

Mapping the Global Structure of Antarctica Researchvis-à-vis Antarctic Treaty System (ATS)

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Introduction

Antarctica is a continent of science and peace- a common heritage of mankind. This fifth largest continent is governed by a set guiding principles- the Antarctica Treaty System (ATS). ATS is the basic instrument for managing the activities in this icy continent. Conducting science is occupying a central place in Antarctic Treaty System (ATS). This icy, coldest and windiest continent is covered with a sheet of ice with more than 2 km. average thickness (4.7 kilometres at its thickest point) provides an ideal setting for conducting science. In this paper we have attempted to visualize the structure of science that is being pursued by the member countries of the Antarctic Treaty System.

Materials Methods

Title search on 'Antarc*' retrieved 10287 papers from SCI database (CD-Rom), published in 934 journals during the last 24 years (1980 through 2003). These papers formed the basis of our analysis. To bring uniformity in country names, Fed Rep Ger and Ger Dem Rep were merged into Germany, while USSR were merged into Russia. Bibexcel algorithm (Persson 2004) was used to derive citations between countries as well as joint authorship papers.

Multidimensional Scaling technique was used to map the collaboration structure among the countries. The size of the circles is proportional to the size of productivity, while lines between the countries indicate collaboration links and widths indicate size of the frequency. Bonacich Power centrality is used to indicate the position of the countries in the network (Bonacich 1987).

Results

The interest about Antarctica is on the rise, as also evident from the increasing number of research articles published in the peer reviewed journals; fishing and tourism in this icy continent is getting popular. There is a distinct upward trend in the number of publications over the years; 1980 saw only 169 papers, while 735 papers were published in

the year 2002. Going in the spirit of ATS, the international papers are also on the rise, signifying increasing number of multinational projects in the field (Fig 2).

The network map of the countries shows a distinct core periphery structure (Fig 3). The Higher centrality values of USA (2.20), UK (1.68), Germany (1.67), France (1.40), Australia (1.28) and Italy (1.0) indicate their interest and commitment in undertaking collaborative projects. Individually also, they are the most productive countries, occupying a central position in Antarctic Science.

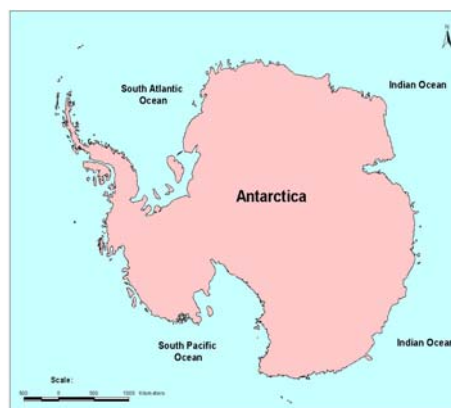


Figure 1. Map of Antarctica, surrounded by South Atlantic Ocean, Indian Ocean, and South Pacific Ocean.

To map the preferences of the countries in citing other countries, a country to country citation matrix was created (Table 1). Interestingly enough, we see that there is no clear cut Matthew effect at work here, since small producers like Norway and Denmark appear among the winners in this citing game by receiving more citations than they give. However, time is at work here, and the winners appear to have been longer in the game.

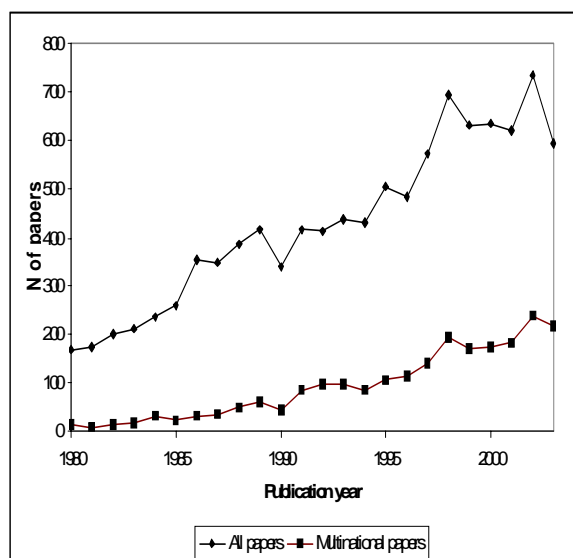


Figure 2. Rising trend of Antarctic research publications and multinational papers.

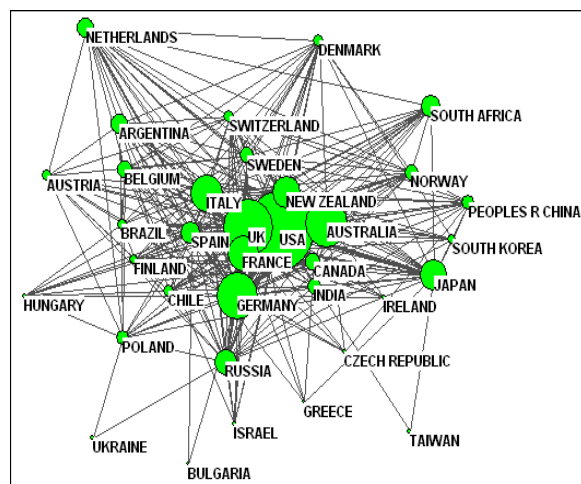


Figure 3. Collaboration map of 35 most productive countries involved in Antarctic research.

Conclusion

The present analysis throws light on the research structure of Antarctic Science that is being practiced by the nations under Antarctic Treaty System (ATS). Bibliometric analysis of Antarctic Science on a regular basis will help to scale the functioning of the ATS, where science is occupying a central place.

Table 1. Citations given to and received from other countries⁴.

Country	Pap-ers	Cita-tions given	Cita-tions recei-ved	Cita-tions gain-ed %	Cita-tions per paper	Mean publi-cation year of papers
USA	3311	7635	10080	32,0	3,0	1993
UK	1738	5183	6590	27,2	3,8	1994
Australia	1259	3367	3782	12,3	3,0	1995
Germany	1191	4165	3485	-16,3	2,9	1995
Italy	734	2724	874	-67,9	1,2	1997
France	701	2115	2209	4,4	3,2	1995
New Zeal.	549	1312	1994	52,0	3,6	1993
Japan	539	1082	1028	-5,0	1,9	1993
Russia	366	642	824	28,4	2,3	1993
Spain	286	1029	313	-69,6	1,1	1999
South Africa	256	778	603	-22,5	2,4	1993
Argentina	224	787	548	-30,4	2,5	1997
Netherlands	206	1199	556	-53,6	2,7	1998
Canada	174	654	775	18,5	4,5	1995
Belgium	157	561	512	-8,7	3,3	1997
Sweden	151	704	463	-34,2	3,1	1997
India	133	233	89	-61,8	0,7	1995
Norway	131	510	703	37,8	5,4	1994
Poland	117	309	270	-12,6	2,3	1992
P. R. China	113	330	86	-73,9	0,8	1997
Denmark	91	324	485	49,7	5,3	1996
Switzerland	89	347	269	-22,5	3,0	1996
Chile	84	262	217	-17,2	2,6	1995
Austria	73	204	294	44,1	4,0	1997
Brazil	64	209	76	-63,6	1,2	1997
Finland	50	218	56	-74,3	1,1	1999

References

- Bonacich, P (1987), Factoring and weighting approaches to status scores and clique identification, *Journal of Mathematical Sociology*, 113-120.
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- Persson, O (2004), *BIBEXCEL, a tool-box for scientometric analysis*, <http://www.umu.se/inforsk/Bibexcel>.

⁴ Citations among the papers. Country self-citations excluded.