sciecominfo
Nordic-Baltic Forum for Scientific Communication

THE GEOGRAPHY OF SCIENCE – AN EXAMPLE FROM CHALMERS

Stina Johansson

There are numerous possible forms of collaborative research. The first examples that come to my mind are collaboration between and within disciplines, universities and industries, national research collaboration, which involves researchers belonging to the same country and international research collaboration which involves scientists belonging to more than one country. When taking part in a research assessment of the eight Areas of Advance at Chalmers[1], the bibliometricians at Chalmers Library[2] were interested in all of the above forms of research collaboration. We asked ourselves: Who are Chalmers research partners? How international is Chalmers? And how can "the geography of Chalmers" be visualized? In our quest to visualize the collaboration network of Chalmers, we came across a recent study by Olle Persson and Loet Leydesdorff on the "Mapping the Geography of Science" (2010).

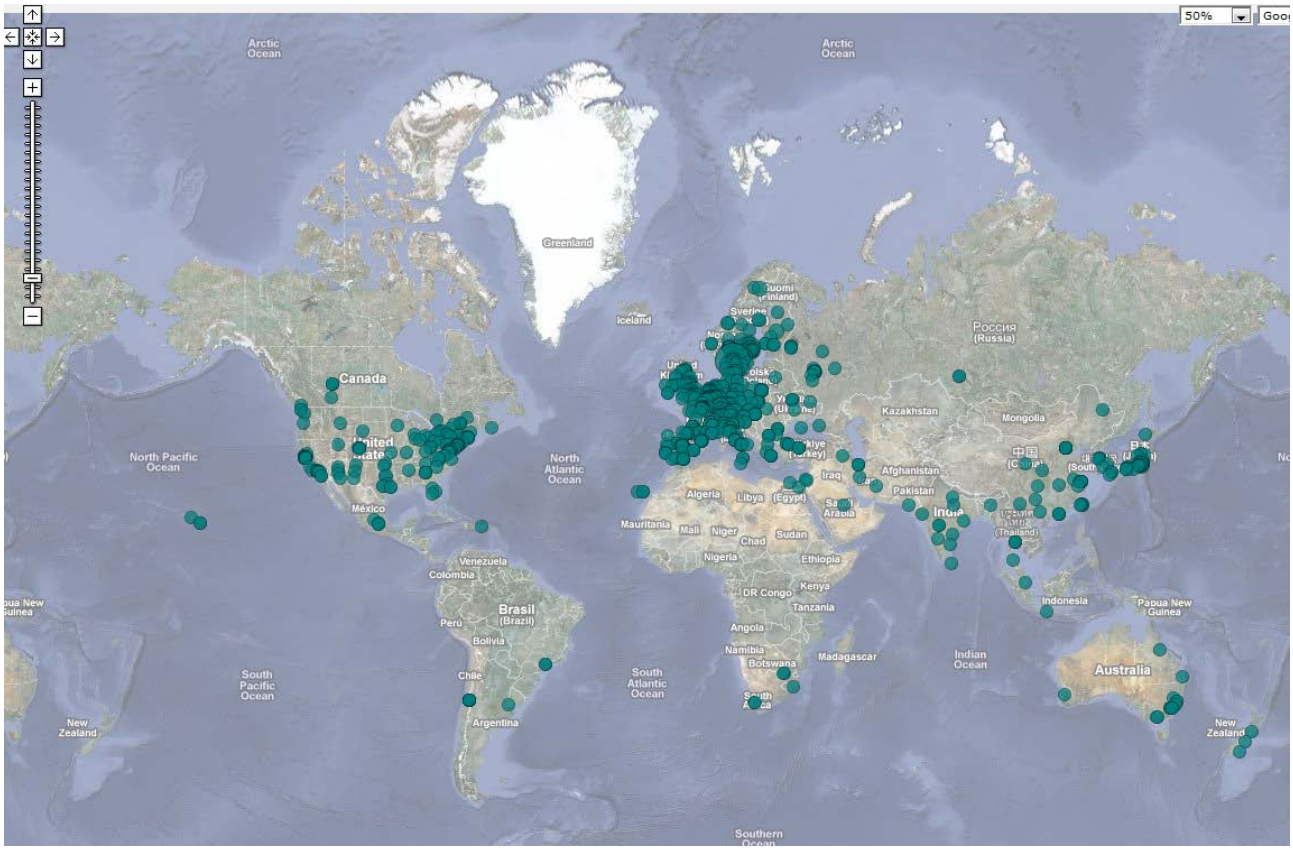
In bibliometrics, research collaboration is studied through co-authorship analysis. One can say that the method used operationalizes the activity studied. From a bibliometrician's way of looking at research collaboration, contributors in research collaboration tend to become authors, and evidence of research collaboration is therefore found in multiply authored papers. (Hicks & Katz, 1996) As early as 1963, Derek J. de Solla Price reported on a steady increase of authors per publication - indicating that collaborative research was growing in depth and size (Price, 1963). Today, research collaboration is often referred to as being the norm of conducting science. Its activities are believed to have several benefits, for instance cross-fertilization of ideas and cost cuts in research infrastructure and training of personnel. These intellectual and cost related benefits are also believed to grow as the distance between the research partners increases. You are more likely to find a better match the greater search radius you allow. (Hoekman et al., 2010) What is more, articles produced through international collaborative projects tend to be cited more frequently, on average, than their national counterparts. (Narin et al., 1991; Hoekman et al., 2010) Over the years, numerous initiatives have been launched to bring different constellations of researchers, disciplines, universities and industries together in larger groups. (Katz & Hicks, 1996) On the European level, there is the European Union's research policy, which encourages formal international linkages among member states, through the program *European Research Area* (ERA). Central to the research policies and activities within ERA are the *Framework Programmes*, which are designed to promote R&D cooperation between the EU member states. Its' main purpose is to improve research collaboration and communication between scholars, researchers, engineers and industries (Hoekman et al., 2010).
To get ideas on how to visualize the geography of Chalmers we turned to recent bibliometrics literature on the subject of mapping. Leydesdorff and Persson (2010) report on newly available methodologies for projecting research collaboration patterns ("the geography of science") on the world map. With Leydesdorff and Persson's thorough manual in hand[3], a map of all of Chalmers articles, reviews, proceeding papers and letters available through Web of Science published in 2011 was produced. The data was collected from Web of Science; the names and the locations of institutions occurring in the address field were then extracted. These were in the next step put into GPS Visualizer[4]'s geocoder (a program on the internet of free use). Through the geocoder, the geographic positions of the institutions (longitude and latitude) were produced. In Excel, the positions produced through the Geocoder were added to the names and frequencies of the institutions. The text string was produced in Excel was again put in GPS visualizer and a map was made. On the map one finds 873 circles, i.e. 873 institutions other than Chalmers are present in the address fields of the selected publications. A circle on the map represents a contribution to one or more of the publications, i.e. if

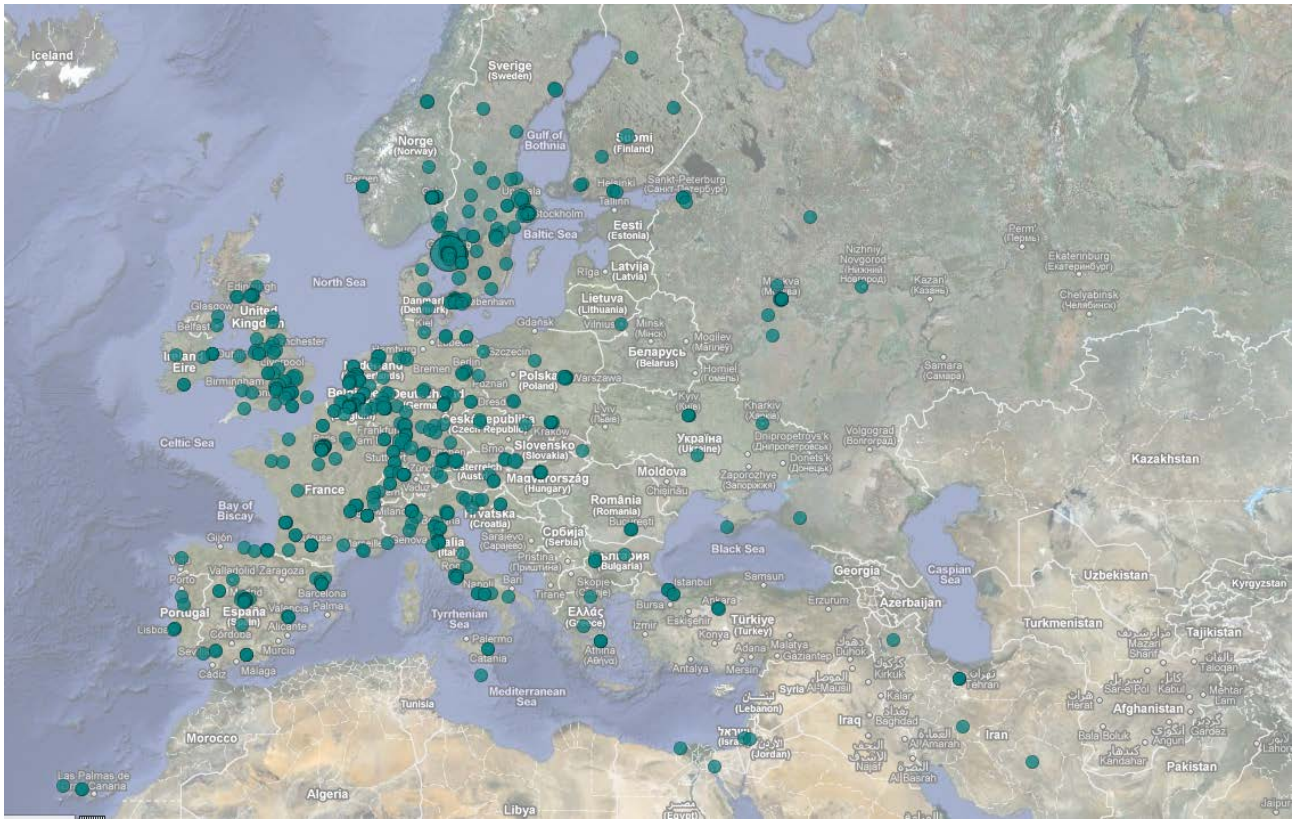
[1] http://www.chalmers.se/en/Research/Pages/default.aspx
[2] http://www.lib.chalmers.se/libraryinfo/

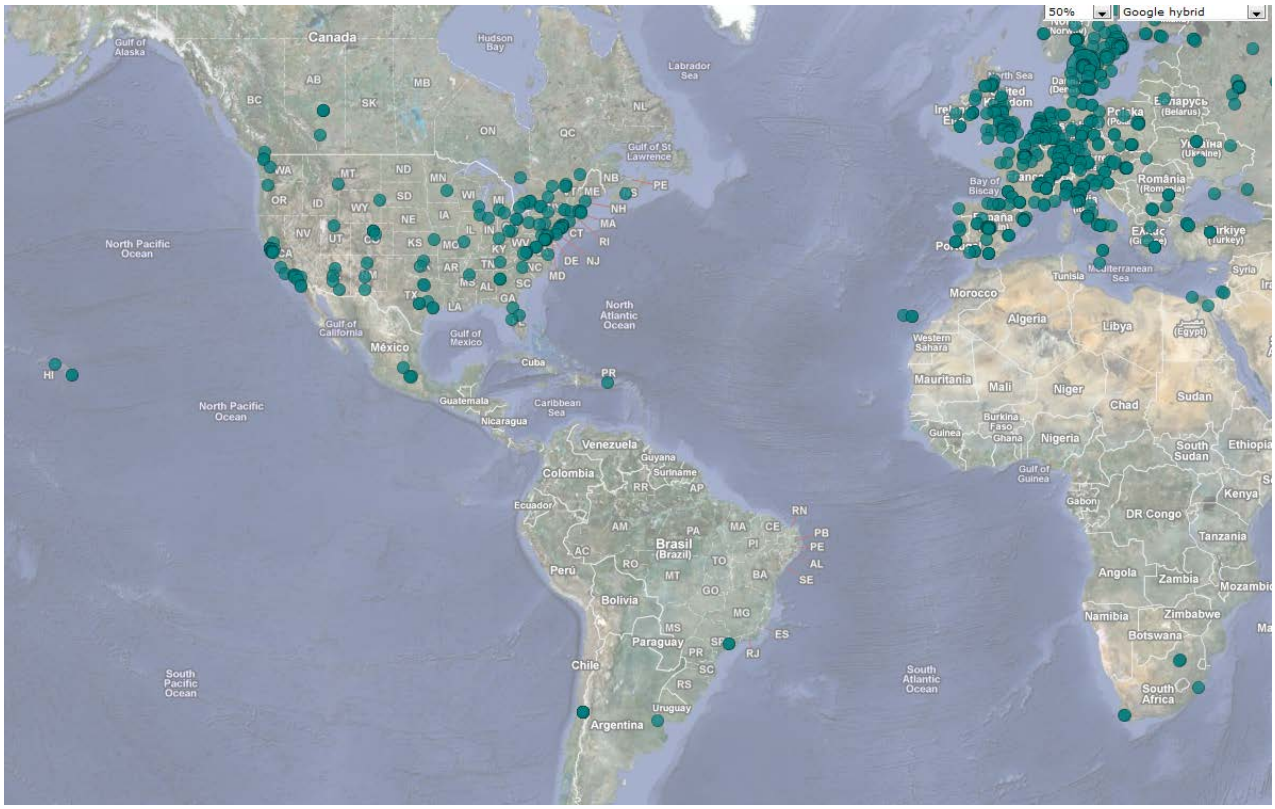
[3] Among other things, the manual also offers instructions on how to integrate Pajek into the geographic mapping.
[4] http://www.gpsvisualizer.com/

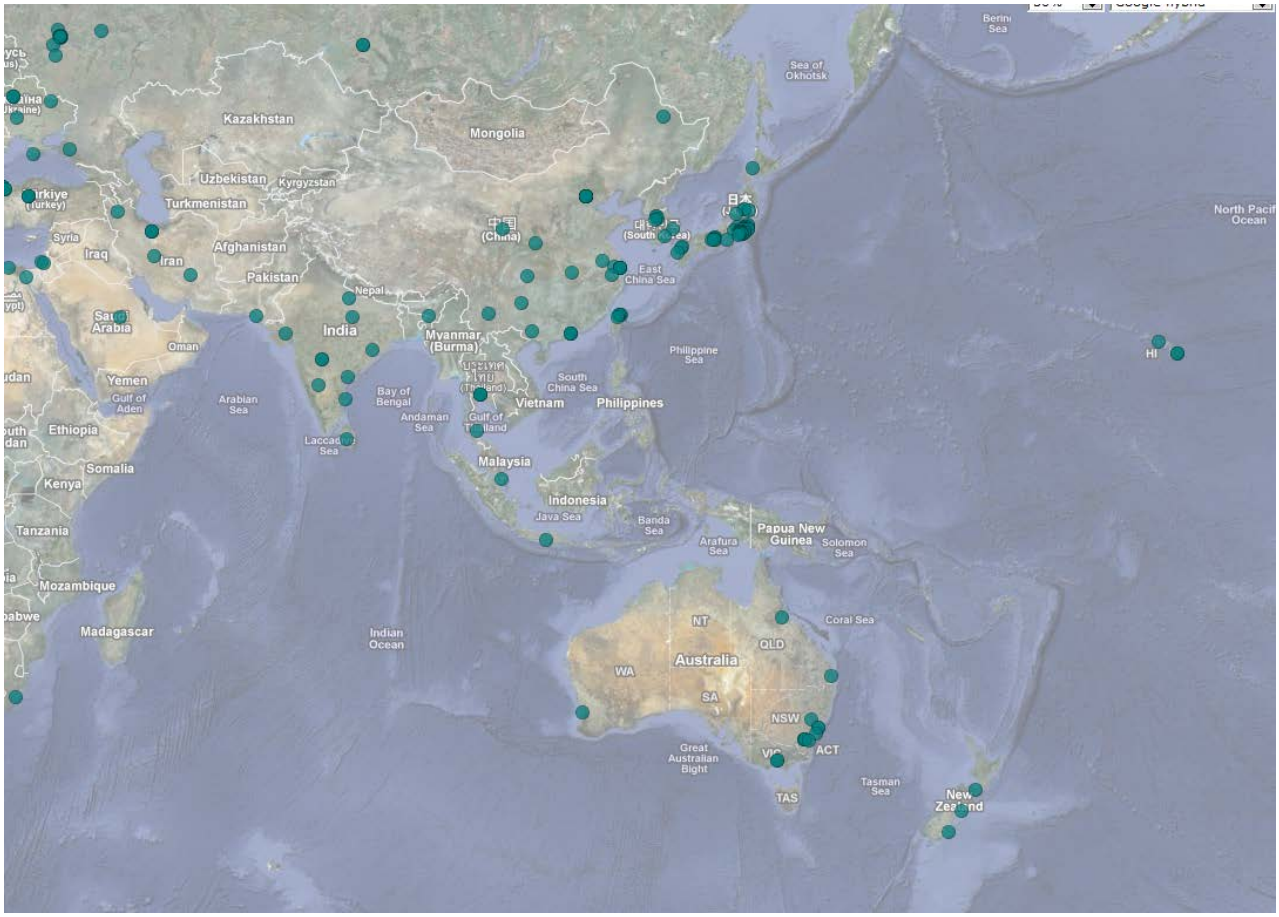
e.g. the University of Gothenburg is present in any of the address fields of the publications mentioned from 2011, you will find a circle representing University of Gothenburg put on the coordinates of the city of Gothenburg. The size of the circle is dependent on frequency. As you may have noticed, the circle representing University of Gothenburg is the biggest circle on the map – University of Gothenburg is also the institution that is most frequently occurring in the address fields of the Chalmers publications published in 2011. When looking at the map, you're also able to zoom in and out. If you are interested in a certain region or country, e.g. Germany, double click where you want to put your focus while zooming in, then on the left hand side of the map, you find a zoom in and out function

As the world map shows us most of Chalmers research partners are situated in Europe. This map also shows us that there is a spread of research partners across all continents. A closer look at the map shows us the names of research partners, ranging from academia to industry. A next step in this small quest could be to "redraw" the map at a later point, and see how and if the geography of Chalmers changes over time. Now we ask: *How will the geography of Chalmers look in a few years' time?*


Arctic Ocean
Greenland
Canada
North Pacific Ocean
North Atlantic Ocean
México
Venezuela
Colombia
Brasil (Brazil)
Peru
Bolivia
Chile
Argentina
South Pacific Ocean
South Atlantic Ocean
New Zealand
Iceland
Россия (Russia)
Kazakhstan
Mongolia
Afghanistan
Pakistan
Iraq
Algeria
Libya
Mauritania
Mali
Niger
Chad
Sudan
Nigeria
Ethiopia
Kenya
DR Congo
Tanzania
Angola
Namibia
Botswana
Madagascar
Indian Ocean
Indonesia
Papua New Guinea
Australia
Southern Ocean


Iceland
Sverige (Sweden)
Norge (Norway)
Gulf of Bothnia
Suomi (Finland)
Eesti (Estonia)
Baltic Sea
Latvija (Latvia)
Lietuva (Lithuania)
North Sea
Беларусь (Belarus)
Polska (Poland)
Celtic Sea
Slovensko (Slovakia)
Magyarország (Hungary)
Moldova
România (Romania)
France
Bay of Biscay
Србија (Serbia)
Black Sea
Georgia
Caspian Sea
Azerbaijan
Türkiye (Turkey)
Portugal
España
Tyrrhenian Sea
Mediterranean Sea
Tunisia
Morocco
Algeria
Libya
Syria
Iraq
Iran
Afghanistan
Pakistan
Kazakhstan
Uzbekistan
Turkmenistan
Kyrgyzstan
Tajikistan


50%
Google hybrid
Canada
Hudson Bay
Labrador Sea
Gulf of Alaska
North Pacific Ocean
México
Gulf of California
Gulf of Mexico
North Atlantic Ocean
Cuba
PR
Guatemala
Nicaragua
Caribbean Sea
Venezuela
Guyana
Suriname
Colombia
Ecuador
Brasil (Brazil)
Perú
Bolivia
Paraguay
Chile
Argentina
Uruguay
South Pacific Ocean
South Atlantic Ocean
Morocco
Algeria
Libya
Tunisia
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Nigeria
Ghana
Guinea
Burkina Faso
Gulf of Guinea
Gabon
DR Congo
Kenya
Tanzania
Angola
Zambia
Namibia
Zimbabwe
Botswana
South Africa
South Sudan
Ethiopia
Mediterranean Sea
Bay of Biscay
România
Syria
HI


Sea of Okhotsk
Kazakhstan
Mongolia
Uzbekistan
Kyrgyzstan
Turkmenistan
Afghanistan
Pakistan
Iran
Iraq
Syria
Nepal
India
Myanmar (Burma)
China
East China Sea
Philippine Sea
South China Sea
Vietnam
Philippines
Malaysia
Indonesia
Java Sea
Banda Sea
Arafura Sea
Papua New Guinea
Solomon Sea
Coral Sea
Australia
NT
QLD
WA
SA
NSW
ACT
VIC
TAS
Great Australian Bight
Tasman Sea
New Zealand
Indian Ocean
Arabian Sea
Bay of Bengal
Andaman Sea
Gulf of Thailand
Laccadive Sea
Gulf of Aden
Oman
Yemen
Saudi Arabia
Ethiopia
Somalia
Kenya
Tanzania
Mozambique
Madagascar
North Pacific Ocean
HI

References

Hicks, Diana; Katz, Sylvan (1996). Science policy for a highly collaborative science system. *Science and Public Policy* vol. 23, no. 1, p 39–44.

Hoekman, Jarno; Frenken, Koen; Tjissen, Robert J.W (2010). Research collaboration at a distance: Changing spatial patterns of scientific collaboration within Europe. *Research Policy* vol. 39, p. 662-673.

Narin, F.; Stevens, K.; Whitlow, E.S. (1991). Scientific cooperation in Europe and the citation of multinationally authored papers. *Scientometrics* vol .21 no.3, p. 313–323.

Persson, Olle; Leydesdorff, Loet (2010). Mapping the Geography of Science: Distribution Patterns and Networks of Relations Among Cities and Institutes. *Journal of the American Society for informations Science and Technology* vol. 61, no.8, p.1622–1634.

Price, J. de Solla (1963). *Little Science, Big Science*, New York: Columbia University Press.

http://www.chalmers.se/en/Research/Pages/default.aspx, 2011-11-30, 09.35

http://www.lib.chalmers.se/libraryinfo/, 2011-11-30, 09.35

http://www.gpsvisualizer.com/, 2011-11-30, 09.40

Stina Johansson is currently working at Chalmers Library, department for publishing services and bibliometrics, Gothenburg, Sweden