

1 A Review of the Israeli Cloud Seeding Experience in the Context of the
2 Israel 4 Null Primary Result

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DRAFT

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24 **ABSTRACT**

25

26 The result of a fourth long-term randomized cloud seeding experiment in
27 Israel, Israel 4, has been reported by Benjamini et al. 2023. The seven-
28 season randomized cloud seeding experiment ended in 2020 with a non-
29 statistically significant result on rainfall (a suggested increase in rain of
30 1.8%). This review puts the results of Israel 4 in the context of prior
31 independent reanalyses of Israel 1 and 2, reanalyses that can be said to have
32 anticipated a null result of both the Israel 4 experiment and the lack of
33 evidence that rain had been increased in the 30 plus years of the operational
34 cloud seeding program targeting the Lake Kinneret (Sea of Galilee)
35 watershed discovered in 2006 by an independent panel of Israeli experts.
36 The published literature that overturned the reports of success in the first two
37 experiments, Israel 1 and Israel 2, was omitted by Benjamini et al., and thus,
38 misled readers about full story concerning those first two experiments.

39 The lack of cloud seeding success in Israel can be attributed to unsuitable
40 clouds for seeding purposes, ones that form prolific concentrations of natural
41 ice at relatively slight to moderate supercoolings which preclude seeding
42 successes using glaciogenic seeding agents.

43 The phenomenon of "one-sided citing," practiced by Benjamini et al. via
44 the omission of relevant contrary literature is addressed. Several
45 corrections to and enhancements of the Benjamini et al. article are also
46 included.

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48 **1. Introduction and Background**

49

50 The results of the first two randomized crossover cloud seeding
51 experiments in Israel, Israel 1 and Israel 2, discussed recently by Benjamini
52 et al. 2023, and the descriptions of "ripe for seeding" microstructure of the
53 clouds in Israel, had an important role in the history of cloud seeding. For
54 many years it appeared that the viability of cloud seeding to have produced
55 economically important amounts of rain had been established in those two
56 "crossover" experiments conducted by scientists at the Hebrew University of
57 Jerusalem (HUI) (e.g., Kerr 1982, Mason 1982, Dennis 1989). In
58 descriptions concerning these first two benchmark experiments, ones that
59 created the scientific consensus described above, Benjamini et al. (2023,
60 hereafter, "B23,") do not tell the whole story in their history of cloud
61 seeding in Israel that preceded the evaluation of Israel 4.

62 This review is meant to fill in the gaps for the reader left by B23 about
63 those first two experiments that had so much practical impact. For example,
64 the Israel National Water Authority (INWA) began a several decades-long
65 operational cloud seeding of the watersheds around Lake Kinneret (aka, Sea
66 of Galilee) based on the seemingly favorable results of Israel 1 and those in
67 the "confirmatory" Israel 2 experiment that followed (Gabriel 1967a; b;
68 Neumann et al. 1967; Wurtele 1971; Gagin and Neumann 1974; 1976). The
69 INWA began seeding Lake Kinneret's watersheds in November through
70 April, beginning with the 1975/76, the winter season that immediately
71 followed the end of Israel 2.

72 The statistical results of Israel 1 and 2 were backed by several cloud
73 microstructure reports over the years that underpinned the idea that rain
74 could be increased by seeding Israel's clouds (e.g., Gagin 1975, 1981, 1986,
75 Gagin and Neumann 1974, 1976, 1981). These reports caused *Science*
76 magazine's reporter Richard Kerr to proclaim in 1982 that those first two
77 Israeli experiments constituted the "One success in 35 years" of cloud
78 seeding experimentation. Kerr (1982) also wrote:

79 *"The Israeli II¹ data must still be reanalyzed by other statisticians, but*
80 *most researchers are also impressed that the results make so much physical*
81 *sense. The clouds that Gagin and Neumann hypothesized would be most*
82 *susceptible to seeding did indeed produce the most additional rain after*
83 *seeding."*

84 These statements are compatible with the history that B23 have provided,
85 but it was far from the end of the "story."

86 Fifteen years after Israel 2 had been completed it was learned that the
87 random seeding of the south target clouds of Israel 2, a crossover experiment
88 as Israel 1 had been, produced the suggestion that cloud seeding had
89 *decreased* rainfall by a substantial amount, 15% (Gabriel and Rosenfeld
90 1990). Gagin and Neumann (1981), however, had claimed that the random
91 seeding that took place in the south target was "non-experimental" and so
92 did not report the results of random seeding there. No one challenged this

¹ The Israeli experiments have had several names over their history. We use the latest terms for them here.

93 claim. Until 1981 the result of seeding in the south target seeding had been
94 described as "inconclusive" (Gagin and Neumann 1976), and prior to that,
95 by (Gagin and Neumann 1974) after the first two seasons of Israel 2, that
96 seeding had resulted in a seed/no seed average rainfall fraction in the south
97 target that was "less than 1," suggesting rain might have been decreased.

98 However, the crossover evaluation of seeding in Israel 2 was not reported
99 until Gabriel and Rosenfeld (1990).² The design document completed
100 before Israel 2 began had, however, mandated a crossover evaluation
101 (Silverman 2001). Nowhere did Gagin (1981) or Gagin and Neumann
102 (1974, 1976, 1981) explain why they did not perform the mandated
103 crossover evaluation of Israel 2.

104 Instead of Israel 2 crossover evaluation replicating Israel 1, where
105 seeding appeared to have increased rainfall by about 15% when the data
106 from both targets was combined (e.g., Wurtele 1971), the crossover
107 evaluation of Israel 2 indicated a slight decrease in rainfall of 2% (not
108 statistically significant). Thus, Israel 2 had *not* replicated Israel 1 in an
109 important way. But results of Israel 2 were complex, as noted by Gabriel
110 and Rosenfeld (1990) and they left questions that they could not resolve.
111 The most revealing statement in Gabriel and Rosenfeld (1990) in reporting
112 the "full" results of Israel-2 was this enigma:

² Pressure was applied in 1986 on the HUJ researchers by the Israeli experiments',
"Chief Meteorologist," Mr. Karl Rosner, who began a letter writing campaign to have the
important results of seeding in the south target published.

113 *“There is a surprising contradiction between this finding and those of the*
114 *analyses of Tables 4-17. The difference occurs because the historical*
115 *comparison of Table 18 ignores the unusually high south precipitation on*
116 *north-seeded days (as well as the north precipitation on south-seeded days).*
117 *In other words, it is what happened when there was no seeding that causes*
118 *the differences between the two analyses. The different choice of "control"*
119 *days for the south, whether all the rainy days of 1949-60 or the north-seeded*
120 *days of 1969-75, is what crucially affects the comparison. If such large*
121 *differences-of a magnitude of several standard errors and clearly significant*
122 *by the usual statistical criteria-occur by chance, then chance operates in*
123 *unexpected ways on precipitation and historical comparisons become highly*
124 *suspect (see also Gabriel and Petrondas 1983). Otherwise, **one would need***
125 ***to explain why there was so much more rain in the south when the north***
126 ***was being seeded; as of now, no explanation is available, especially as the***
127 *prevailing wind direction is from the southwest.”*

128 A “Type I statistical error,” the “good draw,” in Israel 2 that affected both
129 targets on north target seeded days, was there for all to see if they wanted
130 to.³

131 Thus, a severe blow to the idea of randomizing cloud seeding
132 experiments occurred in Israel 2 due to the exceptional draw described by

³ It is critical that a certified copy of the list of random decisions for Israel 2 be compared against those days used in the experiment. The remarkable random draw described by Gabriel and Rosenfeld (1990) could be explained if the original list was violated by the experimenters: draws were assigned to “seed” days when heavy storms were forecast by the Israel Meteorological Service.

133 Gagin and Rosenfeld (1990). Randomization could produce wildly
134 unrepresentative results in which slight, but important, rain increases due to
135 seeding could be forever hidden.

136 The null result of the combined targets in Israel 2 was due to an apparent
137 decrease in rainfall on seeded days in the south target (~15%) that canceled
138 out apparent increases in rainfall (~13%) in the north target. Despite the
139 new result and the many questions it raised, the INWA continued the
140 commercial-like seeding of the Lake Kinneret watersheds during the winter
141 rain seasons for more than 20 years after Gabriel and Rosenfeld's (1990)
142 disclosure of the "full" results of Israel 2.

143 The continuation of seeding of Lake Kinneret watersheds in northern
144 Israel by the INWA despite the Israel 2 null result may have been due to the
145 hypothesis put forward by Rosenfeld and Farbstein (1992)⁴; "dust/haze" had
146 interfered with seeding in Israel 2 by creating high natural ice particle
147 concentrations in supercooled clouds and that it even resulted in collisions
148 with coalescence-formed rain that does not require the ice phase. These
149 cloud attributes, they concluded, meant there could be no increases in
150 rainfall due to cloud seeding in the south target nor in the north target when
151 dust/haze was present. Without dust/haze, Rosenfeld and Farbstein argued,
152 the clouds of Israel were as ripe as ever for cloud seeding.

153

⁴ Rosenfeld (1989) in an unpublished HUI report, had argued earlier that the divergent apparent effects of cloud seeding were real.

154 **2. The Motivation for a Reanalysis of Israel 1 and Israel 2**

155

156 The publication and the hypothesis of Rosenfeld and Farbstein (1992)
157 formed the motivation for the Rangno and Hobbs 1995, hereafter RH95)
158 reanalyses of Israel 1 and 2. This writer had spent 11 winter weeks in Israel
159 in 1986 studying the rain-producing characteristics of Israeli clouds and felt
160 Rosenfeld and Farbstein's hypothesis had little credibility; a full
161 *independent* review of Israel 1 and 2 needed to be undertaken as had been
162 suggested in Science magazine (Kerr 1982). And it would be done by
163 someone who knew the clouds and weather of Israel (Rangno 1983, rejected,
164 1988, the latter, hereafter, R88). I am also experienced in exposing suspect
165 cloud seeding claims in the published literature (e.g., Hobbs and Rangno
166 1978, 1979, Rangno 1979, 1986, Rangno and Hobbs 1980a, b, 1981, 1987,
167 1993, 1995)⁵. By the time I began reanalyzing the Israeli experiments in
168 1992 I had logged more than 400 flights for the University of Washington's
169 Cloud and Aerosol Group in studies mostly concerning cloud ice
170 development in slightly supercooled clouds in polar air masses similar to
171 those that affect Israel (Rangno and Hobbs 1983, 1991, Hobbs and Rangno
172 1985, 1990).

173

174 **3. The results of the Rangno and Hobbs (1995) benchmark reanalyses**
175 **of Israel 1 and Israel 2 that went unmentioned by B23**

⁵ All on my own spare time except Hobbs and Rangno 1978; not on grant monies.

176

177 RH95 concluded that neither Israel 1 nor Israel 2 had produced bona fide
178 increases in rain on seeded days, contradicting the HUI experimenters'
179 reports and those contained in B23 that cloud seeding had increased rain in
180 each of these experiments. The conclusions of RH95 were given support by
181 Silverman (2001) and later, for Israel 2, by Levin et al. (2010).

182 Moreover, in R88 it was strongly suggested that the "ripe for seeding"
183 clouds described repeatedly by the experimenters (e.g., Gagin and Neumann
184 1974, 1976, 1981, Gagin 1975, 1981, 1986) did not exist. The findings in
185 R88 concerning shallow clouds that rained was not news to Israel
186 Meteorological Service forecasters with whom I spoke nor to the Israeli
187 experimenters' "Chief Meteorologist," Mr. Karl Rosner. Mr. Rosner wrote to
188 me in 1987 that, "sometimes heavy rain fell from clouds with tops at -8°C ."
189 Thus, in contrast to the many HUI experimenters' reports cited previously, it
190 was widely known by weather forecasters in Israel that rain fell regularly
191 from clouds with tops $\geq -10^{\circ}\text{C}$ ($\sim 3\text{-}4$ km thick clouds) as was documented in
192 R88.

193 The HUI experimenters had also concluded that many clouds with radar
194 measured tops between -15°C and -21°C often did not precipitate naturally
195 due to a lack of ice in them or precipitation formation by warm rain
196 processes (e.g., Gagin 1981, 1986). Those non-precipitating clouds in this
197 low temperature range were responsible for extra-large increases (46%) in
198 rain due to cloud seeding (Gagin and Neumann 1981, Gagin and Gabriel
199 1987). Seeding, they also reported, had no effect on naturally precipitating
200 clouds, a finding compatible with the "static" seeding method carried out by

201 the HUI experimenters where small amounts of silver iodide are released.
202 Namely, when seeding took place, it rained for more hours on seeded days
203 than on control days, but not heavier. B23 also refer to the Israel 2 low radar
204 top temperature partition as having been associated with increases in rain.

205 But is it possible that Israeli weather forecasters had a better idea of
206 which clouds rained in Israel than those whose research careers at the HUI
207 depended on reliable assessments of their own clouds and their cloud
208 seeding potential? Probably not.

209 This writer, while welcomed at the Israel Meteorological Service, was
210 denied access in 1986 to the seeding experimenters' radar on the grounds of
211 Ben Gurion AP to obtain echo heights by the leader of the Israeli
212 experiments, Prof. A. Gagin. He insisted in our meeting that my monitoring
213 of tops would only confirm his cloud reports.

214 It was also learned during January 1986 at about this same time that no
215 less than six attempts had been proposed by outside groups to do airborne
216 studies of the seemingly unique clouds of Israel, ones that had responded so
217 well to cloud seeding (Personal communication, Gabor Vali, 31 January
218 1986). *Every one* of them had been blocked Why? And by whom?

219 Today we can make a pretty good guess about why and by whom.

220

221 **4. More about Rangno and Hobbs (1995): the most controversial and**
222 **commented on paper ever published in an Amer. Meteor. Soc. journal**
223 **and the unusual strategy used by the editor in choosing reviewers**

224

225 In a moment of brilliance (in retrospect), the editor for our journal
226 manuscript, L. Randall Koenig, chose three reviewers who would be sure to
227 reject the RH95 manuscript and its negative findings concerning cloud
228 seeding. But at the same time, Koenig realized that there would be no easy
229 pass on it; no stone would go unturned by the reviewers, and our findings
230 would be severely tested. In fact, RH95 was significantly better for having
231 cloud seeding partisans, H. Orville, W. Woodley, and D. Rosenfeld, review
232 it (all signed their reviews).

233 Editor Koenig, himself an expert on weather modification and cloud
234 microphysics (e.g., Koenig 1963, 1977, 1984), was also steeped in the long
235 record of frequent mischief by those in the cloud seeding domain, weighed
236 the arguments of the reviewers and the modifications of RH95 that reflected
237 the reviewers' criticisms: He made the choice to publish RH95.

238 It took courage for Editor Koenig to do that and recognizing who he felt
239 had the better arguments. In RH95 were the first two *independent re-*
240 *analyses* of Israel 1 and Israel 2, as had been recommended years earlier in
241 Kerr (1982) but ones that were clearly not going to take place. How many
242 other papers in our journals would be the improved and bogus claims
243 corrected if editors used the strategy of of Koenig and were as informed
244 about the topic of the manuscript?

245 Perhaps due to the size of the ox being gored, our paper drew comments
246 by the reviewers of our manuscript and others (1997a, b, c, d, e). The
247 number of journal pages involved in “Comments” and “Replies” on a single
248 article is still a record for an Amer. Meteor. Soc. journal. We draw
249 particular attention to our "Replies" to the many, and as we showed,

250 specious, "Comments" of Dr. Rosenfeld in RH97a and RH97b, a B23 co-
251 author. Let the reader decide where truth lies. We urge the reader to
252 *carefully* review RH95 and our replies for the considerable evidence we
253 present that the Israel 1 and Israel 2 experiments were both mirages of cloud
254 seeding successes, contrary to the assertions in B23.

255

256 **5. Israel 3: enhancing B23's description**

257

258 B23 describe the results of the longest randomized cloud seeding
259 experiment ever conducted, Israel 3 (1975-1995), a single target experiment.
260 However, they omit informing the reader that the "inconclusive" result was a
261 suggested 9% decrease in rainfall on seeded days compared to non-seeded
262 days (Rosenfeld 1998). By omitting the sign of the null result, B23 left the
263 reader to speculate on what the sign of the "null" result was. The suggestion
264 of a decrease in rain on seeded days again points to clouds naturally form
265 precipitation very efficiently in Israel. With the result of Israel 3 in hand,
266 the reader would now learn, with Israel 2 (Gabriel and Rosenfeld 1990), that
267 over a period of 26 plus years (Israel 2 and Israel 3 combined) decreases in
268 rainfall due to seeding were suggested in central and southern Israel by
269 cloud seeding!

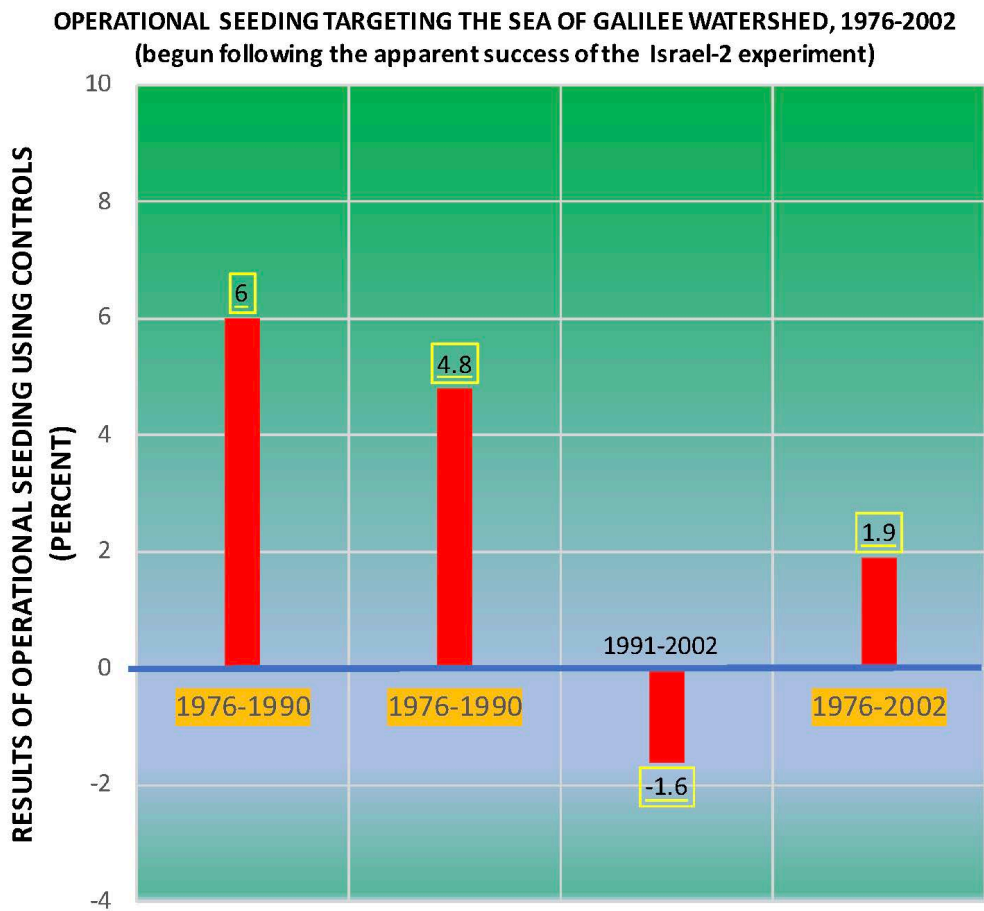
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271 **6. Rectifying B23's statement concerning operational seeding**

272

273 B23 state the increase in rainfall during the operational seeding, 1975/76
274 winter to 1990 reported by Nirel and Rosenfeld (1995) was “6-11%.” In the
275 abstract of the quoted article, the authors state that rainfall due to cloud
276 seeding was increased by 6%, not “6-11%.” This same increase in rain (6%)
277 was also quoted by Sharon et al. (2008).

278 Moreover, the 6% increase in rain (said to be statistically significant by
279 Nirel and Rosenfeld 1995) was not confirmed by Kessler et al. (2006) in
280 their *independent* evaluation of operational seeding through the same period.
281 The independent panel reported 4.8% suggested rain enhancement over the
282 same period evaluated by Nirel and Rosenfeld (Figure 1).



283

284 Figure 1. The results of operational seeding on the watersheds of Lake
285 Kinneret (aka, Sea of Galilee) as reported by Kessler et al. 2006. (a) is that
286 result of seeding on rainfall reported by Nirel and Rosenfeld (1995), b-d are
287 the results found for various periods, including the very same era evaluated
288 by Nirel and Rosenfeld (1995).⁶

289

290 **7. What triggered the formation of an independent panel to evaluate** 291 **cloud seeding?**

292

293 The panel was created after RH95 was published and then followed by
294 extensive journal exchanges by RH97a, b, c, d, e, in “Replies” to various
295 “Comments” in 1997. The INWA was then inspired to form an *independent*
296 panel of experts due to these exchanges to evaluate what they were getting
297 from the operational seeding of Lake Kinneret’s watersheds rather than
298 relying on the evaluations by the seeding promoters at the HUJ (e.g., Nirel
299 and Rosenfeld 1995). The results found by the panel are shown in Figure 1.

300 Should the lack of seeding results shown in Figure 1 surprise? I don't
301 think so. This sequence of optimistic claims by seeding experimenters
302 concerning their own experiments followed by reanalyses by external
303 skeptics that find the original claims were "scientific mirages" (Foster and

⁶ The findings of Kessler were challenged by seeding partisans at the HUJ and who claimed that “air pollution” had decreased rain as much as cloud seeding had increased it after 1990. While this was a convenient explanation, it was not found credible by many subsequent independent investigators, including by Kessler et al. (2006).

304 Huber 1997) is a pathology within the cloud seeding realm that has dogged it
305 since its earliest days (e.g., Brier and Enger 1952, versus MacCready 1952).

306

307 In view of Figure 1, one must ask, "What if there had been no RH95"?

308

309 We suspect that not citing our *independent* re-analyses of Israel 1 and
310 Israel 2, Silverman's (2001) review, and Wurtele (1971) who first drew the
311 attention to a major red flag in Israel 1, combined with the fact that the HUI
312 experimenters failed to even understand the precipitating nature of their own
313 clouds for *decades* with all the tools at their command, all pose monumental
314 science embarrassments for Israel, their scientists, and for the prestigious
315 HUI from which the faulty reports emanated.

316 Can there be other reasons for not citing the work of external, foreign
317 workers who overturned benchmark experimental science by the home
318 country's scientists?

319

320 **8. Were the background airborne microphysical measurements that**
321 **preceded Israel 4 adequate?**

322

323 B23 cite Freud et al. (2015) as having demonstrated cloud seeding
324 potential in the mountainous north region of Israel through a series of
325 airborne flights; but did it support the idea of strong cloud seeding potential
326 as B23 assert? No.

327 I was not asked to review Freud et al. 2015, as one might have expected
328 given my background. Nevertheless, I carried out a post publication
329 “comprehensive review” that can be found here. _____ (not yet
330 posted online)

331 Freud et al. 2015 was a “Jekyll and Hyde” read; some of the best
332 reporting by the HUI’s cloud seeding unit was contained in it. But it also
333 contained misleading statements. My recommendation after reading what I
334 considered to be a strongly biased study that was going to mislead the
335 INWA concerning cloud seeding potential: “Don’t do a cloud seeding
336 experiment in northern Israel based on the research of Freud et al. (2015)!”

337 As the INWA could have suspected, Freud et al. (2015) would not be the
338 first time that cloud seeding researchers at the HUI had misled the INWA
339 about the clouds of Israel being filled with cloud seeding potential. My
340 conclusion regarding the false picture of “abundant” cloud seeding potential
341 in the northern mountains of Israel painted by Freud et al. 2015 was, in
342 essence, affirmed *post facto* by the “primary” results of Israel 4. The
343 “abundant” cloud seeding potential in northern Israel described by Freud et
344 al. (2015) was not realized or was imaginary to begin with.

345 A caveat on airborne sampling: One can “lie” with aircraft
346 measurements by sampling only newly risen turrets and avoiding those that
347 are maturing or in aged states with appreciable ice particle concentrations.
348 Gagin and Neumann (1974), for example, stated that they chose only newly
349 risen turrets, narrow ones at that, and flew research flights on mostly dry
350 days, and those choices misled them and the rest of the scientific community
351 regarding the microstructure of Israeli clouds and their cloud seeding

352 potential. Significant rain days in Israel are comprised of large complexes of
353 convective clouds in various stages of development, “tangled masses,” as
354 they were described by Neumann et al. (1967). To their credit, Freud et al.
355 informed the reader that they sampled only newly risen turrets when
356 reporting the low (<2 per liter) modal ice particle concentrations in those
357 turrets.

358 Freud et al.’s measurements could not have been more incompatible with
359 uncited by B23 measurements of Levin (1992: 1994; Levin et al. 1996).
360 Tens to hundreds per liter of ice particles were found in six flights on four
361 days in clouds having tops $\geq -13^{\circ}\text{C}$. Freud et al. 2015 could not bring
362 themselves to inform their readers of similar high ice particle concentrations
363 that they likely encountered during their 27 flights (that is, if they did not
364 deliberately avoid those high ice particle concentration regions). Freud et al.
365 2015, therefore, may be a first in the evaluation of cloud seeding potential in
366 which measurements of ice particle concentrations in mature and aging
367 clouds were not reported; the absence of such data made their entire report
368 unreliable.⁷

⁷ One of the B23 co-authors (DR) has claimed that ice particle measurements measured in their airborne research were “unreasonably high” in Israeli clouds due to probe shattering and thus weren’t reliable. D. Axisa, a representative of the manufacturer, Droplet Measurement Systems, of the CAPS probe used by Freud et al. (2015) stated that this statement was false: “They could have reported accurate ice particle concentrations if they had wanted to.” Dr. Axisa is a former president of the Weather Modification Assoc. It seems likely that HUJ researchers are once again withholding vital information on the clouds of Israel.

369

370 **9. What do we know about cloud seeding in Israel today?**

371

372 What we know today is that if careful, skeptical and independent
373 analyses of Israel 1 and Israel 2 experiments and equally careful evaluations
374 of the clouds of Israel had been done in the first place by *independent* Israeli
375 scientists or ones outside Israel that are non-partisan cloud seeding scientists
376 (as was carried out by RH95, R88, and by Silverman 2001), there would not
377 have been 30 plus years of wasted operational cloud as would be found by
378 *independent* evaluators in the decades ahead (Kessler et al. 2006, Sharon et
379 al. 2008). Fortunately, we need not guess whether those 10s of millions of
380 dollars were wasted on the seeding of Lake Kinneret watersheds. They
381 were. Inexplicably, the INWA drove through the “stop sign” presented by
382 Kessler et al. (2006) and commercially seeded around Lake Kinneret for
383 another seven years after this report came out according to B23.

384

385 **10. Why hasn't cloud seeding worked In Israel?**

386

387 Answer: too much natural ice formation in clouds.

388 B23 failed to mention that the "ripe-for-seeding" cloud foundation for the
389 statistical results of Israel 1 and Israel 2 no longer exists. The mythical
390 clouds described by HUI researchers were *critical* in the acceptance of the
391 Israeli cloud seeding rain increases by the scientific community, as quoted in
392 Kerr (1982) earlier and by Dennis (1989).

393 A review of the Israeli cloud microstructure shows that they are "ripe,"
394 but not for cloud seeding, but for an explosion of ice as the tops ascend to
395 temperatures below -5°C and age. In most cases, precipitation-sized drops
396 have already formed when the Israeli cloud ascend through this level (Gagin
397 and Neumann 1974, Figure 13.4), and the concentration of cloud droplets
398 exceeding the Hallett-Mossop riming-splintering criterion of $\geq 23 \mu\text{m}$
399 diameter can be inferred to be copious in that -2.5° to -8°C temperature
400 zone. Furthermore, there is an enhancement of the H-M process when
401 droplets $\leq 13 \mu\text{m}$ are present (Goldsmith et al. 1976, Mossop 1985) and such
402 drops would be present in the semi-polluted air masses; initially, shallow
403 cold layers diluted by the warming of the Mediterranean Sea to depths of 3-9
404 km on shower/thunderstorm days by the time they reach Israel under cold
405 polar troughs.

406 Without the "ripe for seeding" clouds, ones with great seeding potential
407 to cloud top temperatures as low as -21°C as described by Gagin and
408 Neumann (1976, 1981 and Gagin 1981), there can be no viable increases in
409 rainfall due to cloud seeding. This does not mean that some small, slightly
410 supercooled clouds can't be seeded to make small amounts of rain as noted
411 by the HUI researchers, Gagin and Neumann (1981), and by Sharon et al.
412 (2008). However, those small amounts weren't deemed viable for a cloud
413 seeding operation.

414

415 **11. The nature of the reporting of the experiments by the HUI cloud** 416 **seeding researchers**

417

418

419 The omission of the south target result (Gagin and Neumann 1976, 1981)
420 was tantamount to the cancer researcher who only reports on the 50 mice his
421 treatment cured while not reporting on the 50 mice that died from the same
422 treatment. This kind of behavior in virtually every field but weather
423 modification/cloud seeding, would be termed, "scientific misconduct,"
424 specifically of a type called, "falsification" when data are omitted or
425 adjusted (Ben-Yehuda and Oliver-Lumerman 2020). Inexplicably, Prof. K.
426 Ruben Gabriel, the Israeli cloud seeding statistician, acquiesced in this
427 omission as a reviewer of Gagin and Neumann's 1981 paper in which this
428 critical omission occurred.

429 Moreover, reporting the apparent negative effect on rainfall in the south
430 target of Israel 2 would have raised numerous questions about the clouds of
431 Israel: How could seeding Israeli clouds, described as being filled with
432 great seeding potential as had been repeatedly described by the HUI
433 researchers, have resulted in what appeared to be a large decrease in rainfall
434 in the south target on seeded days? Cloud tops in the south target in Israel
435 average higher temperatures than those in the north (e.g., GN74; RH95)
436 making interpretations of decreased rainfall due to cloud seeding (as
437 Rosenfeld 1989, Rosenfeld and Farbstein 1992 suggested) even harder to
438 explain.

439 Moreover, while interim "positive" reports of cloud seeding increases in
440 rain emanated from the HUI during Israel 1 and Israel 2, HUI researchers
441 clearly felt differently about reporting indications of rain decreases in Israel
442 2 and Israel 3. For example, the scientific community was not informed of
443 the suggestion of decreased rain due to clouds seeding in Israel 3 by the HUI

444 experimenters until 17 years after randomized seeding had begun (Rosenfeld
445 and Farbstein 1992). Is this what the HUI stands for? This chronology
446 demonstrates a pattern that HUI experimenters have had reporting
447 suggestions of decreased rainfall or null results due to cloud seeding and in
448 correcting their flawed cloud microstructure reports to the scientific
449 community and to their countrymen in the years prior to B23.

450 Moreover when “good draws” or null results are suggested, the HUI
451 researchers reach for the magic bag to explain why “cloud seeding did it,”
452 not nature. For example, when the Israel 1 chief meteorologist provided a
453 plume analysis that the buffer zone (BZ) of Israel 1 could not have been
454 appreciably contaminated by inadvertent seeding (a conclusion also
455 supported by Neumann et al. 1967), Gagin and Neumann (1974), however,
456 countered with an opposite explanation; the BZ had surely been
457 contaminated on Center seeded days. The reason and data behind these two
458 different explanations for the difference in the two plume analyses was not
459 given except in general unsatisfactory terms.

460 When a Type I error and massive “good draw” affected the north seeded
461 days of Israel 2 that also brought heavy rain to the south target, the crossover
462 null result was then explained as due to “dust/haze” that produced different
463 cloud microstructures when present in each target, first proposed by
464 Rosenfeld (1989) in an HUI report.

465 When RH95 showed that the results of seeding on the coast of Israel in
466 Israel 1 were too close to the cloud base seeding release point to have
467 resulted in rain practically falling on top on the seeding aircraft that flew in a
468 line along the coast, Rosenfeld (1997) wrote a magical explanation filled

469 with conjectures, one requiring nine steps to be fulfilled to explain the
470 troublesome indication of rain increases in the BZ and in the coastal zone on
471 Center seeded days. Please see my extended “Reply,” p11, to the hypothesis
472 of Rosenfeld (1997) at:

473 [http://carg.atmos.washington.edu/sys/research/archive/1997_comments_s](http://carg.atmos.washington.edu/sys/research/archive/1997_comments_seeding.pdf)
474 [eeding.pdf](http://carg.atmos.washington.edu/sys/research/archive/1997_comments_seeding.pdf).

475 When the independent panel could find no viable increases in rain in the
476 seeding of the Lake Kinneret watersheds, the HUI seeding team then
477 asserted that “air pollution” was now decreasing rain as much as cloud
478 seeding was increasing it (Givati and Rosenfeld (2005). One might ask,
479 “what happened to “dust/haze”?

480 Ice crystal concentrations measured in Israeli clouds by our best
481 instruments are “unreasonably high” according to B23 co-author, Rosenfeld
482 (private communication, 2018) in his review of this author’s history of
483 Israeli cloud seeding, submitted to *Bull. Amer. Meteor.*, rejected in 2019)
484 Rosenfeld’s statement, however, contrasts with that of Droplet Measurement
485 Technologies, the manufacturer of the Cloud, Aerosol and Precipitation
486 Spectrometer (CAPS) probe used by the HUI researchers: “They could have
487 reported accurate ice particle concentrations if they had wanted to” (D.
488 Axisa, DMT representative, personal communication). Q. E. D.

489 With the certainty of dust/haze days and incoming Israeli shower clouds
490 affected by “sea spray” as Freud et al. 2015 described on shower days during
491 the time the HUI experimenters were flying their research aircraft in the
492 early 1970s, monitoring storms with their radars, or examining rawinsondes
493 during rain spells, we can conclude confidently that the lack of detecting

494 shallow precipitating clouds that occurred regularly in Israel is one of the
495 more inexplicable and troubling aspects in the reporting of the Israeli cloud
496 seeding experiments.

497 Deepening this enigma is that for two winter seasons in the late 1970s,
498 the experimenters measured the depth of raining clouds with a vertically
499 pointed 3-cm wavelength radar with research aircraft overflights to verify
500 accuracy (Gagin 1980). Dr. Rosenfeld, a B23 co-author who studied clouds
501 and radar imagery at this time, is the sole living person who can tell us what
502 happened (Rosenfeld 1980, master's thesis). One must necessarily ask if the
503 HUI experimenters discovered clouds they "didn't like," and withheld that
504 information from us as they did the results of seeding in the south target of
505 Israel 2? Without conjuring up a stupefying degree of incompetence, it
506 seems likely.

507 It is not science that we are dealing with concerning the reporting by the
508 HUI cloud seeding researchers. There will ALWAYS be another problem
509 that prevented seeding from working and if only corrected, seeding will
510 work, as we are sure to learn when the "secondary" results of Israel 4 are
511 published.

512 Will I be given a chance to review it? It seems unlikely with the journal
513 atmosphere we have today.

514

515 **12. The on-going journal problem of "one-sided citing" the equivalent**
516 **of today's "cancel culture," as seen in B23**

517

518 The omission of the work by myself and with Prof. Peter V. Hobbs was
519 shocking to see in B23 since all the B23 authors knew of this work. In
520 human terms, external skeptics from a foreign country that expose faulty
521 science in another country are not going to be exactly welcomed (or
522 apparently cited) by that's country's scientists when a scientific
523 embarrassment unfolds, as has happened in Israel concerning cloud seeding.
524 While this may seem like an outlandish claim, what happened could be
525 interpreted as tinged with nationalism has previously been shown to
526 obfuscate science (Broad and Wade 1982, p114).

527 For journal readers who are used to "one-sided citing" in partisan media,
528 our scientific journals are supposed to be immune from these acts due to a
529 peer-review "filter" that is supposed to eliminate this practice before an
530 article reaches the publication stage.

531

532 **a) Why do authors, like B23, tell only one side of the story?**

533

534 In the words of Ben-Yehuda and Oliver-Lumerman (2020)⁸ such
535 deceptions are, "...a deliberate attempt to create a false reality, persuade
536 audiences that these realities are valid, and enjoy the benefits that
537 accompany scientific revelations, whether those of prestige, money,
538 reputation, or power...." The effect of one-sided citing on journal readers is

⁸ Ben-Yehuda and Oliver-Lumerman's book should be required reading for B23.

539 well expressed in the U. S. Federal Trade Commission's (FTC) statement on
540 consumer fraud:

541 *“Certain elements undergird all deception cases. First, there must be*
542 *a representation, **omission** or practice that is likely to mislead the consumer*
543 *[journal reader].”*

544 For the reader, one-sided citing, if it is not obvious, is purposefully done
545 by authors to hide results that they do not want you to see. In effect, B23
546 performed the same act as Gagin and Neumann (1981) did when the latter
547 authors did not report the results of random seeding of the south target of
548 Israel 2, results that they did not want the world to see, and results that
549 would have raised so many questions.

550 Regrettably, one-sided citing (a form of deception) is widely observed in
551 Amer. Meteor. Soc. journals and in *J. Weather Modification* articles on
552 cloud seeding/weather modification:

553 [https://cloud-maven.com/journal-citing-practices-in-a-controversial-](https://cloud-maven.com/journal-citing-practices-in-a-controversial-domain-cloud-seeding/)
554 [domain-cloud-seeding/](https://cloud-maven.com/journal-citing-practices-in-a-controversial-domain-cloud-seeding/)

555 B23 practiced one-sided citing (defined by Schultz 2009) in their article
556 concerning the Israel 1 and Israel 2 experiments. Inexplicably, our
557 groundbreaking work (e.g., R88, Rangno and Hobbs 1988, who pointed out
558 how anomalous the Israeli cloud reports were compared to other clouds, and
559 RH95) was uncited by B23. This work can be said to have, *in toto*,
560 anticipated the both the null result of decades of operational seeding of Lake
561 Kinneret (Kessler et al. 2006, Sharon et al. 2008) and the null "primary"
562 result of Israel 4 reported by B23. Thus, B23 repeatedly misled/deceived

563 readers, the "consumers" of journal science, concerning Israel 1 and Israel 2.
564 If there is something different than what was done by B23 than what is
565 described by the FTC above its not apparent.

566 Nor did B23 cite Wurtele (1971), Silverman (2001) or mention the
567 critical airborne cloud measurements by one of Israel's own leading
568 scientists, Levin 1992, 1994, and Levin et al. 1996). The latter
569 measurements were the first cloud ice measurements in Israel since Gagim
570 (1975). Those new, independently acquired cloud ice measurements
571 supported the conclusions in R88, Rangno and Hobbs (1988) and those in
572 RH95 all of which contravened the many HUI experimenters' reports of
573 "ripe for seeding" clouds whose tops ascended to $\sim -20^{\circ}\text{C}$ without
574 precipitating.

575 Later measurements of cloud properties via satellite would also confirm
576 the independent cloud measurements and assessments; that the clouds of
577 Israel formed precipitation far more readily and at much higher cloud top
578 temperatures (Ramanathan et al. 2001) than the HUI experimenters could
579 discern over many decades.

580 In 2015, the HUI cloud researchers discovered that "sea spray" in the
581 Mediterranean makes the cumuliform clouds invading Israel precipitate
582 more efficiently and at the high cloud top temperatures like those reported in
583 R88 (Freud et al. 2015). We can be quite sure that Mediterranean Sea spray
584 has been occurring and affecting clouds that move into Israel for millions of
585 years, and of course, did so during the 1970s when the HUI scientists were
586 performing their aircraft and radar cloud studies. Yet, they could not detect,

587 or did not report, on those clouds that would have erased most of their
588 seeding potential.

589 The shame of one-sided citing in B23 is that the authors could have
590 added a *single* sentence following their repeated claims of rain increases in
591 Israel 1 and 2: "However, these results, and the cloud reports that gave the
592 statistical results credibility, have been questioned/overturned," followed by
593 a string of citations. But B23 could not bring themselves to do that.

594

595 **b) Why should we care about one-sided citing?**

596

597 Knowledgeable readers of a specific topic like this writer will know that
598 an article has been skewed to deliberately mislead readers due to omissions
599 of contrary findings that go against what the authors assert. But less
600 informed readers will not know, and their knowledge will be truncated
601 regarding an important public policy, as when their state or local
602 government considers a cloud seeding program. They will want to know the
603 unabridged findings about the Israeli experiences as a tale of caution about
604 accepting claims by promoters of seeding that have not been closely
605 scrutinized by outside experts.

606 Moreover, "one-sided citing" sullies the reputations of all the authors
607 even those who may not have agreed with doing it, and likewise sullies the
608 reputations of institutions represented by the authors who practice it by
609 suggesting that those institutions do not uphold standard science practices by
610 those who work there. It also damages the authors whose work goes

611 uncited since one's impact in science is measured by citation metrics.
612 Finally, even the journal in which one-sided citing occurs can be considered
613 to have been damaged since unreliable findings have been published in it.

614 Nevertheless, it would appear that reviewers, editors, and journal
615 management do not care so much about this issue. No statement in our
616 Amer. Meteor. Soc. ethics statement addresses the question of the pernicious
617 practice of one-sided citing as seen in B23. Its intellectually dishonest to
618 omit relevant findings for your science audience just because you don't like
619 them.

620

621 **c) Who's responsible for "one-sided" citing in journals?**

622

623 "One-sided" citing, specifically as observed in B23, is due to poor peer
624 reviews of manuscripts by seeding partisans or reviewers ignorant of the
625 literature they are supposed to know. However, it is also due to those that
626 *do* know the literature and do not get those manuscripts to review. For
627 example, even though I would be deemed an expert on Israeli clouds,
628 weather, cloud seeding, and on cloud microstructure, I was inexplicably not
629 asked to review a manuscript in my specialty; that by B23 which would have
630 made these comments unnecessary.

631 The reviewers of B23 manuscript were either ignorant of the literature
632 they were supposed to be knowledgeable about or were cloud seeding
633 partisans that also desired that the "other side" of the story for Israel 1 and
634 Israel 2, as represented in the peer-reviewed literature by R88, RH88, RH95,

635 RH97a, b, c, d, e, Silverman (2001), Wurtele (1971) and Levin's cloud
636 measurements (e.g., Levin et al. 1996), be hidden from the journal readers.

637 At the top of the "responsibility pyramid" for one sided citing in journal
638 articles, however, must reside the editor of the journal who chose the
639 reviewers that allowed this to happen. Whomever this was at the *J. Appl.*
640 *Meteor. Climate*, should not be allowed to be an editor who disburses cloud
641 seeding manuscripts again.

642

643 **d) Concluding remarks on one-sided citing**

644

645 While all the B23 authors are technically responsible for its misleading
646 content, one suspects some were likely "drug along" by stronger author
647 personalities or authors who have funding power over them. As with
648 *Geophys. Res. Letts.*, the actual contributions of each author to this article
649 should have been listed so we can truly know who was responsible for
650 providing one-sided histories for Israel 1 and Israel 2 and other misleading
651 statements.

652 We know, too, seeding partisans at the HUJ that have cost their own
653 country so much will not let the "primary" null result of B23 stand; there
654 will be "secondary" and "tertiary" stratifications of Israel 4 perhaps designed
655 to mislead the INWA into another randomized cloud seeding experiment or
656 to resume operational seeding of Lake Kinneret.

657 It will be critical that if a new experiment is conducted at the behest of
658 the HUJ seeding partisans, that outside, *independent* experts conduct it! It is

659 also critical that prior to a new experiment that new airborne measurements
660 of the clouds of Israel also be undertaken by outside, *independent* and
661 experienced researchers in view of the problems that researchers at the HUU
662 have had over several decades in reporting ice particle concentrations in
663 their clouds and their clouds' actual seeding potential.

664 The major question we must now confront to avoid further science
665 mischief by HUU cloud seeding researchers, is how was it that they were not
666 aware of the natural state of their clouds, namely, that clouds with tops
667 warmer than -10°C that regularly rained, a finding that seriously limits cloud
668 seeding potential? To date, no explanation has been put forward. And what
669 evidence will they skew or miss in a likewise manner in the inevitable Israel
670 4, "secondary" results?

671 Lastly, a note of scientific etiquette for B23 and young researchers: B23
672 cite the work of French et al. (2018) in demonstrating cloud seeding efficacy
673 via the use of mm-wavelength radar.

674 The first use of mm-wavelength radar of the type used by French et al.
675 (2018) was used by the Cloud and Aerosol Group at the University of
676 Washington in a "proof of concept" experiment (Hobbs et al. 1981).
677 Scientific etiquette means citing those that went first (Schultz 2009)
678 Thus, a citation to the Hobbs et al. (1981) article should have preceded
679 that of French et al. 2018).⁹ Our experiment proved that cloud seeding
680 works in limited situations as in those described by French et al. (2018).

⁹ The present writer suggested the use of our vertically pointed, mm-radar after seeing virga signatures pass overhead of that radar, realizing that creating lines of seeding in

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supercooled cloud layers that pass over such a radar could prove the viability of cloud seeding in a new way. I also carried out portions of this experiment. However, I was not credited for this idea by Prof. Hobbs in the article.

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