1   **News Media Coverage of Conflict and Cooperation Dynamics of Water Events in the**

2   **Lancang-Mekong River Basin**

3   Jing Wei[1], Yongping Wei[2], Fuqiang Tian[1*], Natalie Nott[2], Claire de Witt[2], Liying Guo[1], You Lu[1]

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5   [1]Department of Hydraulic Engineering, State Key Laboratory of Hydroscience and Engineering,

6   Tsinghua University, Beijing 100084, China

7   [2] School of Earth and Environmental Sciences, University of Queensland, St. Lucia, QLD 4072,

8   Australia

9

10   Correspondence to:

11   Fuqiang Tian, tianfq@mail.tsinghua.edu.cn

14   **Abstract**

15   Riparian countries have their respective values and priorities for water management, and

16   their values of shared water often has possible impacts for their propensity to involve in

17   cooperative management and adhere to treaties/agreements. However, there are limited

18   understanding of the changing values and interests of each riparian country. This paper

19   aims to analyse the evolution of conflict and cooperation dynamics in Lancang-Mekong

20   River Basin the perspectives of multiple countries. Newspaper articles were used as the

21   key data source as it provides insights into events reported on by the media that are

22   representative of each country/sector they are published within. The results depict a trend

23   of cooperative sentiments towards water events occurring within the region. The six

24   riparian countries (China, Myanmar, Laos, Thailand, Cambodia, Vietnam) have had a

25   greater average sentiment score (0.5) for cooperation than international countries (0.16) for

26   the majority of the study period. The trend also shows that countries further downstream

27   showed lower cooperative sentiments except for Vietnam (China 0.86, Myanmar 0.58,

28   Laos 0.46, Thailand 0.34, Cambodia 0.13, Vietnam 0.91). Dam infrastructure was often

29   negatively reported (60% of negatively reported articles), thus, it is likely a major

30   contributor to conflict for the Lancang-Mekong River Basin, while events that are

31   positively reported are those that aid in connecting leaders and project developers between

32   riparian countries including meetings, bilateral and multilateral cooperation and

33   development projects. These findings provide the basis for further revealing the mechanism

34   of cooperation and conflicts among riparian countries in order to more proactively manage

35   cooperation/conflict in transboundary rivers.

36   Keywords: transboundary river management, conflict and cooperation, Lancang-Mekong

37   river basin, newspaper, sentiment analysis, societal value, big data

38   **1.   Introduction**

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39   Globally there are 310 transboundary rivers that flow across more than 47% of the world's land

40   surface (McCracken and Wolf, 2019), providing approximately 60% of the global river flow

41   (Wolf et al., 2005). Transboundary rivers flow across political boundaries with spatial and

42   temporal variance, often resulting in very different views on how the transboundary water should

43   be used, and how it should be managed among its riparian countries (Sunchindah, 2013). Tensions

44   and uncertainties often occur when sharing this consumable, indispensable resource and

45   compounded by the dynamic interaction of hydrological, technical and social systems (Zeitoun

46   and Mirumachi, 2008). Transboundary rivers are therefore characterized for evolving cooperation

47   and conflict dynamics (Wolf et al., 1999; Petersen‐Perlman and Wolf, 2015; Yoffe et al., 2003;

48   Zeitoun and Mirumachi, 2008).

49   Understanding transboundary waters through the lens of conflict and cooperation has been a

50   dominant approach embraced by many scholars in different disciplines (Wolf et al., 2003; Yoffe

51   et al., 2003; De Stefano et al., 2010; Zawahri, 2008; Gleick, 1998). As the first and fundamental

52   advance to analyse the tendency for conflict or cooperation along international rivers, some

53   inventories have been built up to provide global snapshot of conflict and cooperation dynamic to

54   recognise future tensions. Often cited is the Transboundary Freshwater Dispute Database (TFDD)

55   developed by Oregon State University (Wolf, 1999) that compiled historical water incidents, both

56   conflictive and cooperative, on a global scale from 1948 to 2008. Based on the data, Basin at Risk

57   Projects (BAR) (Yoffe and Larson 2001) categorised intensities of water incidents, varying

58   between-7 and +7, in order to understand possible social - political threats. Underpinned by the

59   recognition that cooperation and conflict are not a binary construct, as all-or-nothing (Grey and

60   Sadoff, 2002), but rather in co-existence, in their Transboundary Waters Interaction Nexus

61   (TWINS) tool, Zeitoun and Mirumachi (2008) attended to the nexus of water conflict and

62   cooperation underlining the dual nature of interaction.

63   However, current event-based approach is inadequate to recognise the nuance nature of conflict

64   and cooperation instances, i.e., lack of understanding of each riparian country's attitude/value

65   toward the shared river. Simply classifying water events into conflict or cooperation could mask

66   various forms of conflictive or cooperative responses elicited from each riparian country

67   underneath (Watson et al., 2009). Riparian countries have their respective values and priorities

68   for water management (Wolf et al., 2005; Di Baldassarre et al., 2013), and their attitudes toward

69   shared water often has possible impacts for their propensity to involve in cooperative management

70   and adhere to treaties/agreements. Understanding value in the context of transboundary river

71   basins is therefore vital for developing effective management and policies toward cooperation

72   (Bennett and Dearden, 2014; Hartley, 2006; Larson et al., 2009; Turner et al., 2014).

73   Values, arising from the concept of culture along with norms and beliefs, posit as deeply held

74   ideas that influence on water management decisions and outcomes (Caldas et al., 2015;

75   Roobavannan et al., 2018; Wei et al., 2017). Shaping the way people see, perceive and interpret

76   the outer environment (Caldas et al., 2015), value is considered as a mediating variable that

77   connect human with the natural environment. In the context of transboundary rivers, where

78   multiple water users are interconnected (Petersen-Perlman et al., 2017), their different values

79   towards their shared water are often manifested as conflictive or cooperative attitudes toward

80   other competing water users. When further complicated by the interdependent web of

81   hydrological, political, economic, technical, and social processes (Dinar, 2004; Di Baldassarre et

82   al., 2019), that could result in greater cooperation or conflict at basin-scale. Improving

83   transboundary water management therefore firstly requires nuance understanding the changing

84   values and interests of each riparian country, however, it remains under researched. An in-depth

85   analysis that looks into each riparian country's conflictive or cooperative perspectives is key to

86   understand their cooperative or non-cooperative behaviour.

87   Recently, conflict and cooperative dynamics in transboundary rivers have also been considered

88   as a socio-hydrological phenomenon (Di Baldassarre et al., 2019), emerged as a result of the long-

89   term evolution of hydrological, political, economic, technical and social processes settled within

90   the transboundary river system (Di Baldassarre et al., 2019). Socio-hydrological approach, which

91   emphasize the feedback mechanism between human and water system, is thus proposed to unravel

92   how and why different actors came into cooperation. However, challenges exist in how to measure

93   value as the key social element in the socio-hydrological approach for developing the

94   transboundary socio-hydrological models.

95   Therefore, this paper aims to provide a new perspective to understand the conflict and cooperation

96   dynamics by highlighting each country's conflictive or cooperative attitude towards their shared

97   water. Lancang-Mekong River Basin is taken as a case study to investigate how the conflict and

98   cooperation dynamics has changed over time and the main issues associated with the conflictive

99   and cooperative sentiments. This paper can serve as a reference for water managers to

100   collaboratively identify, manage and overcome potential conflict to achieve effective

101   transboundary water management. It can also serve as a reference to measure the value in the

102   socil-hydrological appraoch to contribute to understanding the mechanism that drives the conflict

103   or cooperation choices in the long run.

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105   **2.   Case Study Area - Lancang-Mekong River Basin**

106   The Lancang-Mekong River is one of the largest and longest river systems in South-East Asia. It

107   flows from Tibetan Plateau in China, down 4,880 km through Myanmar/Burma, Lao PDR (Laos),

108   Thailand, Cambodia and exiting into the South China Sea through Vietnam (MRC, 2019b), as

109   seen in Figure 2. The river course that runs within China is named Lancang River, whilst river

110   course flows through downstream is referred as Mekong River. The Lancang-Mekong River is an

111   essential water source that supports the livelihoods for some 65 million people from the six

112   riparian countries in maintaining food security and nutrition (Dugan et al., 2010).

113   The Lancang-Mekong River has experienced a lengthy record of conflictive and cooperative

114   events, see Figure 3. Significant movement towards cooperation over water resources between

115   the riparian countries primarily began in the 1950s when the Mekong Committee was established,

116   consisting of the lower Mekong countries, after the Geneva Convention granted independence to

117   Laos, Cambodia, and Vietnam (Hirsch and Cheong, 1996). This committee ran from 1957 to 1978

118   despite disagreements among the riparian countries in how the decision-making processes were

119   implemented (Yorth, 2014). In 1995, all members of the Mekong River Commission (hereafter,

120   MRC) signed the "Agreement on the Cooperation for the Sustainable Development of the

121   Mekong River Basin" (Hirsch and Cheong, 1996), with China and Myanmar presenting as

122   Dialogue Partners of the MRC throughout discussions (Yorth, 2014). The beginning of the 21st

123   Century has marked China's cooperative commitment for providing 24-hour water level and 12-

124   hour rainfall data as well as entering cooperative regimes with the MRC (Dore, 2003).

125   Meanwhile, construction of large-scale dams in upstream has received mounting criticism, i.e.,

126   the Xayaburi Dam, as the first of the eleven proposed cascade dams on the Lower Mekong began

127   construction in 2010 despite a lack of agreement between all four lower Mekong countries and

128   failure of the regional consultation process. After that, several treaties and plans were signed,

129   including the Lancang-Mekong Water Resources Cooperation Centre in 2017 and the formation

130   of the Lower Mekong Committee (LMC) framework, marking a significant step towards

131   cooperation.

132   One of the most prominent reasons behind the tension between the riparian countries is their

133   competing desires for the use of the water. China in particular has an interest in hydropower

134   projects to generate electricity and also in clearing and expanding waterways to improve

135   navigation for greater trade (Yorth, 2014). Myanmar, with access to part of the Lancang-Mekong

136   River through the share of a border with Laos, has not projected a preferred use of the water

137   vocally but is generally cooperative with China (Yorth, 2014). Laos, similarly to China also has

138   a great interest in hydropower developments and are in a position favourite to alter the

139   downstream flow of the Mekong River (Dugan et al., 2010). Thailand primarily diverts water

140   from the main Lancang-Mekong tributary into its North-eastern areas for irrigation (Nesbitt,

141   2005). Cambodia has a particular interest in preserving water quantity and quality for their

142   fisheries sector to ensure aquatic species abundance (Yorth, 2014). As a result, Cambodia

143   demands that fewer large structures are constructed along the Lancang-Mekong, such as dams

144   and irrigation systems that may affect the sediment flow and water quantity downstream (Yorth,

145   2014). Vietnam has an interest in utilizing the water for agriculture and aquaculture and generally

146   contests upstream dams that will have an effect on its water quantity for irrigation and aquaculture

147   and its flood control abilities (Nesbitt, 2005).

148   **3.   Methods**

149 Newspaper articles provide insights into events reported on by the media that are representative

150 of each country/sector they are published within (Cooper, 2005). Through its noted "agenda-

151 setting" capability, newspaper reflect what is important to the public as well as it shapes the public

152 perception of an issue (Bengston et al., 1999;Hurlimann and Dolnicar, 2012;Neuendorf, 2017).

153 Newspaper has increasingly been recognized as a valid proxy to track societal values or public

154 opinion (Wei et al., 2015;Wei et al., 2017;Quesnel and Ajami, 2017). Thus, utilizing newspaper

155 articles as a key data source allows the analysis of the perceptions of different countries pertaining

156 to water events over time.

157 This paper takes newspapers as data sources to uncover the conflictive and cooperative sentiments

158 and associated topics in news coverage through sentiment analysis and topic analysis. The search

159 did not limit the timeframe but aim to include all that is relevant in discussing conflict/cooperation

160 water events. The step-by-step illustration of how the data is collected and analysed is given in

161 Figure 1. First of all, newspaper articles were collected from a database using pre-defined

162 keywords, which resulted in total of 12,314 articles. All of these articles were then manually read

163 by authors to remove irrelevant and duplicates articles based on pre-determined criteria, which

164 left 3877 articles for final analysis. These articles were classified based on their origin of

165 publication, and the conflictive and cooperative sentiments expressed from these articles were

166 then determined using sentiment analysis, and the main topics associated with

167 conflict/cooperation were analysed using topic analysis. More detailed step-by-step information

168 were illustrated in each section below.

169 **2.1 Data Retrieval**

170 The Lexis-Nexis database was selected to extract newspaper information, which is home to more

171 than 6000 news publications around the world and is among most commonly used news sources

172 in the field of social sciences (Weaver and Bimber, 2008;Racine et al., 2010). Searching scope

173 include both major regional and international English newspapers. Although English is not

174 frequently used in most riparian countries, English newspapers are accessible and regularly reach

175 an international audience, and is therefore considered a reference to the government's foreign

176 policy (Curtin, 2012). News articles in these newspapers reflect national interests and political

177 responses that riparian countries want to deliver to the international public.

178 The search terms are one of the key determinants of the validity of the data to be collected. The

179 search terms used in this study, as seen in Table 1, were adopted from Yoffe and Larson (2001)

180 and refined to enable the results to water events along the Lancang-Mekong river related to

181 conflict and cooperation between riparian countries. Specifically, the search terms requires

182 articles to be included must discuss "Mekong" river basin in one of topics indicated below, such

183 as dam, irrigation, pollution, etc. These articles need to discuss the conflictive or cooperative

184 aspects of the events involving at least one of riparian countries. The above categories can narrow

185 down the search to the desired scope, with the list of unwanted words further screen out irrelevant

186 topics.

187 **2.2 Data Cleaning**

188 Initially, the search generated a total of 12,316 results. To further ensure the accuracy of results,

189 all articles were then manually read and examined for their relevancy to ensure the sentiment

190 analysis to be conducted would be reflective of the perspectives of water events along the

191 Lancang-Mekong. Those articles not relevant were removed from the analysis alongside any

192 duplicate articles and those with missing necessary information including article body and date

193 published. The relevancy of each article was determined using the criteria in Table 2. The final

194 number of articles utilized for the analysis was 3,877.

195 **2.3 Sentiment Analysis and Topic Analysis**

196 Generally, there are two ways of coding available when examining the news content, manual

197 coding and computer-assisted coding. While manual coding could uncover latent content to a

198 larger extent (Wei et al., 2015;Wei et al., 2017), it is more time consuming and less efficient when

199 examining large datasets. Sentiment analysis, a widely used computer-based analysis, was

200 utilized in determining the cooperative or conflictive perspectives towards water events, and how

201 they have changed over time. Sentiment analysis is the process in which thoughts, attitudes and

202   perceptions expressed in a text are identified and classified in a computational way, particularly

203   in order to determine authors' viewpoints and position towards certain issues (positive, negative,

204   or neutral) (Danneman and Heimann, 2014). The sentiment analysis was conducted through the

205   interface of R. The process involved inputting textual data into the program, tokenising the

206   sentences to differentiate each word from one another, and then attaching the tokenised text to a

207   sentiment lexicon to identify the overall sentiment (Danneman and Heimann, 2014). As there is

208   no "conflict and cooperation" lexicon for transboundary rivers available, a general sentiment

209   lexicon AFINN was utilized in this analysis. AFINN contains a total of 2,477 attached word-

210   sentiments, which produces a positive and negative value on a scale from -5 to +5 (Nielsen, 2011).

211   In order to represent the conflictive and cooperative sentiments, the searching scope has limited

212   the articles content to instance of cooperation or conflict that occurs within an international basin

213   involving one or more riparian to that basin. Therefore, the calculated sentiment scores based on

214   AFINN scores ranging from - 5 to + 5 was considered being able to reflect the intensity of conflict

215   and cooperation accordingly.

216   To reflect topics associated with conflict or cooperation in water events, topic analysis - Structural

217   Topic Modelling (STM) (Roberts et al., 2014) was utilized. Structural Topic Modelling (STM)

218   allows frequent words to be extracted from text, identify commonalities between the words,

219   phrases and groups of words to generate a topical prevalence and topic content factor (Roberts et

220   al., 2013). This tool is particularly useful when managing big data sources as the process to

221   identify key topics manually is inefficient and time-consuming, whereas STM has the ability to

222   identify topics automatically. The STM was processed by using the STM package in R (Roberts

223   et al., 2014). The number of topics selected was ten which was decided through an analysis of

224   the topics produced until clear, relevant topics emerged as a result. For example, at five topics,

225   all topics were pertaining to water, resources, and the six riparian countries; however, at ten

226   topics, there were more clear events emerging such as dam infrastructure, agriculture and

227   fisheries. The topics were then manually labelled based on the most frequent words found within

228   each topic as the statistical software cannot extrapolate the overall topic from most frequent

229   words. This topic classification was based on previous literature reviews and the main water-

230   related topics outlined in Wei et. al.'s (2015) study.

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232   **4.   Results**

233   **4.1 Overall News Coverage of Conflict/Cooperation Water Events on**

234   **Lancang-Mekong River Basin**

235   Overall, there was an observed increase in both the number of conflictive and cooperative articles

236   published over time. There has consistently been a greater number of articles with cooperative

237   sentiment than conflictive sentiments since 2002 (Figure 4). This ratio of cooperative to

238   conflictive articles published has remained relatively stable since 2000 with majority of all years

239   having 60% to 70% of all articles being cooperative. There are also multiple peaks and troughs

240   in terms of the proportion of cooperative and conflictive reported articles shown in Figure 4, peaks

241   were reached in year 2004 and 2015, troughs were found in year 2011.

242   **4.2 Topics Associated with Conflict/Cooperation Sentiments**

243   To understand the most concerned topics associated with conflict/cooperation sentiments, topic

244   analysis was conducted with ten topics identified. It was found that nearly one third of all articles

245   were pertaining to dam infrastructure, implying that this is a significant topic that countries have

246   a vested interest in (Figure 5a). Following this there is a large proportion of topics that are

247   associated with the reporting of relationships between countries or their cooperation. i.e. bilateral

248   relations, multilateral relations, joint management and meetings.

249   Figure 5b also depicts the proportion of topics that are frequently associated with conflictive

250   sentiment. Dam infrastructure and hydropower, which operate hand-in-hand, were negatively

251   reported by the media accounting for 60% of the total topics. Whilst another 10% of all negative

252   articles had a focus on meetings, bilateral relations, flooding and fishing/environment. When

253   analysing the major topics that prompt a greater cooperative sentiment towards water events in

254   the media, it is clear that there are five main topics that are focused on: development, meetings,

255 hydropower, bilateral cooperation and multilateral cooperation (Figure 5c). Development,

256 meetings and hydropower all are key topics, accounting for 22.22% of topic relevance to articles.

4.3 Dynamics of Conflictive and Cooperative Sentiments as Perceived within and
beyond the Basin

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259 Conflictive and cooperative sentiment as reflected within and beyond the basin countries was

260 calculated to reveal detailed insights into the evolving perspectives, as seen in Figure 6a. It was

261 observed that from 1991 to 2018 there is an apparent trend in increasing cooperative sentiment

262 scores for both international (beyond the basin) and regional (within the basin) publications

263 (Figure 6a). There has also been decreased variability in the average sentiments over time with a

264 similar sentiment score between 2008 and 2018 approximately. The six riparian countries have

265 had a greater average sentiment for cooperation than international countries for the majority of

266 the time scale showing that the region perceived transboundary water management in the

267 Lancang-Mekong River Basin more positively than global audiences. This figure also highlights

268 some of the key players in transboundary river basin management for the Lancang-Mekong region

269 such as Australia and the United States of America (Figure 6b). Both Australia and the United

270 States of America are development partner of the region and thus positively involved in the water

271 management. Philippines is one of the major publication places for the Asian Development Bank

272 (ADB) which is a key player for funding and international aid and has been frequently mentioned

273 in the publications.

4.3 Dynamics of Conflictive and Cooperative Sentiments as Perceived from Each
Riparian Country

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276 Most importantly, Figure 7 shows the average sentiment scores for each of the riparian countries

277 from 1991 until 2018. The results showed that all riparian countries demonstrated mostly

278 cooperative sentiment relating to water events in Lancang-Mekong River Basin with overall

279 average sentiments scores from each riparian country in order of lowest to highest are Cambodia

280 (0.13), Thailand (0.34), Laos (0.46), Myanmar (0.58), China (0.86) and Vietnam (0.91). Upstream

281 riparian countries, such as China, Laos, and Myanmar, are exhibiting more positive sentiments

282 compared to the downstream countries, Cambodia and Thailand (Figure 7). However, one major

283 outlier is Vietnam, the most downstream country, which exhibits the highest sentiment value

284 among all riparian countries. With the exception of Vietnam's sentiment score, the trend shows

285 that countries further downstream show more conflictive sentiments. China has also consistently

286 expressed very positive sentiments relating to water events in Lancang- Mekong River Basin over

287 time (Figure 8). Upon inspection into the articles from China, predominantly published by Xinhua

288 News, the Lancang-Mekong Cooperation (LMC) is a common occurrence in the text that

289 contributes China's positive outlook on transboundary river basin management in the region.

290 Thailand presents similar results, except for one year, 2011, which shows a negative average

291 sentiment score. Laos' average sentiment scores between 2007 and 2018 were very variable and

292 do not seem to follow any certain trend. Cambodia showed predominantly negative average

293 sentiment scores as fishing issues has been a concerned issue cited in newspaper throughout the

294 study period. Myanmar has minimal data with only 32 articles were found in total, and only one

295 year, 2014, has shown a negative average sentiment score.

296 **5.   Discussion**

297 It is important to understand the change of sentiments toward their shared transboundary water

298 resources to be able to understand their cooperative or non-cooperative behaviour, the factors that

299 encourage and discourage changes toward cooperation or conflict. This paper develops a new

300 perspective to understand the evolution of conflict and cooperation dynamics with in-depth

301 analysis of multiple countries. Key findings of this study are summarised below.

302 The overall sentiment analysis depicts a current trend of cooperative sentiments towards water

303 events occurring within the region. This is in contrary with the previous studies in which the

304 dominant trend in media coverage analysis was the decreasing of cooperative events from 1948

305 to 2008 (De Stefano et al., 2010). This research was able to bridge the gap in the literature and

306 depict the trends that the proportion of cooperative to conflictive articles has not continue to drop

307 but started to rise in favour of cooperative events. The reason behind is that dam construction and

308   infrasctrure development are the key controversial issues as a majority of negative sentiments was

309   associated with these topics, as reflected in topic analysis results (Figure 5b) and worldwide

310   transboundary rivers (De Stefano et al., 2010). Therefore the absence and presence of dam related

311   topics marks the ups and downs of the cooperation trend. Prior to 1990s, extensive headway was

312   made towards cooperative actions with the establishment of the MRC with all lower Mekong

313   countries and the adoption of associated treaties and agreements throughout its duration (Yorth,

314   2014). With an absence of dam proposals and construction prior to the 1990s and hence a

315   significant source of conflict was absent during this time (Yorth, 2014). From 1990s, dam

316   proposals and construction started to be discussed, which attracted concerns associated with

317   infrastructure development along the river including limited sediment flow, lower water quality,

318   the effect on fish species and livelihoods of people who rely on the river. After 2000, Mekong

319   River attracted attention from the international community for its management and development,

320   financial and infrastructure aids started flew in to assist cooperation within the basin. After 2014,

321   new cooperation mechanism was proposed and implemented involving all basin countries.

322   Cooperative sentiments expressed from the newspaper has been generally stable ever since.

323   As stated above, water events that are negatively reported on are associated with dam

324   infrastructure (see Figure 5b) and thus, this is a major contributor to conflict for the Lancang-

325   Mekong River Basin. This could be attributed to a variety of reasons. Historically, for all

326   transboundary river systems, infrastructure and water quantity have been the most contested

327   events occurring in rivers for their ability to alter the current water system and the significant

328   downstream and upstream impacts (De Stefano et al., 2010). Primarily, major concerns over the

329   construction of dams is associated with water quantity and the effects this has on sediment flux

330   changes, water discharge, fisheries and water access for irrigation and agriculture (Yorth, 2014).

331   Throughout the history of all dam proposals and construction in the Lancang-Mekong, it is found

332   that not just the construction and operation of the dam that received a significant amount of

333   negative media attention but also the proposal and planning process. Therefore, to ensure this

334   pattern of conflict over dam infrastructure is minimized in the future, investments need to be made

335   in promoting the duty to notify, conducting proper consultation programs and producing impact

336   assessments available publicly.

337   It was also found that the greatest events that are positively reported on by the media are those

338   that aid in connecting leaders and project developers between riparian countries including

339   meetings, bilateral and multilateral cooperation and development projects. Development is also

340   generally viewed positively in the media due to the potential for desired growth and is promoted

341   by many international NGOs including the ADB. In fact, the ADB aided in the establishment of

342   the Greater Mekong Subregion Economic Cooperation in 1992 to focus on nine priority areas of

343   economic growth along the Lancang-Mekong: transport, telecommunications, energy, tourism,

344   human resources development, environment, agriculture, trade, and investment (Krongkaew,

345   2004). Thus, development is considered a crucial topic and action in providing greater

346   cooperation and collaboration between riparian countries. By allowing this continual interaction

347   and joint projects that facilitate riparian countries considering all interests and impacts on a larger,

348   transboundary river scale, there is great potential for future cooperation to solve the current issues

349   within the Lancang-Mekong Basin.

350   This study also differentiated between international countries and regional countries in how each

351   topic was perceived by the media. It was found that basin countries on average have a higher

352   cooperative sentiment score than international countries in each year from 1991 to 2018. This is

353   likely associated with the topics that are considered 'newsworthy' to be published in a regional

354   area, pertaining to another country. Generally speaking, when countries report on events not

355   occurring within their close proximity and in different countries, they do so to focus on the major

356   and complex issues and relationships that occur across the globe (Lewis, 2010). Hence, foreign

357   news often focuses on significant instances of either great cooperative events such as international

358   freshwater treaties and major strategic alliances, or significantly conflictive events including

359   extensive war and hostile interactions of both physical and verbal nature (De Stefano et al., 2010).

360   Given that 38.3 % of the total number of topics reported on are associated with meetings, bilateral

361   relations, multilateral relations, joint management programs and local water resources as

362   identified in Figure 5a, it is likely that these topics were not as 'newsworthy' or significantly

363   cooperative or conflictive enough to be reported on consistently by international countries. This

364   understanding can allow for greater collaboration in realizing individual concerns of each country

365   and distributing funding and aid accordingly and ultimately create greater collaborative water

366   management schemes.

367   With the exception of Vietnam's sentiment score, the trend shows that countries further

368   downstream showed lower positive sentiments. It was predicted that Vietnam and Cambodia

369   would express negative sentiments, however, these expectations were not met in the study. The

370   reason behind this pattern is that the true perspectives of some riparian countries including

371   Vietnam and Cambodia could not be analysed as not many regional newspapers from those

372   countries were accessible through Lexis-Nexis and as a result hinders the conclusions made. This

373   is also one of the major limitations of this study that only English newspapers published in

374   regional and international countries were included for analysis. For future research it is imperative

375   that a greater variety of newspaper sources covering local languages are utilized through using

376   multiple newspaper databases in order to gain a representative analysis of the perspectives of all

377   riparian countries.

378   **6.   Conclusion**

379   Understanding conflictive or cooperative responses is critical for establishing effective

380   governance and policies for natural resources. This paper examined newspaper coverage in the

381   conflictive and cooperative sentiments dynamics and its associated topics reflected from and

382   beyond the basin countries. Results found that topics associated with dam construction and

383   infrasctrure development, including not only construction and operation but also planning and

384   proposal process, are key controversial issues. Therefore the absence and presence of dam related

385   topics marks the ups and downs of the cooperation trend. Water events occurring in Lancang-

386   Mekong River Basin exhibited more cooperative sentiments during the study period. Riparian

387   countries on average shows cooperative sentiments, whilst international countries tend to be more

388   critical.

389   The future of the Lancang-Mekong is reliant on the riparian countries to collaboratively manage

390   these resources. If the cooperative water events continue to increase and the issues associated

391   with negative events can be collaboratively identified, managed and overcome, there is great

392   potential for the region to achieve effective transboundary water management. As Kofi Annan,

393   Secretary-General of the United Nations argued in 2002, "… the water problems of our world

394   need not be only a cause of tension; they can also be a catalyst for cooperation…If we work

395   together, a secure and sustainable water future can be ours" (Wolf, 2007).

396

397 **Code/Data availability**

398 The data and code used in this study is openly available.

399

400 **Author contribution**

401 Jing Wei, Yongping Wei and Fuqiang Tian designed research framework. Jing Wei,

402 Natalie Nott and Claire de Witt collected data, conducted manual data sorting, and data

403 analysis. Liying Guo and You Lu revised the code for data analysis. Jing Wei,

404 Yongping Wei and Fuqiang Tian prepared the manuscripts with contributions from all

405 co-authors.

406

407 **Competing interests**

408 The authors declare that they have no conflict of interest.

409

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16

415 **Reference**

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560   **List of Figure Captions**

561   Figure 1 Outline of the Data Retrieval Process and Coding for Sentiment Analysis and

562   Structural Topic Modelling

563   Figure 2 The location of the Lancang-Mekong River, the main river pathway and its

564   tributaries across the six riparian countries (MRC, 2019a)

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566   Figure 4 Proportion of Cooperation/Conflict articles published pertaining to water

567   events along the Lancang-Mekong River Basin

568   Figure 5 The proportion of all topics identified as key topics in newspapers from 1991

569   to 2018 (a); The proportion of Topics Identified within all articles published with an

570   overall conflictive sentiment (b); The proportion of Topics Identified within all

571   articleThe proportion of all topics identified as key topics in newspapers from 1991 to

572   2018 (a); The proportion of Topics Identified within all articles published with an

573   overall conflictive sentiment (b); The proportion of Topics Identified within all articles

574   published with an overall cooperative sentiment (c).

575   Figure 6 The Average Sentiment Score of Regional and International Newspapers from

576   1991 to 2018 (a) Conflict and Cooperation Sentiments perceived within and beyond the

577   Basin (b)

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579   between 1991 to 2018

580   Figure 8 Conflict/Cooperative sentiment scores of the riparian countries (Cambodia,

581   China, Laos, Myanmar, Thailand, and Vietnam) from 1991 until 2018

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586   **List of Table Captions**

587   Table 1 The Search Terms Established to Generate Results

588   Table 2 Criteria for inclusion and exclusion of news articles

589

590   Table 1 The Search Terms Established to Generate Results

Lexis Nexis Requirements	Key Word Search
Must Include the words:	Mekong
Includes at least one of the following words related to **water**:	water* or river* or lake* or dam* or stream* or tributar* or diversion* or irrigati* or polluti* or "water quality" or flood* or drought* or channel*
Includes at least one of the following words related to **conflict/cooperation**:	treat* or agree* or negotiat* or resolution* or commission* or secretariat* or "joint management" or "basin management" or "peace accord" or settle* or cooperat* or collaborat* or dispute* or conflict* or disagree* or sanction* or war* or troop* or "letter of protest" or hostil* or "shots fired" or boycott* or protest*
Includes at least one of the following words related to **countries involved**:	Thai* or Cambodia* or China or Chinese or Lao* or Myanmar* or Burm* or "viet nam" or Vietn*
Does not include any of the following words:	sea, ocean, navigation, nuclear, "water cannon", "light water reactor", "mineral water", "hold water", "cold water", "hot water", "water canister", "water tight", "water down", "flood of refugees", oil, drugs

591

Table 2 Criteria for inclusion and exclusion of news articles

Criteria for Including Data	Irrigation using the Lancang-Mekong river as a source
	Conflict over water resources: e.g. proposed development
	Cooperation over water resources: e.g. bilateral/multilateral agreements, MRC, ASEAN
	Species affected by development projects: e.g. pollution, water quantity and quality
	Salt intrusion due to decreased water quantity and flow from upstream: e.g. dams/diversions
	Livelihoods affected by use of water resources: e.g. dams, diversions, dam failures, contamination of water
	Flooding or droughts as a result of water release or containment in dams
	Infrastructure development that can affect water resources/species e.g. proposed bridge development, dams, diversions
Criteria for Excluding Data	Tourism not related to the use of water resources by riparian countries: e.g. cruises, blogs, personal recounts
	War: e.g. history of Vietnam War, awarding of medals
	Economic development not related to water resources in Lancang-Mekong River
	Bridges across the Lancang-Mekong River and not referring to effects on water resources
	Tariffs and trade agreements that have no association with water resources
	Border conflicts not pertaining to water resources: e.g. security, border control, land ownership disputes

593

Step 1 Data Retrieval	Media/Database selection
	Search determinants
	Data retrieval

12,316 Articles

| Step 2: Manual Data Sorting | Manually Remove Duplicates and Articles with Missing Information |
| | Remove Irrelevant Articles Based on Pre-determined Criteria |

3877 Articles for Coding

Step 3: Sentiment Analysis	Step a: Pre-process data through Tokenisation to separate sentences into words and phrases(i.e. also removing stop-words, punctuation and intergers)
	Step b: Join each article to sentiment lexicon to identify words associated with positive and negative sentiments (i.e.cooperation and conflict)
	Step c: Generate a Data Frame with words from each article associated with a sentiment lexicon and their overall sentiment

3877 Articles with Sentiment Score for Each

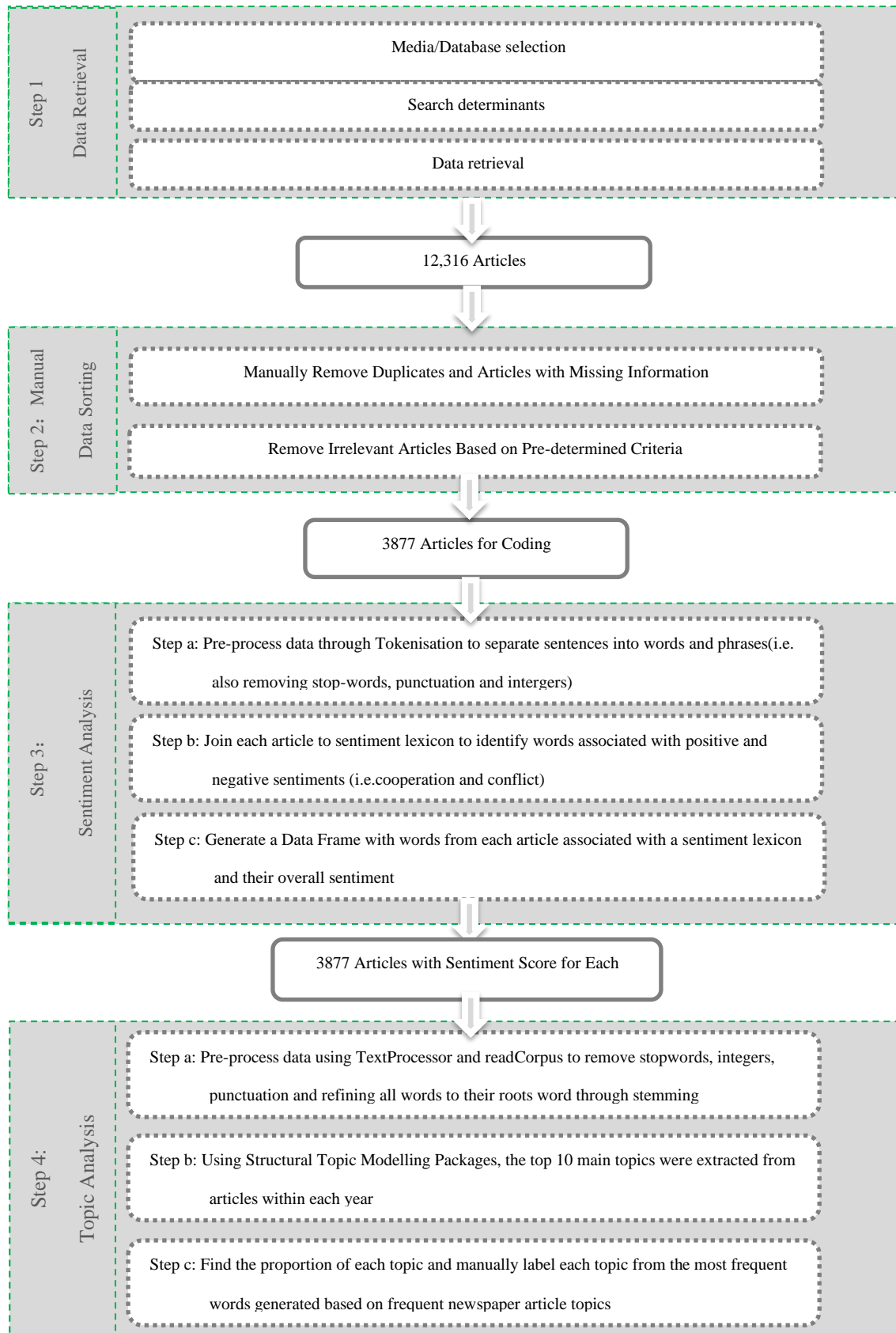| Step 4: Topic Analysis | Step a: Pre-process data using TextProcessor and readCorpus to remove stopwords, integers, punctuation and refining all words to their roots word through stemming |
| | Step b: Using Structural Topic Modelling Packages, the top 10 main topics were extracted from articles within each year |
| | Step c: Find the proportion of each topic and manually label each topic from the most frequent words generated based on frequent newspaper article topics |

594
595   Figure 1 Outline of the Data Retrieval Process and Coding for Sentiment Analysis and

596   Structural Topic Modelling

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600   Figure 2   The location of the Lancang-Mekong River, the main river pathway and its tributaries

601   across the six riparian countries (MRC, 2019a)

28

2005
Agriculture, Irrigation and Forestry
Programme (AIFP) (Phase I)
by MRC

2001-2006
Basin Development Plan (BDP)
Phase I (Laos, Cambodia, Thai, Vietnam)

2006-2010
Basin Development Plan (BDP)
Phase II

2015
Lancang-Mekong Cooperation Center
China, Myanmar, Laos, Cambodia, Thai, Vietnam

1957
Mekong Committee
(Between Cambodia, Laos, Thailand, Vietnam)
founded by United Nations

1977
Interruption of Mekong Committee
Cambodia's absence, lead to Laos, Thailand and
Vietnam form Interim Mekong Committee

1991
Cambodia requested
readmission
Started lengthy discussion

1996
China and Myanmar
becoma dialogue
partners of the MRC

2008
Water Utilization Programme(WUP)
Laos, Cambodia, Thai, Vietnam
Developing 'procedure' for water use that could
be agreed upon by four governments

1950   1960   1970   1980   1990   2000   2010   2020

1954
Geneva Accords
Forming signing

1995
Mekong Agreement

2002
China
Signed an agreement on
provision of hydrological
information on the
Lancang/Mekong River

2010
IWRM-based Basin Management
Strategy
Laos, Cambodia, Thai, Vietnam

1957
Mekong Project
by United Nations Economic Commission for
Asia and the Far East(ECAFE) and United Nations
Developemnt Agency

1995
Mekong River Commisson (MRC)
formed by the Mekong Agreement between
Laos, Cambodia, Thailand and Vietnam, signed
"The agreement on the cooperation for the
sustainable development of Mekong River
Basin

2011
Mekong River Law Enforcement and
Security Cooperation
China, Myanmar, Laos, Thai

2009
Mekong-Japan Cooperation
Japan, Myanmar, Laos, Cambodia,
Thai, Vietnam

2009
Lower Mekong Initiative
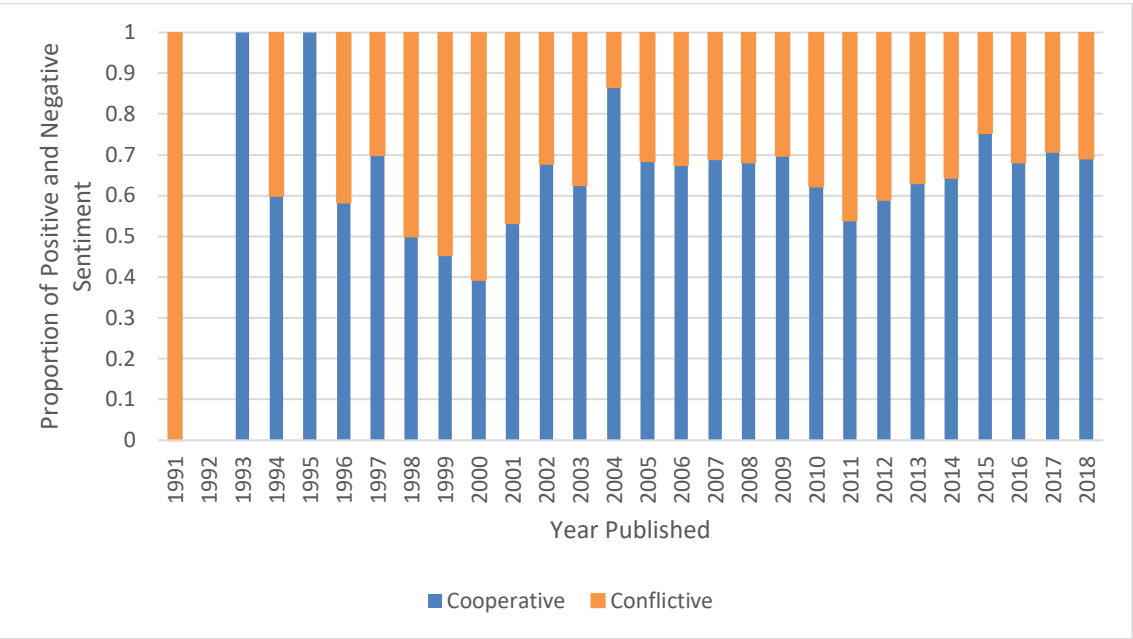USA, Myanmar, Laos, Cambodia,
Thai, Vietnam

60

603   Figure 3 History of Major Events within Lancang-Mekong River Basin (Orange line refers to

604   interruption of Mekong Committee; Green line refers to policy/strategy/committee/commission

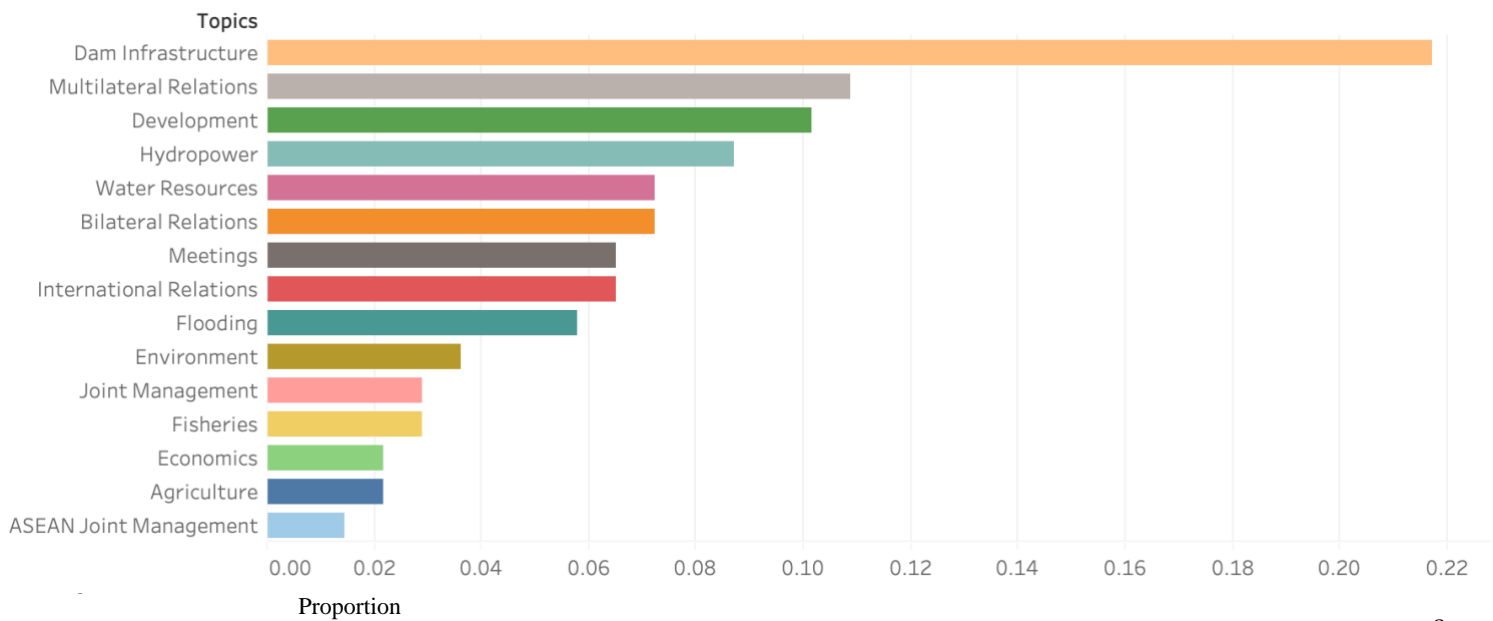605   establishment; Blue line refers to projects)

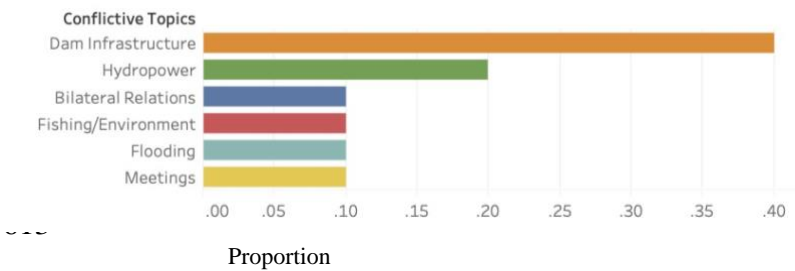29

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607

608   Figure 4 Proportion of Cooperation/Conflict articles published pertaining to water events along

609   the Lancang-Mekong River Basin
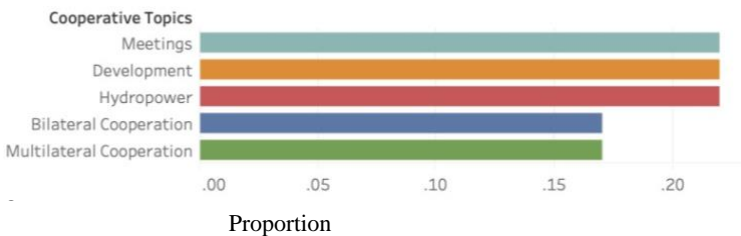
610

611

a

b

c

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616   Figure 5 The proportion of all topics identified as key topics in newspapers from 1991 to 2018

617   (a); The proportion of topics identified within all articles published with an overall conflictive
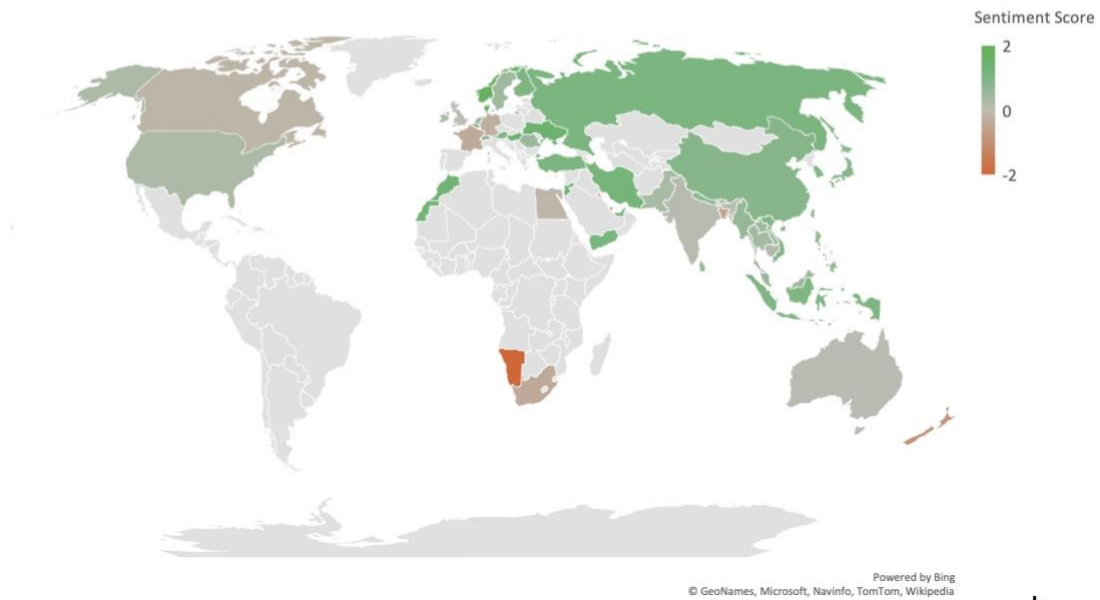
618   sentiment (b); The proportion of topics identified within all article published with an overall

619   cooperative sentiment (c).

Average Score of International and Regional Articles Over Time

a
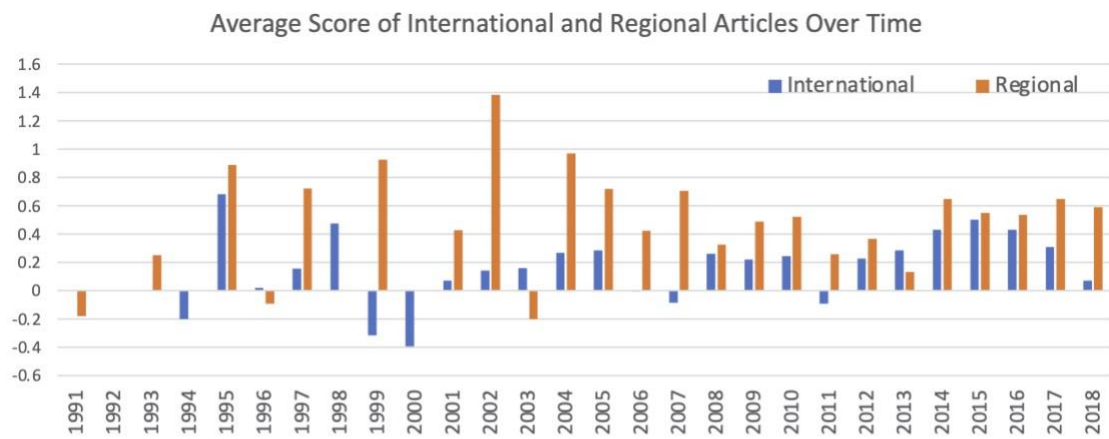
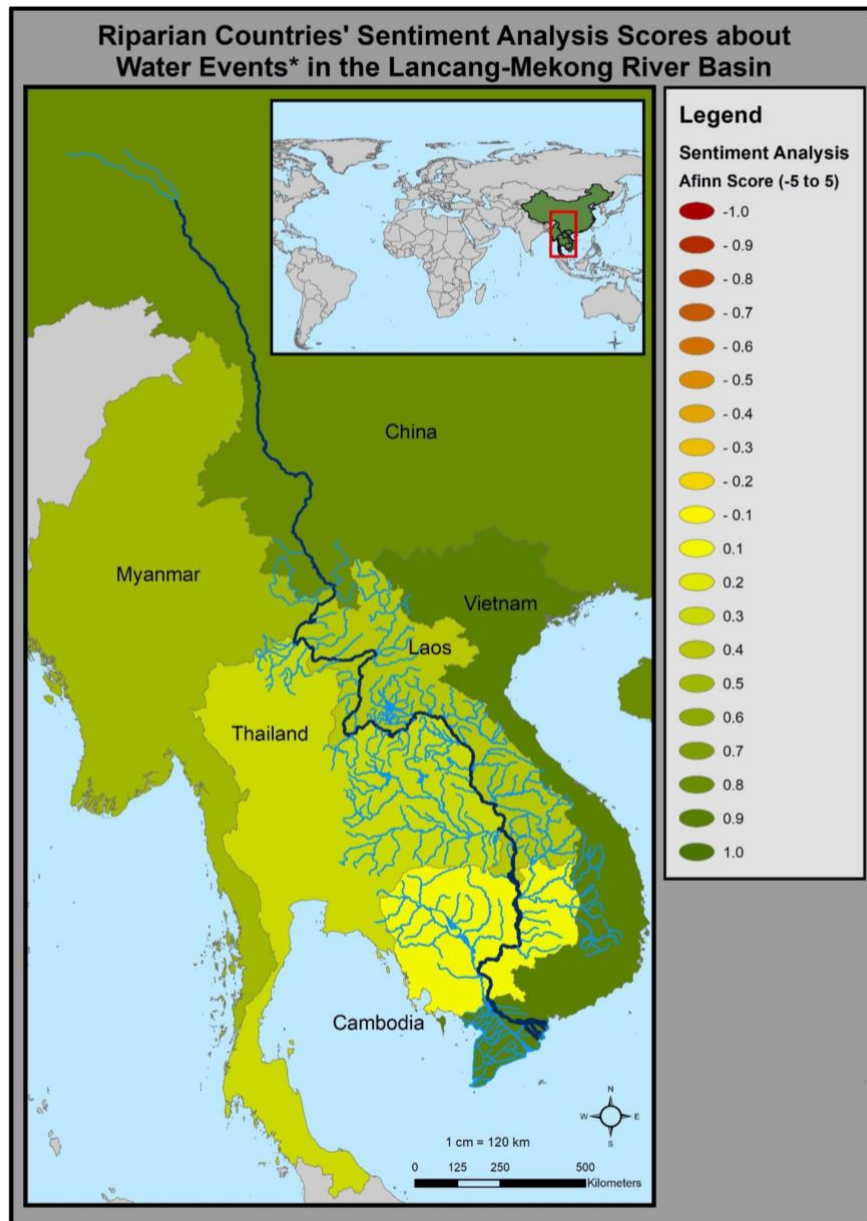Conflict and Cooperation Sentiments Perceived within and beyond the Basin

b

620

621   Figure 6 The Average Sentiment Score of Regional and International Newspapers from 1991 to

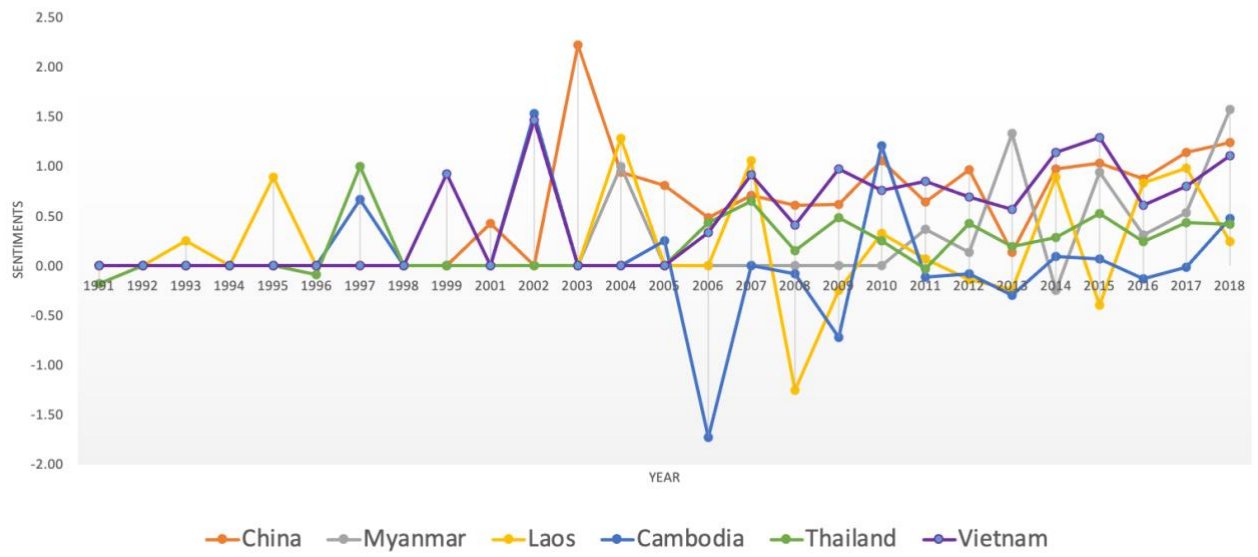622   2018 (a) Conflict and Cooperation Sentiments perceived within and beyond the Basin (b)

Riparian Countries' Sentiment Analysis Scores about Water Events* in the Lancang-Mekong River Basin

623

624   Figure 7 Average Conflict/Cooperation Sentiments Score of Each Riparian Country between

625   1991 to 2018

626

Figure 8 Conflict/Cooperative sentiment scores of the riparian countries (Cambodia, China,

Laos, Myanmar, Thailand, and Vietnam) from 1991 until 2018