#### CMCC WEBINAR April 17, 2018 - h. 12:30 pm CEST

"Mapping innovation: a global outlook of Climate Services"

Francesca Larosa Fondazione CMCC – Centro Euro-Mediterraneo sui Cambiamenti Climatici, Ca' Foscari University of Venice

Antonio Bombelli - Moderator Fondazione CMCC – Centro Euro-Mediterraneo sui Cambiamenti Climatici





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To investigate and model our climate system and its interactions with society to provide reliable, rigorous, and timely scientific results, which will in turn stimulate sustainable growth, protect the **environment**, and develop science driven adaptation and mitigation policies in a changing climate



# **MISSION**

# NETWORK





# RESEARCH DIVISIONS

# TOPICS

Modelling PolicyAdaptation AgricultureSociety PredictionsImpacts Hydrogeology ForestsSimulations OceansEcosystems Computing Services



#### **Publications**



**Events** 







Communication

### **Q&A** session



To participate in the Q&A Session, please use the chat room provided by the Go-to-Webinar system

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# Aim of the work

Mapping the landscape of climate innovation in Europe and beyond, by focusing on research on Climate Services

• Analysis of socio-centric and ego-centric bibliographic networks

1 Bibliometrics

 Assessment of the main characteristics of co-authorship networks' and identification of the poles of innovations in Europe

2 Social Network Analysis

• Identification of the most relevant topics tackled by authors

Content analysis

# **Tackling climate innovation: climate services**



"Timely production, translation and delivery of useful climate data, information and knowledge" (Board on Atmospheric Sciences and Climate, **2001**)



"CSs provide climate information in a way that <u>assists</u> <u>decision making</u> by individuals and organizations. Such services require <u>appropriate engagement</u> along with an effective access mechanism and must respond to user needs (Global Framework for Climate Services, **2009**)



European Commission

"the transformation of climate-related data — together with other relevant information — into <u>customised products</u> such as projections, forecasts, information, trends, economic analysis, assessments (including technology assessment), counselling on best practices, development and evaluation of solutions and any other service in relation to climate that <u>may be of use for the society at large</u>" (European Roadmap for Climate Services, **2015**)

# **Building bibliometric networks**

- Query in Scopus database, cross-checked with Web of Science
- Included documents: peer-reviewed articles, book chapters, books, conference proceedings, press articles and reports;
- 330 records in 173 sources: 95% co-authored; 12% annual growth rate since 1980

#### **Descriptive statistics**

<b>Table 1.</b> Descriptive statistics of the sample	
Articles	330
Sources (Journals, Books, etc.)	173
Keywords Plus (ID)	1480
Author's Keywords (DE)	573
Period	1980-2018
Average citations per article	11.7
Authors	1203
Authors of single authored articles	56
Authors of multi authored articles	1147
Articles per Author	0.27
Authors per Article	3.65
Co-Authors per Articles	4.54
Collaboration Index	4.55

# 60-900 40-1980 1985 1990 1995 2000 2005 2010 2015 Year

#### **Annual scientific production**

# **Building bibliometric networks (cont.)**



Articles

#### Inside the socio-centric co-autorship network

dobler a. Weaver a Balmaseda M. s. Balmaseda M. s. Wilson mauritzen c. mezghani a groot a. dhenain s. benestad r<sub>stuy</sub>t I. bessembinder j. stammer d. le traon p.y. rgen h-o. witter m.p. heimbach p. malone t blom-zandstra g. de bruin k.p.t. de groot-reichwein m.a.m. tinto shafer m. hygen h.-o. schiller a. tintoré j. godfrey s. brown d. church j.a. bindoff n.l. forst e. koekoek a. morste. Koekeek a masselink I. bärring I. trenberth ksmith nzhong a. brown t. heim r. dupar m tseitkin f. bachofen c. héctor i, svoboda m. rippey b. muth m. chesterman's goosen h. nilsson c. nikulin g. wang g. hadwent murph/v. wordellt. champalle c. webb r.s. strandberg g. singh rhissan h. meyers g. hug s. juichiro s. capela lourenço t. Persson g. capela lourenço t. Persson d. I.t. ta. lourenço t.c. dilling I. de perez e.c.van aalst m. coughlan m. jjemba w.e. coughlan m. coughlan m. anderson k. delgado e. crane t.a. reynaldo, ramirez Pgarfin g. cramer I. reynaldo, ramírez pgarfin g. cramer I. dilling I. jiemba w.e. cougr miralles d.g. guhérrez r. robbins k. klein bércin e. arrighi j. bischiniotis k. suarez p. troccoli a<sub>ebinger j</sub> meirink j.t. robbins k. Klein o-torre arright j. bischiniotis k. suarez p. stegehuis a.t. robinson p. wingaard j.b. ward p.j. gordon e.s. stephense, alves o. van heerwaarden c.c. redmond k. shulski m. martez p. jeuling aj. melsen ja timer doseher p. bouget b. franks s.w. boar bramen i.m. ij. stephens e. alves o. hansen j.w. w. aldrian e. sun I. boulahya m.s. nabuurs g.-j. döscherr: pougeti. ling aj. melsen I.a. hilberg s.d. hananei c. bouwer I.m. de areilano j.v-g. mcguirk m. de gaetano a.t. veets a.h. kiellström o stockdele t.n. yun w.t. teuling a.j. stockdale th Yugwit tall a. garanganga biolas-corradi m. peña m. deque m mason s. martinez r. dubus l<sub>o</sub>luritha c gallardo I. van den hurk b.j.j.m. kjellström e. jones L coughian de perez e kumer k, tornoeki o van aalst m.k. dubus l. franchistéguy l vautard r. schneider m. pittams d. ramos m.-h. bate e. nobre p. luo y pahalad j. n a.w. landman w. nobr ding y. kamga a.<sup>coelho</sup> c. li I. moisselin j.m. brown ti peter h. middleham r. in I m dequé m ouzeau g<sub>comerr</sub> san-martin d uzell k. tevlor noël t<sup>lemond</sup> j. ait-cheilouche y graham r.j. braganza k. iones c. geindre s. planton s.som de cerff wde vreede e. m. richards m. dandin p scalle a. p. tourre y.m. kerdoncuff m<sub>r</sub>unge t<sub>lawrence e stanley s.</sub> schweitzer m. fuchst kahana r. plummer n. srinivasan g. kim jjones d. wilding j. conrad e. céron j.-p. cardoso r.m. scott j falloon j douldes p. vlachogiannis d area p.m. scott j falloon p. vlachogiannis d area p.m.m. pagé c. havman p vunw.-t. subbiah a r brasseur g.p. watkins a. dettinger m. walland d. wiles p.speer m.s. christodoulides p. torralba v cotiño a.s. fernandez j ituri robinson n.kolli r.k. rafisura k.m. s.e. goddard I. knight jeade r. kanamaru h. hovsepyan a. tang x. dez j iturbide m. casanueva a<sub>terra t</sub>buja l gic hermanson l huebenestad remment d. viet chinder / vangve e huebener h. bojovic d. hanien r.m. culmant s. vega mbedia j. bojovic d. hanien r.m. s. vega mbedia j. fischer a.m. cuccaletti f. gonzalezapvinence . herren eager, andrewsm, terblanched, bouchetv. bakianova. pepler a. dunstone n. herrera s mez j.m. betterretche m. better e jockwood j.t. pope elewis kcapel-timms i grimmond c. olotson k.t. thompson v. carlson d langendiik g. economou t. gonzalez-revilriego II. gutiérrez j.m. https://www.conomou.t. bowyer p. rasmussen r jacob d waten p. doblasterjest dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dolsawer f. dessals. hawiti c. zhur scatte a.a. krave n. watsberg d. dolsawer f. dolsawer f. too to f. dolsawer f. dolsawer f. dolsawer f. dolsawer f. dolsawer f. too to f. dolsawer f. lee b. olofson k.f.g. lindberg f. m, waidhofer c. schulz j. wen c. fang x. bett p. usag a. guik n. hansler a. garcia-serrano j. siuy-l. liu s. hayden m. zeb g. eibner w<sup>k</sup>totava l<sub>liener</sub>t f. rodrigues I.r.l. costa m.m. Waweru s.m. zeb hormson m. hansen j. grillakis m.g. zebiak s. coffey k. lake i. giorgi f. elitien with neukon foundation in the second of the second koutroulis a.g. haselberger c. hewison t. diggle p.j. khon vadillo a. hershey c.l. mejia r. nersney c.i. mejia r. fan borbor-cordova m. anderson v. fan gossellin p. ukawuba i. chong n.jmee c. corral j. faniriantsoa r.

#### Undirect weighted graph:

- Weights: #publications
- 468 authors are connected in the central network
- Analysis on the structure (cohesion) of the network using SNA statistics reveal a loose graph:
  - Density = 0.0069
  - Degree centrality (av.): 8.56
- Focus on the largest connected sub-network

## Inside the socio-centric co-autorship network



- 25 sub-clusters weighted on the #published records using the Louvain method (Blondel et al., 2008);
- Higher density than full network = 0.026 (>0.0069);
- Analysis of the «popularity» of actors (*degree centrality*) reports Buontempo C. (106), Kumar A. (54).
  Kjellström E. (52) and Doblas-Reyes (41) in top positions, with an average of 12, indicating that many authors are poorly connected;
- 10 cliques (subgraphs 3+ nodes directly connected)

# Moving towards an ego-centric network





Main network. Betweenness centrality



### The ego-centric network



## The country level network



- 63 countries are included in the main network
- English-speaking countries (United States and United Kingdom) are confirmed the top connected (betweenness centrality and degree), followed by Germany, Switzerland, France and Spain
- Findings confirm the positioning previously found in other climate-related studies (Zare et al., 2017; Corbera et al., 2015; Costanza and Kubiszewski, 2012)

## The institutional level: degree vs betweenness



Institutions	betweenness
Columbia University	0.1818
Met Office	0.0924
Bureau of Meteorology AUS	0.0755
University of Liverpool	0.0569
University of Oxford	0.0410
ECMWF	0.0290
Juniversity of Tasmania	0.0257
University of Reading	0.0239
Desert Research Institute	0.0157
Victoria University of Wellington	0.0121
University of New South Wales	0.0121
University of Exeter	0.0099
National Center for Atmospheric Research	0.0090
Climate Service Center (GERICS)	0.0073
University of Leeds	0.0072
University of Cape Town	0.0036
SMHI	0.0013
University of Maryland	0.0
University of Arizona	0.0
RMIT University of Melbourne	0.0
Red Crescent Climate Center	0.0

### **Inside the content: content analysis**



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### **Inside the content: abstract analysis**



### Inside the content: abstract cluster analysis

crop soil mortality demand accuracy relative humidity surface emission forest temperature <sup>malaria</sup> atmosphere duration meteorological service investment precipitation mitigation variability farmer time series evidence strategy commitment probability value global warming policy model flooding significant skill decade public health year benefit forecast skill agriculture meteorology data partnership seasonal prediction ensemble evaluation scale predictability adoption assessment science disaster forecasting drought seasonal forecasting user energy uncertainty project challenge adaptation enso weather government water resource data provider climate science climate projection opportunity tourism end user integration barrier climate information user need climate risk credibility climate risk management uptake local government

# Identifying the poles of innovation in Europe

- Collection of data from CORDIS and ERA4CS database: 35 research projects (Horizon2020 and ERA4CS 2016-2017)
- Analysis of competitiveness between NUTS2 regions, and SNA between coordinating entities, key partners and countries





## **Discussion and conclusions**



#### eigencentrality

- 0,021611 0,181543
- 0,181544 0,315387
- 0,315388 0,436561
- 0,436562 0,630866



- Interest in CSs has significantly increased (+12%) since 1980: multiple actors and disciplines are feeding a vibrant world
- A small sample of individual scholars presents high betweenness centrality, driving the information flows
- English-speaking and Western continental EU countries are dominant in shaping research on CSs
- The dynamic content analysis of abstract reveals CSs are progressively shifting the attention towards adaptation-focused and user-centered perspectives
- Analysis from projects at EU level demonstrates a clear North-West vs South-East climate knowledge divide in EU, with a small cluster of organisations dominating the knowledge flow
- There is a moderate link between innovation&competitiveness environment and intensity of climate innovation (#projects secured)



### **Reactions and feedbacks mostly welcome!**

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### **Q&A** session



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# **Forthcoming CMCC Webinar**

"Water management: innovative ways to assess precipitation spatial distribution"

**Presenter**: Paola Marson CMCC, «Ocean Predictions and Applications» Division

> 29 May 2018 12:30 pm CEST



Thank you for attending this CMCC webinar.

This webinar was recorded and will be uploaded to the CMCC website: www.cmcc.it

If you have any further question about the webinar, please email: webinar@cmcc.it

