Web-based tools for air pollution modellers

Helge Rørdam Olesen

Chairman of the “Harmonisation…” initiative

A central theme at the Harmo conferences

- We should build upon the experiences of each other.
- We should make the most of our knowledge – ensure that acquired knowledge is not forgotten, but used by the modelling community, ensure that it is included in the decision-making process.

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Implications:

- We should make our work visible.
- We should as far as possible be aware of available tools.
- We should be able to find relevant tools when needed.

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A wide range of web-based tools have emerged

Wikipedia
The Free Encyclopedia

Google

Google scholar

delta

A tool for

FAIRMODE
Forum for Air Quality
Modelling in Europe

OPEN source

Google play

Topics to be touched

- Seeking and providing information (Wikipedia; Search engines)
- Tools focussed on air pollution modelling
- Hints on generally useful tools in your daily work
- Apps for mobile devices
- Newsletters and mailing lists
- Social networks for researchers

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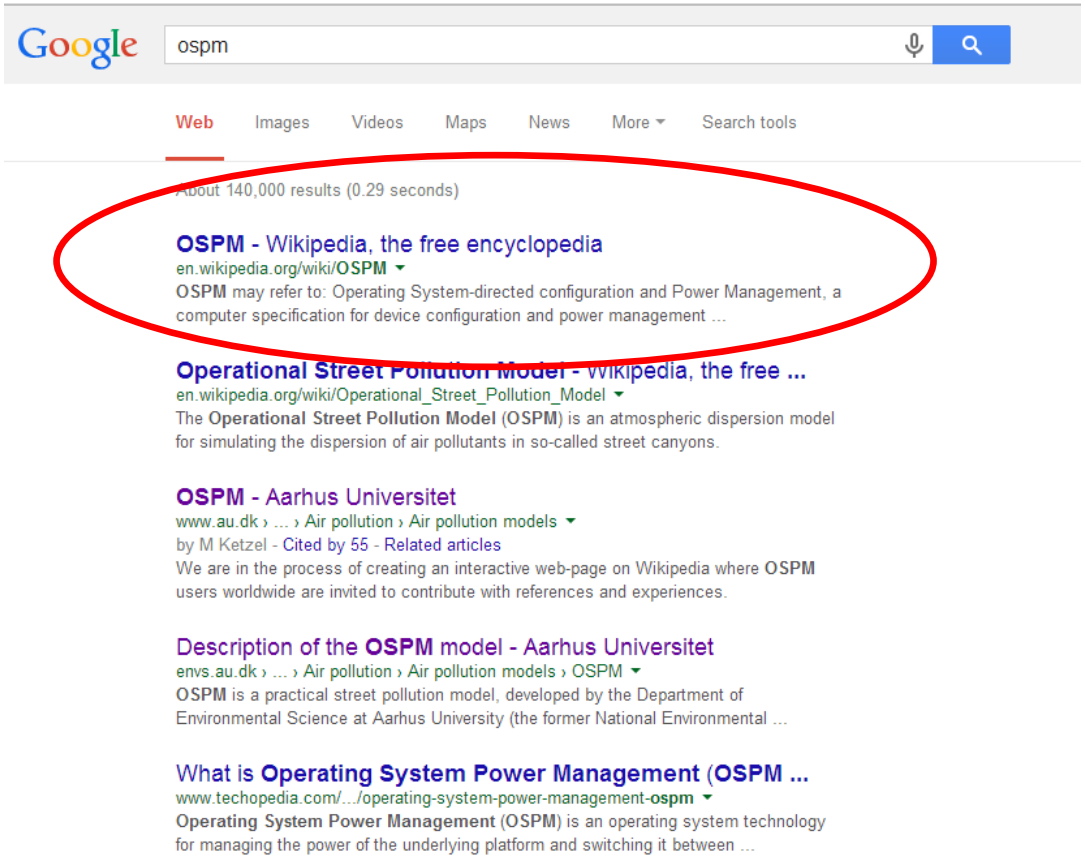
Seeking and providing information

- Some words on Wikipedia

OSPM

Wikipedia ranks very high among search results



Wikipedia seems more or less neglected by the air pollution community

- With a tiny effort you can make your information available to a wide audience.
- You can contribute to Wikipedia.
- Steps to take
  - Create an account
  - Consult “About Wikipedia” about rules of conduct
  - Add information

.

- Wikipedia carries a long list of atmospheric dispersion models as well as entries for a number of models.

Create account Log in

Article Talk | Read Edit View history | Search

List of atmospheric dispersion models

From Wikipedia, the free encyclopedia

Atmospheric dispersion models are computer programs that use mathematical algorithms to simulate how pollutants in the ambient atmosphere disperse and, in some cases, how they react in the atmosphere.

Contents [hide]

U.S. Environmental Protection Agency models [edit]

Many of the dispersion models developed by or accepted for use by the U.S. Environmental Protection Agency (U.S. EPA) are accepted for use in many other countries as well. Those EPA models are grouped below into four categories.

Preferred and recommended models [edit]

- AERMOD - An atmospheric dispersion model based on atmospheric boundary layer turbulence structure and scaling concepts, including treatment of multiple ground-level and elevated point, area and volume sources. It handles flat or complex, rural or urban terrain and includes algorithms for building effects and plume penetration of inversions aloft. It uses Gaussian dispersion for stable atmospheric conditions (i.e.

Models developed in the United Kingdom [edit]

- ADMS-3 - See the description of this model in the Alternative Models section of the models accepted by the U.S. EPA.
- ADMS-URBAN - A model for simulating dispersion on scales ranging from a street scale to city-wide or county-wide scale, handling most relevant emission sources such as traffic, industrial, commercial, and domestic sources. It is also used for air quality management and assessments of current and future air quality vis-a-vis national and regional standards in Europe and elsewhere.
- ADMS-Roads - A model for simulating dispersion of vehicular pollutant emissions from small road networks in combination with emissions from industrial plants. It handles multiple road sources as well as multiple point, line or area emission sources and the model operation is similar to the other ADMS models
- ADMS-Screen - A screening model for rapid assessment of the air quality impact of a single industrial stack to determine if more detailed modelling is needed. It combines the dispersion modelling algorithms of the ADMS models with a user interface requiring minimal input data.
- GASTAR - A model for simulating accidental releases of denser-than-air flammable and toxic gases. It handles instantaneous and continuous releases, releases from jet sources, releases from evaporation of volatile liquid pools, variable terrain slopes and ground roughness, obstacles such as fences and buildings, and time-varying releases.
- NAME - Numerical Atmospheric-dispersion Modelling Environment (NAME) is a local to global scale model developed by the UK's Met Office. It is used for: forecasting of air quality, air pollution dispersion, and acid rain; tracking radioactive emissions and volcanic ash discharges; analysis of accidental air pollutant releases and assisting in emergency response; and long-term environmental impact analysis. It is an integrated model that includes boundary layer dispersion modelling.
- UDM - Urban Dispersion Model is a Gaussian puff based model for predicting the dispersion of atmospheric pollutants in the range of 10m to 25 km throughout the urban environment. It is developed by the Defense Science and Technology Laboratory for the UK Ministry of Defence. It handles instantaneous, continuous, and pool releases, and can model gases, particulates, and liquids. The model has a three regime structure: that of single building (area density < 5%), urban array (area density > 5%) and open. The model can be coupled with the US model SCIPUFF to replace the open regime and extend the model's prediction range.

Models developed in continental Europe [edit]

The European Topic Centre on Air and Climate Change, which is part of the European Environment Agency (EEA), maintains an online Model Documentation System (MDS) that includes descriptions and other information for almost all of the dispersion models developed by the countries of Europe. The MDS currently (July 2012) contains 142 models, mostly developed in Europe. Of those 142 models, some were subjectively selected for inclusion here. Anyone interested in seeing the complete MDS can access it here.

Some of the European models listed in the MDS are public domain and some are not. Many of them include a pre-processor module for the

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Some of the European models listed in the MDS are public domain and some are not. Many of them include a pre-processor module for the input of meteorological and other data, and many also include a post-processor module for graphing the output data and/or plotting the area impacted by the air pollutants on maps.

The country of origin is included for each of the European models listed below.

- AEROPOL (Estonia) - The AERO-POLlution model developed at the Tartu Observatory in Estonia is a Gaussian plume model for simulating the dispersion of continuous, buoyant plumes from stationary point, line and area sources over flat terrain on a local to regional scale. It includes plume depletion by wet and/or dry deposition as well as the effects of buildings in the plume path.
- ATSTEP (Germany) - Gaussian Puff Dispersion and Deposition model used in the decision support system RODOS (Real-time On-line Decision Support) for nuclear emergency management. RODOS is operational in Germany by the Federal Office for Radiation Protection (BfS) and test-operational in many other European countries. More information on RODOS is available here and on the ATSTEP model here.
- AUSTAL2000 (Germany) - The official air dispersion model to be used in the permitting of industrial sources by the German Federal Environmental Agency. The model accommodates point, line, area and volume sources of buoyant plumes. It has capabilities for building effects, complex terrain, plume depletion by wet or dry deposition, and first order chemical reactions. It is based on the LASAT model developed by Ingenieurbüro Janicke Gesellschaft für Umweltphysik.
- BUO-FMI (Finland) - This model was developed by the Finnish Meteorological Institute (FMI) specifically for estimating the atmospheric dispersion of neutral or buoyant plume gases and particles emitted from fires in warehouses and chemical stores. It is a hybrid of a local scale Gaussian plume model and another model type. Plume depletion by dry deposition is included but wet deposition is not included.
- CAR-FMI (Finland) - This model was developed by the Finnish Meteorological Institute (FMI) for evaluating atmospheric dispersion and chemical transformation of vehicular emissions of inert (CO, NOx) and reactive (NO, NO_2, O_3) gases from a road network of line sources on a local scale. It is a Gaussian line source model which includes an analytical solution for the chemical cycle $NO\text{-}O_3\text{-}NO_2$.
- CAR-International (The Netherlands) - Calculation of Air pollution from Road traffic(CAR-International) is an atmospheric dispersion model developed by the Netherlands Organisation for Applied Scientific Research. It is used for simulating the dispersion of vehicular emissions from roadway traffic.
- DIPCOT (Greece) - DIsPersion over COmplex Terrain (DIPCOT) is a model developed in the National Centre of Scientific Research "DEMOKRITOS" of Greece that simulates dispersion of buoyant plumes from multiple point sources over complex terrain on a local to regional scale. It does not include wet deposition or chemical reactions.

Models developed in Australia [edit]

- AUSPLUME - A dispersion model that has been designated as the primary model accepted by the Environmental Protection Authority (EPA) of the Australian state of Victoria. (update:AUSPLUME V6 will no longer be the air pollution dispersion regulatory model in Victoria from the 1st of January 2014. From this date the air pollution dispersion regulatory model in Victoria will be AERMOD.)
- pDsAUSMOD -Australian Graphical User Interface for AERMOD
- pDsAUSMET -Australian meteorological data processor for AERMOD
- LADM - An advanced model developed by Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) for simulating the dispersion of buoyant pollution plumes and predicting the photochemical formation of smog over complex terrain on a local to regional scale. The model can also handle fumigated plumes (see the books listed below in the "Further reading" section for an explanation of fumigated plumes).
- TAPM - An advanced dispersion model integrated with a pre-processor for providing meteorological data inputs. It can handle multiple pollutants, and point, line, area and volume sources on a local, city or regional scale. The model capabilities include building effects, plume depletion by deposition, and a photochemistry module. This model was also developed by Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO).
- DISPMOD - A Gaussian atmospheric dispersion model for point sources located in coastal regions. It was designed specifically by the Western Australian Department of Environment to simulate the plume fumigation that occurs when an elevated onshore pollution plume intersects a growing thermal internal boundary layer (TIBL) contained within offshore air flow coming onshore.
- AUSPUFF - A Gaussian puff model designed for regulatory use by CSIRO. It includes some simple algorithms for the chemical transformation of reactive air pollutants.

Models developed in India [edit]

- HAMS-GPS - Software used for management of Environment, Health and Safety (EHS). It can be used for training as well as research involving dispersion modeling, accident analysis, fires, explosions, risk assessments and other related subjects.

Wikipedia – bottom line

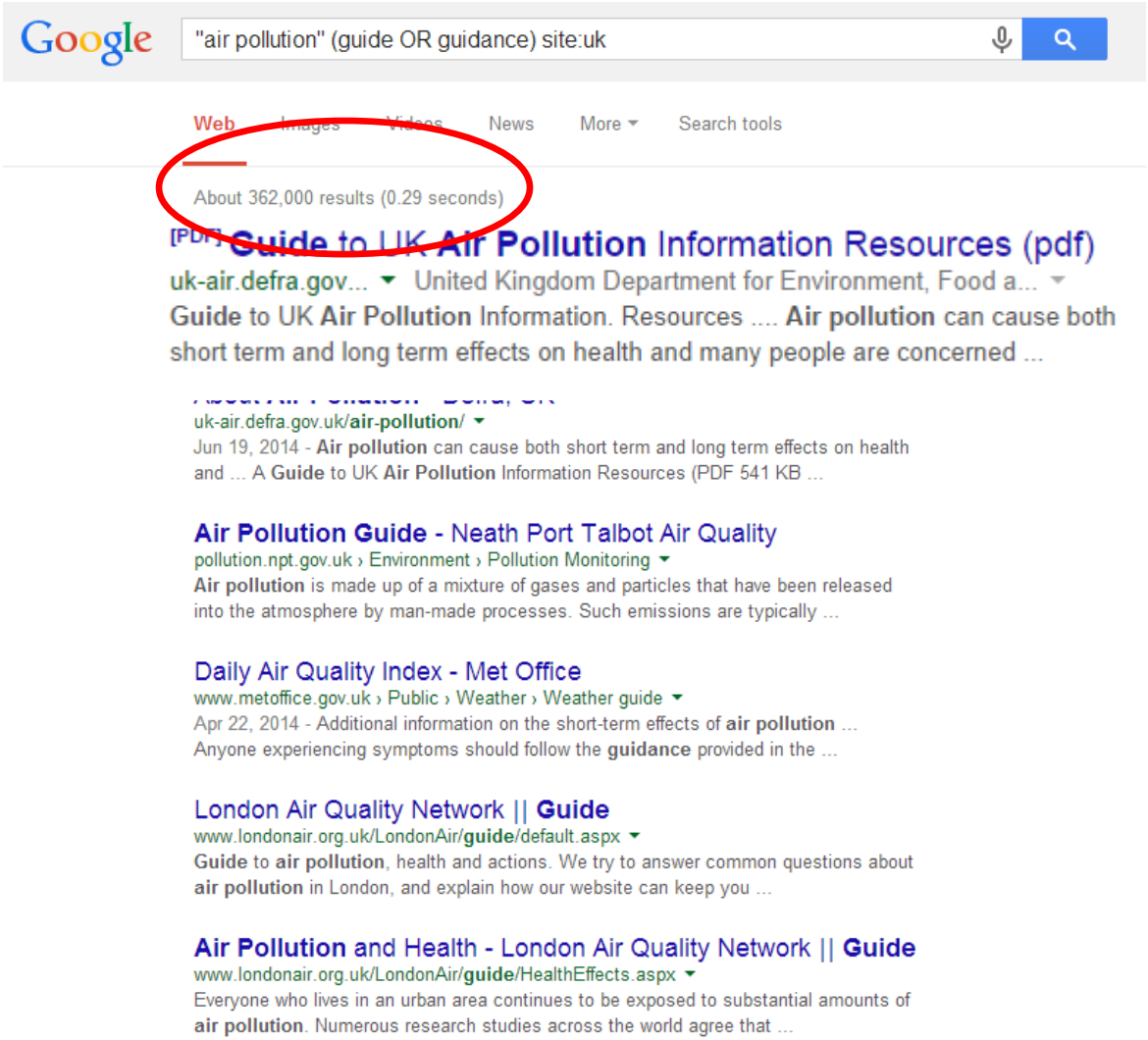
- Wikipedia is under-used by the modelling community.
- By contributing to Wikipedia you can make some of your work much more visible.

Seeking and providing information: Search strategy

- **Google** is an excellent tool but often yields “noisy” results
- **Google Scholar** is more tuned towards a scientific audience
- **Commercial bibliographic data bases** offer better facilities for fine-tuning results than Google Scholar (seach within search results)

Google offers advanced search features

- Example:
- **”air pollution” (guide OR guidance) site:UK**


Google
"air pollution" (guide OR guidance) site:uk
Web
News
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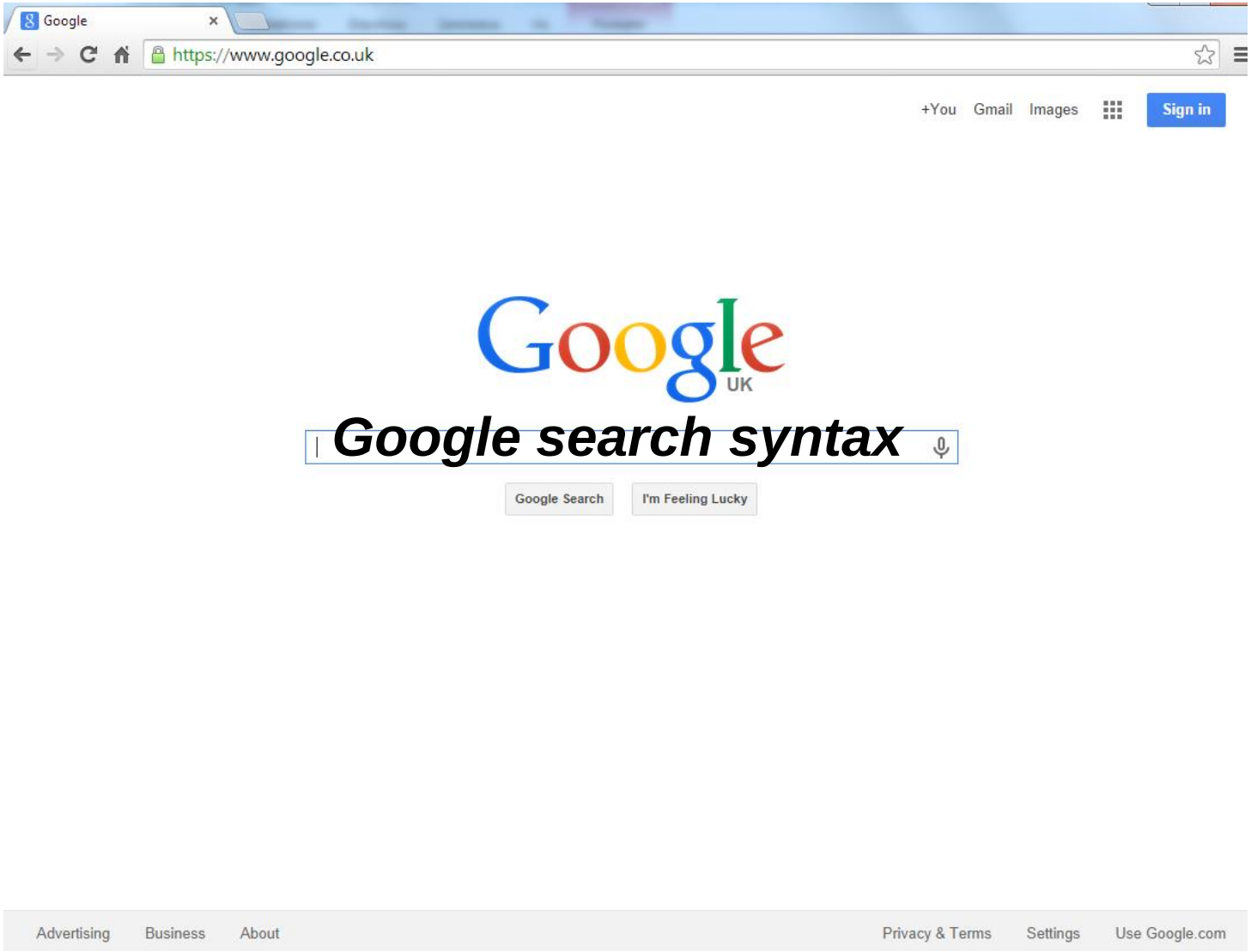
[PDF] Guide to UK Air Pollution Information Resources (pdf)
uk-air.defra.gov... United Kingdom Department for Environment, Food a...
Guide to UK Air Pollution Information. Resources .... Air pollution can cause both short term and long term effects on health and many people are concerned ...
uk-air.defra.gov.uk/air-pollution/
Jun 19, 2014 - Air pollution can cause both short term and long term effects on health and ... A Guide to UK Air Pollution Information Resources (PDF 541 KB ...
Air Pollution Guide - Neath Port Talbot Air Quality
pollution.npt.gov.uk › Environment › Pollution Monitoring
Air pollution is made up of a mixture of gases and particles that have been released into the atmosphere by man-made processes. Such emissions are typically ...
Daily Air Quality Index - Met Office
www.metoffice.gov.uk › Public › Weather › Weather guide
Apr 22, 2014 - Additional information on the short-term effects of air pollution ... Anyone experiencing symptoms should follow the guidance provided in the ...
London Air Quality Network || Guide
www.londonair.org.uk/LondonAir/guide/default.aspx
Guide to air pollution, health and actions. We try to answer common questions about air pollution in London, and explain how our website can keep you ...
Air Pollution and Health - London Air Quality Network || Guide
www.londonair.org.uk/LondonAir/guide/HealthEffects.aspx
Everyone who lives in an urban area continues to be exposed to substantial amounts of air pollution. Numerous research studies across the world agree that ...

Important details

”air pollution” (guide OR guidance) site:UK

- Adjacent words surrounded by quotation marks
- Operators like OR in capitals
- No space after colon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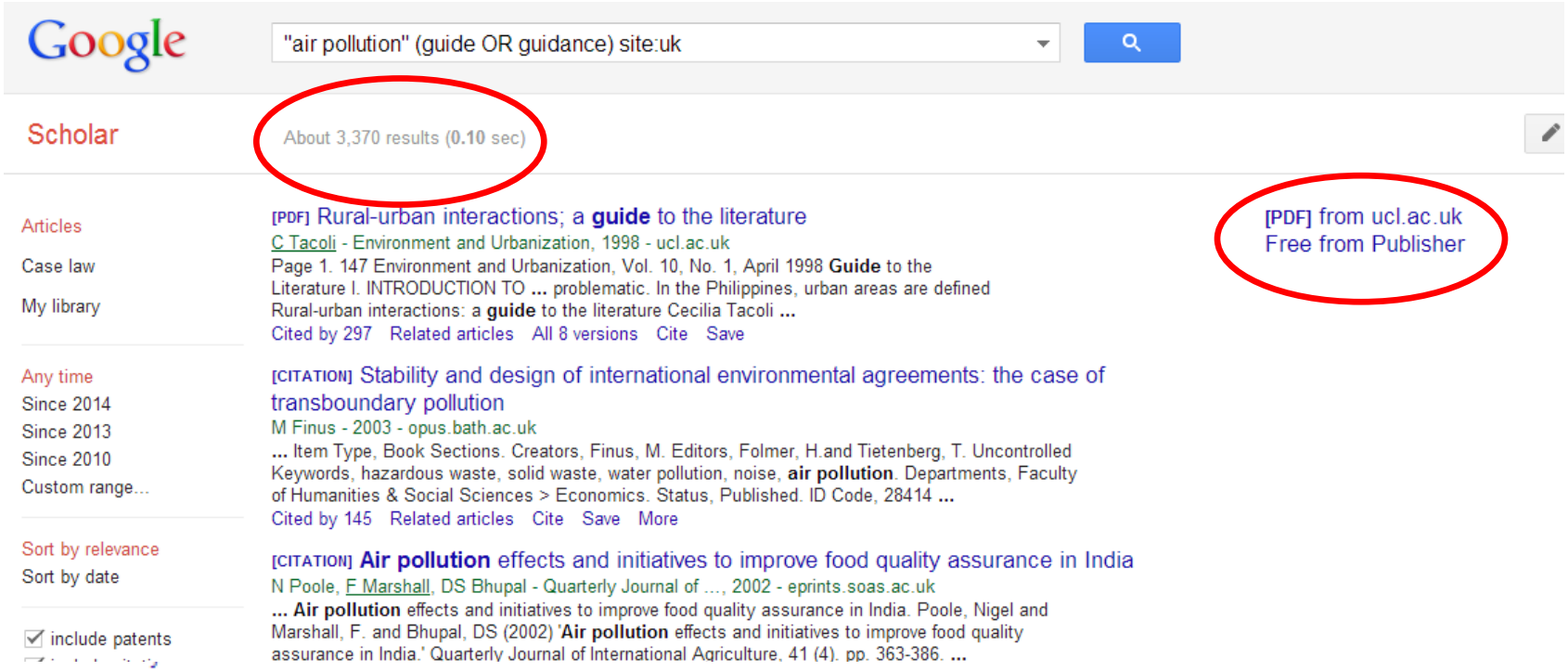
https://www.google.co.uk
+You Gmail Images Sign in
Google
UK
Google search syntax
Google Search
I'm Feeling Lucky
Advertising Business About
Privacy & Terms Settings Use Google.com

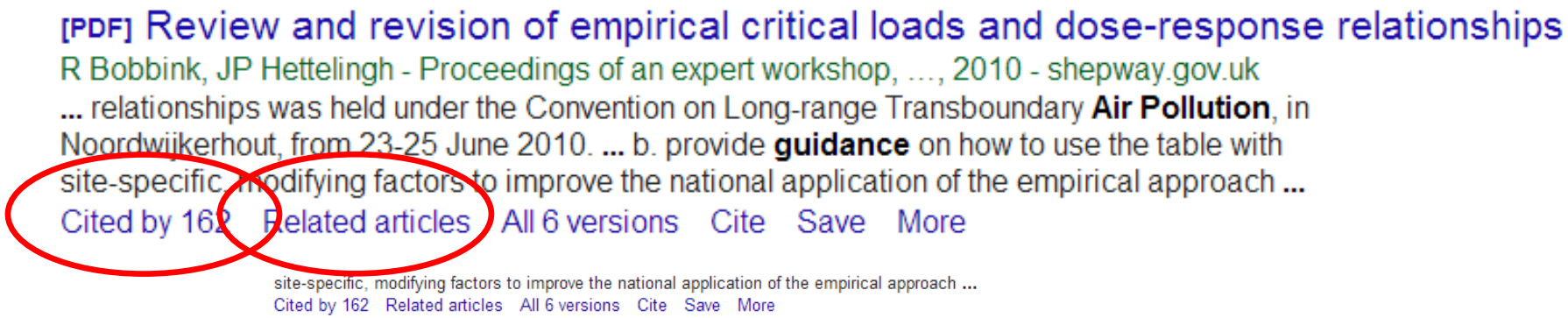
My message about Google

- A lot of the answers you seek in your work can be found on the web.
- Invest a bit of time to become familiar with Google syntax and the potential of Google.

Google Scholar: http://scholar.google.com

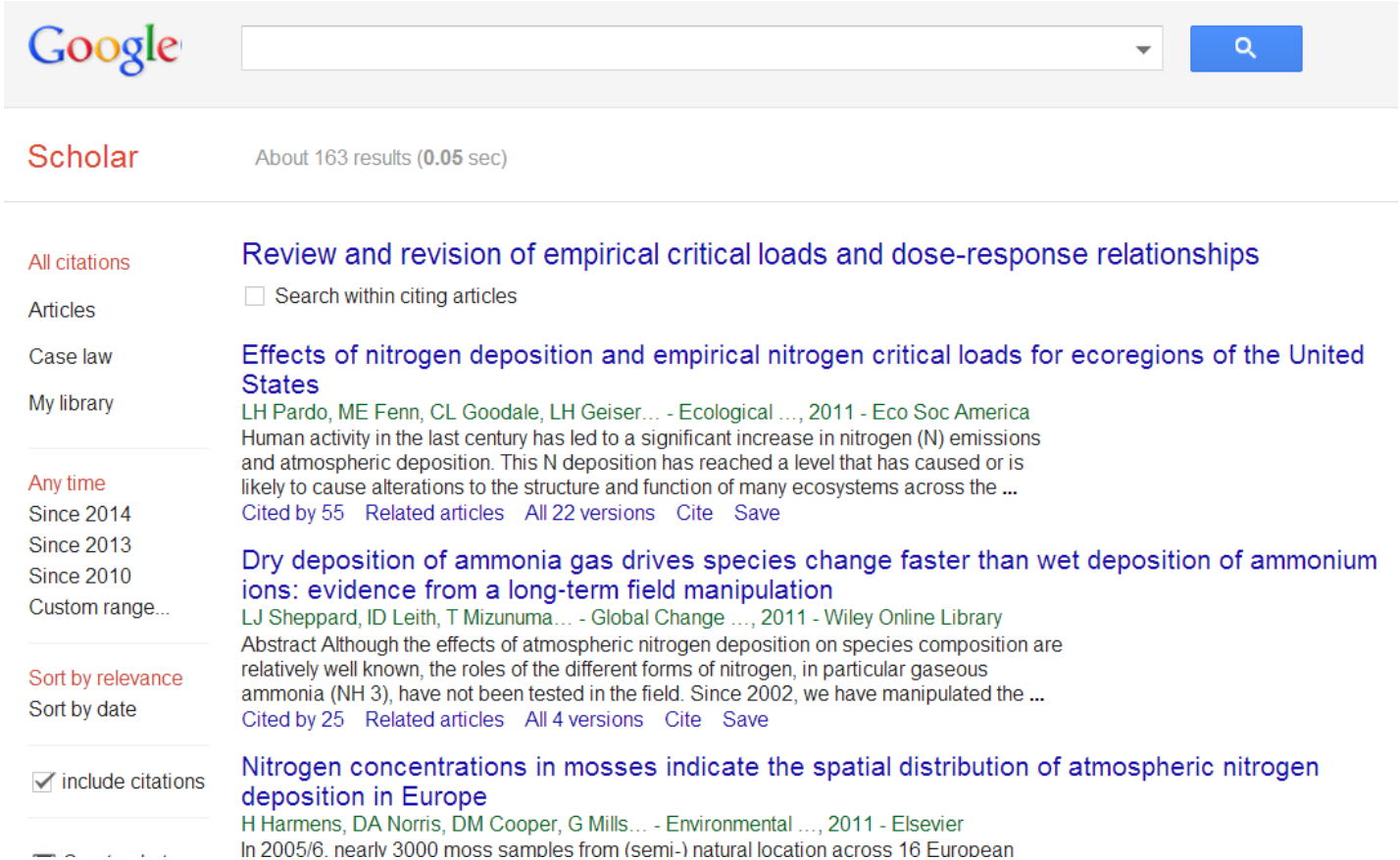
- ”Google Scholar provides a simple way to broadly search for scholarly literature..”
- Google Scholar returns primarily scientific papers, reports and conference publications.
- Google Scholar is a very powerful tool.
- Full text papers are often available.
- Note the power of
  - **“Cited by”**
  - **“Related articles”**





site-specific, modifying factors to improve the national application of the empirical approach ...
Cited by 162 Related articles All 6 versions Cite Save More

”Cited by:”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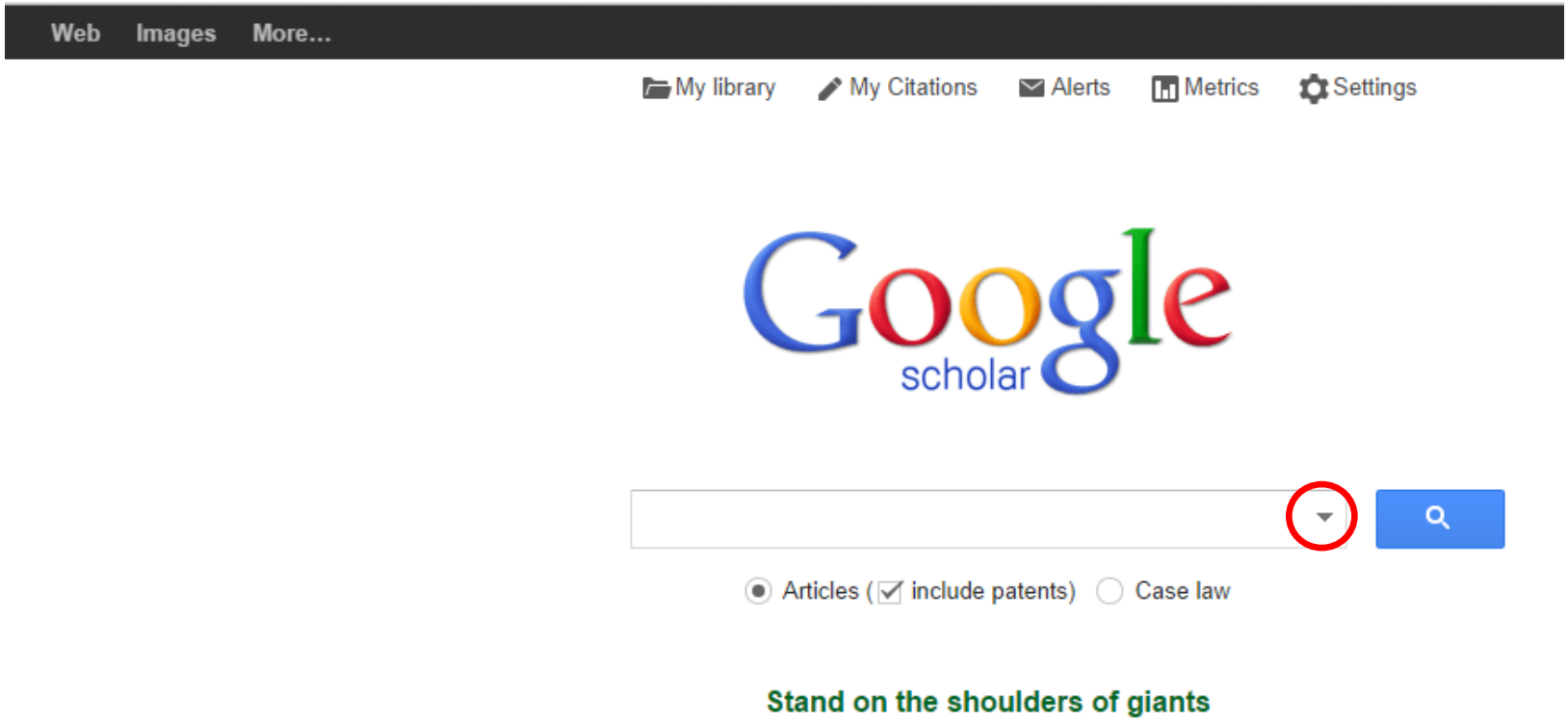
Any time
Since 2014
Since 2013
Since 2010
Custom range...
Sort by relevance
Sort by date
include citations
Review and revision of empirical critical loads and dose-response relationships
Search within citing articles
Effects of nitrogen deposition and empirical nitrogen critical loads for ecoregions of the United States
LH Pardo, ME Fenn, CL Goodale, LH Geiser… - Ecological …, 2011 - Eco Soc America
Human activity in the last century has led to a significant increase in nitrogen (N) emissions and atmospheric deposition. This N deposition has reached a level that has caused or is likely to cause alterations to the structure and function of many ecosystems across the ...
Cited by 55 Related articles All 22 versions Cite Save
Dry deposition of ammonia gas drives species change faster than wet deposition of ammonium ions: evidence from a long-term field manipulation
LJ Sheppard, ID Leith, T Mizunuma… - Global Change …, 2011 - Wiley Online Library
Abstract Although the effects of atmospheric nitrogen deposition on species composition are relatively well known, the roles of the different forms of nitrogen, in particular gaseous ammonia (NH 3), have not been tested in the field. Since 2002, we have manipulated the ...
Cited by 25 Related articles All 4 versions Cite Save
Nitrogen concentrations in mosses indicate the spatial distribution of atmospheric nitrogen deposition in Europe
H Harmens, DA Norris, DM Cooper, G Mills… - Environmental …, 2011 - Elsevier
In 2005/6, nearly 3000 moss samples from (semi-) natural location across 16 European

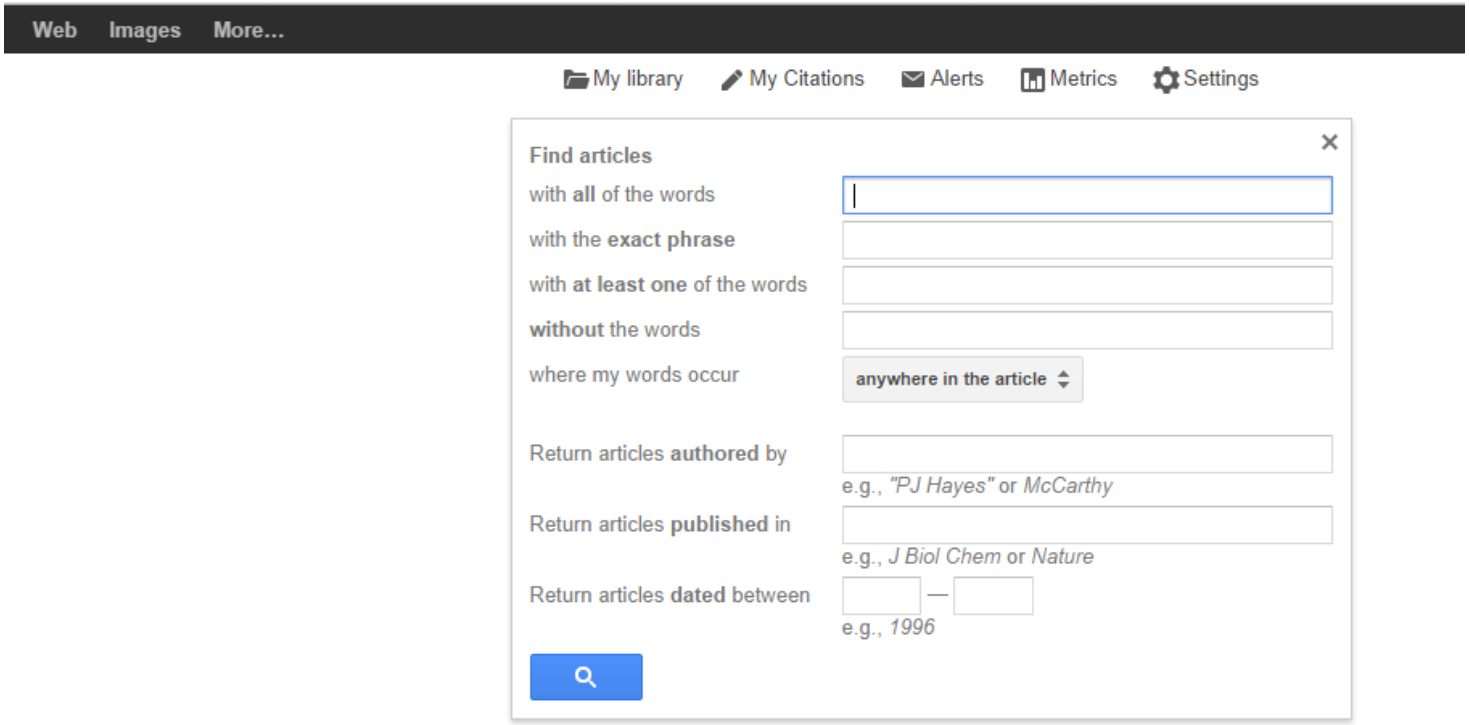
Google Scholar has two different methods for “advanced search”

- Use a button next to the search field
- Use the same search operators as in Google. Example
  - **”air pollution” (guide OR guidance) site:uk**

- **The two methods are not identical – it is most flexible to use search operators**

Advanced search button in Google Scholar




Web
Images
More...
My library
My Citations
Alerts
Metrics
Settings
Find articles
with all of the words
with the exact phrase
with at least one of the words
without the words
where my words occur
anywhere in the article
Return articles authored by
e.g., "PJ Hayes" or McCarthy
Return articles published in
e.g., J Biol Chem or Nature
Return articles dated between
e.g., 1996

Tools focused on air pollution modelling

Numerous tools exist. We will hear about some during the coming days.

- Openair
- DELTA Tool

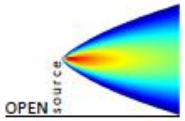
Openair: www.openair-project.org

- A collection of open-source tools for the analysis of air pollution data.
- Written in ”R” programming language.
- It has a command line interface.

The openair manual

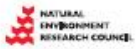
open-source tools for analysing air pollution data

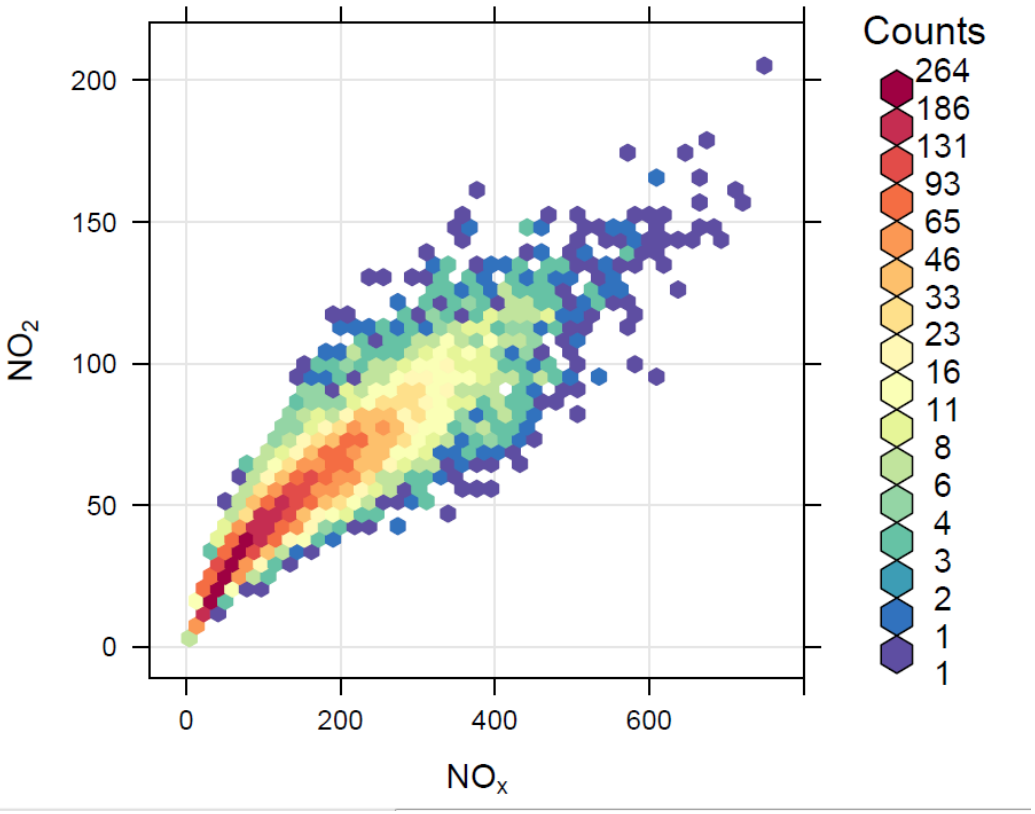
King's College London



David Carslaw

version: 19th September 2012




Counts
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131
93
65
46
33
23
16
11
8
6
4
3
2
1
1
200
150
100
50
0
NO_2
0
200
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600
NO_x

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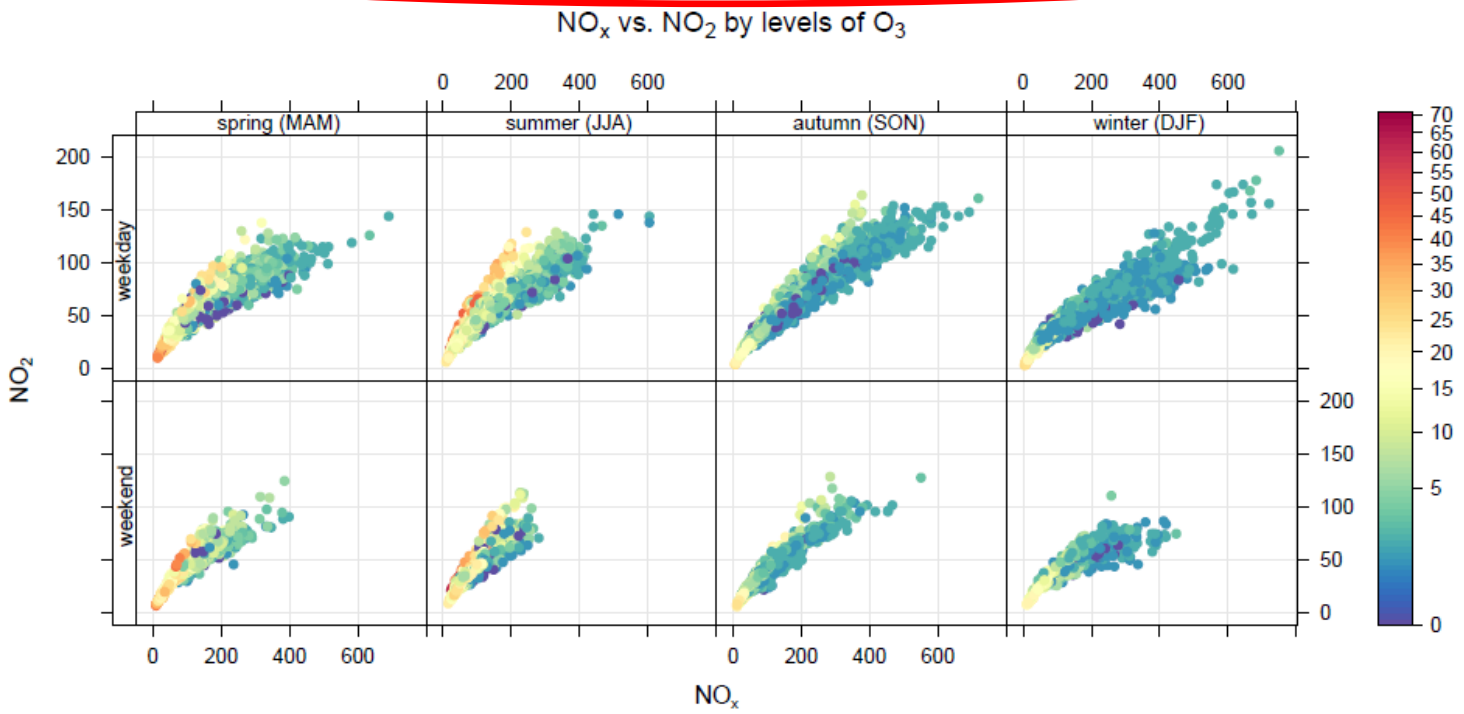
```



Exploratory data analysis

The capability to perform exploratory data analysis is very central when you work with modelling.

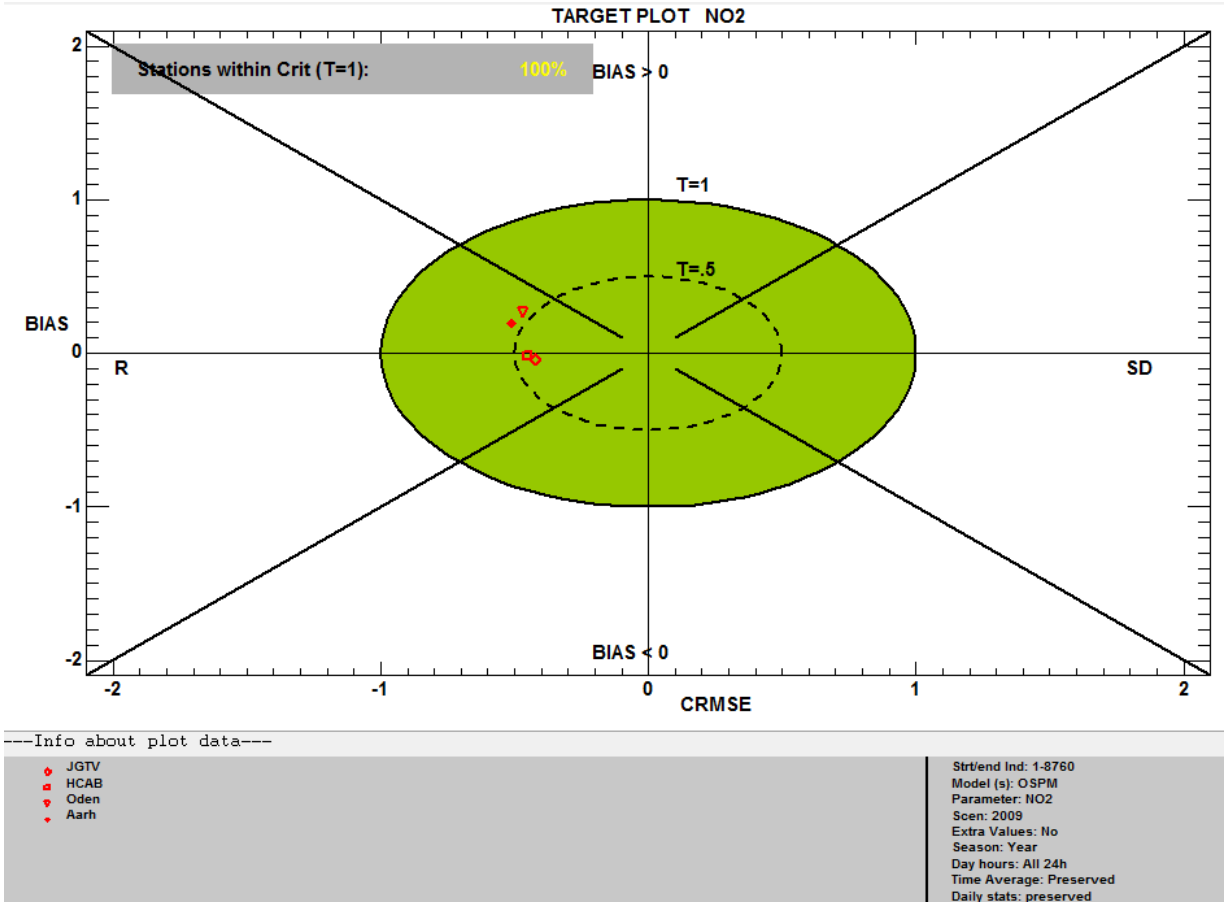
”Look at your data. They wish to tell you something!”

Ruwim Berkowicz :

The Delta Tool (authored by JRC)

- The Delta Tool provides a common frame of reference for evaluating model performance.
- Used in the context of FAIRMODE.
- The Delta Tool is a set of software. The user prepares
  - Data for one year of observations for a number of stations.
  - Model results at the corresponding locations.
- The Delta Tool can visualize model performance, notably through the ”Target plot”.
- It is possible to make some exploratory analyses within the system.

The Delta Tool: Target plot

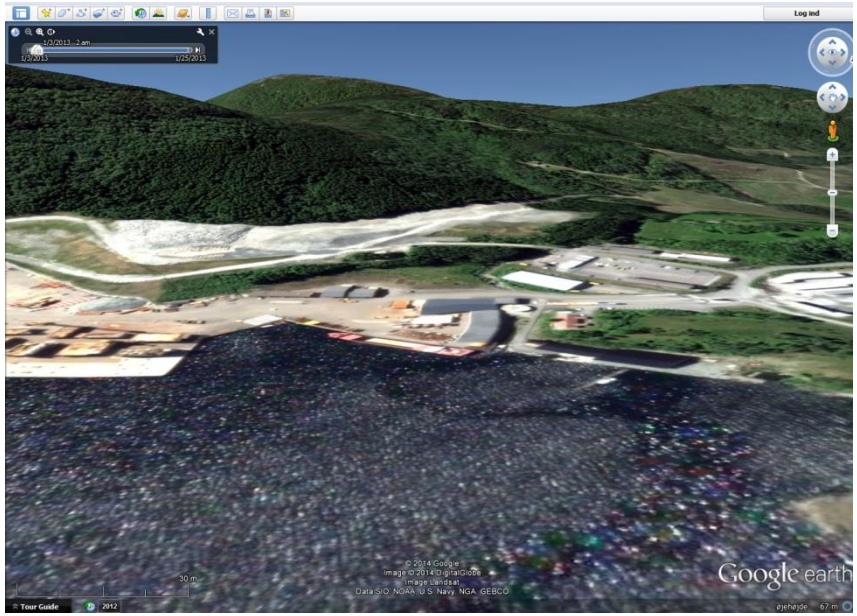


General tools – a few hints

- Google Earth
- AutoHotKey

Google Earth

- Excellent tool to get an impression of on-site conditions for a specific location.
- Invest half an hour of your time to become familiar with the various tools for navigating etc..

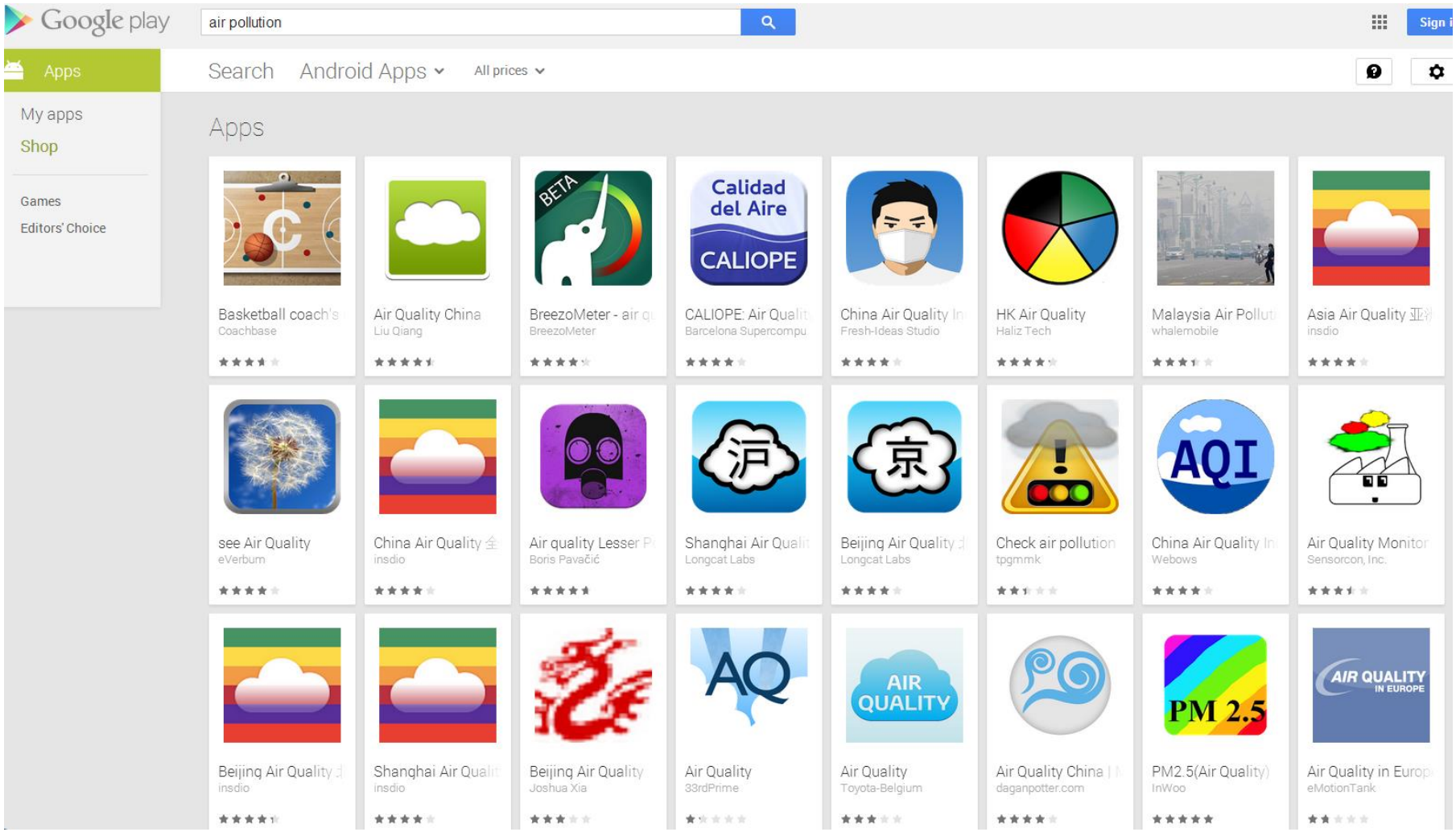


AutoHotKey: Automation utility

- AutoHotkey (AHK) is a free, open-source macro-creation and automation software for Windows that allows users to automate repetitive tasks.
- Expands abbreviations
- Defines hotkeys
- Can be use to create macros that can do almost anything in Windows. Has scripting language.
- **http://ahkscript.org/**

Apps for mobile devices

- Around 50 apps on ”air pollution”.
- They are mostly focused on measured local air quality, sometimes forecasts.


Google play
air pollution
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Shop
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Editors' Choice
Apps
Basketball coach's
Coachbase
Air Quality China
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Fresh-Ideas Studio
HK Air Quality
Haliz Tech
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China Air Quality 全
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Air quality Lesser P
Boris Pavačić
Shanghai Air Qualit
Longcat Labs
Beijing Air Quality
Longcat Labs
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tpgmmk
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Sensorcon, Inc.
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Joshua Xia
Air Quality
33rdPrime
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Toyota-Belgium
Air Quality China
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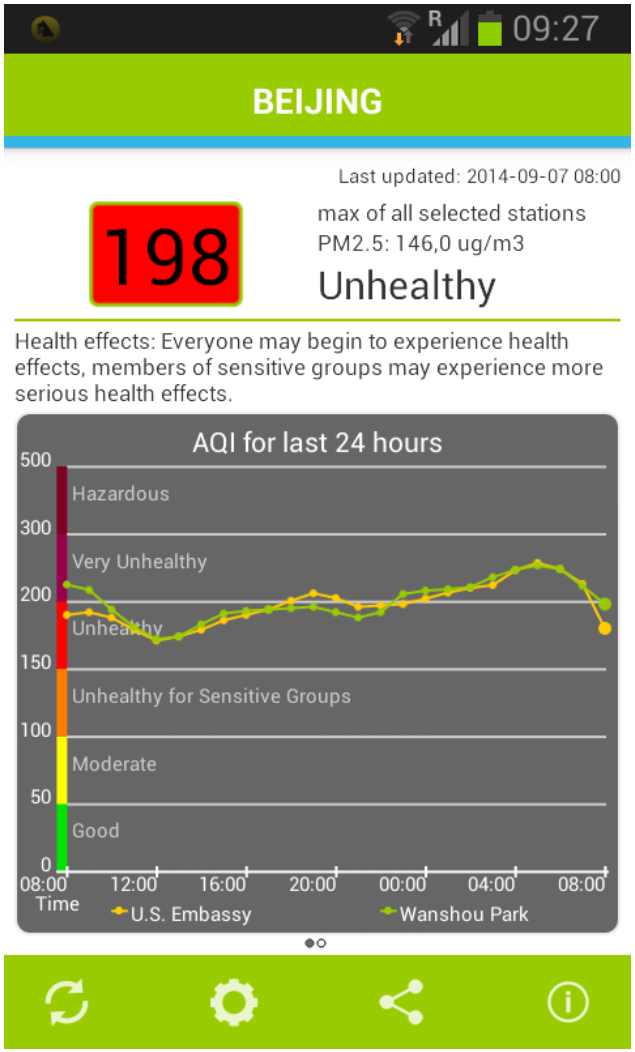
PM2.5(Air Quality)
InWoo
Air Quality in Europ
eMotionTank


09:27
BEIJING
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198
max of all selected stations
PM2.5: 146,0 ug/m3
Unhealthy
Health effects: Everyone may begin to experience health effects, members of sensitive groups may experience more serious health effects.
AQI for last 24 hours
500
300
200
150
100
50
0
Hazardous
Very Unhealthy
Unhealthy
Unhealthy for Sensitive Groups
Moderate
Good
08:00
12:00
16:00
20:00
00:00
04:00
08:00
Time
U.S. Embassy
Wanshou Park

Newsletters and mailing lists

- Newsletters and mailing lists are plentiful.
- Many of you will benefit from subscription to an EEA newsletter with notifications on new reports and products.

About social networks

- Social networks have the potential to become very time-consuming.
- Take a decision about your priorities if you engage in social networks.

LinkedIn – reasons to care about it

- If somebody performs a Google search for your name, then a profile in LinkedIn is likely to be among the top ranking results.
- There are interest groups such as
  - Air Quality Dispersion Modeling
  - Air Quality & Emission Testing Network

Air Quality Dispersion Modeling

Search for people, jobs, companies, and more... Advanced

Is AERMOD still appropriate for a site located about 4 km away from the shoreline?

Xinlian (Sheila) Chang, Ph.D., P.E.
Environmental Engineer at WorleyParsons
Top Contributor

In this situation, CalPuff is probably more appropriate. But I am wondering if AERMOD is still suitable for modeling the site. The distance between the site and the neareast shoreline is 4 km.

Like (1) • Comment (8) • Follow • 11 days ago

Ashraf Ramadan-PhD BEng PMP EurIng CEng MIMechE likes this

See all 8 comments

Hans Erbrink I agree with Boris; we have been answering this very same question by implementing a TIBL module into our advanced model STACKS (with ...
10 days ago

Igor Baptista de Araújo I agree with Boris and Hans! Sheila, as TIBL grows with distance inland, it will be high and your site it will below TIBL, ...
2 days ago

Xinlian (Sheila) Chang, Ph.D., P.E. I appreciate everyone's comments.
1 day ago

Add a Comment...

Is there any method/software, which can convert upper air data (.xls) file to TD-6201 format file required by AERMET (AERMOD)?.

Sunil Gulia
Senior Project Scientist at IIT Delhi

Like (3) • Comment (18) • Follow • May 4, 2012

Sergio Ibarra Espinosa, Alba Luz Gutiérrez and 1 other like this

See all 18 comments

dispersion modeling using models such as AERMOD, , ISCST3, CALPUFF, HYSPLIT, SCIPUFF, CAL3QHC, CALINE3/4, CMAX, SLAB, DEGADIS, and INPUFF. Feel free to contribute your experiences using these or any...
22h ago

See all activity

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LinkedIn Corp. © 2014

Air Quality & Emission Testing Network

SO2 and NOx Monitoring Equipment

David Bradley
Ambient Air Quality Project Manager

I am looking for a portable solution for monitoring SO2 and NOx for periods of up to 48 hours. Ideally will be Lamp post mounted or tripod mounted. Complete with data logging facility. Any products or solutions would be greatly received.

Like • Comment (6) • Follow • 29 days ago

See all 6 comments

Bruce Rising Are you looking at a source, or ambient air? If you are looking at a source, you could just monitor the fuel consumption and sulfur ...
24 days ago

Brian Cochran If you're talking about ambient air monitoring and don't need continuous or short-term (e.g., hourly) measurement data then Ogawa passive ...
23 days ago

Waseem Ijaz You can go for Ametek Lancom analyzer. It is easy to use and very simple analyzer.
18 days ago

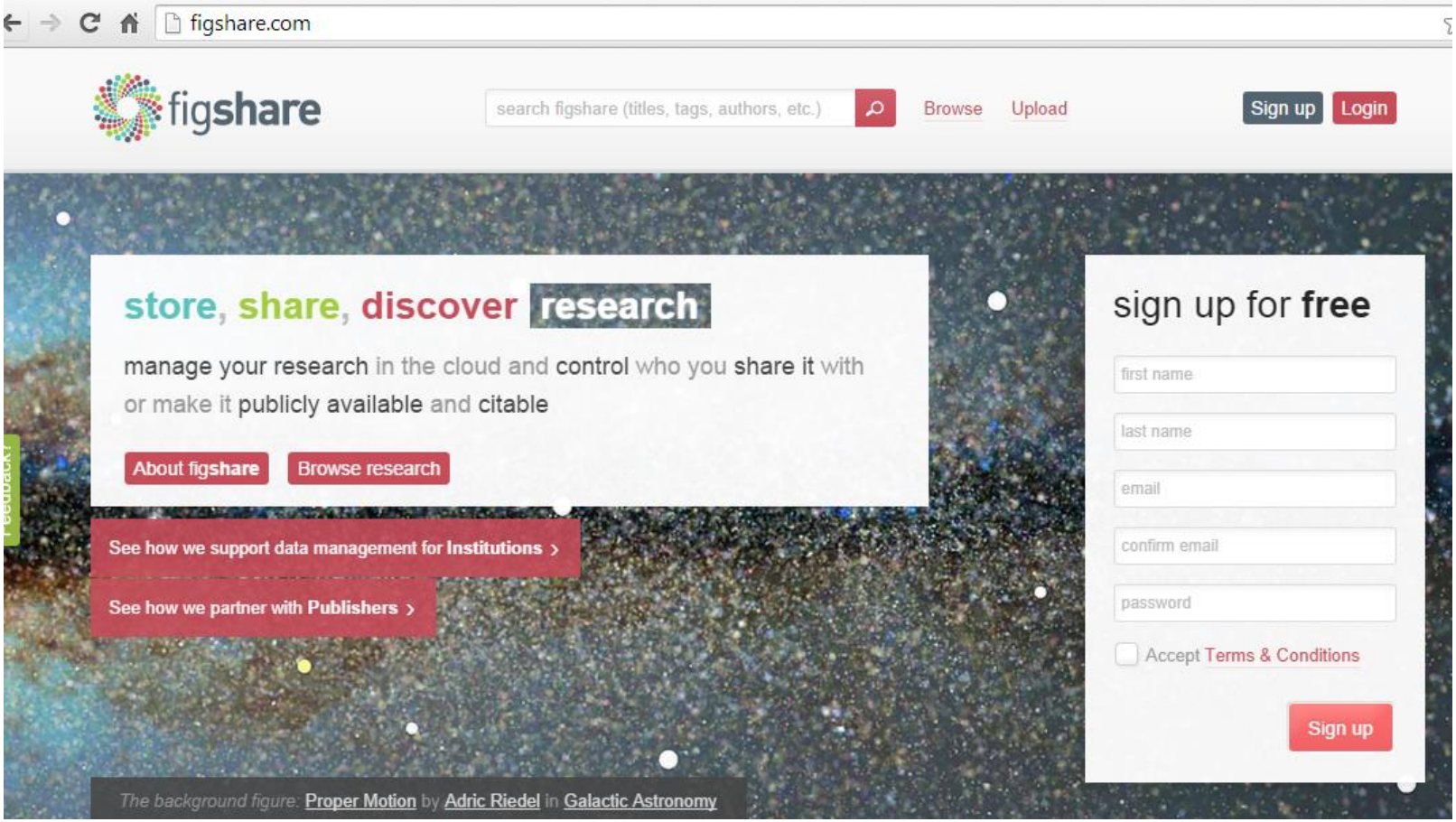
Add a Comment...

ResearchGate.net - somewhat controversial

- Social networking site for scientists and researchers to share papers, ask and answer questions, and find collaborators.
- Has a tendency to force you into more activity than you might feel appropriate.
- Controversial because of aggressive mailing policy tending to spam.
- Receives critique because it encourages you to upload papers, whereby you can easlly violate copyright.
- On the positive side: Makes papers available.
- If you join it: Check your settings on Notification and Privacy in order to avoid to much e-mail.

Figshare (figshare.com, established 2011)

- “Online digital repository where researchers can preserve and share their research outputs, including figures, datasets, images, and video.”
- It is free to upload content and free to access it.
- Typically, Figshare will be used as a supplement to traditional publishing.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The background figure: Proper Motion by Adric Riedel in Galactic Astronomy

Summary

- Wikipedia is under-used by the modelling community. With a tiny effort you can make some of your work much more visible by contributing to Wikipedia.
- A lot of the answers you seek in your work can be found on the web. Therefore it is worthwhile to invest some time to become familiar with tools to find information, such as advanced search features in Google and Google Scholar.
- I have given you many small pieces of information. There are a couple of additional hints in my paper. If you feel a need to refresh your memory about what I have said, then consult my extended abstract.

Thank you!