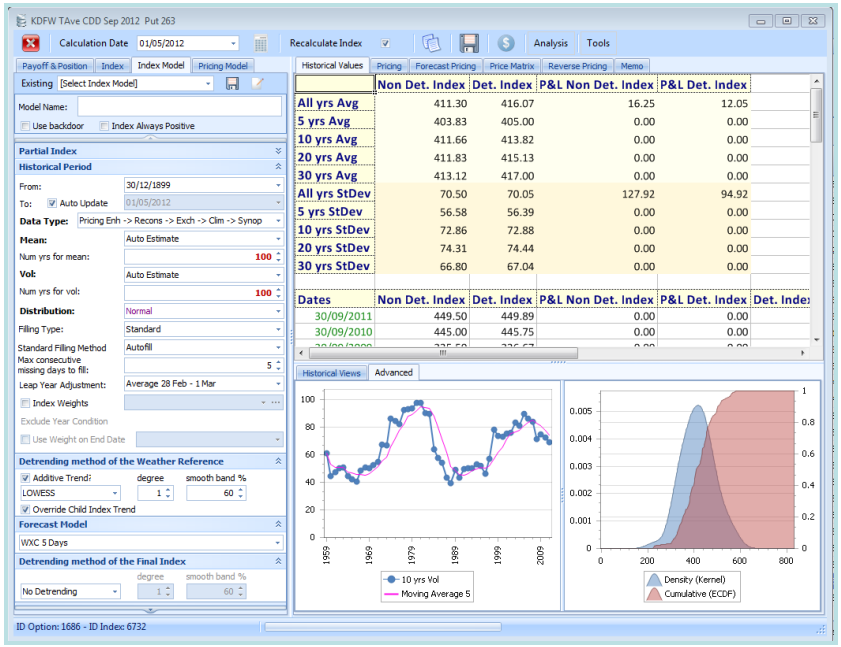
Speedwell Weather



	Non Det. Index	Det. Index	P&L Non Det. Index	P&L Det. Index
All yrs Avg	411.30	416.07	16.25	12.05
5 yrs Avg	403.83	405.00	0.00	0.00
10 yrs Avg	411.66	413.82	0.00	0.00
20 yrs Avg	411.83	415.13	0.00	0.00
30 yrs Avg	413.12	417.00	0.00	0.00
All yrs StDev	70.50	70.05	127.92	94.92
5 yrs StDev	56.58	56.39	0.00	0.00
10 yrs StDev	72.86	72.88	0.00	0.00
20 yrs StDev	74.31	74.44	0.00	0.00
30 yrs StDev	66.80	67.04	0.00	0.00

Dates	Non Det. Index	Det. Index	P&L Non Det. Index	P&L Det. Index	Det. Inde
30/09/2011	449.50	449.89	0.00	0.00	
30/09/2010	445.00	445.75	0.00	0.00	

SWS is an enterprise software application for pricing weather risk contracts, managing a portfolio of weather risk contracts and managing historical weather data and feeds.

Speedwell Weather
Speedwell Weather System

SWS

An Introduction

About SWS

SWS is an enterprise system used by traders of parametric weather-risk contracts since 2002. It provides front, middle and back office support

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About SWS: Software components

SWS includes these software elements:

- SWS Oasis Desktop for pricing/portfolio management/back office
- SWS Data Manager for management of weather data / forecasts and for configuring permissions and the scheduling of automatic reports
- SWS Contracts and Invoices module (SWS Enterprise only)
- APS Module: user configurable to allow fully automated responses to pricing requests
- SQL Server Database for weather data / forecasts and commodity data: fully integrated with Speedwell SuperPack® unlimited weather data licence

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About SWS: Key Features

SWS enables you to:

- Price weather risk contracts and provide analysis including gas “quantos”
- Manage portfolios of risk and create risk reports
- Manage contracts, invoices, settlement
- Manage historical weather data, feeds and forecasts (including gridded data)
- Help meet regulatory requirements
- *New in SWS Vs 12*:
  - streamlined response to weatherXchange® RFPs*
  - seamless integration with new weatherXchange tradeable sites database
  - optional integration with configurable Automated Pricing Service. This allows fully automated responses to weatherXchange RFPs
  - direct API based access to gridded data, subject to data licence

*weatherXchange® is an independent platform which helps companies access index-based weather protection. It is free-to-use by Hedgers

RFPs are Requests for Pricing sent in machine readable weatherML format

weatherML is a mark-up language used for encoding the terms sheets of both simple and complex weather derivatives

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A multi-user, enterprise-wide solution

Traders, Risk Officers, Legal Officers, Back Office, …
Weather Derivative Pricing
Deal Booking, Confirmations and legal doc management
Portfolio P&L and Risk Measures
Data Management – ad hoc import and quality control
Correlation analysis
Weather dependency analysis
Settlement, Invoicing, EMIR, Dodd Frank Reporting
…

weatherXchange **Integration**
Requests For Pricing streamlined
Optional Automated Pricing Service for weatherXchange RFP
Online Data Streaming

Database Server
(MS SQL Server)

SWS Application Server
Continuous Data and Forecast Imports from multiple data providers
End of Day Tasks:
- Settlement Calculations
- Daily and Expiry VaR
- P&L reports
- Credit Risk Reports

System Administrator
Set up Users
Manage Permissions
Importation of additional data e.g. gas / power data

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Front Office

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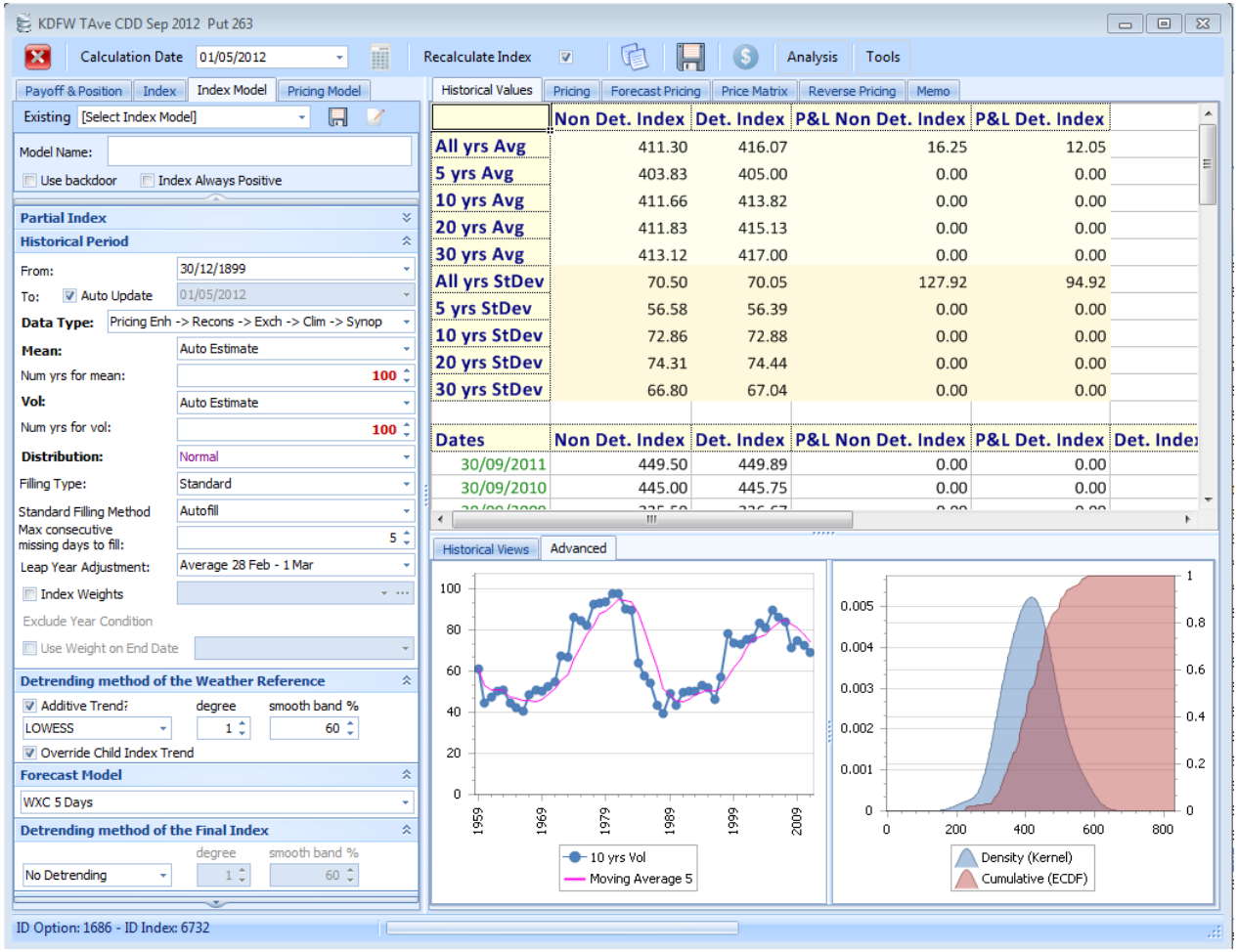
Pricing a Weather Derivative



SWS enables you to price standard and ultra exotic weather derivatives by providing a “tool box” of modelling options.

The user can choose multiple detrending methods, distribution fitting methods, leap year adjustments. Historic data and forecasts (if specified) can also be automatically incorporated.

A mixed actuarial / market approach can also be applied. Eg using a market level for the underlying swap to price options.

Simulation of temperature and rainfall process also available

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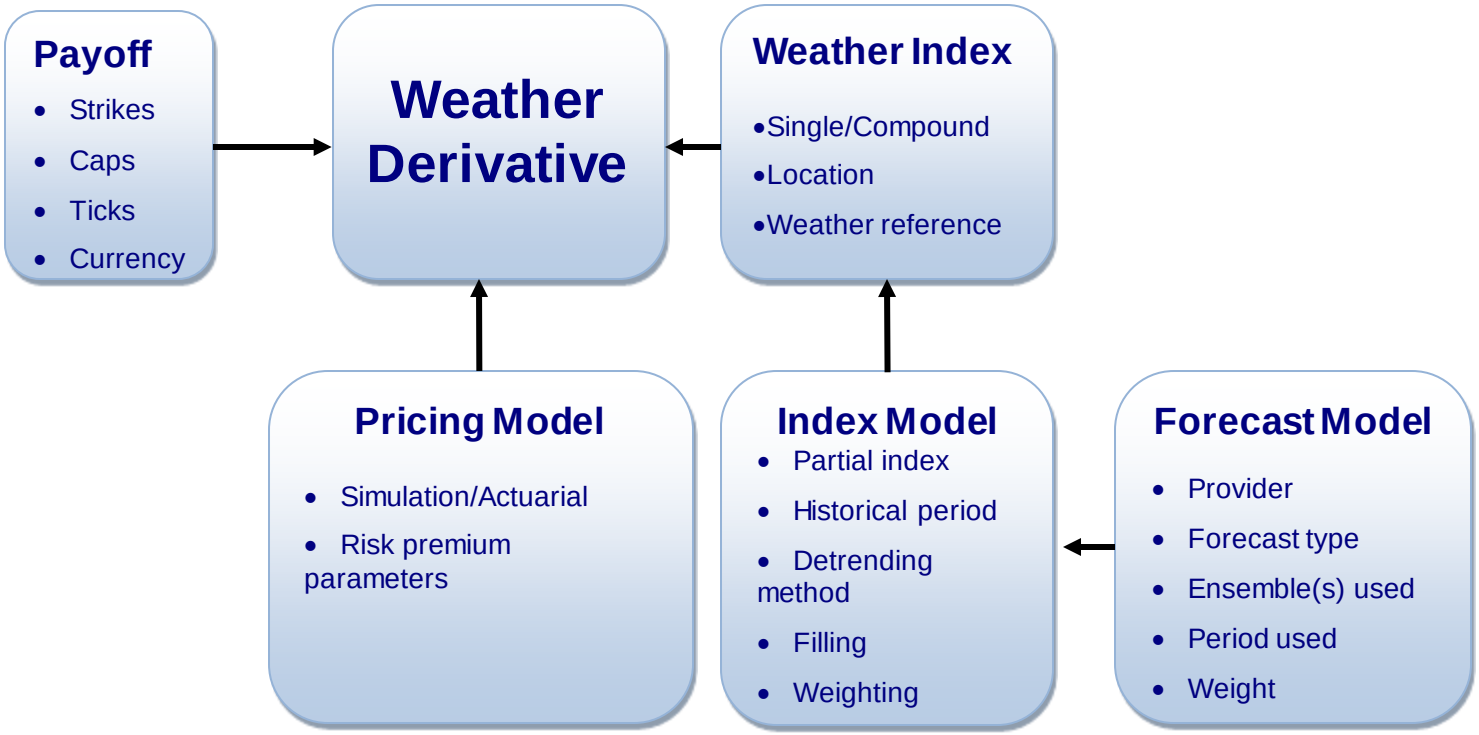
Pricing a Weather Derivative

The SWS Object Model

All elements are user configurable



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Index Structure Support

- Daily / Hourly / sub Hourly Indexes
- Basket Indexes
- Compound Indexes e.g. Wind + Temp
- Multiple stations (baskets, any weights)
- Mix of daily and hourly variables
- Super exotics
- Strips – multi year, month, flexi
- Power Curve Builder Scripting Tool: simplifies the transformation of a wind turbine power curve table into an SWS-compatible index for weighting wind speeds
- Gas-Quanto pricer using daily temperature simulation and gas price simulation (mean-reverting with jump process)

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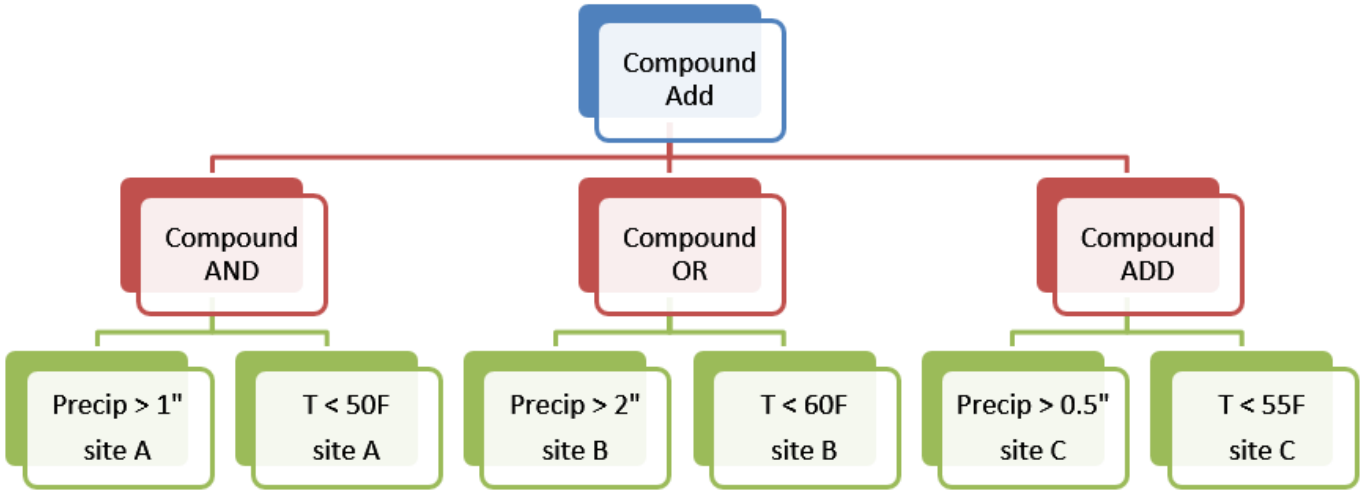
Compound Indices

SWS supports super-exotic structures by allowing complex compounding



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Complex Trades: C# Script

The new C# engine simplifies and speeds up complicated index calculations.

It allows access to the SWS database to allow climatologies for a station to be retrieved, for example. All data points in the current risk period are passed in to the calculation function, allowing:

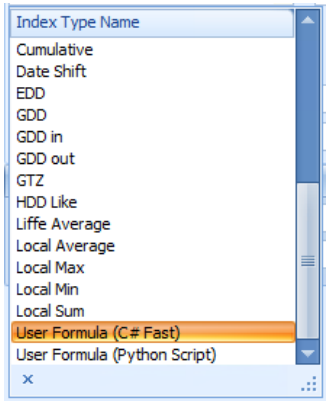
- Entering an index to calculate the departure from normal for an automatically-calculated normal curve …this can be done in just a few lines
- Returning the average of an index value for this year and previous year
- Returning the sum of the 10 smallest values in the risk period
- Calculating indices that are path dependent (eg the average of current year and previous year)

```
// example 2: Return on the last day the average value of the perioc
if (MeasDate == DataDates[DataDates.Length-1])
        return Average(DataValues[0]);
else
        return 0.0;

// example 3: Return On the last day the sum of the 10 smallest valu
if (MeasDate == DataDates[DataDates.Length-1])
{
        var r = (from d in DataValues[0]
                 orderby d ascending
                 select d).Take(10);
        return r.Sum();
}
else
        return 0.0;

// example 4: Returns where possible the average of the value and t
if (m_DDL == null)
        m_DDL = GetFullHistory(2082, 10);
DateTime wPrevYear = MeasDate.AddYears(-1);
if (m_DDL.ContainsDate(wPrevYear))
        return (m_DDL[wPrevYear].Value + WR[0]) / 2.0;
else
        return WR[0];

// example 5: Calculate the departure from Normal
if (m_Climatology == null)
{
        LoadClimatology(2082, 10);
}
return DifferenceVsClimatology(MeasDate, WR[0]);
```



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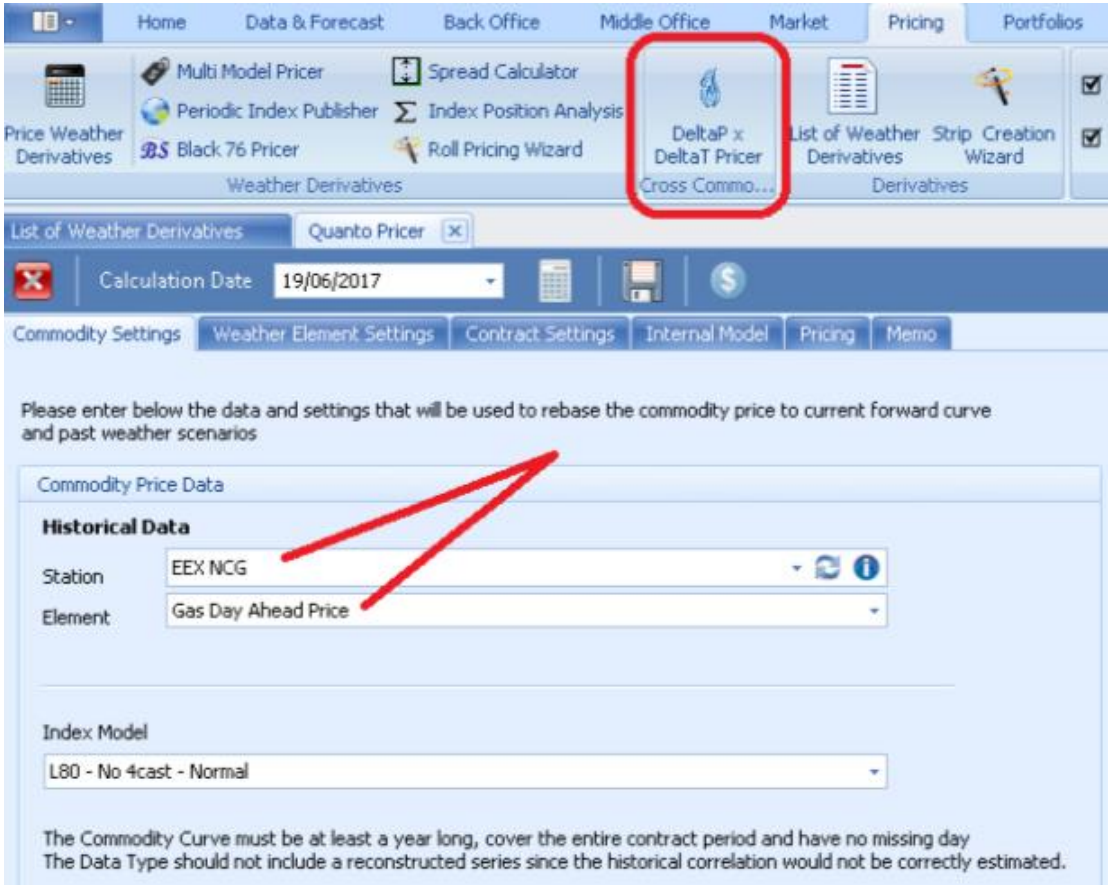
Gas Quantos

SWS 12 now supports Delta T * Delta P type gas-settled quantos

Pricing uses rebased historical data and quanto specific simulation.

Both temperature and the commodity are simulated on a daily basis that respects:

· temperature process
· gas process
· forward curves
· correlations



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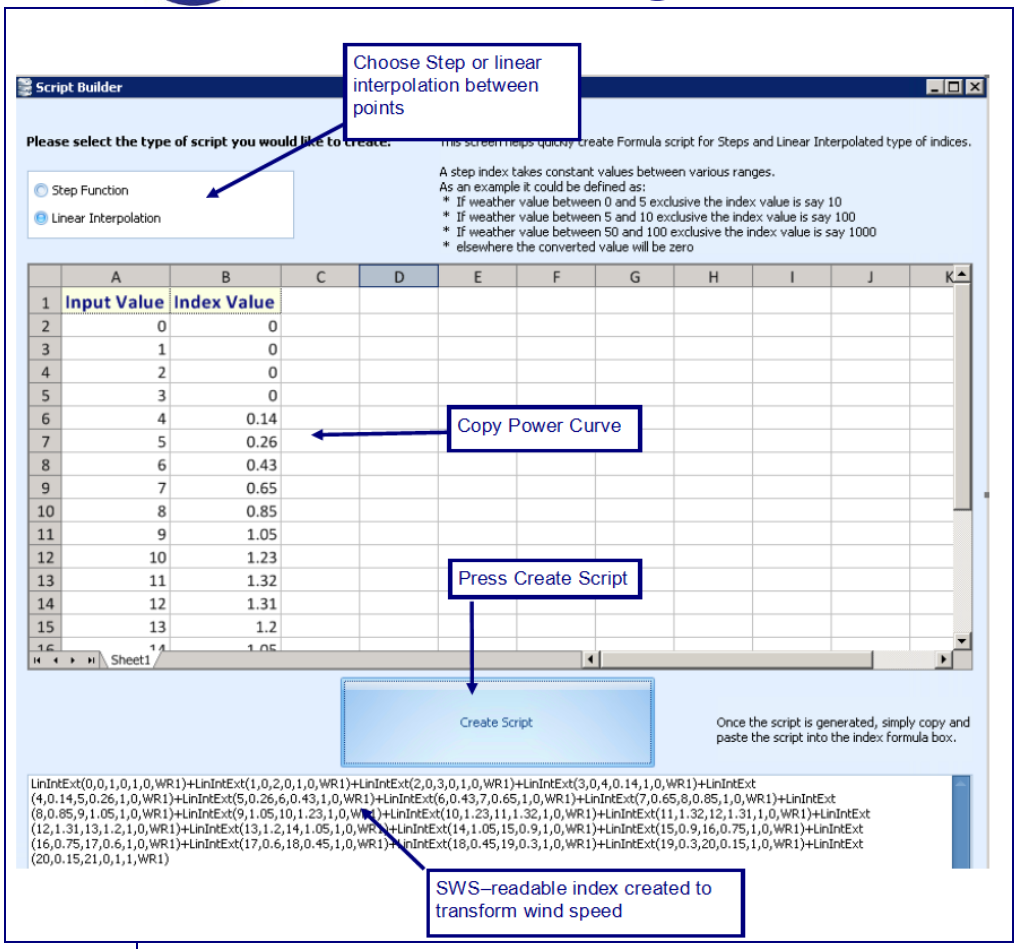
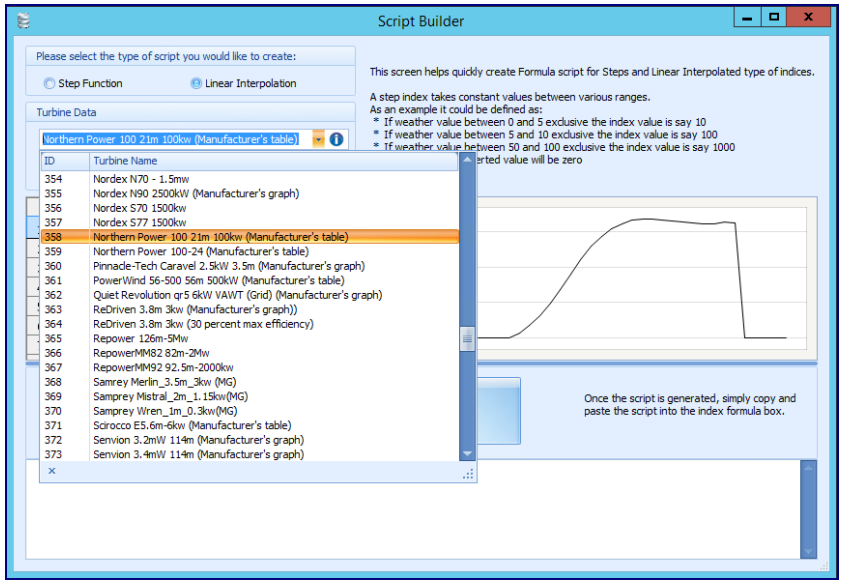
Building Power Curves





SWS incorporates a Power Curve Builder Scripting Tool.
This makes it easy to transform a wind speed index into a power index
The power curve for over 200 turbine types is pre-loaded

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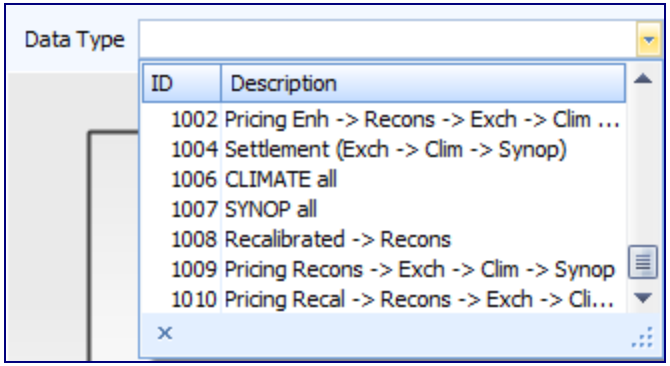
SWS Pricing and Settlement Hierarchies: Hiding Complexity



SWS Pricing Hierarchies ensure that the best data are automatically loaded for contract pricing and that settlement automatically data is automatically picked up as soon as the risk period starts

In a nutshell:

- Data are easy to use
- Multiple data types allow full understanding of data provenance and quality
- Hierarchies mean that processing of those data types is simplified but fully transparent

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Analysis Tools

- Reverse Pricing
- Time Series Analysis
- Multi-model analysis
- Distribution fitting
- Index model analysis
- Burn analysis
- Correlation analysis
- “Cone chart”

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Middle Office:
Portfolio Risk Management

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Portfolios

SWS supports four types of portfolios:

- *Real Portfolios* are the portfolios that contain actual executed transactions.
- *Working Portfolios* are “throw away” portfolios and can be used for analysis (eg marginal impact of a proposed transaction).
- *Mirrored Portfolios* are working portfolios that mirror a real portfolio but for which a different portfolio risk model is attached to for analysis or reporting purposes.
- *The Enterprise Portfolio* is the portfolio made of all Real Portfolios

There is no limit to the number of Portfolios

SWS uses client-specific portfolios to create credit risk reports

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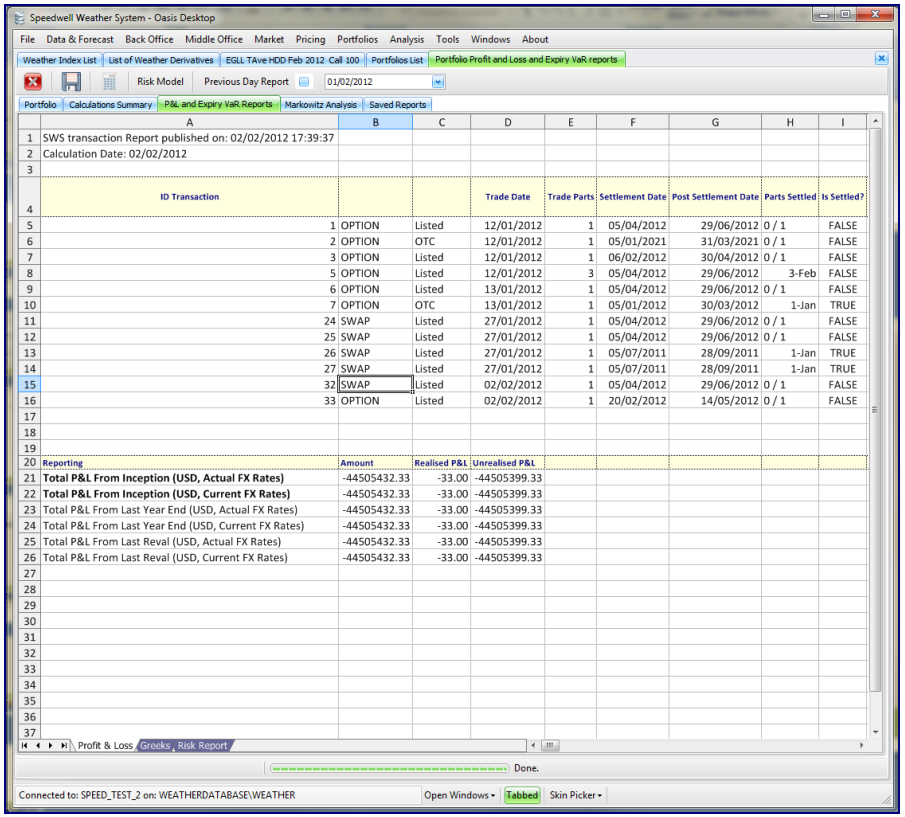
Portfolio and Risk Reports

- Historical
- Simulations
- PL
- Expiry VaR
- Daily VaR
- Markowitz Charts
- PCA
- SSD

These reports are easily exported, may be automatically run on a schedule and emailed. They can be used for integration with internal risk and back office systems



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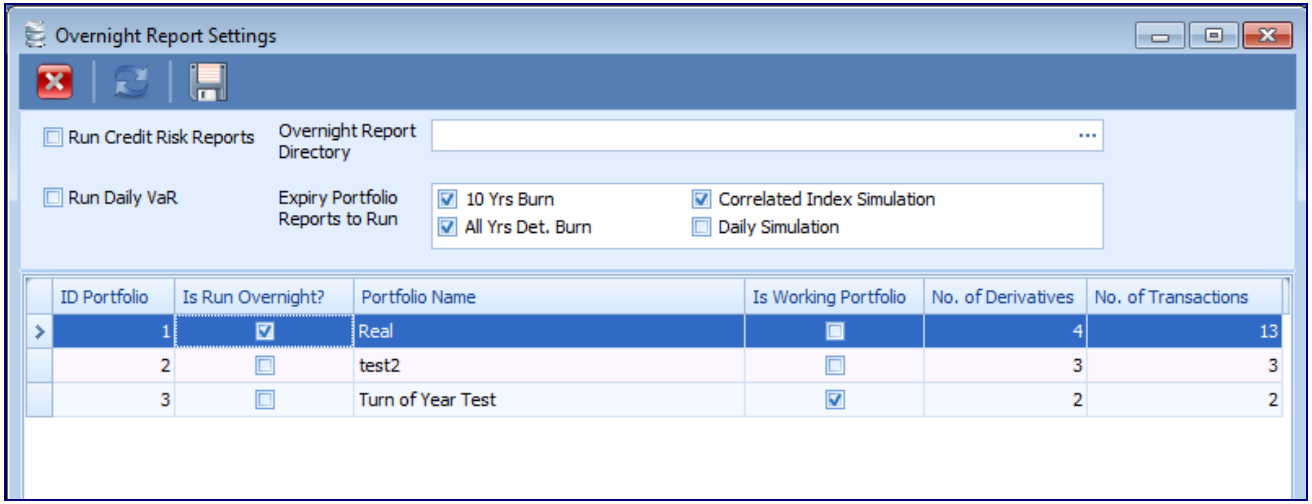
Automating Portfolio Calculations



Application exe name	Main Parameter	Action
SWSDesktop	**/OVERNIGHT**	Automatic portfolio and risk calculations

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Back Office and Invoicing

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Summary of Back Office Functionality

- Flow of the weather trade (notification of each stage)
- Generation of confirms
- Generation of invoices
- Payment reports
- Settlement reports
- Export of reports to Excel®
- Trade query
- Static data maintenance – counterparty details...

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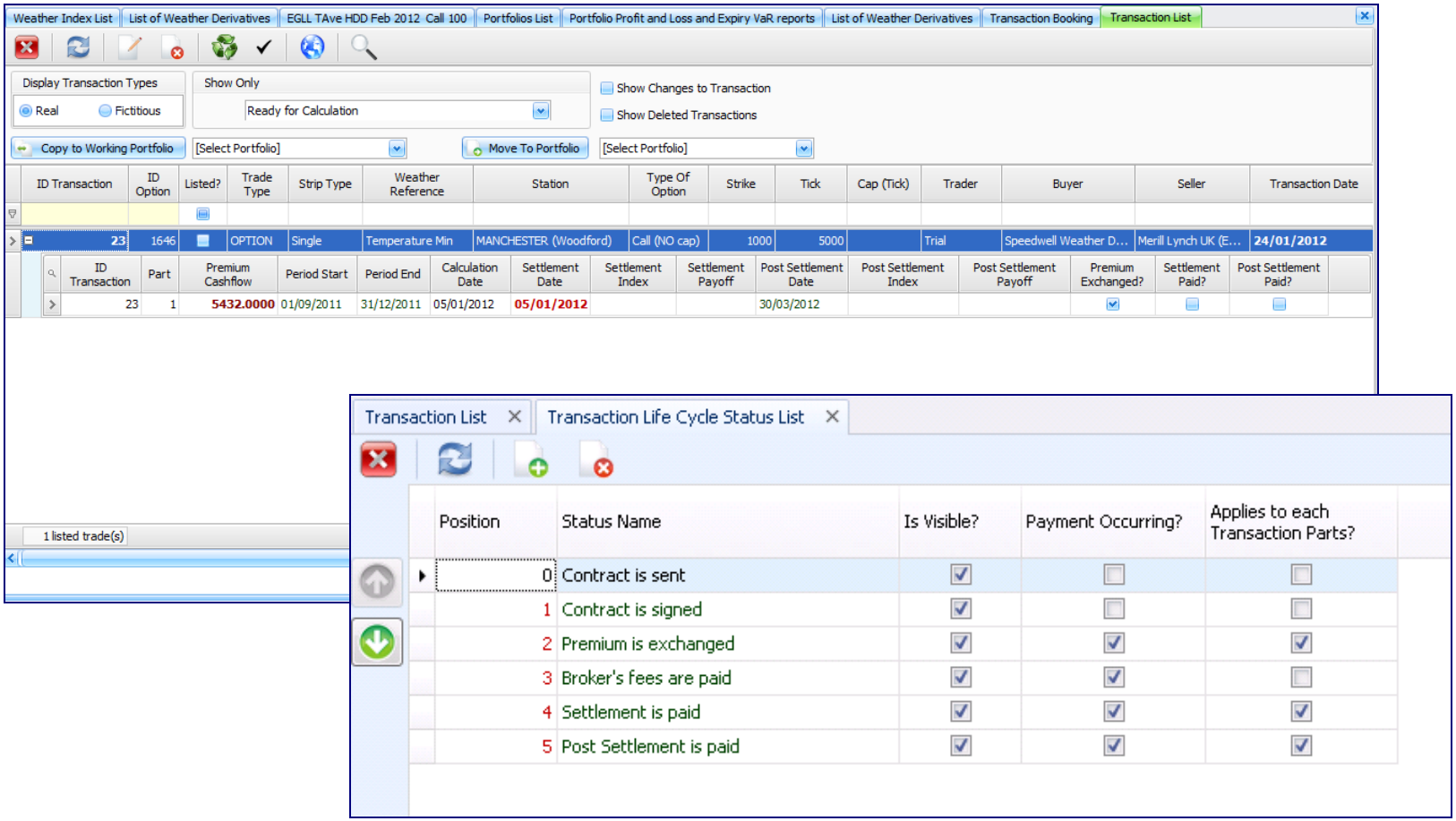
Full Support for the Trade Life-Cycle

Take control of the entire trade flow



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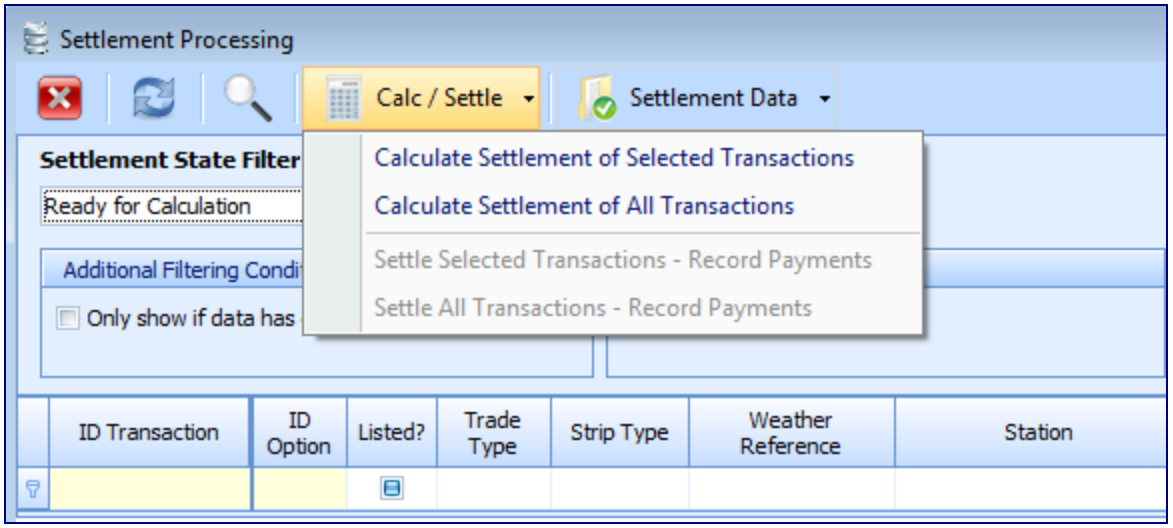
Automatic Batch Processing of Trades



- Configure SWS to automatically calculate and settle trades at the end of each day
- Never forget a trade
- Additional optional components available to further automate trade processing

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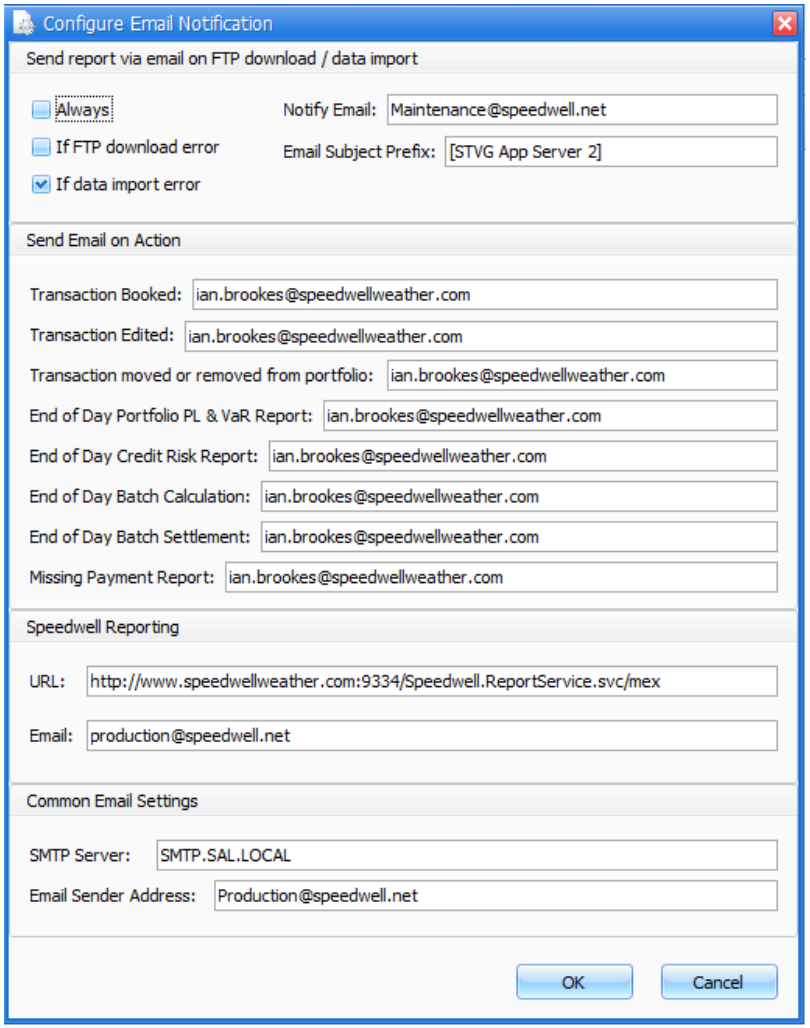
Automatic Notifications



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Booking a Weather Trade:

SWS immediately does the following:

- Locks up for editing/deleting the Weather Derivative
- Sends an internal message to SWS desktops
- Makes available the Transaction in the Back Office
- Integrates the Transaction in P&L, VaR, Credit Reports, etc

Only a person with Back Office privileges can:

- Edit the Transaction (e.g. Premium/Transaction Date)
- Mark the Transaction as deleted (the Transaction is never physically deleted from the DB)
- Record statuses
- Record payments
- Settle the Transaction
- Remove the Transaction from the assigned portfolio

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Weather Data Support

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Data Support

- The SWS data base supports any daily, hourly or sub hourly time series. The data does not even have to be weather related ..eg it could be commodity price data
- Any new ‘weather element’ can be added at a press of a button
- SWS supports multiple data types and hierarchies
- SWS supports deterministic and ensemble forecasts
- API access to tradeable weatherXchange data sets
- Direct Access to Speedwell Forecast Archive: archived forecasts can be viewed and imported into SWS.
- Gridded Data Services integration: direct access to several gridded data catalogues supported by Speedwell

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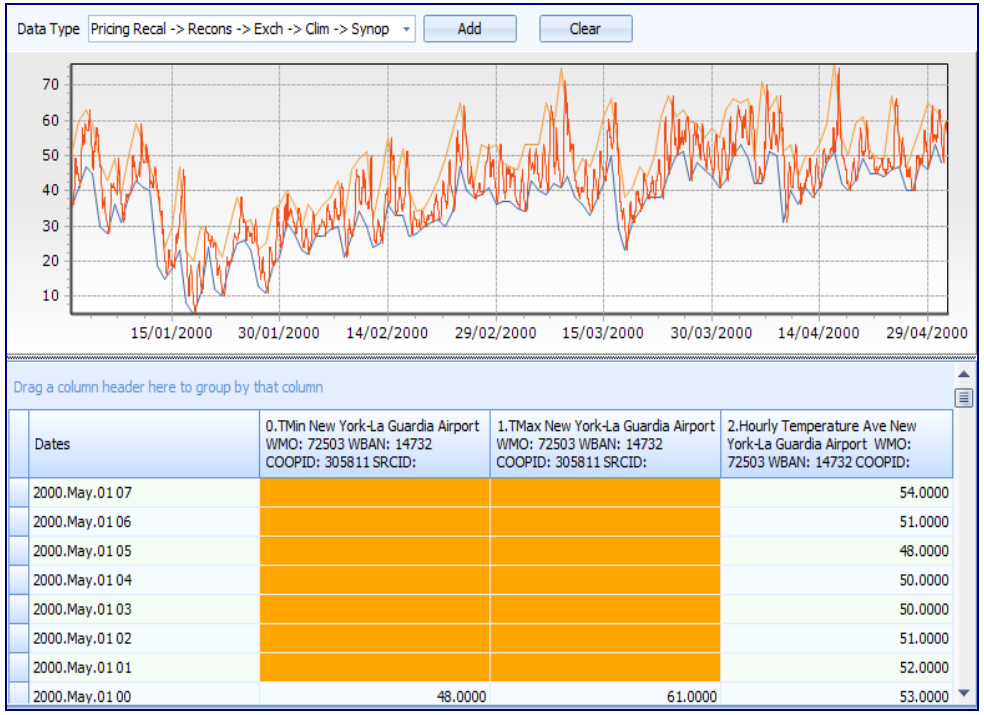
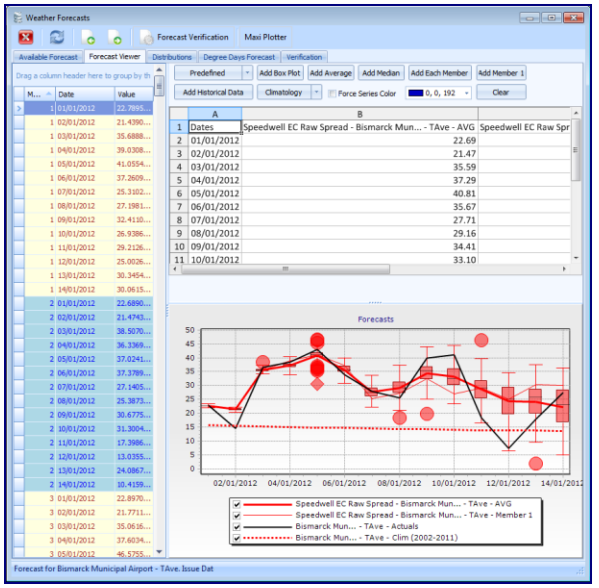
Data and Forecasts

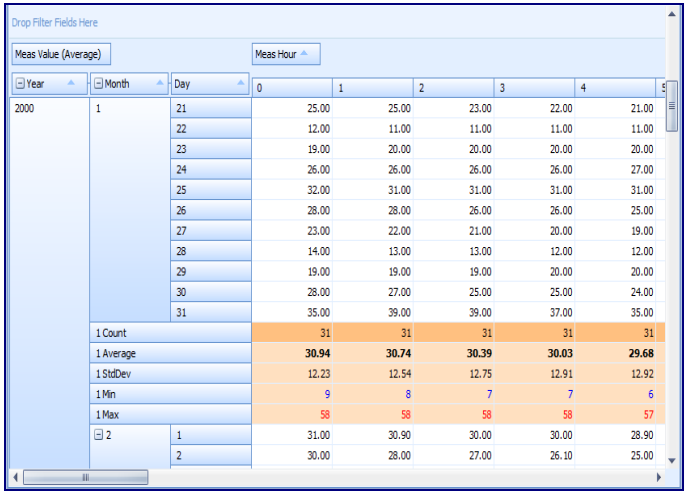
Plot Daily and Hourly Data



Dates	0.TMin New York-La Guardia Airport WMO: 72503 WBAN: 14732 COOPID: 305811 SRCID:	1.TMax New York-La Guardia Airport WMO: 72503 WBAN: 14732 COOPID: 305811 SRCID:	2.Hourly Temperature Ave New York-La Guardia Airport WMO: 72503 WBAN: 14732 COOPID:
2000.May.01 07			54.0000
2000.May.01 06			51.0000
2000.May.01 05			48.0000
2000.May.01 04			50.0000
2000.May.01 03			50.0000
2000.May.01 02			51.0000
2000.May.01 01			52.0000
2000.May.01 00	48.0000	61.0000	53.0000



Plot and verify forecast



View Pivot Hourly data tables

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Gridded Data Integration

SWS provides direct access to several gridded data catalogues supported by Speedwell (subject to subscription). Point data is available for any latitude/longitude within a given catalogue. In addition to point data, users can apply mathematical functions over user-defined areas or standard regions. For example, this could be daily average over a given region or the maximum/minimum of all data points within a chosen area

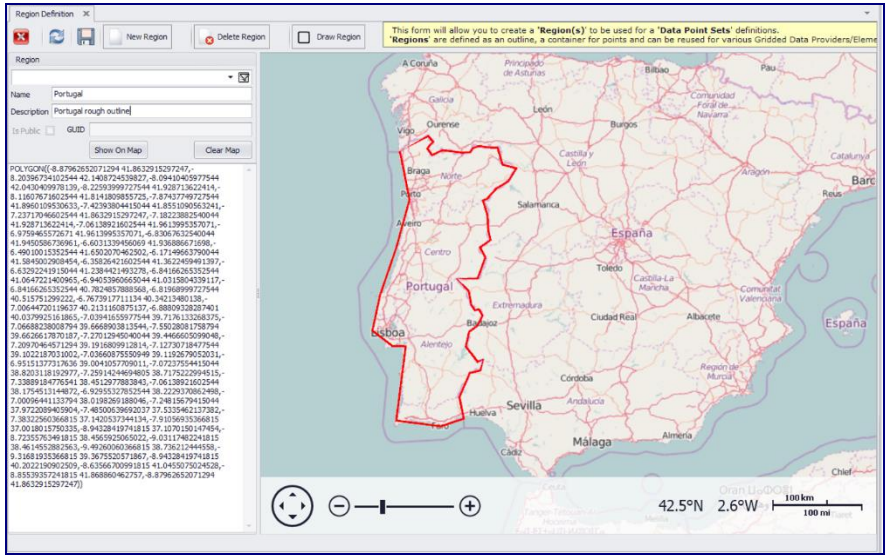
Gridded Data Services - Region | Speedwell Data Service | Gridded Data Services - Region | Gric

Catalogue

Data Element Name	Data Provider Name	Earliest Data	Is Hourly	Latest Data	Measure Units
Rain	ARC2	01/01/2015	☐	14/12/2015	mm
Rain	Aus BOM	01/01/1900	☐	15/04/2016	mm
Solar Exposure	Aus BOM	01/01/1990	☐	28/04/2016	MJ/m2
Rain	CHIRPs	01/01/1988	☐	13/02/1988	mm
Mean Wave Direction	ERA 0.75 resolution	01/01/1979	☑	31/01/2016	degrees
Sea Surface Tempera...	ERA 0.75 resolution	01/01/1979	☑	31/01/2016	K
Temperature 2m	ERA 0.75 resolution	01/01/1979	☑	31/01/2016	K
Wave Height and Swell	ERA 0.75 resolution	01/01/1979	☑	31/01/2016	m
Wind u +10m	ERA 0.75 resolution	01/01/1979	☑	31/01/2016	m/s
Wind v +10m	ERA 0.75 resolution	01/01/1979	☑	31/01/2016	m/s

Select gridded data source

Define the area with the cursor tool and Transform data (eg sum / max /min / average) and extract to SWS



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How to manage your weather data by doing nothing!

The SWS Data Manager manages weather data and forecasts so well that most SWS clients don't even know it exists.

- New historical data sets that are delivered to the FTP are automatically imported
- Daily/hourly updates of weather data feeds are automatically imported

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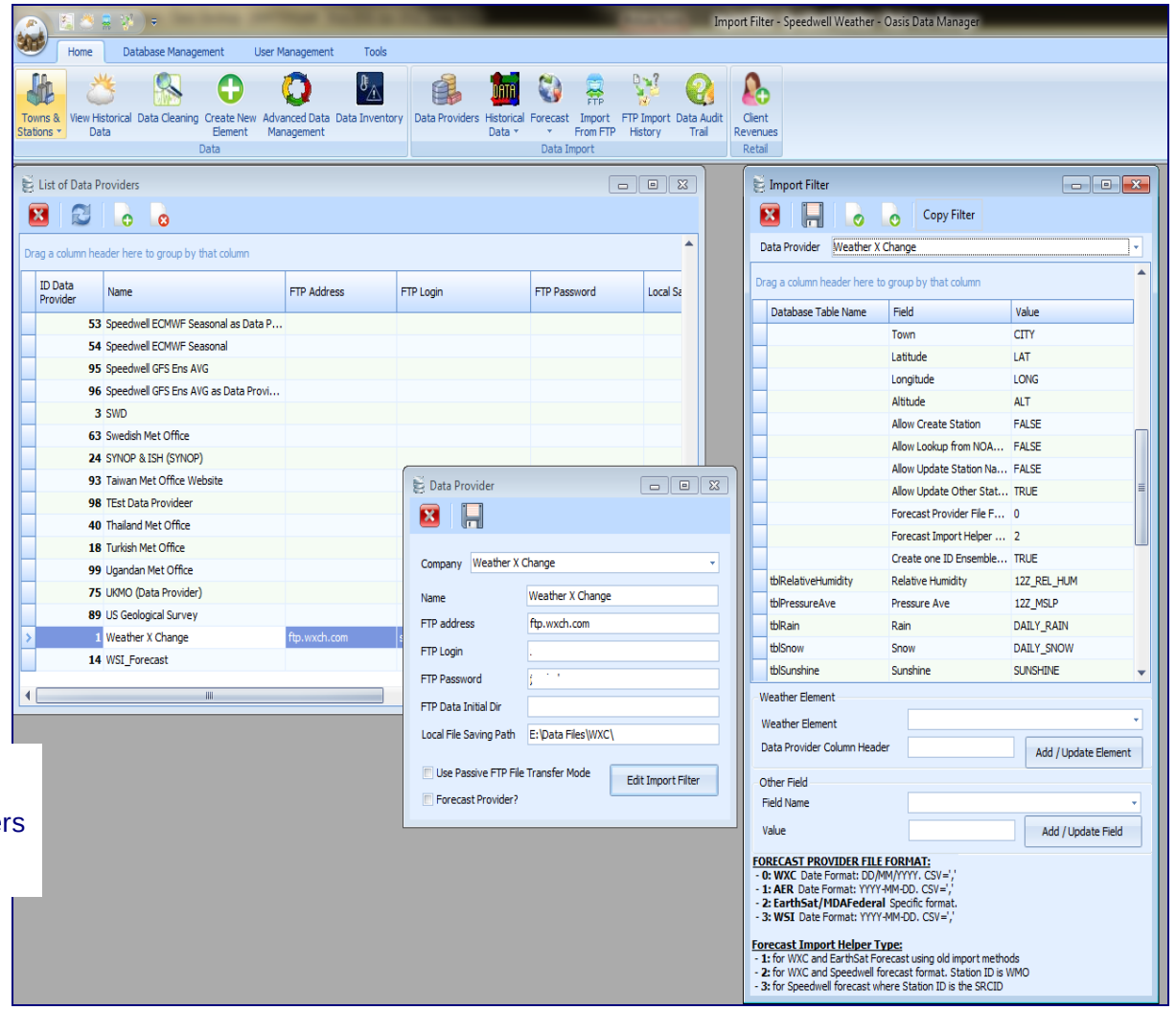
Seamless Data Management



Define the data sources

Map the CSV files Headers

That is it – done!

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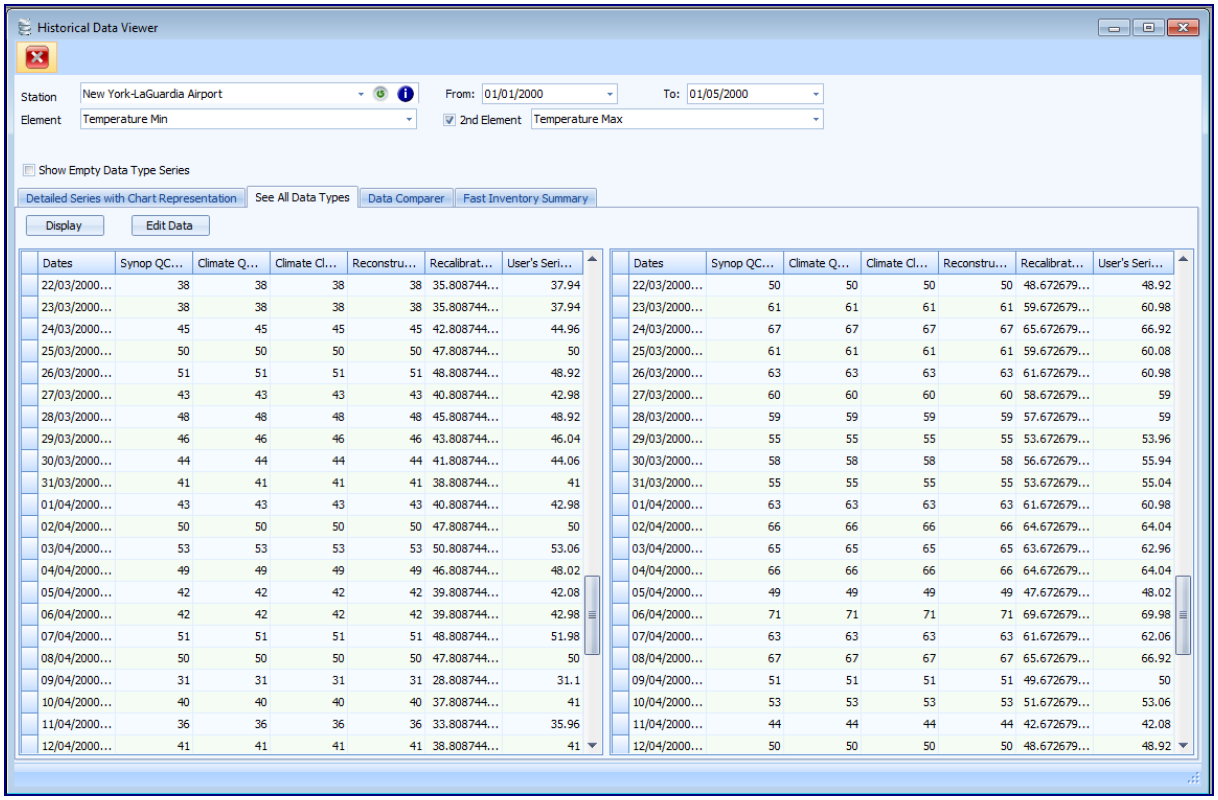
Strict Data Type Management



Dates	Synop QC...	Climate Q...	Climate Cl...	Reconstru...	Recalibrat...	User's Seri...
22/03/2000...	38	38	38	38	35.808744...	37.94
23/03/2000...	38	38	38	38	35.808744...	37.94
24/03/2000...	45	45	45	45	42.808744...	44.96
25/03/2000...	50	50	50	50	47.808744...	50
26/03/2000...	51	51	51	51	48.808744...	48.92
27/03/2000...	43	43	43	43	40.808744...	42.98
28/03/2000...	48	48	48	48	45.808744...	48.92
29/03/2000...	46	46	46	46	43.808744...	46.04
30/03/2000...	44	44	44	44	41.808744...	44.06
31/03/2000...	41	41	41	41	38.808744...	41
01/04/2000...	43	43	43	43	40.808744...	42.98
02/04/2000...	50	50	50	50	47.808744...	50
03/04/2000...	53	53	53	53	50.808744...	53.06
04/04/2000...	49	49	49	49	46.808744...	48.02
05/04/2000...	42	42	42	42	39.808744...	42.08
06/04/2000...	42	42	42	42	39.808744...	42.98
07/04/2000...	51	51	51	51	48.808744...	51.98
08/04/2000...	50	50	50	50	47.808744...	50
09/04/2000...	31	31	31	31	28.808744...	31.1
10/04/2000...	40	40	40	40	37.808744...	41
11/04/2000...	36	36	36	36	33.808744...	35.96
12/04/2000...	41	41	41	41	38.808744...	41

Dates	Synop QC...	Climate Q...	Climate Cl...	Reconstru...	Recalibrat...	User's Seri...
22/03/2000...	50	50	50	50	48.672679...	48.92
23/03/2000...	61	61	61	61	59.672679...	60.98
24/03/2000...	67	67	67	67	65.672679...	66.92
25/03/2000...	61	61	61	61	59.672679...	60.08
26/03/2000...	63	63	63	63	61.672679...	60.98
27/03/2000...	60	60	60	60	58.672679...	59
28/03/2000...	59	59	59	59	57.672679...	59
29/03/2000...	55	55	55	55	53.672679...	53.96
30/03/2000...	58	58	58	58	56.672679...	55.94
31/03/2000...	55	55	55	55	53.672679...	55.04
01/04/2000...	63	63	63	63	61.672679...	60.98
02/04/2000...	66	66	66	66	64.672679...	64.04
03/04/2000...	65	65	65	65	63.672679...	62.96
04/04/2000...	66	66	66	66	64.672679...	64.04
05/04/2000...	49	49	49	49	47.672679...	48.02
06/04/2000...	71	71	71	71	69.672679...	69.98
07/04/2000...	63	63	63	63	61.672679...	62.06
08/04/2000...	67	67	67	67	65.672679...	66.92
09/04/2000...	51	51	51	51	49.672679...	50
10/04/2000...	53	53	53	53	51.672679...	53.06
11/04/2000...	44	44	44	44	42.672679...	42.08
12/04/2000...	50	50	50	50	48.672679...	48.92

Speedwell Weather uses a standard SWS data base as the backbone of its own data and forecast business with over 140,000 weather stations storing multiple weather elements and multiple data quality types….it scales!

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Technical

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Back Office Integration

- Integration is possible whether SWS is internally installed in your organisation or hosted by us
- For internal installations, Speedwell have experience of integrating SWS into other existing back office processes
- It is possible to raise email alerts at key stages in the settlement life cycle (eg when a Transaction has been edited). These can be implemented using SQL Server emailing functionalities and triggers or by creating specific Windows Services

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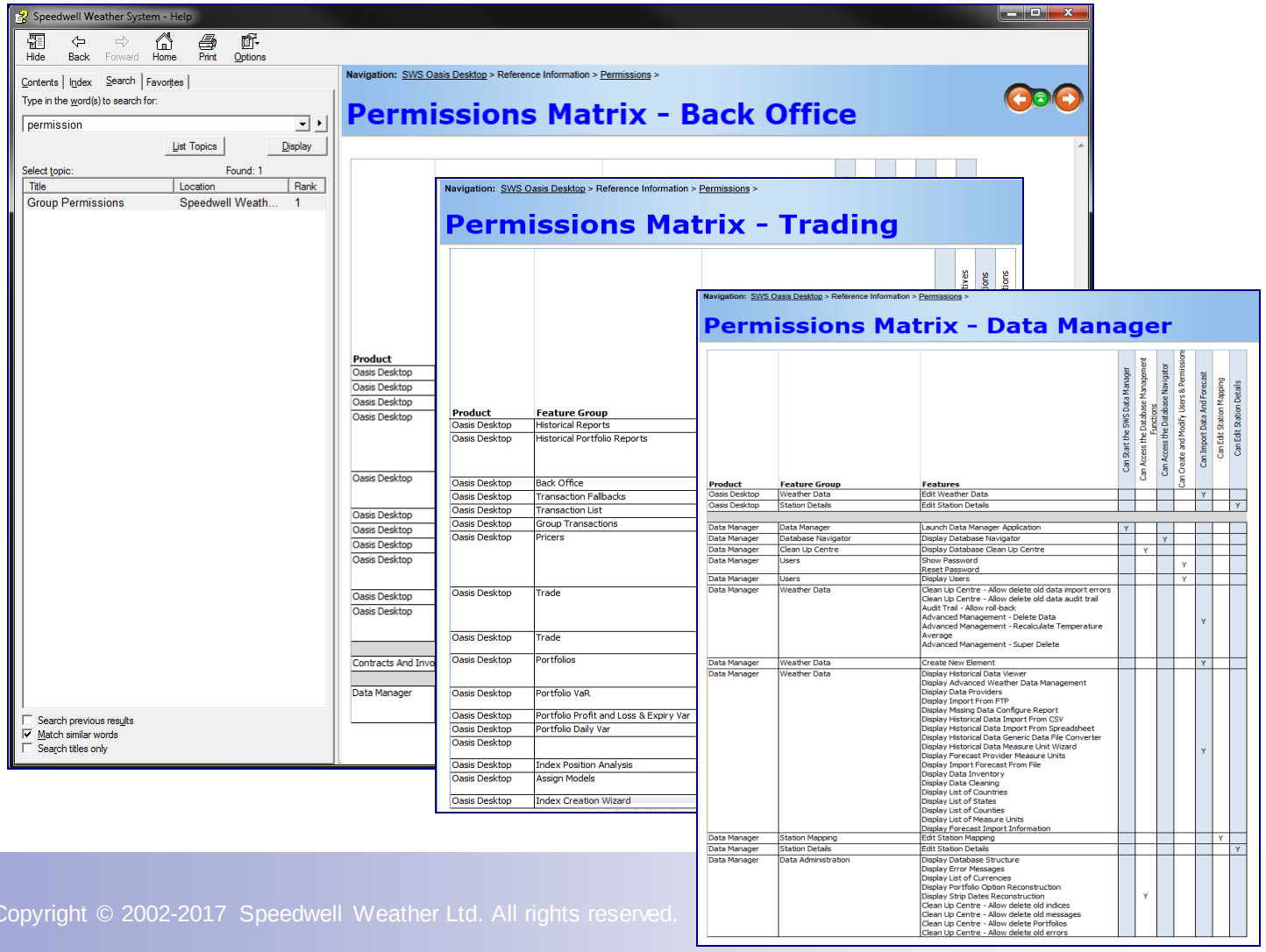
SWS Permissions Matrix

Full user permissioning is supported either with standard permissions or configurable permissions



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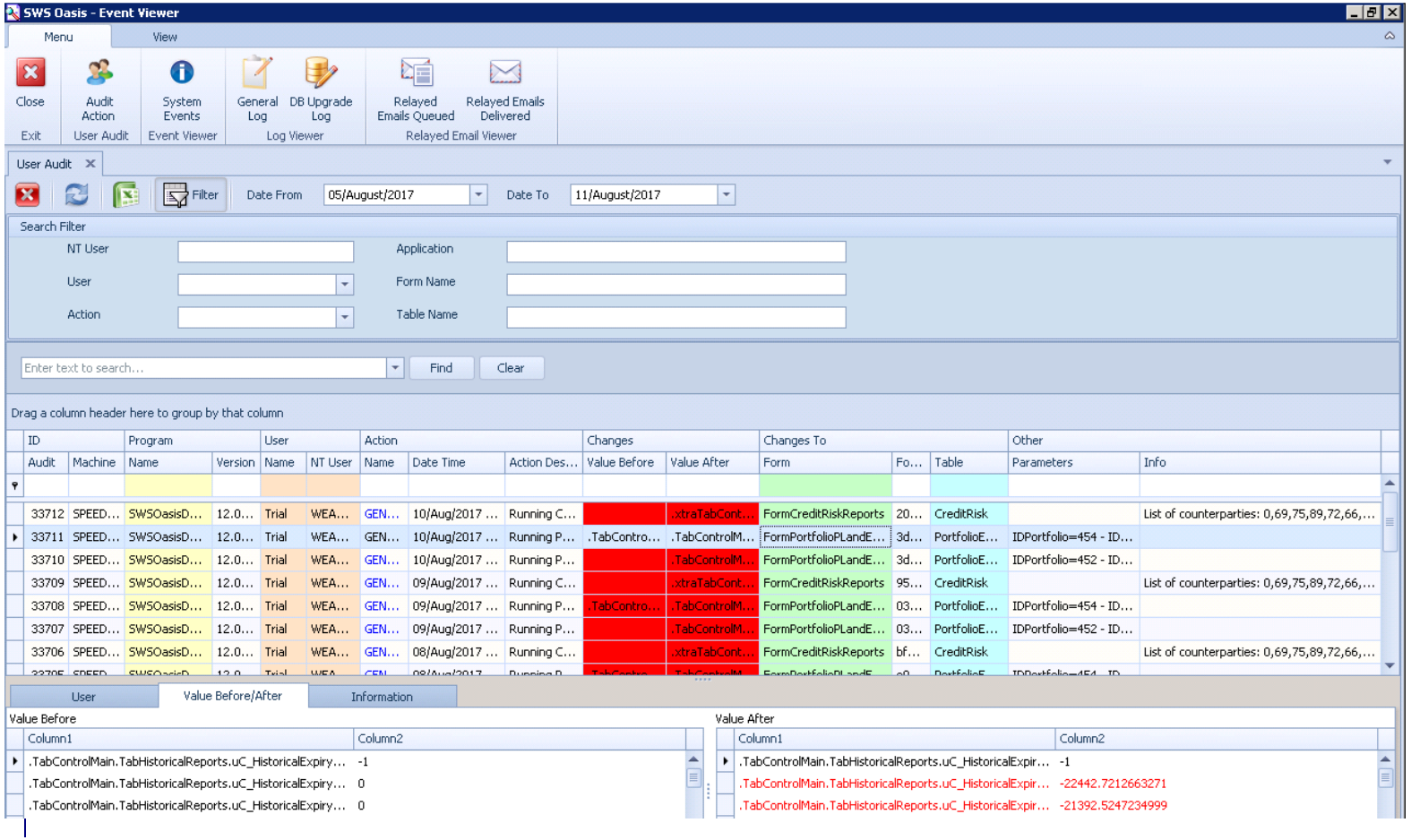
Auditing



Allowing the compliance function to monitor changes/actions such as trade entry, creation of new pricing models, changes to valuation models, portfolio outputs, transaction edits….

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weatherXchange® Integration with SWS

weatherXchange® is an independent platform designed to help companies access index based weather risk protection

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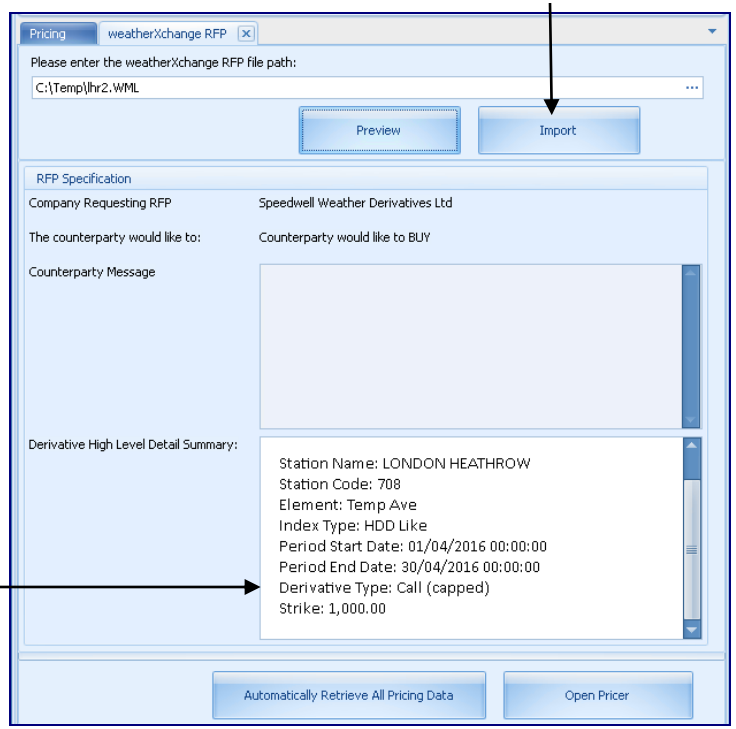
Easy weatherXchange RFP Response

Communicating the terms of a weather deal between clients and risk takers has been revolutionised with the integration of Speedwell WeatherML. Once the terms of a deal have been captured using either the weatherXchange website, or another user's SWS, a WeatherML file can be generated and sent to interested counterparties. These counterparties are able to import the WeatherML file directly into SWS and then download the relevant historical data, if required, to price the deal.

Speedwell WeatherML based term sheet from weatherXchange Platform

Click to save structure in SWS for easy pricing



Summary of weather structure derived from Speedwell WeatherML

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Automated Pricing Service (APS)

SWS v12 includes a pricing service to fully automated the process of responding to RFPs coming from the weatherXchange® platform. It can be configured to filter pricing requests on a number of criteria and uses dedicated user-defined index models to generate a price.

The APS is a web service and is fully integrated with the Speedwell Weather System API and Speedwell SuperPack® database.

The APS can be hosted by Speedwell or installed within your organization. It is available for no additional licence charge to companies that subscribe to both SWS Enterprise and Speedwell's SuperPack® -Premium service

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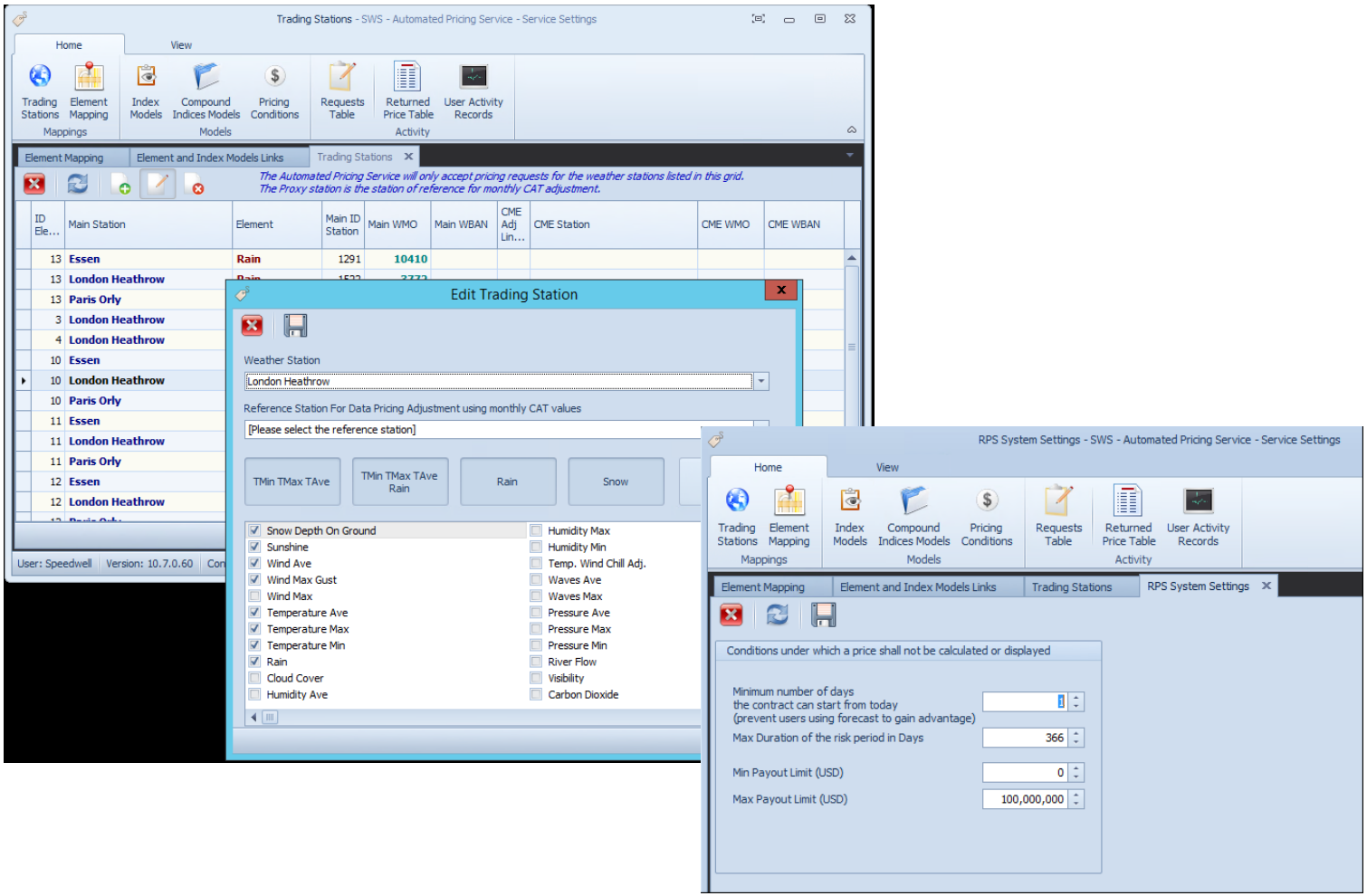
Automated Pricing Service (APS)



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Does your weather system do this?

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Does your weather system do this? - Part 1

- Does your weather system handle hourly data?.. strips? ..compounds?.. multi period deals?..multi triggers? ..baskets ..gas quantos?
- When pricing a transaction can you exclude days of the week and specific dates?
- Does it support ultra-exotic deals through a "back door" with those deals still being fully incorporated in portfolio calculations?
- Can you create a structure that handles risk on specific non-consecutive hourly periods in a day?
- Do you handle leap year adjustments robustly? - we offer six different methodologies
- Can your middle office users stress test a portfolio by overriding the front office valuation models with one of their own choice?
- Can you price a weather hedge using INDIVIDUAL members of an ensemble forecast to capture the implicit convexity?
- Does your weather database respect the different data qualities that are used and which may be dramatically different even at the same weather station?

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Does your weather system do this? - Part 2

- Would your audit trail breakdown if a weather data point already used in settling a transaction is later revised by a national met service and subsequently updated after settlement of a weather hedge?
- Can you detrend the underlying weather data AND the final index?
- Does your detrending method respect the differing trends seen in different months of the year?
- Does your system automate the raising of trade confirmations and invoices?
- Do you have a permissioning structure that prevents, for example, accidental deletion of booked trades by front office users or un-authorised changes to front office models by back office users?
- Does your system provide credit risk reports?
- Can you easily export weather data and historical forecasts for use in external applications ?
- Can you run a weather hedge valuation or a retrospective portfolio valuation using only the information that was available at that time?

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Does your weather system do this? - Part 3

- Can you retrieve a snapshot of the weather data that was used to settle a transaction before and QC revisions to that data?
- Does your weather database respect the various different types of weather data on which a transaction can be priced?
- Can your database support non-weather variables including energy or commodity prices?
- Does your weather database scale to tens of thousands of weather sites and handle daily, hourly and sub hourly ..down to minutes?
- Does your system support daily VaR calculations at the portfolio level?
- Does your system support full regulatory reporting?
- Does your system allow a hybrid actuarial / market approach by allowing means and vols to be over-ridden?
- Does your weather pricing system support Speedwell weatherML for the purpose of sending and receiving weatherXchange RFQs?
- Does your system offer the option of providing configurable, fully automated responses to RFPs?

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More information

Additional documentation is available on our documents web page here: http://www.speedwellweather.com/Pages/Others/Document.aspx

Weather Risk Trading Software, SWS	
An Overview of Speedwell Weather System	
SWS Features Summary List	
SWS Version 12.0 What's New Jul 2017	
SWS Version 11.5 What's New Feb 2017	
SWS Version 11 What's New May 2016	
SWS Back Office Process Flow	
SWS Weather Data Format	
SWS Forecast Format	
SWS Index Model	
SWS Forecast Model	*On Request*
SWS Pricing Methods Used	*On Request*
SWS Supporting Complex Deals	*On Request*
SWS FAQs	
SWS Technical Requirements	
SWS Hosted	
SWS User Help Document(CHM)	*On Request*
SWS Installation Guide	*On Request*
SWS Application Support: Configuring SWS Users	*On Request*

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