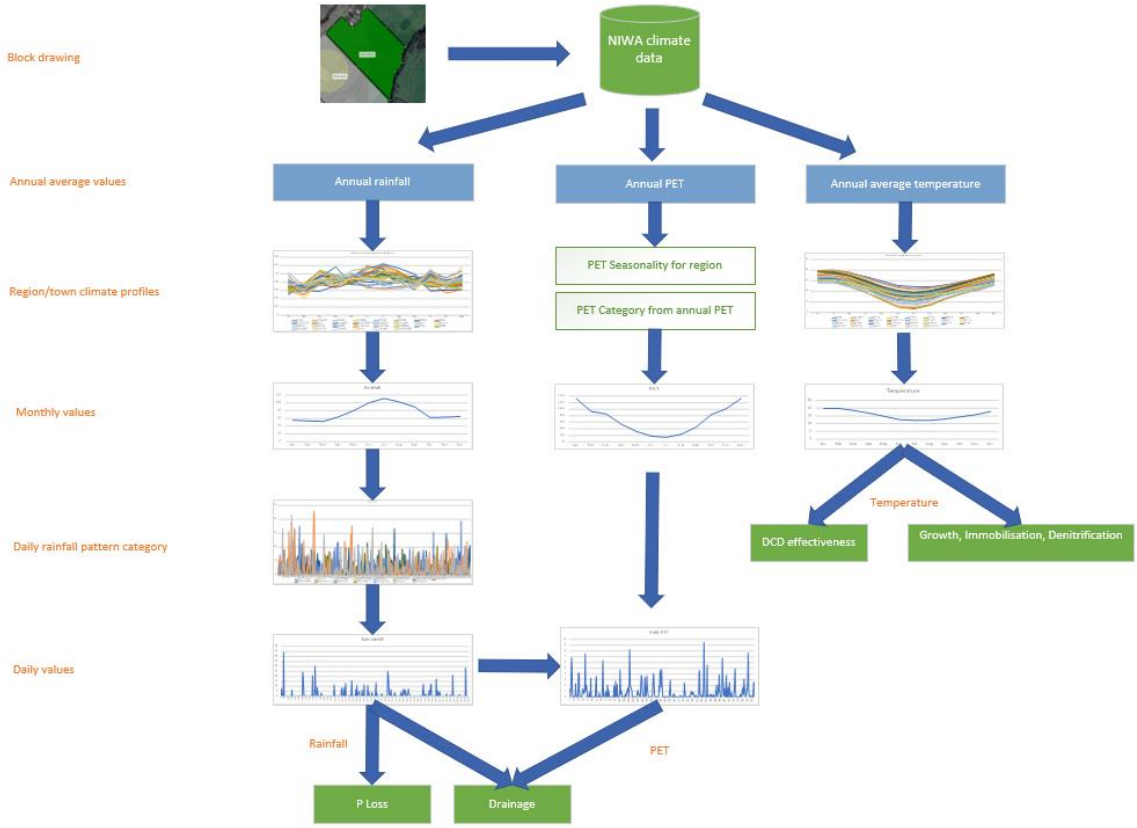
We continue to use the long-term (30 year) climate database to provide users with the ability to compare farm management scenarios. Climate is such a key driver of drainage, that without using consistent climate parameters, any comparison would be difficult to interpret.

Block's location update

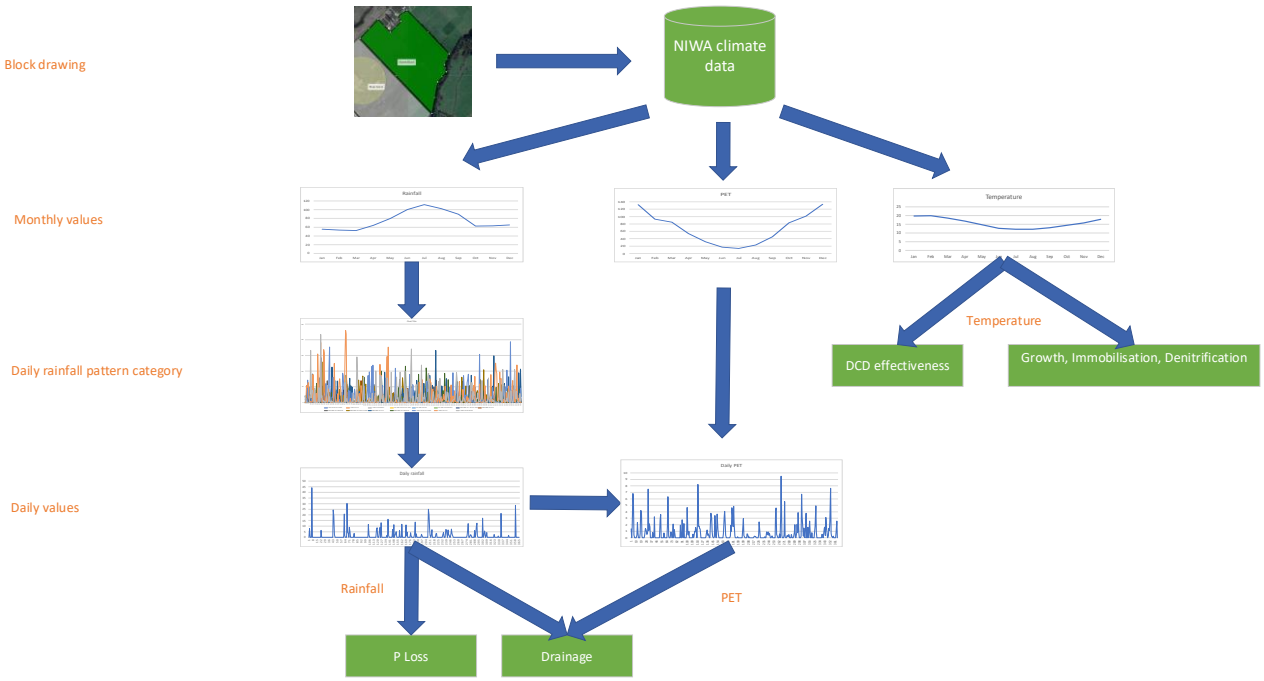
So that all users get the best results out of OverseerFM we have included in this release a requirement to locate the farm, as that will derive the farm-specific climate data, and thus give the most relevant results.

- Block's that are drawn or have coordinates entered will use the monthly data at that location.
- Block's that are not drawn will use the farm's location. The farm's location is based on the address (if a known address was selected). This location can be changed via farm settings if the address does not accurately reflect the farm's location.
- Where blocks are not drawn and the farm has no location, the model will no longer run until the farm's location is set via the farm settings screen.

The following diagram shows how the climate model worked before this release. The annual values were converted to monthly values using region/town profiles.



The new release uses monthly data for the block's location directly and so no longer depends on region or town. The following diagram shows this process.



Approximately 46% of analyses have at least one block geo located, 46% will use a farm's location and 8% do not have a location and so will not run.

All analyses with location-based climate have automatically been updated with the new data with the release of Version 6.4.0. The impact of these changes will vary depending on how well the nearest town/region reflected the farm's location previously, and the change in the climate variables from the old dataset to the new.

Impact

Climate is a key input for the model, consequently some farms may see considerable changes in their N-loss results.

The following lists the key factors that influence a change in N loss:

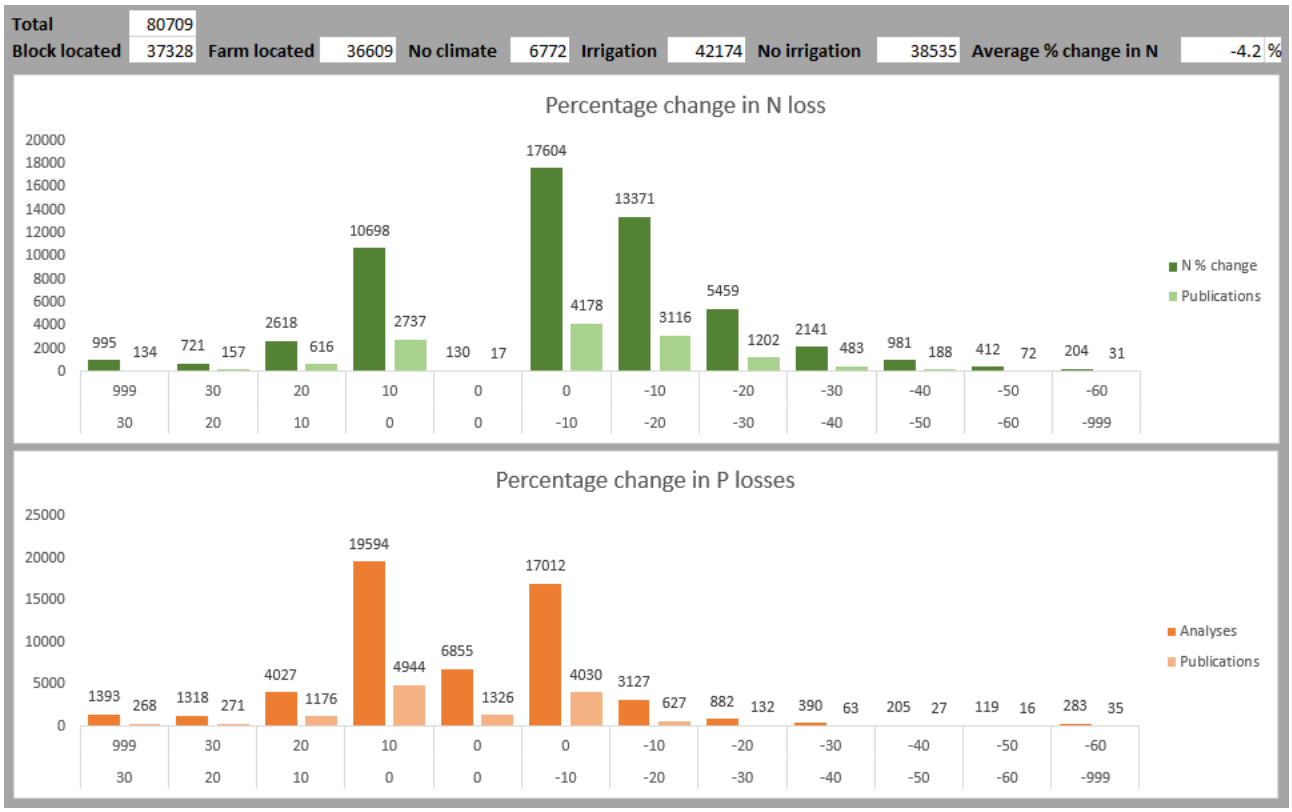
1. The block's monthly climate may differ significantly from the average climate of the nearest town or region due to mountains, valleys etc. This is likely to influence timing and hence possibility of drainage.
2. Where regional averages were used previously.
3. Use of fixed irrigation (return periods and depth applied) may be out of step with the new climate data (rainfall). If a farm follows variable practices, the model will adjust the irrigation to suit the new climate data and so keep it consistent.
4. Farms with low N leaching (below 10 kg/ha/yr) are more significantly impacted (as a percentage change in losses).

The following graphs show the impact on N and P losses for all analyses in OverseerFM:

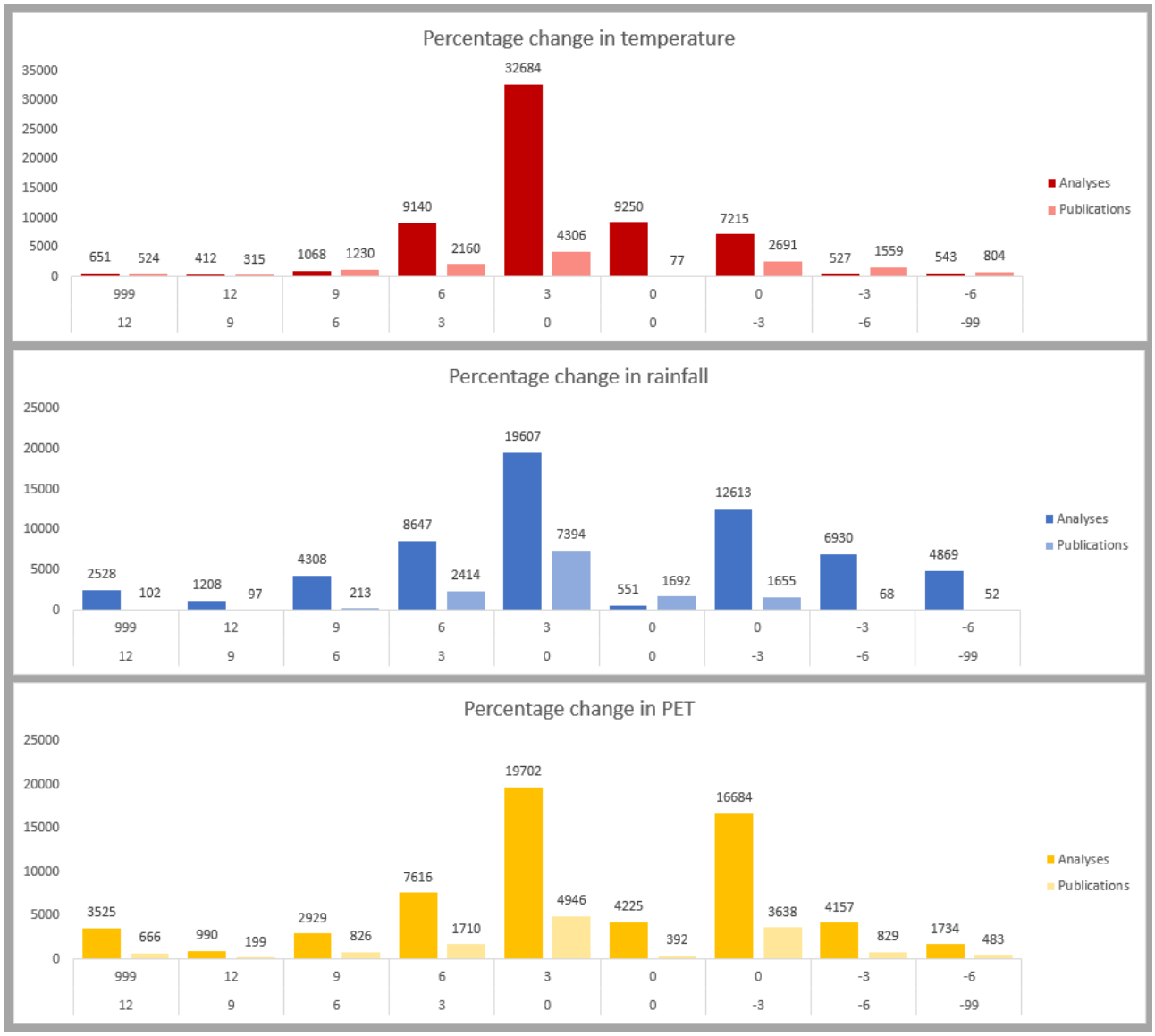
- There are 80,709 analyses and publications.
- 37,328 analyses and publications have at least on block geo located
- 36,609 analyses and publications do not have blocks located, but do have a farm location
- 6,772 analyses and publications have neither and so will not generate a result until they are fixed
- 42,174 analyses and publications have no irrigation, while 38,535 do
- The overall average percentage change in N loss is -4.2%

The x-axis shows ranges for percentage change, e.g. First column is between 30 and 999. The y-axis is the number of analyses that have changed by a percentage within that range. e.g., 10,698 changed by between 0 and 10%.

There are two columns shown for each range, the darker column are analyses, the lighter column are publications.



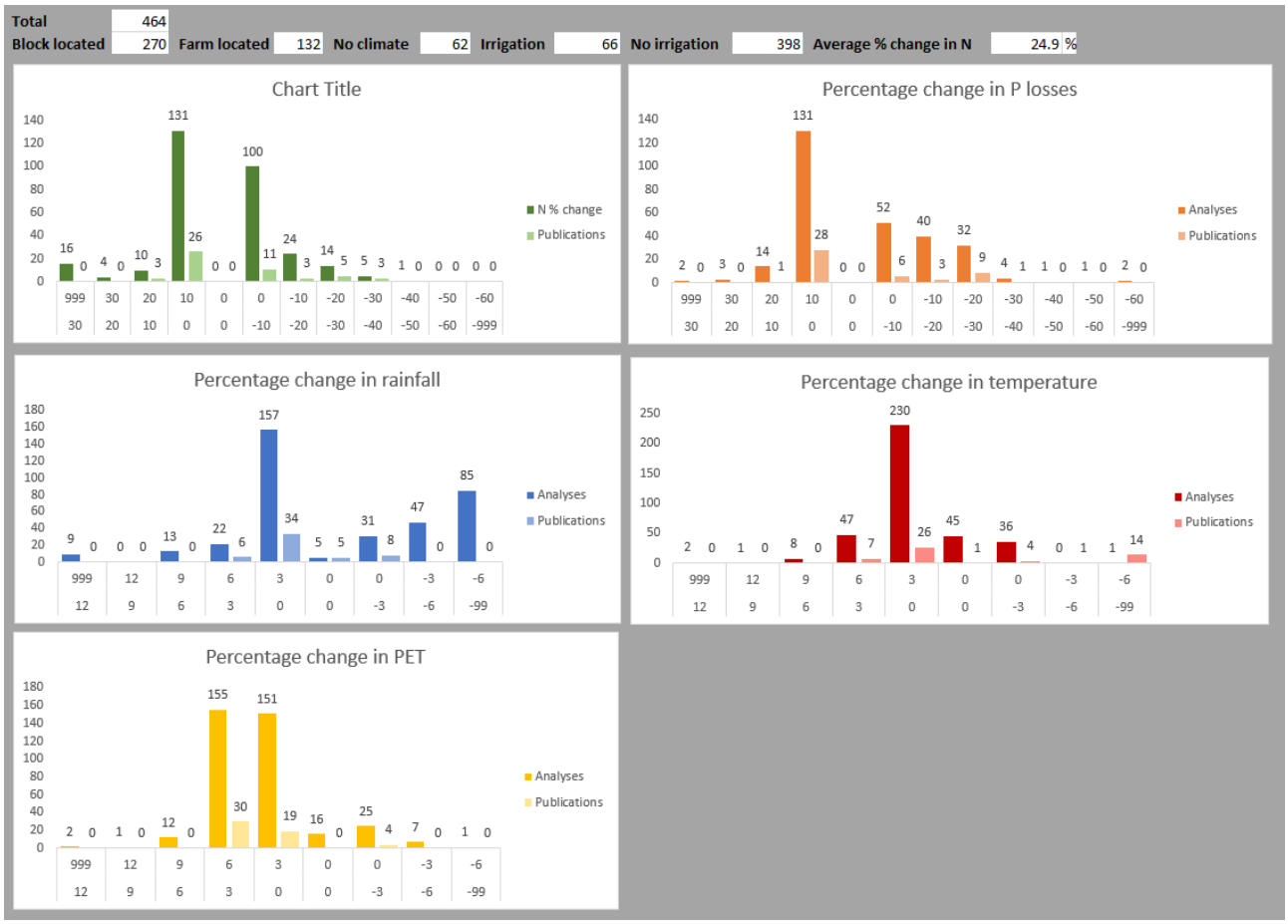
These graphs show the percentage change in annual temperature, rainfall and PET for all analyses and publications. This shows whether the overall annual values have changed, but there are also changes in how these annual values are distributed across the months.



Regions

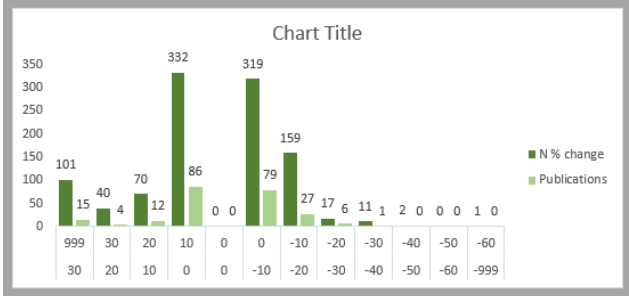
The following sections break down the changes by region. The graphs show the same information as those above, but for each region.

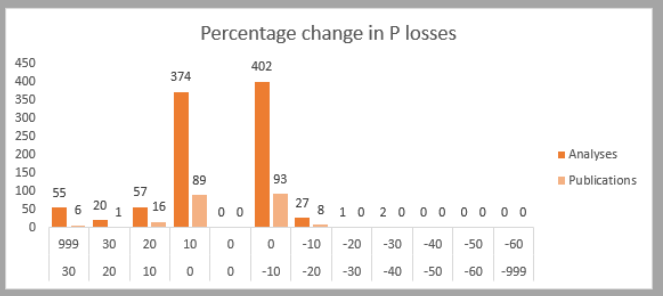
Auckland

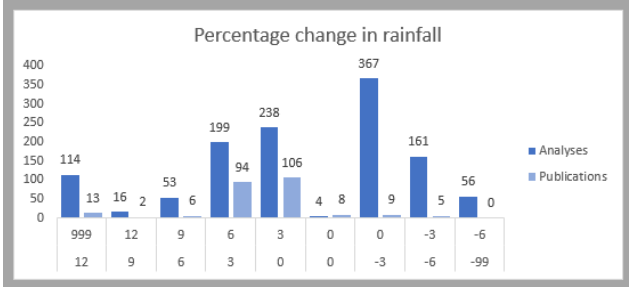

Total 464
Block located 270
Farm located 132
No climate 62
Irrigation 66
No irrigation 398
Average % change in N 24.9 %
Chart Title
N % change
Publications
Percentage change in P losses
Analyses
Publications
Percentage change in rainfall
Analyses
Publications
Percentage change in temperature
Analyses
Publications
Percentage change in PET
Analyses
Publications

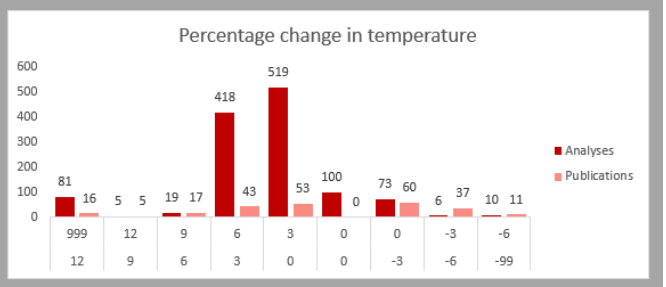
Bay of Plenty

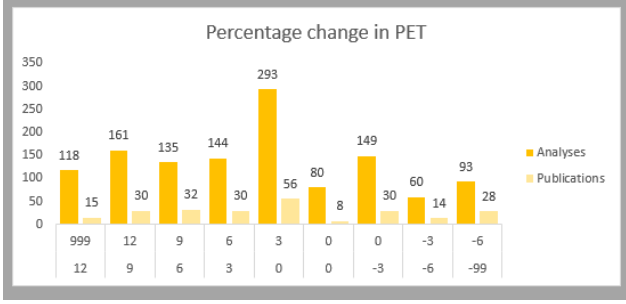
Total	1739										
Block located	1006	Farm located	390	No climate	343	Irrigation	372	No irrigation	1367	Average % change in N	21.5 %









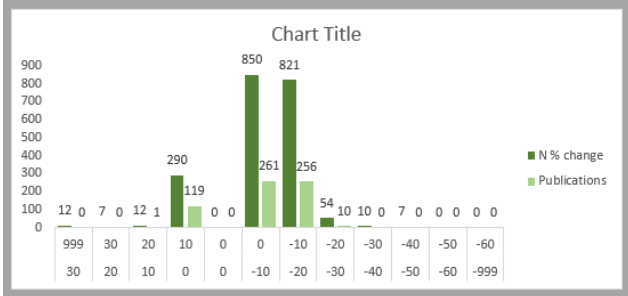


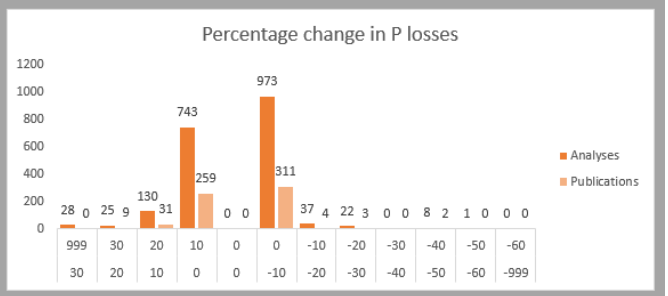
Canterbury

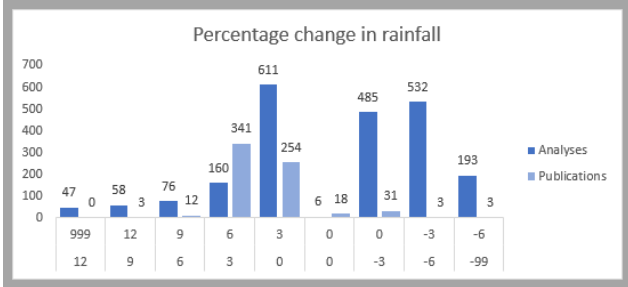

Total 40860
Block located 17738
Farm located 21018
No climate 2104
Irrigation 34894
No irrigation 5966
Average % change in N -8.4 %
Chart Title
N % change
Publications
Percentage change in P losses
Analyses
Publications
Percentage change in rainfall
Analyses
Publications
Percentage change in temperature
Analyses
Publications
Percentage change in PET
Analyses
Publications

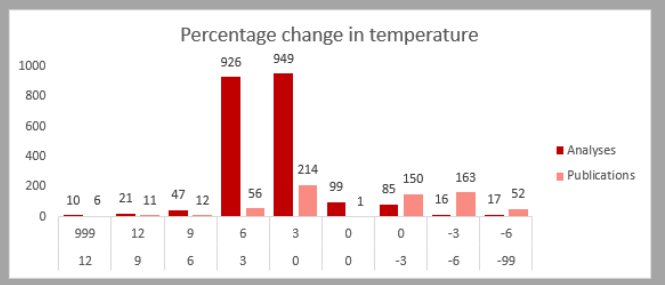
Central Plateau

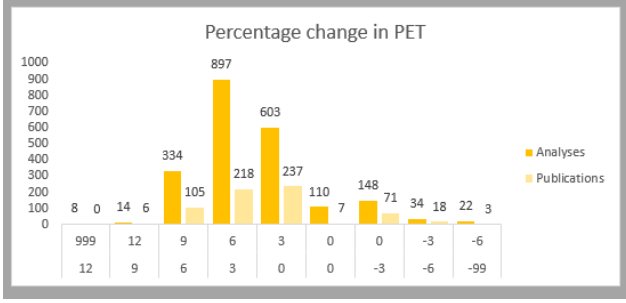
Total	2904										
Block located	1812	Farm located	945	No climate	147	Irrigation	303	No irrigation	2601	Average % change in N	-4.8 %









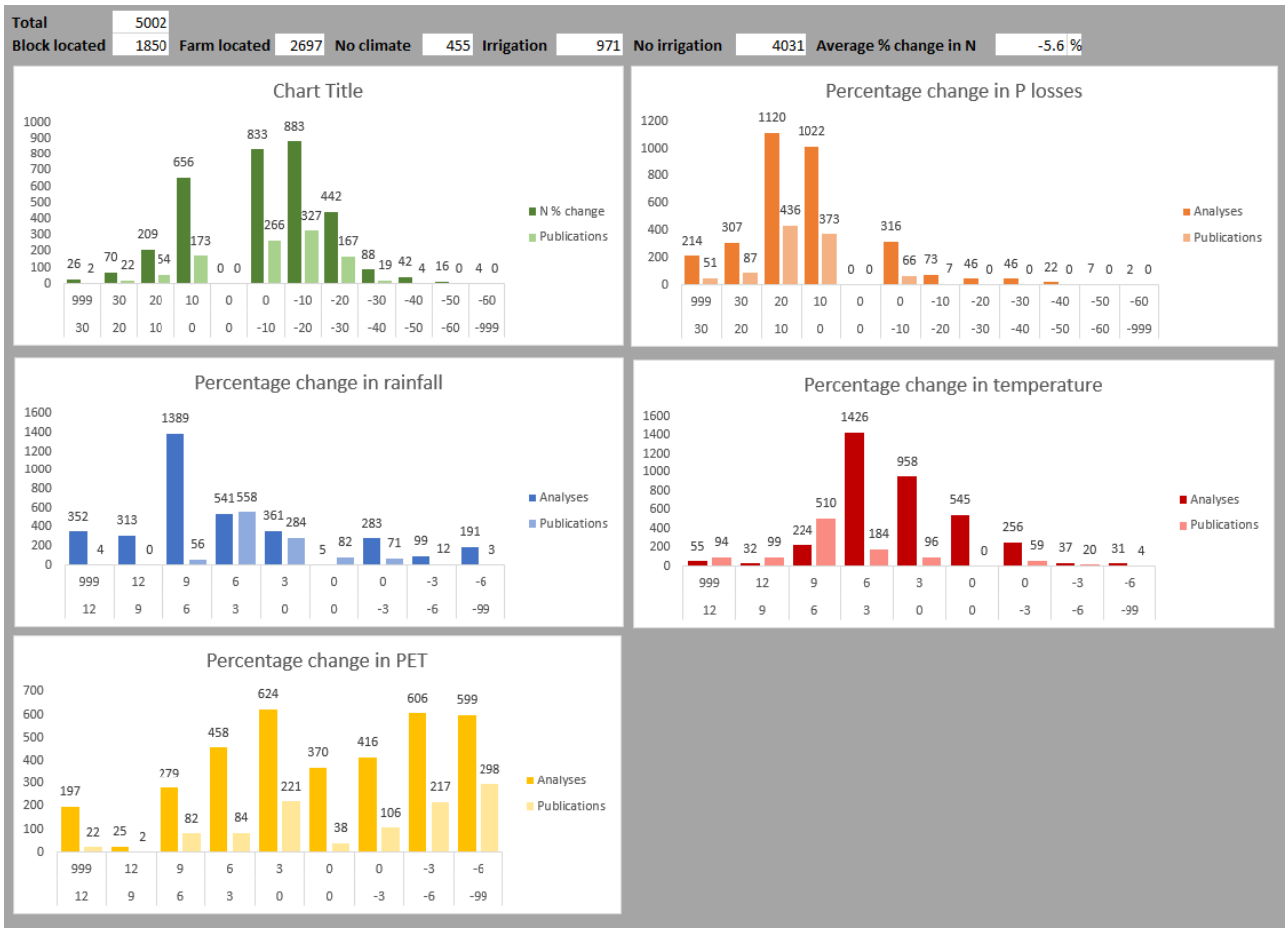


East coast north island

High country 300m

King country/Taihape

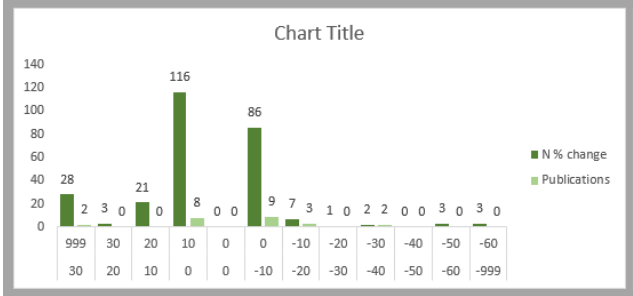
Manawatu/Whanganui

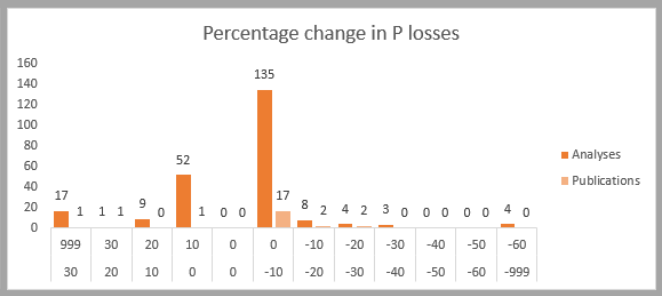


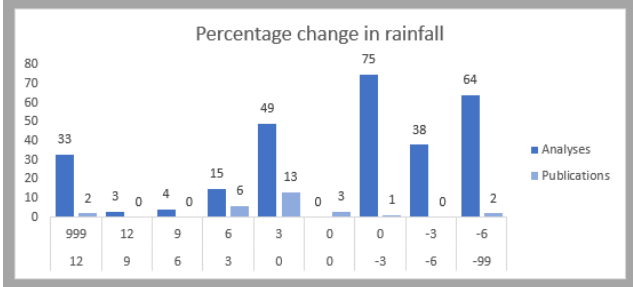
Marlborough

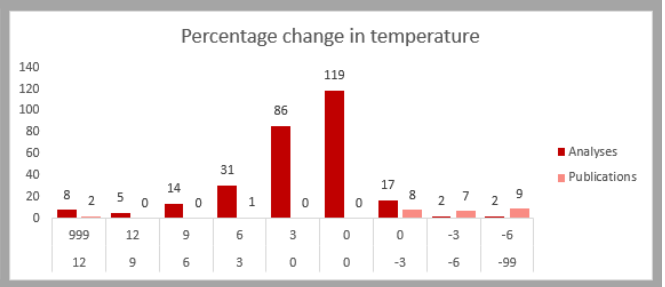
Nelson

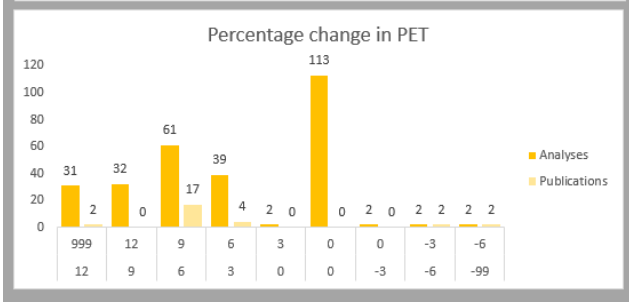
Total	325										
Block located	46	Farm located	258	No climate	21	Irrigation	153	No irrigation	172	Average % change in N	5.8 %





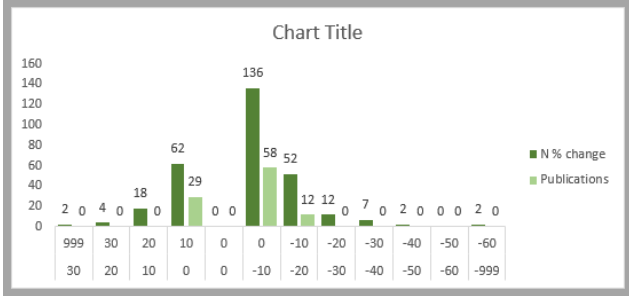


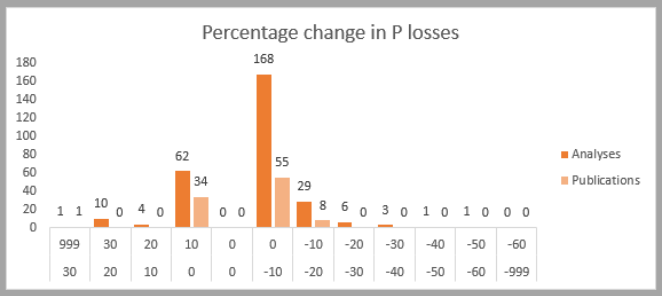


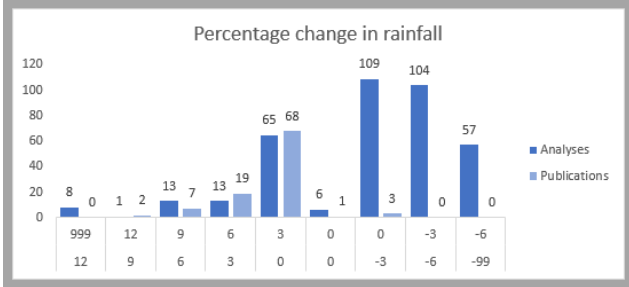


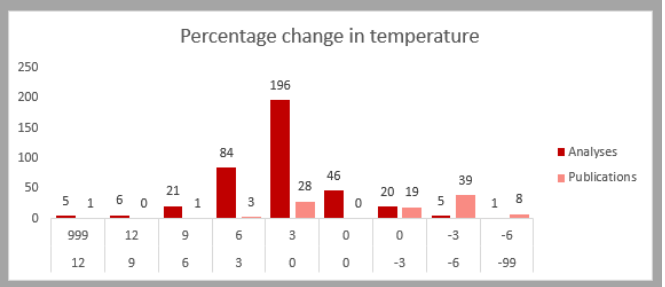
Northland

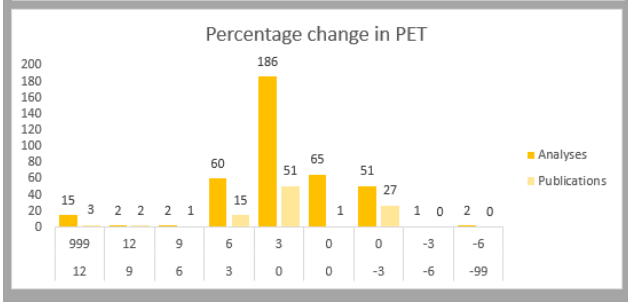
Total	703										
Block located	198	Farm located	262	No climate	243	Irrigation	72	No irrigation	631	Average % change in N	25.0 %





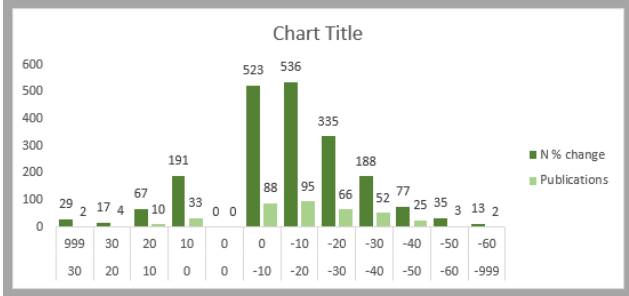


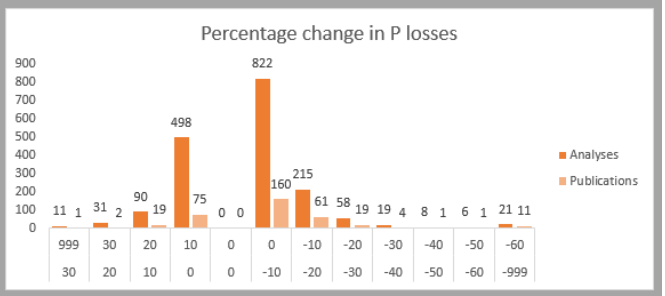


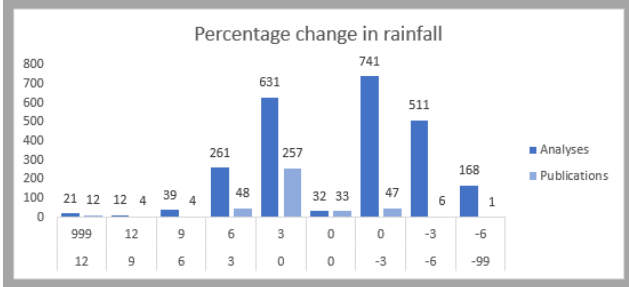


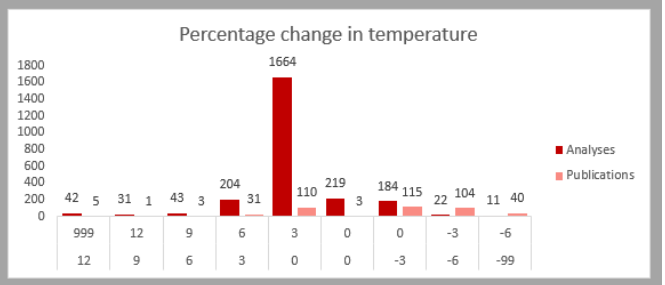
Otago

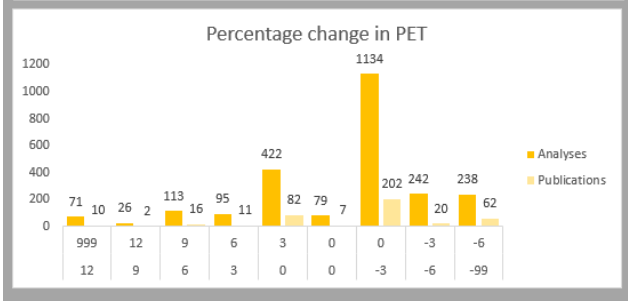
Total	3155										
Block located	1596	**Farm located**	1163	**No climate**	396	**Irrigation**	1796	**No irrigation**	1359	**Average % change in N**	-12.1 %





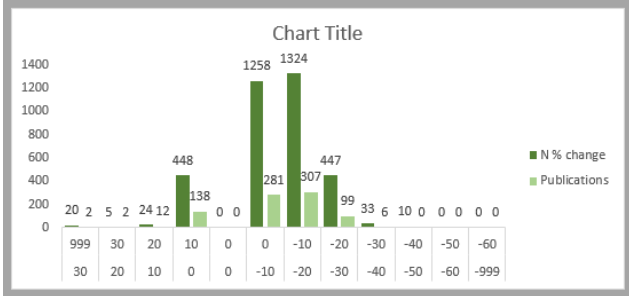


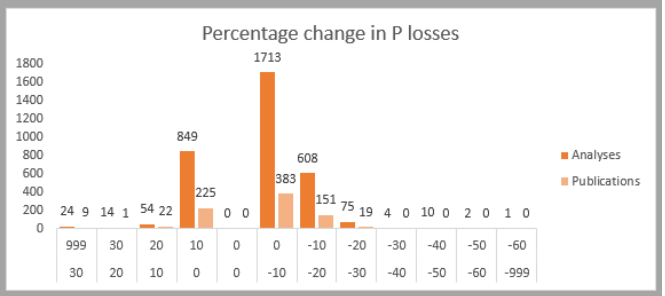


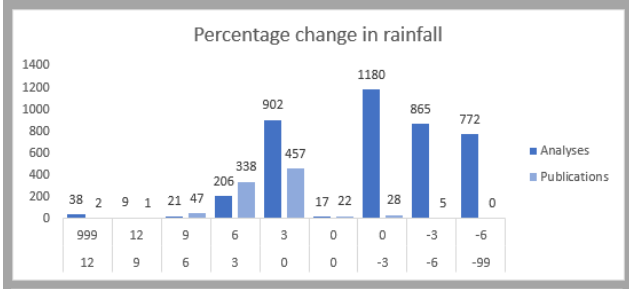


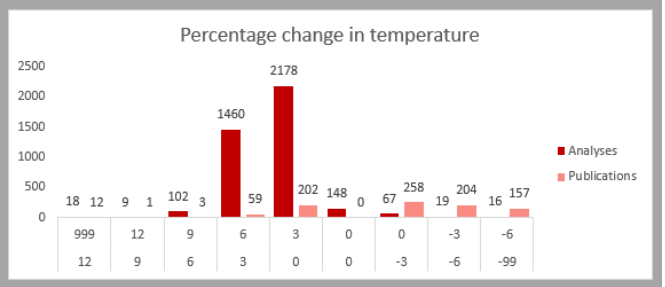
Southland

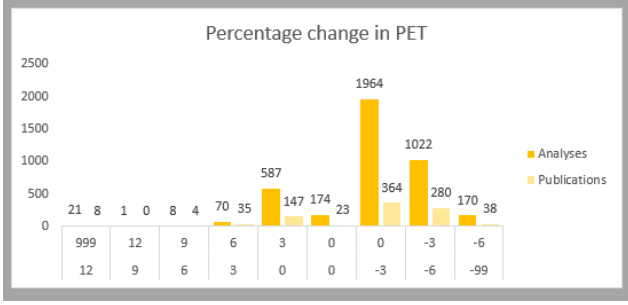
Total	5344										
Block located	3147	**Farm located**	1697	**No climate**	500	**Irrigation**	566	**No irrigation**	4778	**Average % change in N**	-6.7 %







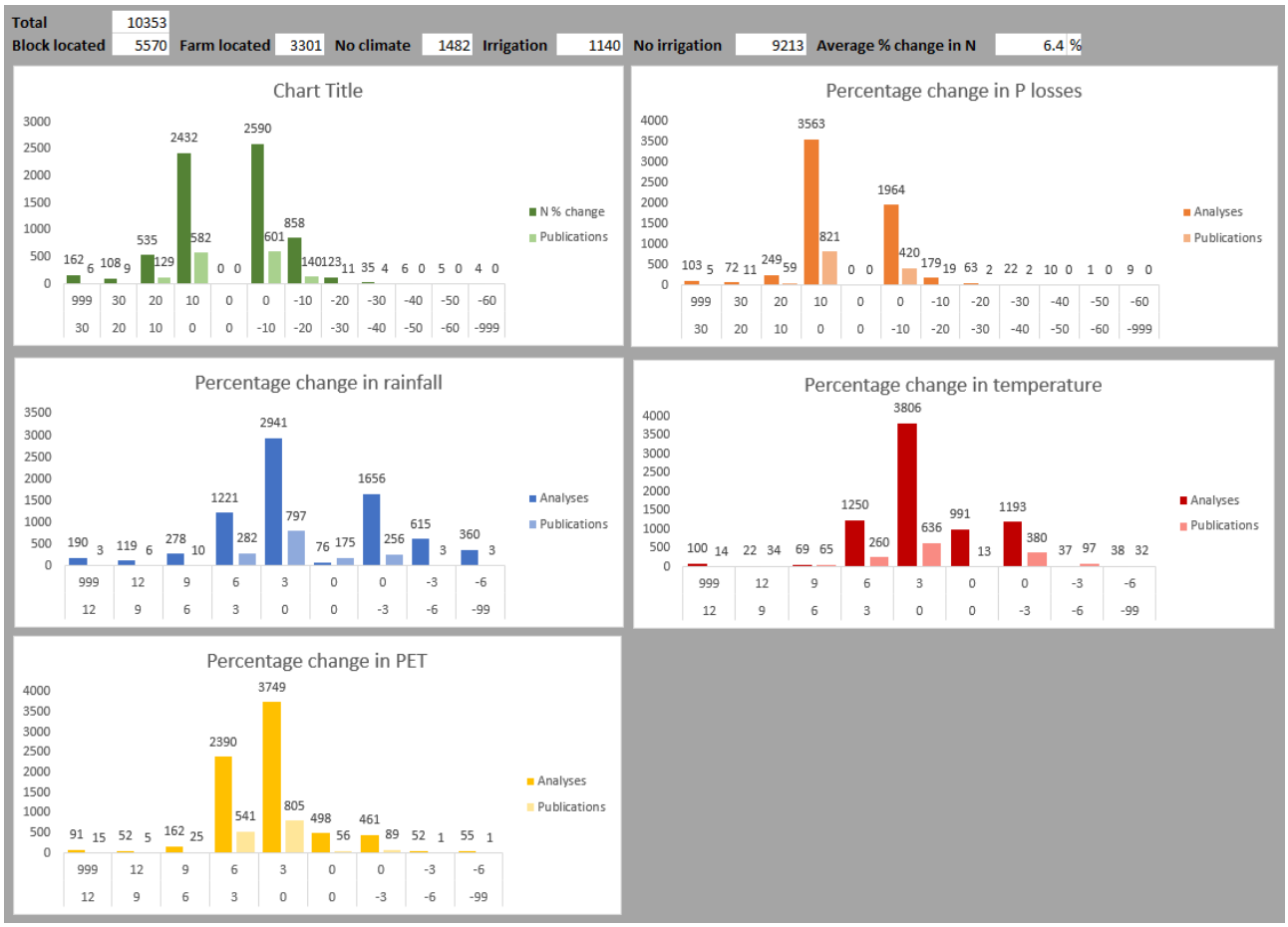




Taranaki


Total 1832
Block located 741
Farm located 922
No climate 169
Irrigation 106
No irrigation 1726
Average % change in N 2.5 %
Chart Title
N % change
Publications
Percentage change in P losses
Analyses
Publications
Percentage change in rainfall
Analyses
Publications
Percentage change in temperature
Analyses
Publications
Percentage change in PET
Analyses
Publications

Waikato/Coromandel



Wellington


Total 407
Block located 216
Farm located 177
No climate 14
Irrigation 174
No irrigation 233
Average % change in N 19.2 %
Chart Title
N % change
Publications
Percentage change in P losses
Analyses
Publications
Percentage change in rainfall
Analyses
Publications
Percentage change in temperature
Analyses
Publications
Percentage change in PET
Analyses
Publications

West Coast South Island

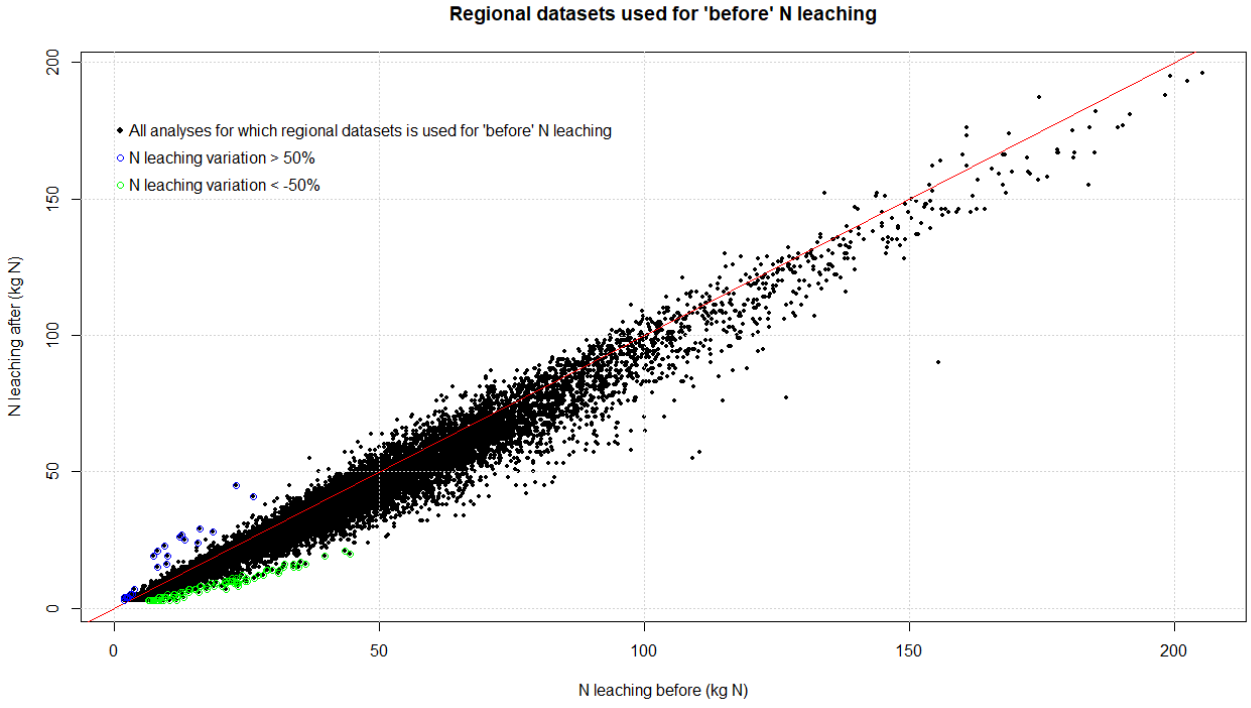
Appendix A – Analyses with location

Region

The following graph compares the impact on N losses for analyses that are located and previously used the region for their distributions. These analyses will now use the monthly climate data for their location.

- 23913 analyses (35% of the total)
- Mean variation: -10%
- Standard deviation: 13%
- 201 significant variations (±50%) observed:
    - Comparison between climate profiles (regional datasets) and actual climate averages (monthly database)
    - Mainly at low N leaching

        ⇒ Due to the structure of the model



Nearest town

The following graph compares the impact on N losses for analyses that are located and previously used the nearest town for their distributions. These analyses will now use the monthly climate data for their location.

- 5676 analyses (8% of the total)
- Mean variation: +1%
- Standard deviation: 10%
- 16 significant variations (±50%) observed:
    - Comparison between climate profiles (old nearest town datasets) and actual climate averages (monthly database)
    - Mainly at low N leaching

      => Due to the structure of the model: sensitive at a small rainfall variation or PET variation or temperature variation.