Creating a spatial meteorological data repository for internal organizational use

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Introduction

The cost involved in acquiring meteorological data requires consideration of all available sources from reliable data providers.

So far the main data provider for Airshed has been the South African Weather Service (SAWS).

Secondary sources include DEAT (Department of Environmental Affairs and Tourism), industry, ISCW (Institute for Soil, Climate and Water, Agricultural Research Council of South Africa) and Lakes Environmental MM5 (5th Generation Mesoscale Model) data.

The aims of this study were to:

- Use GIS as a spatial browsing environment to make the most economical and scientifically appropriate choice as to which meteorological dataset to acquire for a specific project.

This spatial data browser will be the first step towards creating a data repository to integrate internal organizational databases.

Methodology

The matrix model for data maturation stages and information management services by Strebel et. al. (1994) has been adapted below to develop a strategy towards managing the various spatial information datasets.

Table 1. Matrix Model.

Service	Matrix of Data Maturation Stages and Information Management Services		
	Infant Datasets	Adolescent Datasets	Adult Datasets
Acquire Data	• Identify and acquire supporting datasets		
Process, Quality Assurance, Integrate Data	• Process data to standard products	• Create value-added products • Integrate data across research projects	• Integrate data for inter-archive exchange
Provide Access to Data		• Provide limited data distribution	• Develop and provide tools to find and browse data • Maintain permanent archive

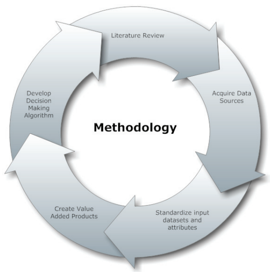


Figure 1. Strategy to create Decision Making Tool.

Data Sources

From a literature review the following data providers were identified. Table 2 shows a comparison between the automatic weather station (AWS) data for these providers.

Table 2. Meteorological Datasets Available from Identified Data Providers

Comparison Between Meteorological Data Sets						
	Description	Coverage	Compliance (WMO standards for meteorology)	Typical cost for 2 years data	Availability	Comments
SAWS AWS	Hourly data (standard meteorological parameters)	Distributed across South Africa	Compliant	R 3 100	Within 5 days	Measured
ISCW AWS	Hourly data (standard) meteorological parameters for agricultural use)	Distributed across South Africa	Compliant with WMO standards for agrometeorology. Data measured at 2 m height	R 250	Within 5 days	Measured Need to take topography into account
Other	Hourly data (selected meteorological parameters)	Selective distribution	Compliant	Some datasets freely available upon written application	Sometimes a lengthy process	Measured
SAWS UM	Hourly data (standard meteorological parameters)	Extracted point (Unified Model Data)	Compliant	R 3 500	Within 5 days	Modelled
Lakes MM5	Hourly data (standard meteorological parameters)	Extracted point (5th Generation Mesoscale Model)	Compliant	$ 399	Within 5 days	Modelled, AERMET-ready

Results

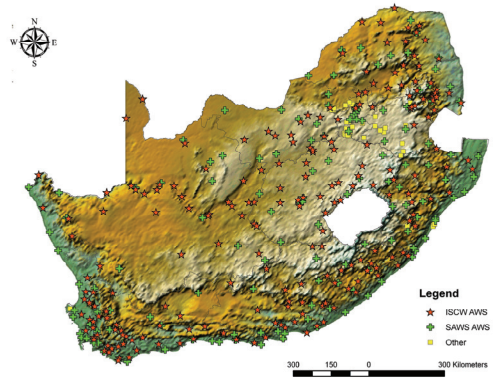


Figure 2. Distribution of automatic weather stations by source, with underlying topography.

Table 3. Acquisition of datasets and standardization of attributes.

Results					
	No of AWS Stations	Spatial Coverage	Metadata	Quality Assurance	Comments
SAWS	138	Complete	Yes	Yes	Sourced from list of open stations per province
ISCW	215	Incomplete	Yes	Yes	Sourced from Agro-Climate Information System
Other	55	Incomplete	No	No	Sourced from DEAT Ambient Monitoring Information System

Table 3 summarizes the results from the second and third steps in the methodology sequence.

Analysis

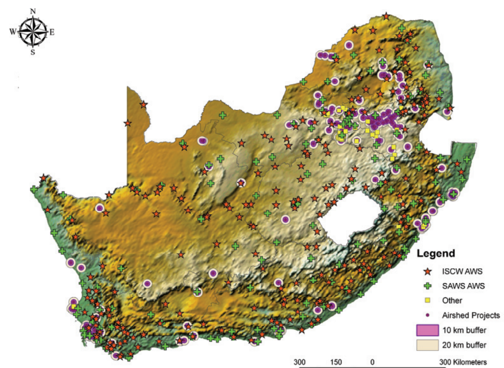


Figure 3. Distribution of air quality projects in relation to weather stations, with added 10km and 20km buffers.

Table 4. Percentage of stations falling within 10 and 20 km buffers from typical projects related to air quality.

Results Analysis			
	10 km buffer	20 km buffer	Comments
SAWS	11.6 %	19.2 %	Stations distributed in closer proximity to populated areas
ISCW	6.6 %	16.7 %	Stations geared towards agricultural use
Other	16.2 %	23.7 %	Stations sometimes coincide with Airshed Projects

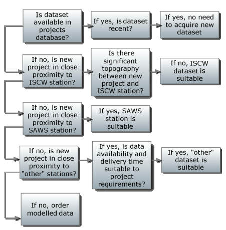
The following value added products were created:

- A topography dataset (from USGS TOPO30 data) to evaluate suitability of a station for a specific project.
- Buffer zones around existing Airshed projects to identify which datasets are contained within 10 and 20 km from typical air quality projects.

Decision-making Process

Table 5. Decision-making Process.

Suppliers	Input Layers	Process	Comments	Customers
• Airshed Projects • SAWS • ISCW • Other • SAWS UM • Lakes MM5	• Projects • SAWS AWS • ISCW AWS • Other	The process describes the steps to determine which meteorological dataset to acquire for any given project. Process map: (see below)	• Measured data should be evaluated first • ISCW and SAWS data are preferred (higher data accuracy and consistency checks) • ISCW datasets are cheaper but topography may present a problem • Model requirements and project budget and timeframe must be considered in making final decision	• Internal Use
Enablers				
• Airshed Project Database • Agro-Climate Information System • DEAT • Eskom • Municipalities and Metros • Industry				



Conclusions

- The study shows the steps taken towards creating a spatial data browser in order to choose which meteorological data to acquire for dispersion modelling.
- The main data providers were identified as the ISCW, SAWS, DEAT, Eskom, industry, and metropolitan and local municipalities.
- Value added products were created to aid in the decision-making process (topography map and spatial buffers around existing projects).
- A decision making algorithm was created to outline the steps for choosing which dataset to acquire.
- This is considered as a first step towards creating a data repository to integrate internal organizational databases and create a permanent archive.

References

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