

SATELLITE UPPER AIR
NETWORK
(SUAN)

Tony Reale
NOAA/NESDIS

WHAT IS SUAN ?

- Global network of radiosonde sites flying a reference **Radiosonde** coincident with NOAA polar satellite overpass

WHY SUAN ?

- Polar satellite radiometers, derived products and associated science *require* absolute scientific calibration ...**CALVAL**
- Global **Radiosondes** “can” provide the necessary ground truth data
- Current available collocated radiosonde and satellite data are **Not Adequate**

WHY NOT ADEQUATE ?

- Satellite and Radiosonde data each have **Systematic Uncertainties** ... so does the Science
- **Different Satellites** collocate with radiosondes in **Different Regions** ... Oceans neglected
- Collocation sample integrity are further compromised by **time and distance** windows

WHAT IS NEEDED

- Acknowledge the requirement for Global Radiosondes to provide Polar Satellite **CALVAL**
- Design global program to launch reference Radiosondes coincident with Polar Satellite overpass ... **SUAN**
- Commit to remote ocean observations from **Ships**

BENEFITS

- Quantify *satellite radiometer and product* uncertainty
- Quantify *radiosonde* data uncertainty
- Quantify *scientific algorithm* uncertainty (OPTRAN, RTTOV ...)
- Long-term *traceability* ... *Past, Present, and Future*
- *Positive impacts* on weather forecast and climate applications

Support

- **International ATOVS Study Conference (November, 2003)**
 - *idea proposed; recommendation to pursue, need to review/finalize, etc ... WMO*
- **Workshop to Improve Usefulness of Radiosondes (March, 2003)**
 - *formal recognition of important role of global radiosondes to validate polar satellite data (via) a carefully designed network of reference radiosondes coincident with satellite overpass ...*
- **NOAA Council on Long-Term Climate Monitoring (Jan., 2003)**
 - *includes specific recommendations for “integrated global observing systems which include reference radiosonde and overflying satellite observations ... **long term, accurate global temperature, moisture ...***

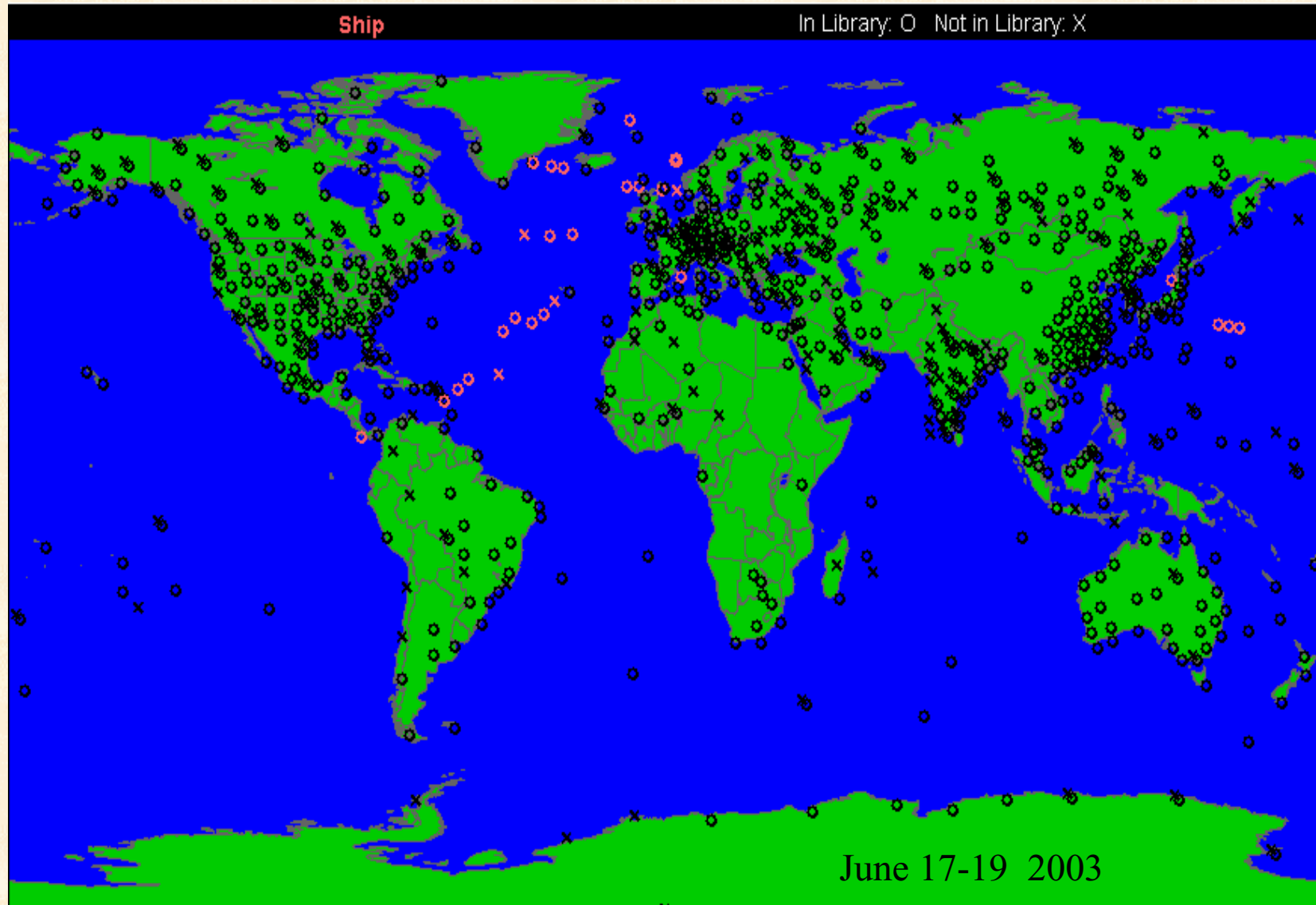
Activities

- **Current Operational Baseline of Collocations**
- Climate (GUAN, GCOS, etc) Radiosonde Scores (Peter Thorne, HadleyCentre)
- Instrument used (WMO Pub-9, TTBB, EMC Dictionary)
- Preliminary SUAN Candidates
- Ships!

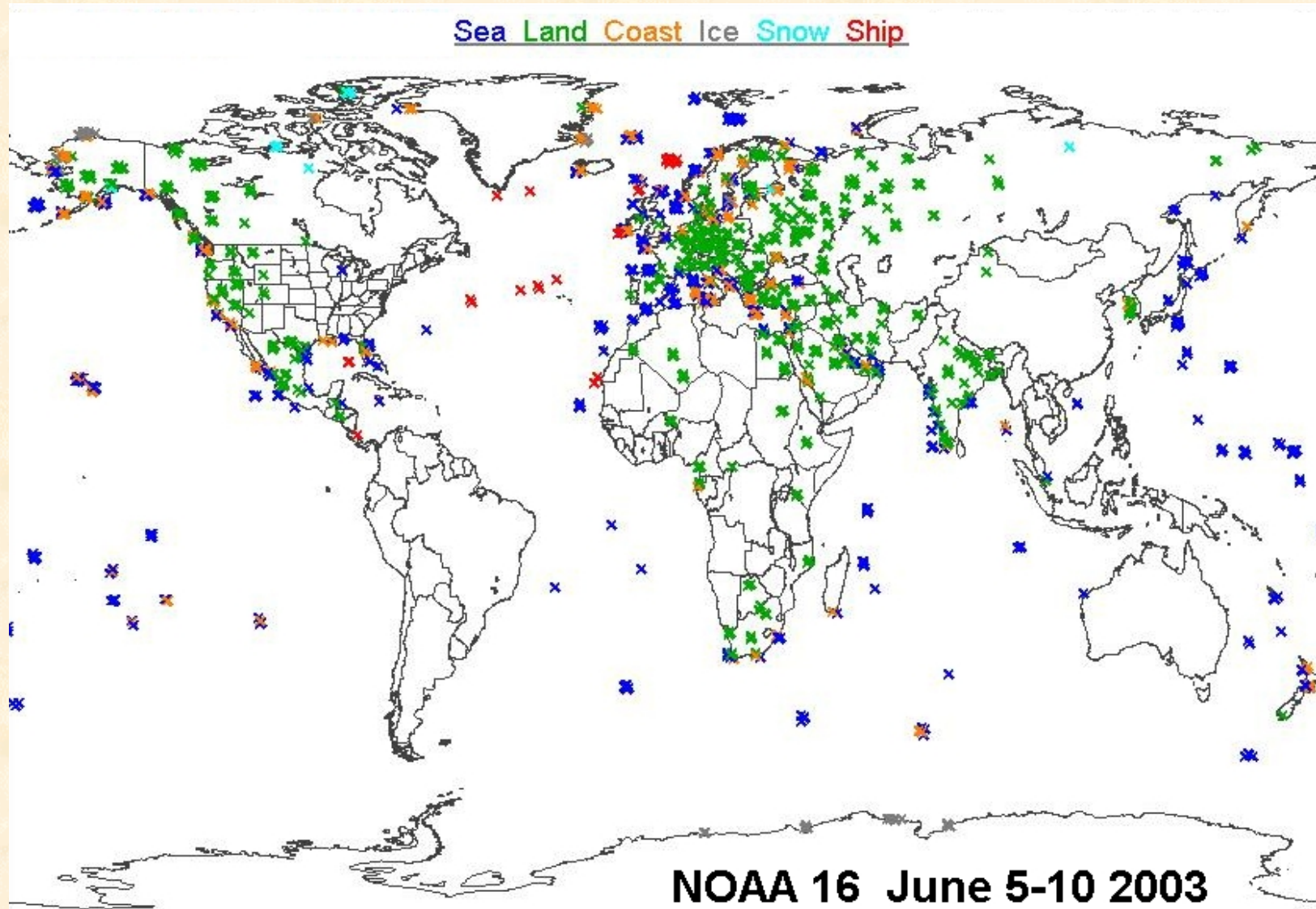
WHY NOT ADEQUATE ?

- Satellite and Radiosonde data each have **Systematic Uncertainties** ... so does the Science
- **Different Satellites** collocate with radiosondes in **Different Regions** ... Oceans neglected
- Collocation sample integrity are further compromised by **time and distance** windows

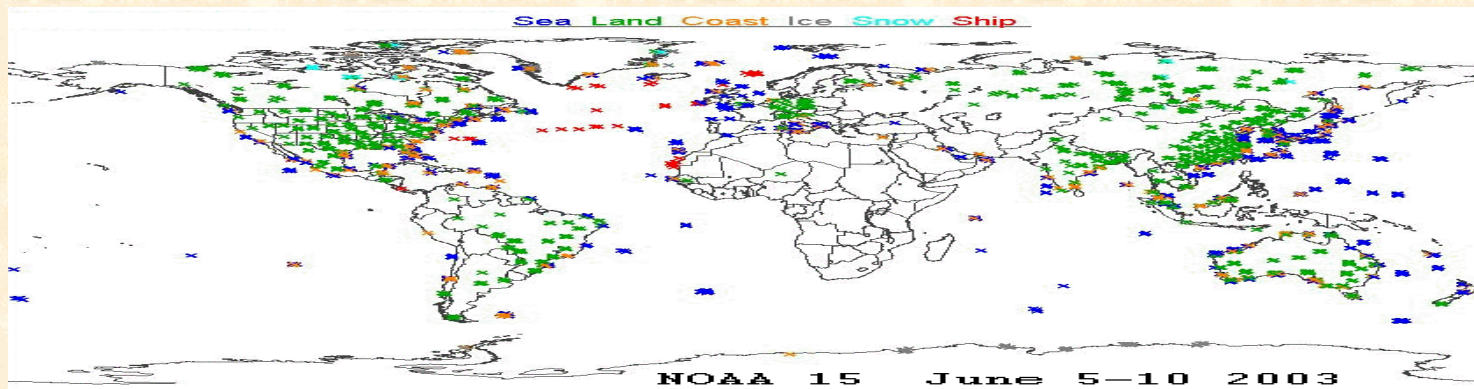
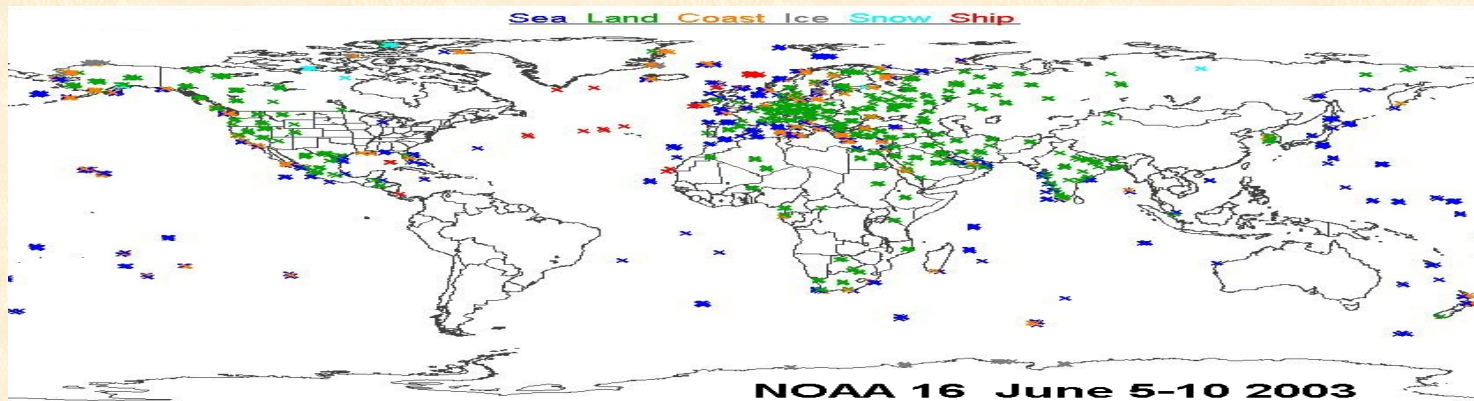
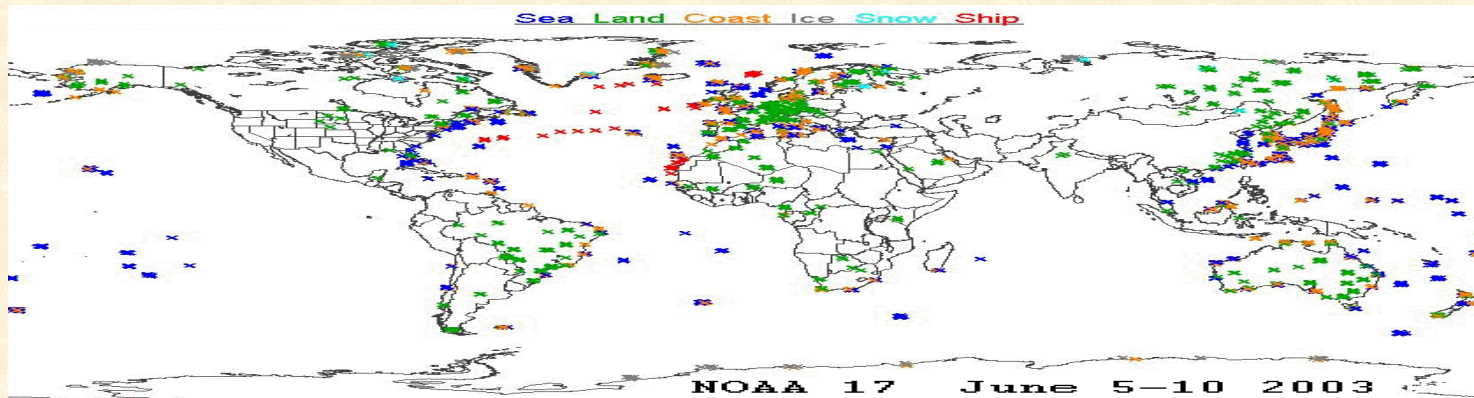
Global Radiosondes



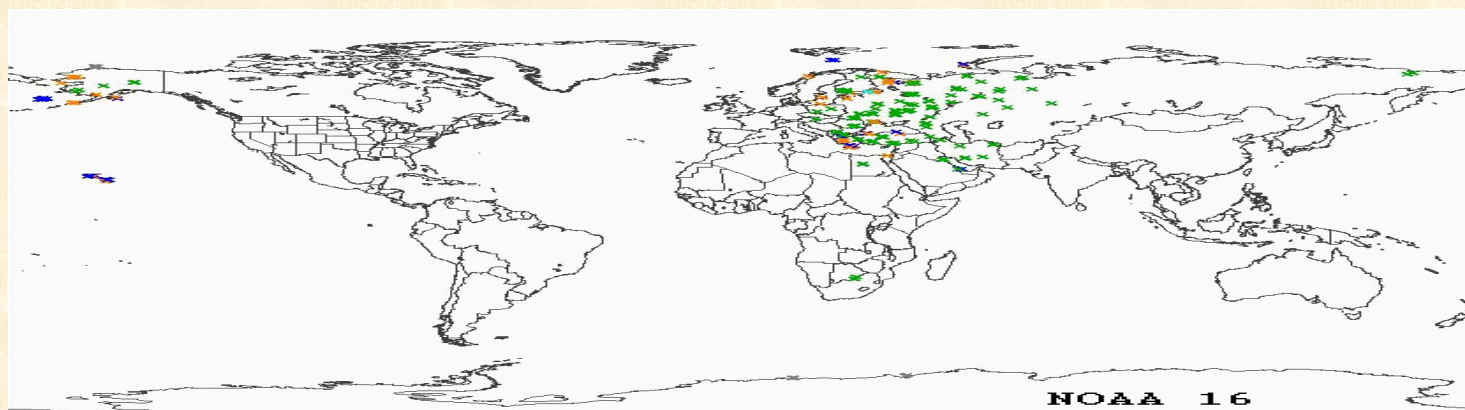
Collocated Radiosonde and Satellite Observations (± 3 hrs, land; ± 5 hrs, Sea)



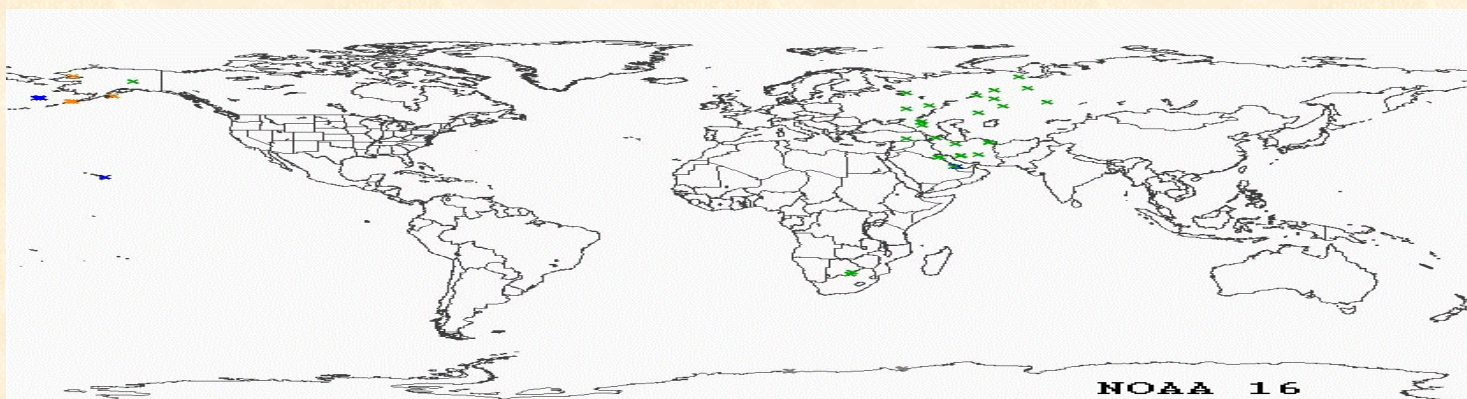
SATELLITE COLLOCATIONS (± 3 hrs, land; ± 5 hrs, sea)



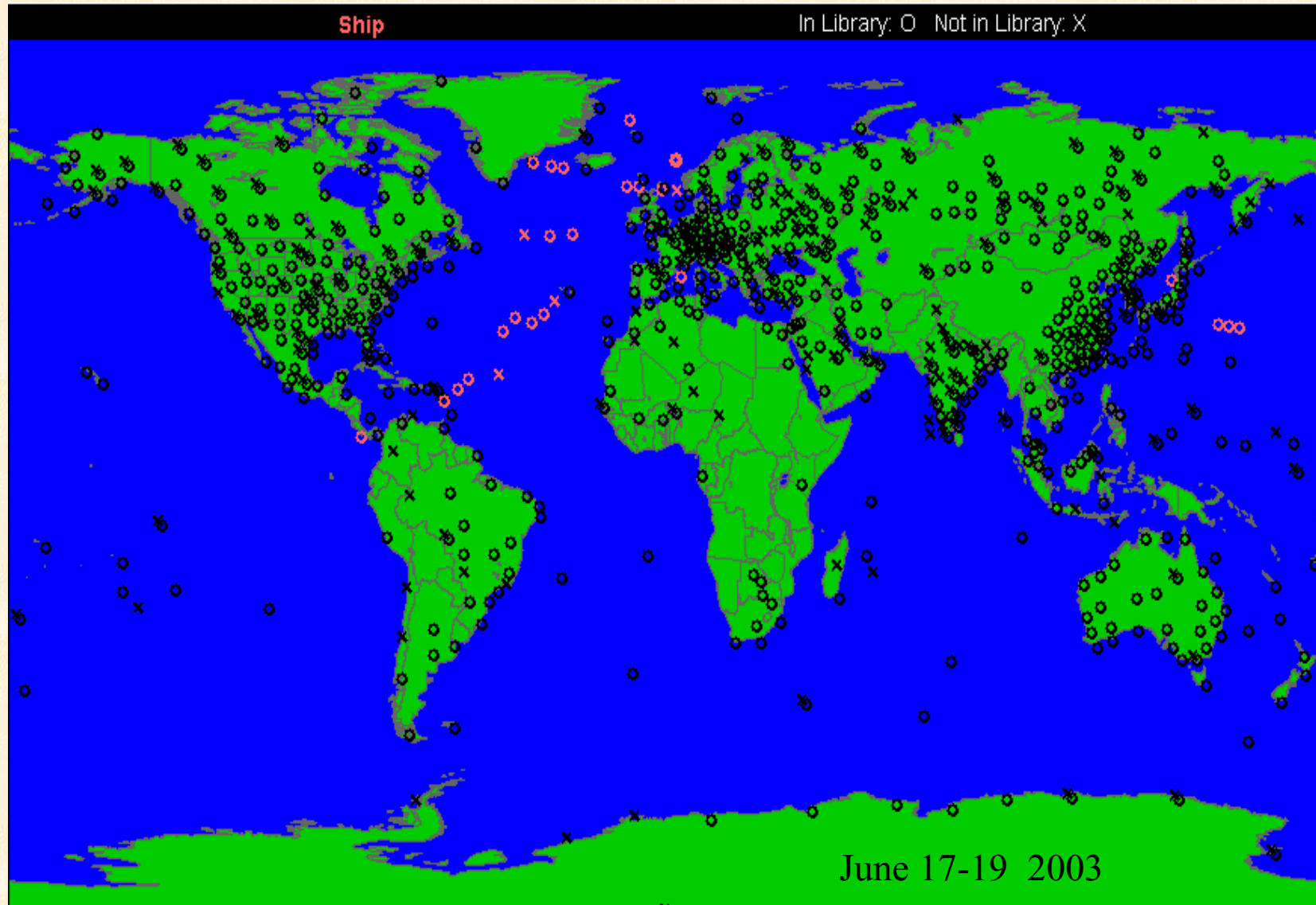
COLLOCATIONS @ +/- 1 HR



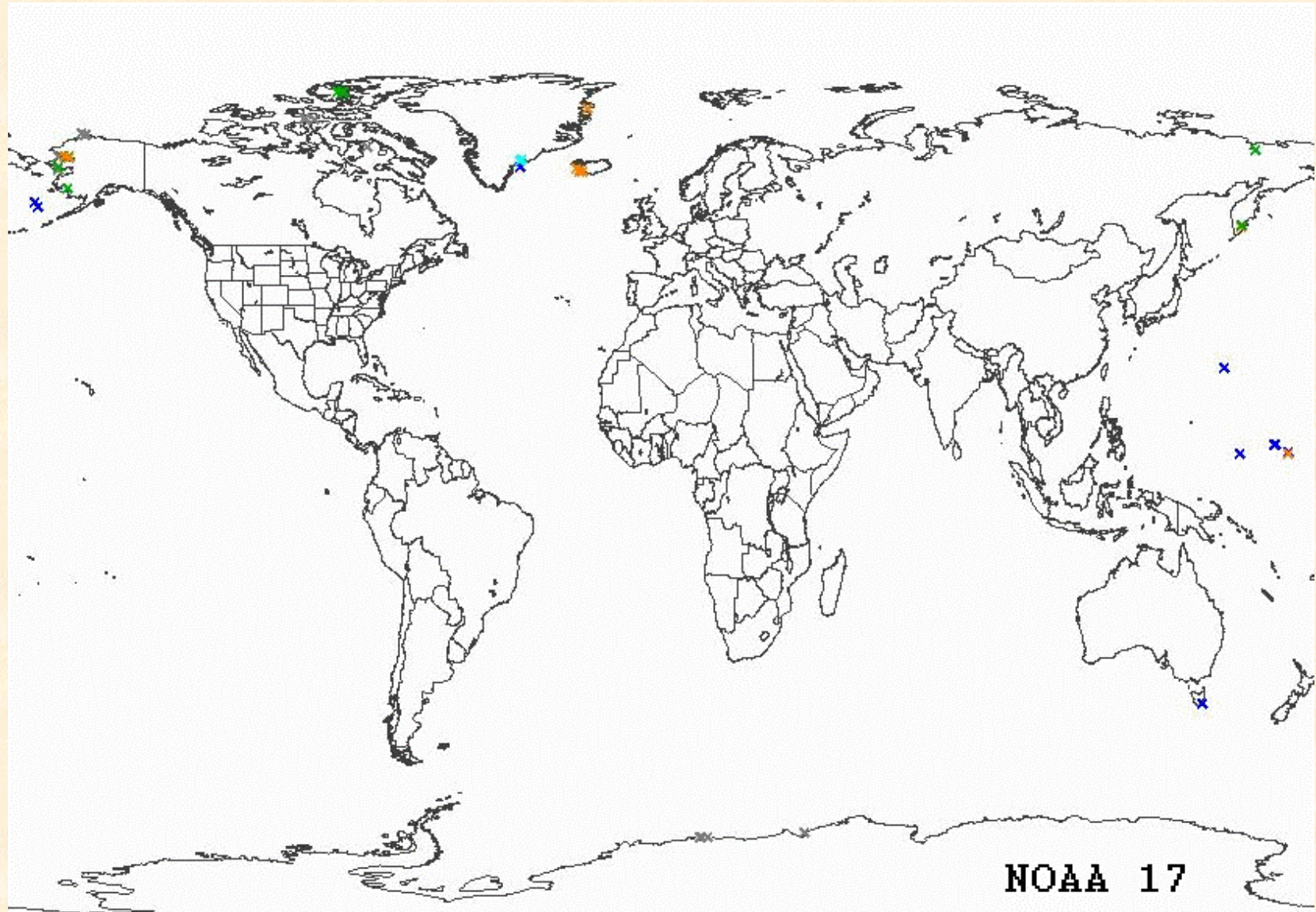
COLLOCATIONS @ -1 HR



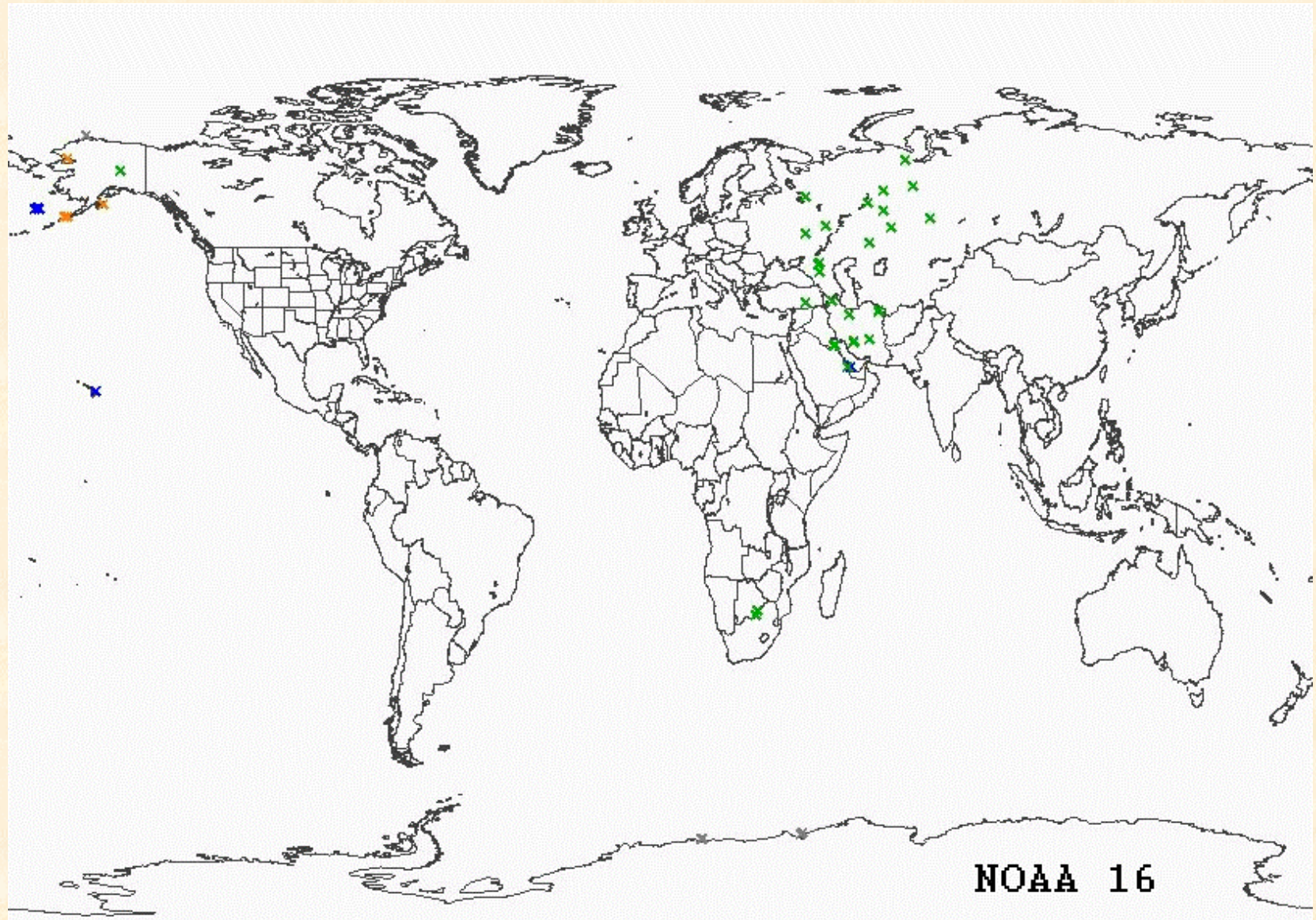
Global Radiosondes



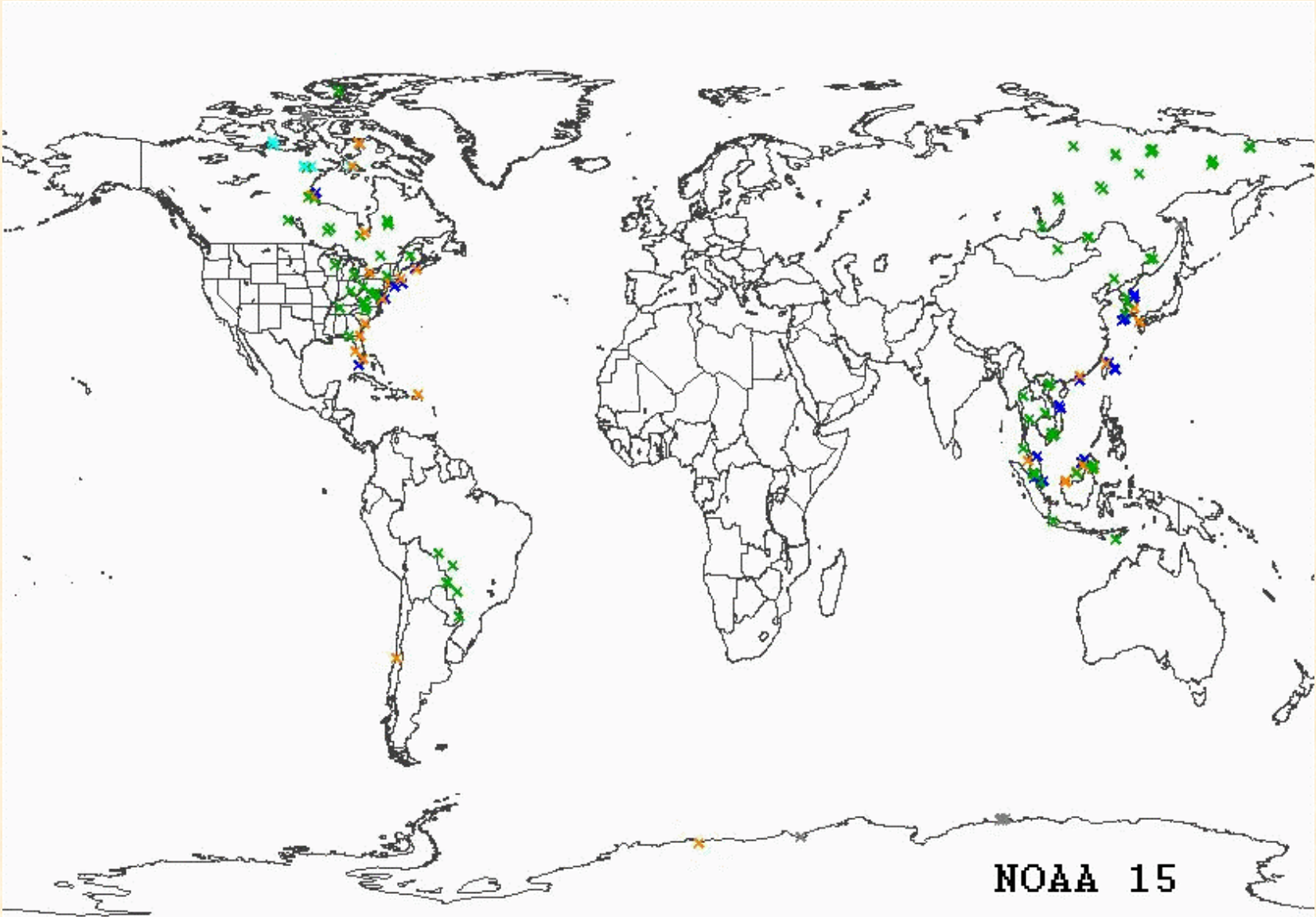
NOAA-17 @ -1hr



NOAA-16 @ -1 hr



NOAA-15 @ -1 hr



THE PLAN?

- Determine “Candidate” SUAN radiosonde sites
- Select final sites (... to alter launch schedules) ... *Ships !!!*
- Establish launch protocol; reference sondes; provide launch schedules; tracking ... *Resources, Education and Training (WMO)*
- Pursue special “*Intensive*” sites for additional ground truth, upper stratosphere ... *expand for NPOESS ?*

CANDIDATE SITE

- Not specified for Climate
 - **GUAN, GCOS, etc**
 - *“Thorne Scores”*
- Active, with “Suitable” Radiosonde
- Adequate Global Distribution ... **Ships !!!**
- Willing and able to change launch schedules
(... *no additional launches* ...)

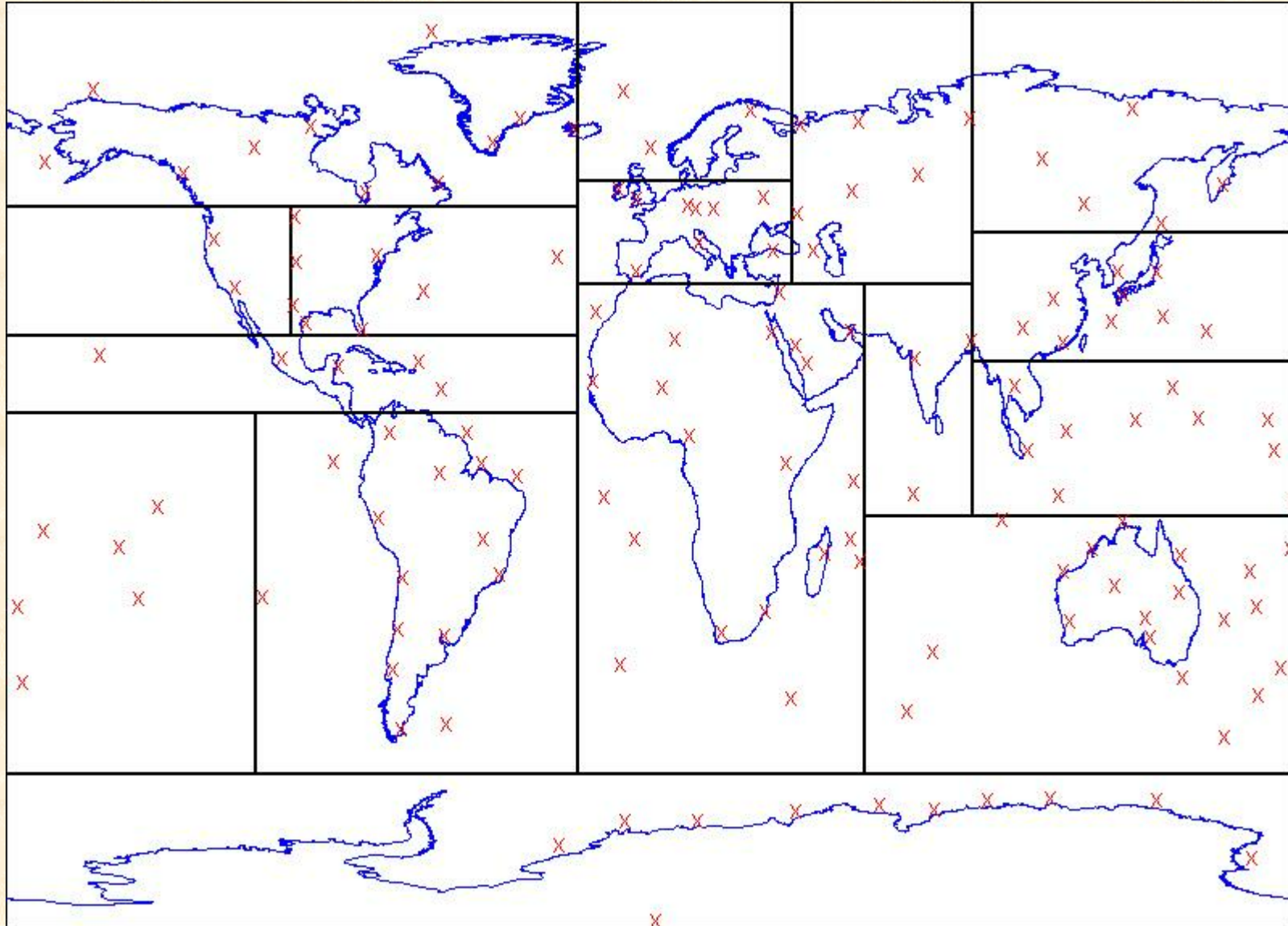
Activities

- Current Operational Baseline of Collocations
- **Climate (GUAN, GCOS, etc) Radiosonde Scores (Peter Thorne, HadleyCentre)**
- Instrument used (WMO Pub-9, TTBB, EMC Dictionary)
- Preliminary SUAN Candidates
- Ships

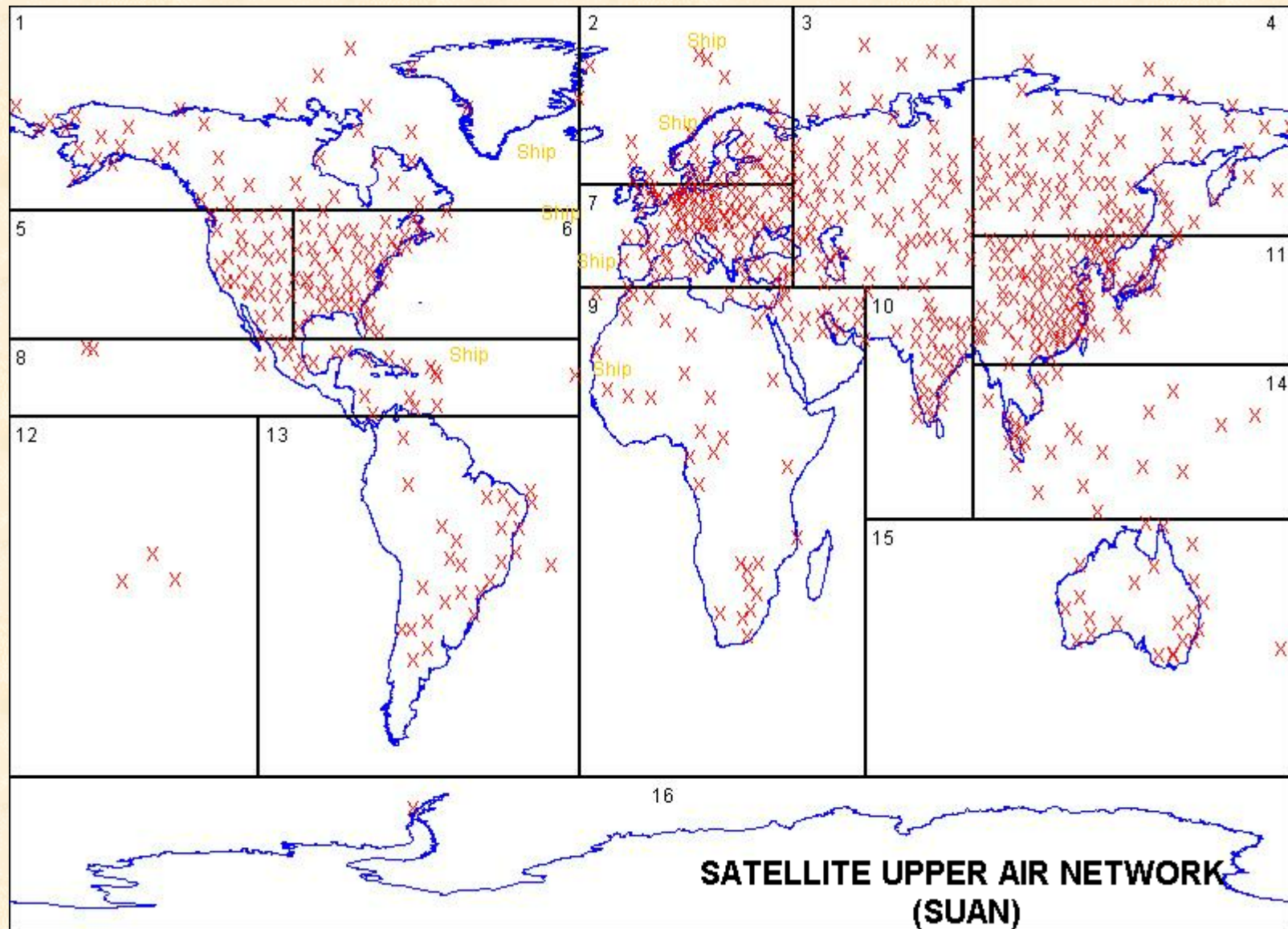
“Thorne” Scores Spread Sheet

| | 4 | 4 | 2 | 1 | | | | |
|--------|------|------|-----|-----|-------|-----------|------------|------------------|
| WMO id | GUAN | Lanz | 477 | 277 | Score | Inst. No. | Radiosonde | Alternate |
| 04018 | 1 | 1 | 1 | 1 | 11 | 61 | VRS80G | |
| 04202 | | | 1 | 1 | 3 | 61 | VRS80 | |
| 04220 | | | 1 | 1 | 3 | 71 | RS90-AG | |
| 04270 | 1 | | 1 | 1 | 7 | 71 | RS90-AG | |
| 04320 | | | | 1 | 1 | 71 | VRS90L | RS90-AL RS80-AG |
| 04339 | | | 1 | 1 | 3 | 71 | RS90-AL | RS80-L (+ Ozone) |
| 04360 | | 1 | 1 | 1 | 7 | 71 | VRS90L | |
| 06011 | | | 1 | 1 | 3 | 61 | RS90-AL | |
| 06060 | | | | | 0 | 9 | VIZ II | |
| 06181 | | | | | 0 | 71 | RS90-AL | RS90-AG |
| 06260 | | | 1 | 1 | 3 | 71 | RS90-AL | RS90-AG |
| 06447 | | | | 1 | 1 | 61 | VRS80L | |
| 06476 | | | 1 | 1 | 3 | 61 | VRS80L | |
| 06496 | | | | | 0 | 9 | | |
| 06610 | | | 1 | 1 | 3 | 26 | ML-SRS | |
| 07110 | | | 1 | 1 | 3 | 74 | VRS90L | |
| 07145 | | | 1 | 1 | 3 | 74 | VRS90L | |
| 07180 | | | | 1 | 1 | 74 | VRS90L | |
| 07481 | | | | 1 | 1 | 74 | VRS90L | |
| 07510 | | | 1 | 1 | 3 | 61 | VRS90L | |
| 07645 | | | 1 | 1 | 3 | 74 | VRS90L | |

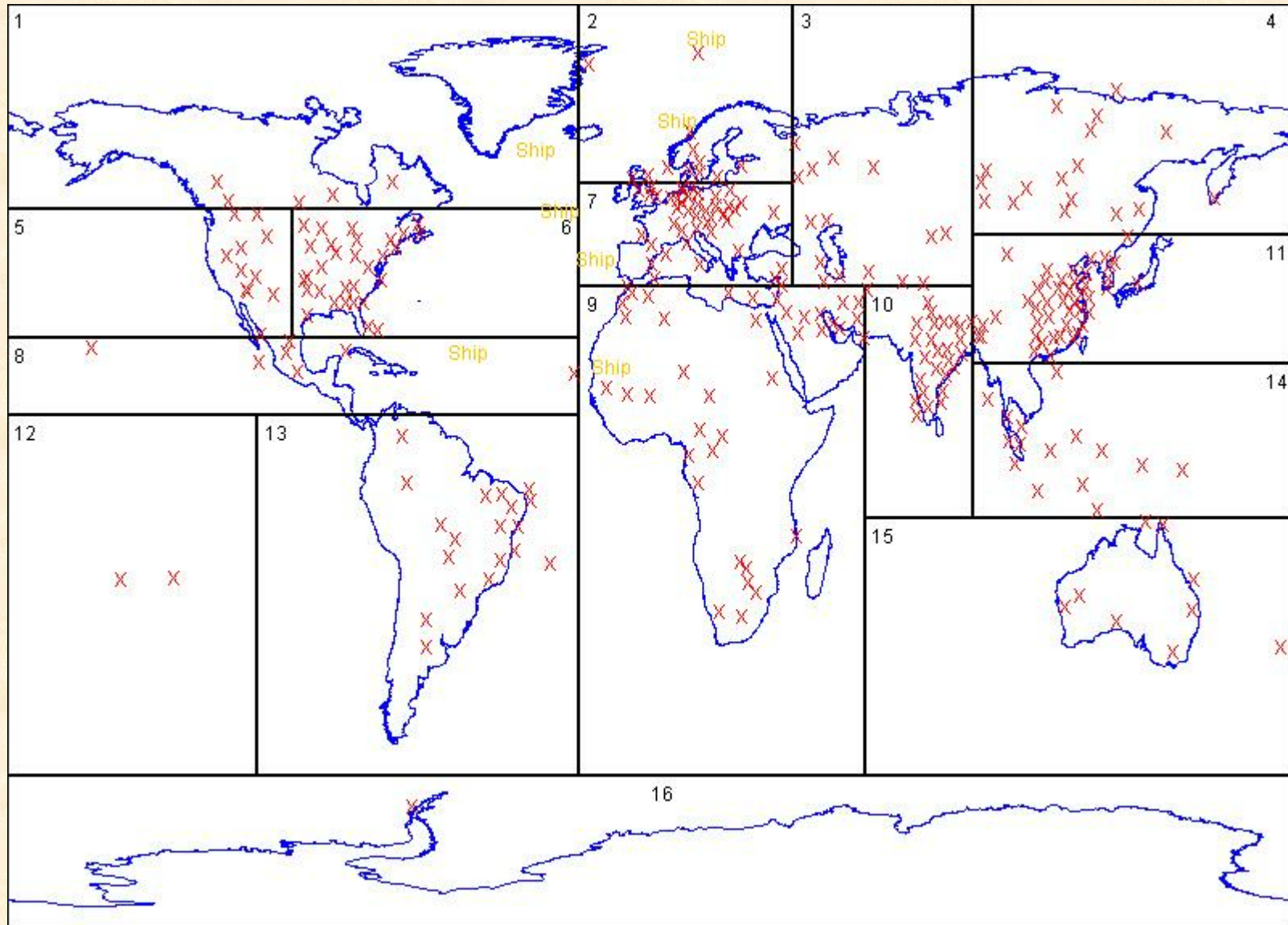
the “Untouchables”: Score > 4



SUAN CANDIDATES: Score < 4



SUAN CANDIDATES: Score @ 1, 0



Activities

- Current Operational Baseline of Collocations
- Climate (GUAN, GCOS, etc) Radiosonde Scores (Peter Thorne, HadleyCentre)
- **Instrument Type (WMO Pub-9, TTBB (31313 Re.), EMC Dictionary)**
- Preliminary SUAN Candidates
- Ships

WMO Pub-9 vs EMC Dictionary

| Country | id | loc | La | Lo | | | | | | | | | | | | Type | Alt | |
|--------------------|----------------|---------------|--------|--------|----|--|----|----|---|----|---|----|---|-----|---|-----------------|-----------------|-----------|
| | 04270 | NARSARSUAQ | 61 09N | 45 26W | 5 | | 4 | R | . | R | . | T | N | AUT | Y | MW11 | 400- RS90-AG | |
| | | DANMARKSHAV | | | | | | | | | | | | | | | | AL,RS80- |
| | 04320 | N | 76 46N | 18 40W | 12 | | 11 | R | . | R | . | CT | N | AUT | Y | MW11 | 406 VRS90L | AG |
| | | ИТТQQQKTOOK | | | | | | | | | | | | | | | 400- | K 80- |
| | 04339 | MIIT | 70 29N | 21 57W | 69 | | 65 | R | . | R | . | CT | N | AUT | Y | MW11 | 406 RS90-AL | L(+Ozone) |
| | 04360 | TASIIAQ | 65 36N | 37 38W | 52 | | 50 | R | . | R | . | CT | N | AUT | Y | MW11 | 400- VRS90L | |
| GUADELO UPE, ST | 27/03 /2000 | | | | | | | | | | | | | | | | | |
| | 78894 | GUSTAVIA, ST. | 17 54N | 62 51W | 52 | | 48 | . | . | P | . | | N | N | | | | |
| | 78897 | LE RAZET, | 16 16N | 61 36W | 11 | | 11 | RW | . | RW | . | CT | N | AUT | Y | V93 Degreane | 403 VRS90G | - |

Available Raob Instrument Types

| | | | |
|---|---|---|---|
| <input type="checkbox"/> 01 Reserved | <input type="checkbox"/> 26 Meteorlabor Basora (Swiss) | <input checked="" type="checkbox"/> 51 VIZ-B2 (USA) | <input type="checkbox"/> 76 AVK-RF95-ARMA (Russian Fed) |
| <input type="checkbox"/> 02 no raob - passive target | <input checked="" type="checkbox"/> 27 AVK-MRZ (Russian Federation) | <input checked="" type="checkbox"/> 52 Vaisala RS80-57H | <input type="checkbox"/> 77 GEOLINK GPSONDE (France) |
| <input type="checkbox"/> 03 no raob - active target | <input checked="" type="checkbox"/> 28 Meteorit Marz2-1 (Russian Fed) | <input type="checkbox"/> 53 AVK-RF95 (Russian Fed) | <input checked="" type="checkbox"/> 78 Reserved |
| <input type="checkbox"/> 04 no raob - passive temp | <input checked="" type="checkbox"/> 29 Meteorit Marz2-2 (Russian Fed) | <input type="checkbox"/> 54 Reserved | <input type="checkbox"/> 79 Reserved |
| <input type="checkbox"/> 05 no raob - active temp | <input type="checkbox"/> 30 Oki RS2-80 (Japan) | <input checked="" type="checkbox"/> 55 Reserved | <input type="checkbox"/> 80 Reserved |
| <input type="checkbox"/> 06 no raob - radio-acoustic sounder | <input type="checkbox"/> 31 VIZ/Valcom type A (Canada) | <input type="checkbox"/> 56 Reserved | <input type="checkbox"/> 81 Reserved |
| <input type="checkbox"/> 07 Reserved | <input type="checkbox"/> 32 Shanghai Radio (China) | <input type="checkbox"/> 57 Reserved | <input type="checkbox"/> 82 Reserved |
| <input type="checkbox"/> 08 Reserved | <input type="checkbox"/> 33 UK Met Office MK3 (UK) | <input type="checkbox"/> 58 Reserved | <input type="checkbox"/> 83 Reserved |
| <input checked="" type="checkbox"/> 09 no raob - system unknown | <input type="checkbox"/> 34 Vinohrady (Czechoslovakia) | <input type="checkbox"/> 59 Reserved | <input type="checkbox"/> 84 Reserved |
| <input type="checkbox"/> 10 VIZ type A pressure (USA) | <input type="checkbox"/> 35 Vaisala RS18 (Finland) | <input checked="" type="checkbox"/> 60 Vaisala RS80/MicroCora (Fin) | <input type="checkbox"/> 85 Reserved |
| <input type="checkbox"/> 11 VIZ type B time (USA) | <input type="checkbox"/> 36 Vaisala RS21 (Finland) | <input checked="" type="checkbox"/> 61 Vaisala RS80/DigiCora (Fin) | <input type="checkbox"/> 86 Reserved |
| <input checked="" type="checkbox"/> 12 RS Space Data Corp (USA) | <input checked="" type="checkbox"/> 37 Vaisala RS80 (Finland) | <input checked="" type="checkbox"/> 62 Vaisala RS80/PCCora (Fin) | <input type="checkbox"/> 87 Reserved |
| <input type="checkbox"/> 13 Astor (Australia) | <input type="checkbox"/> 38 VIZ LOCATE Loran-C (USA) | <input checked="" type="checkbox"/> 63 Vaisala RS80/Star (Fin) | <input type="checkbox"/> 88 Reserved |
| <input type="checkbox"/> 14 VIZ Mark I Microsonde (USA) | <input type="checkbox"/> 39 Sprenger E076 (Germany) | <input type="checkbox"/> 64 Orbital Sciences Corp (USA) | <input type="checkbox"/> 89 Reserved |
| <input type="checkbox"/> 15 EEC Company type 23 (USA) | <input type="checkbox"/> 40 Sprenger E084 (Germany) | <input type="checkbox"/> 65 VIZ transponder (USA) | <input checked="" type="checkbox"/> 90 Unknown Radiosonde |
| <input type="checkbox"/> 16 Elin (Austria) | <input type="checkbox"/> 41 Sprenger E085 (Germany) | <input checked="" type="checkbox"/> 66 Reserved | <input type="checkbox"/> 91 Reserved |
| <input type="checkbox"/> 17 Graw G (Germany) | <input type="checkbox"/> 42 Sprenger E086 (Germany) | <input checked="" type="checkbox"/> 67 Reserved | <input type="checkbox"/> 92 Reserved |
| <input type="checkbox"/> 18 Reserved | <input type="checkbox"/> 43 AIR IS-4A-1680 (USA) | <input type="checkbox"/> 68 Reserved | <input type="checkbox"/> 93 Reserved |
| <input checked="" type="checkbox"/> 19 Graw M60 (Germany) | <input type="checkbox"/> 44 AIR IS-4A-1680 X (USA) | <input type="checkbox"/> 69 Reserved | <input type="checkbox"/> 94 Reserved |
| <input type="checkbox"/> 20 Indian Met Service MK3 (India) | <input checked="" type="checkbox"/> 45 RS MSS (USA) | <input type="checkbox"/> 70 Reserved | <input type="checkbox"/> 95 Reserved |
| <input type="checkbox"/> 21 VIZ/Jin Yang Mark I (S Korea) | <input type="checkbox"/> 46 Air IS-4A-403 (USA) | <input checked="" type="checkbox"/> 71 RS90/DigiCora (Fin) | <input type="checkbox"/> 96 Reserved |
| <input type="checkbox"/> 22 Meisei RS2-80 (Japan) | <input checked="" type="checkbox"/> 47 Meisei RS2-91 (Japan) | <input type="checkbox"/> 72 RS90/PC-Cora (Fin) | <input type="checkbox"/> 97 Reserved |
| <input type="checkbox"/> 23 Mesural FMO 1950A (France) | <input type="checkbox"/> 48 VALCOM (Canada) | <input type="checkbox"/> 73 RS90/Autosonde (Fin) | <input type="checkbox"/> 98 Reserved |
| <input type="checkbox"/> 24 Merural FMO 1945A (France) | <input checked="" type="checkbox"/> 49 VIZ MARK II (USA) | <input checked="" type="checkbox"/> 74 RS90/Star (Fin) | <input type="checkbox"/> 99 Reserved |
| <input type="checkbox"/> 25 Mesural MH73A (France) | <input checked="" type="checkbox"/> 50 GRAW DFM-90 (Germany) | <input type="checkbox"/> 75 AVK-MRZ-ARMA (Russian Fed) | <input type="checkbox"/> 100 Reserved |

Sea
 Land
 Coast
 Ice
 Snow
 Ship
 In Library
 Not In Library

WMO Pub-9 vs EMC Dictionary (Radiosonde Type)

EMC WMO Pub-9

| WMO id | GUAN | Lanz | 477 | 277 | Score | Inst. No. | Radiosonde | Alternate | |
|--------|------|------|-----|-----|-------|-----------|------------|-----------|---|
| 11520 | | | 1 | 1 | 3 | 61 | VRS90LH | VRS80L | X |
| 11722 | | | | | 0 | 61 | VRS80 | | |
| 11952 | | | | 1 | 1 | 71 | VRS90LH | VRS80L | |
| 12120 | | | | 1 | 1 | 71 | VRS90L | | |
| 12330 | | | | 1 | 1 | | ? | | |
| 12374 | | | | 1 | 1 | 61 | VRS90L | | X |
| 12425 | | | | 1 | 1 | 71 | VRS90L | | |
| 12843 | | | | 1 | 1 | 61 | RS90-AL H | | X |
| 12982 | | | | 1 | 1 | 62 | RS90-AL H | | X |
| 13275 | | | 1 | 1 | 3 | 61 | VRS80L | | |
| | | | | | | | | | |
| 42874 | | | | | 0 | 12 | IM MK3 | | X |
| 42971 | | | | 1 | 1 | 12 | IM MK3 | | X |
| 43014 | | | | | 0 | 12 | IM MK3 | | X |
| 43041 | | | | | 0 | 12 | IM MK3 | | X |
| 43128 | | | | 1 | 1 | 12 | IM MK3 | | X |
| | | | | | | | | | |
| 47058 | | | | 1 | 1 | 9 | Shang | | X |
| | | | | | | | | | |
| 50774 | | | | | 0 | 19 | Shang | | X |
| 50953 | | | 1 | 1 | 3 | 19 | Shang | | X |
| 51076 | | | 1 | 1 | 3 | 19 | Shang | | X |
| 51431 | | | | 1 | 1 | 19 | Shang | | X |

“X” indicates where report type disagree

WMO Pub-9 vs EMC Dictionary (Radiosonde Types)

| <u>WMO Pub-9</u> | <u>EMC id's</u> | | | | |
|------------------|-----------------|----|----|----|--|
| AIR | 43 | 44 | 46 | | |
| Graw DFM90 | 50 | | | | |
| IM MK3 | 20 | | | | |
| J/YANG | 21 | | | | |
| MARK II | 49 | | | | |
| Mars | 28 | 29 | | | |
| MEIS RS2-80,91 | 22 | 47 | | | |
| ML-SRS | 26 | | | | |
| MRZ | 27 | 75 | | | |
| MRZ-3A | 27 | 75 | | | |
| MRZ-T | 27 | 75 | | | |
| MSS | 45 | | | | |
| RF95 | 53 | 76 | | | |
| RF95/MRZ | 27 | 75 | 53 | 76 | |
| RS SDC | 12 | | | | |
| Shang | 32 | | | | |

WMO Pub-9 vs EMC Dictionary

(...RS80...)

| | | | | | | |
|----------|----|----|----|----|----|--|
| RS80-57H | 52 | | | | | |
| RS80 | 60 | 61 | 62 | 63 | 37 | |
| RS8015G | | | | | | |
| RS80-18G | | | | | | |
| RS80G | | | | | | |

| | | | | | | |
|-----------|----|----|----|----|--|--|
| VRS8015G | 60 | 61 | 62 | 63 | | |
| VRS8015GA | | | | | | |
| VRS80A | | | | | | |
| VRS80G | | | | | | |
| VRS80G | | | | | | |
| VRS80G | | | | | | |
| VRS80GA | | | | | | |
| VRS80GH | | | | | | |
| VRS80L | | | | | | |
| VRS80L | | | | | | |
| VRS80LA | | | | | | |
| VRS80LH | | | | | | |
| VRS80N | | | | | | |

WMO Pub-9 vs EMC Dictionary (...RS90...)

| | | | | | | | |
|-----------|----|----|----|----|--|--|--|
| RS90A | 71 | 72 | 73 | 74 | | | |
| RS90-AG | | | | | | | |
| RS-90AL | | | | | | | |
| RS90-AL H | | | | | | | |

| | | | | | | | |
|------------|----|----|----|----|--|--|--|
| VRS90 | 71 | 72 | 73 | 74 | | | |
| VRS90-AL G | | | | | | | |
| VRS90G | | | | | | | |
| VRS90G | | | | | | | |
| VRS90L | | | | | | | |
| VRS90LH | | | | | | | |

| | | | | | | | |
|----------|----|----|--|--|--|--|--|
| VIZ A | 10 | | | | | | |
| VIZ B | 11 | | | | | | |
| VIZ B2 | 51 | | | | | | |
| VIZ II | 49 | 51 | | | | | |
| VIZ II L | 49 | 51 | | | | | |

Acceptable Instrument Types

ID

PUB - 9

47

Mesei RS2-91

49

VIZ MARK II

51

VIZ-B2

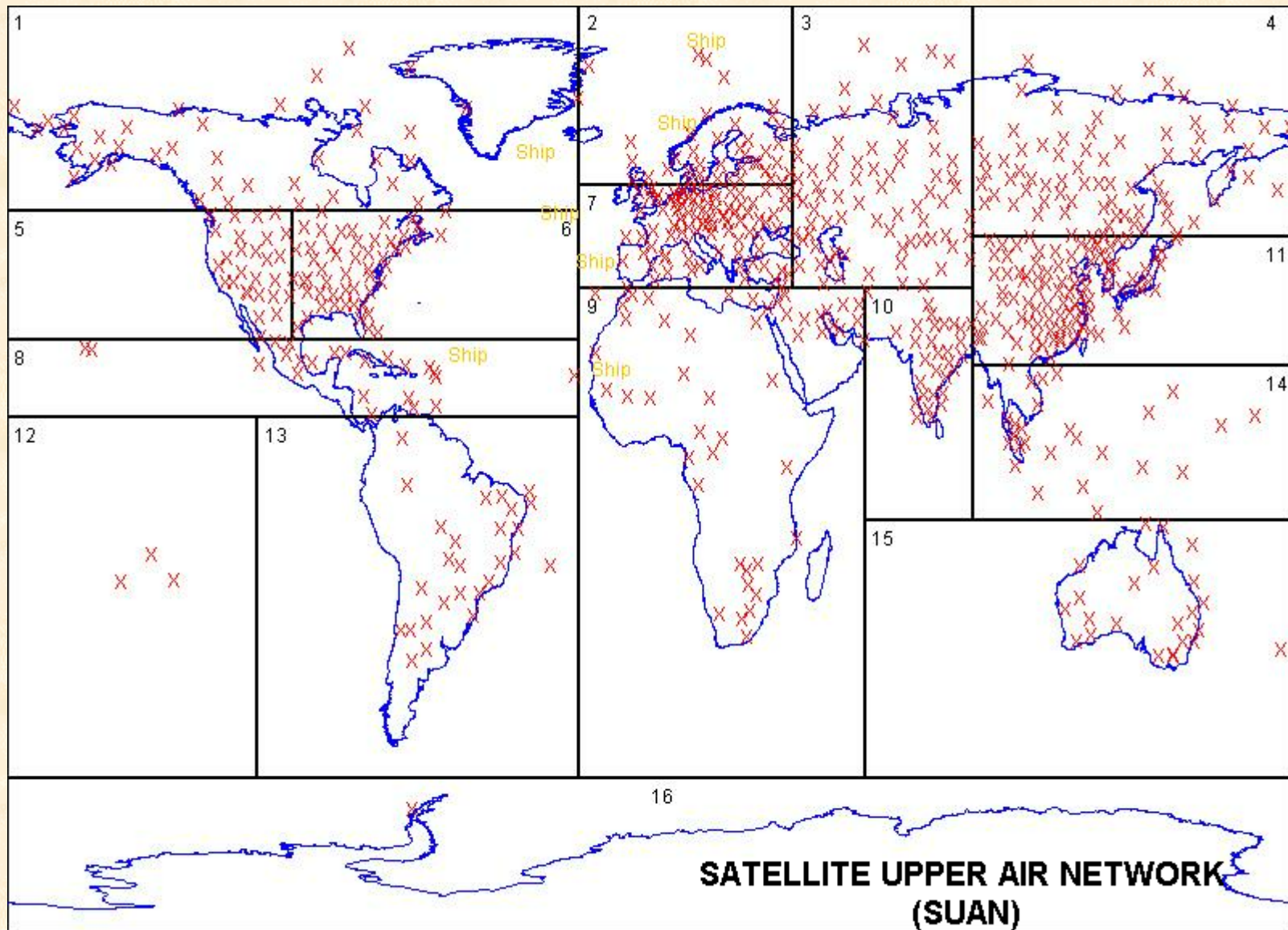
37, 52, 60, 61, 62, 63

Vaisala RS80 ...

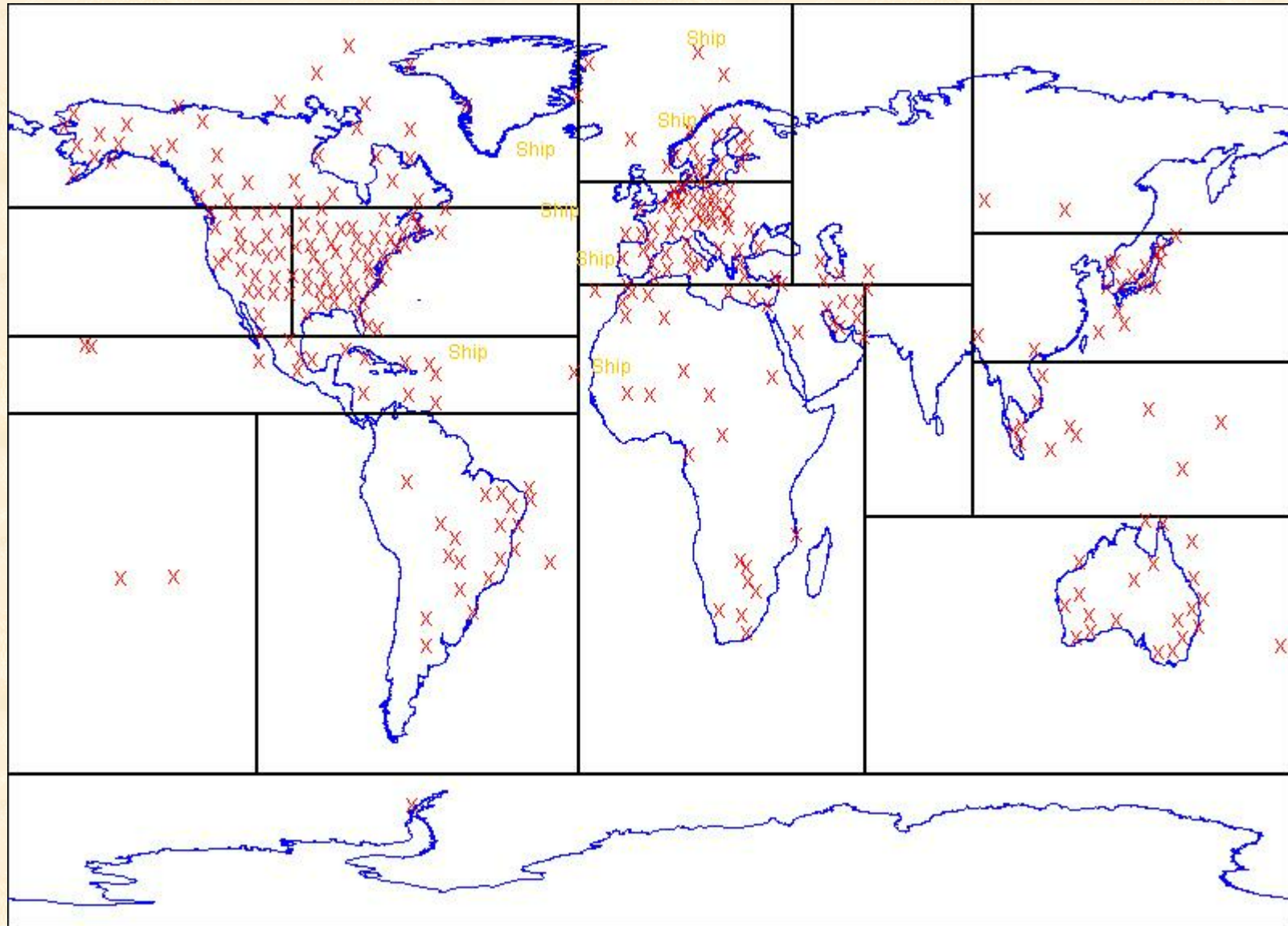
71, 74

RS90 ...

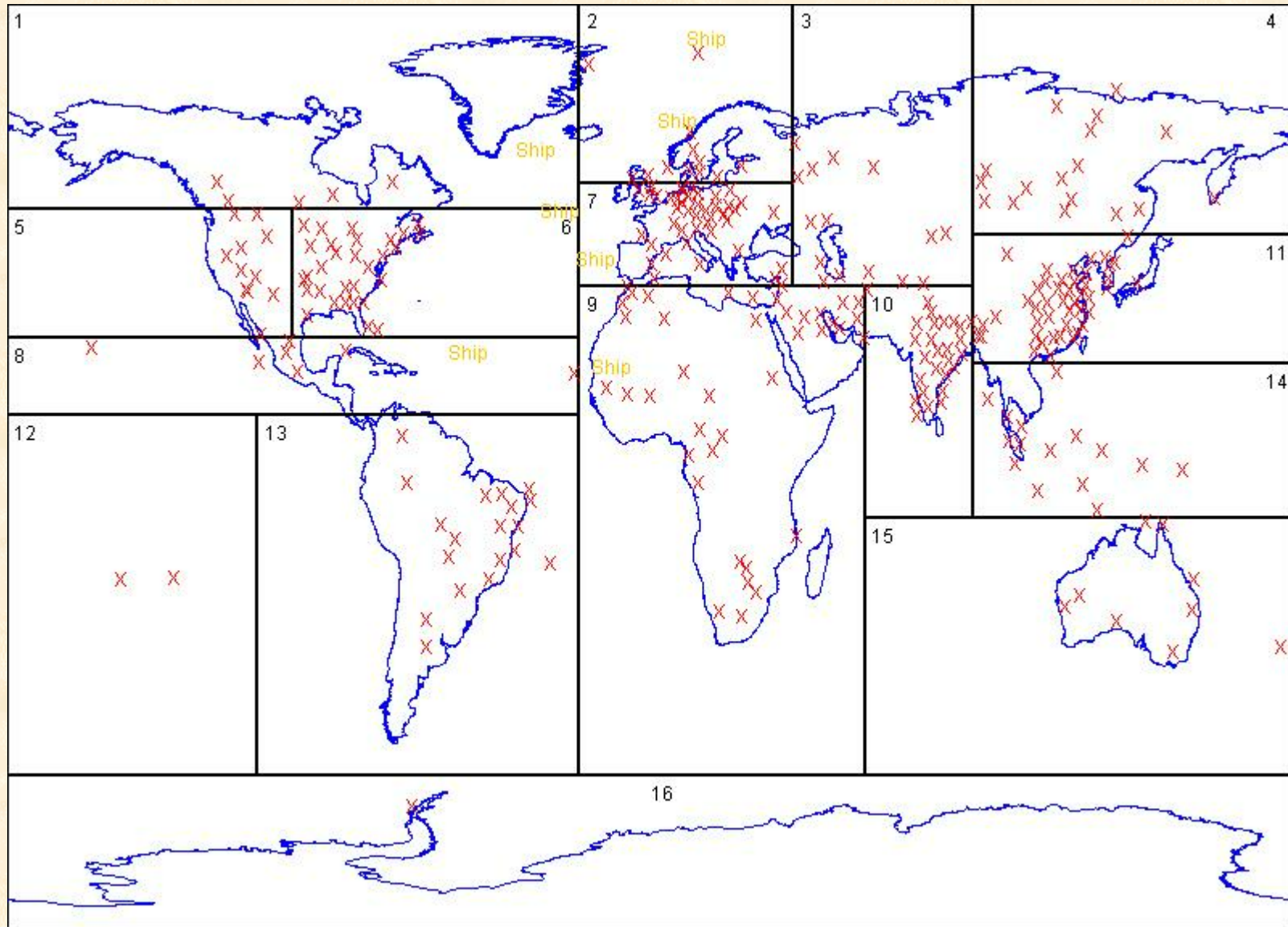
SUAN CANDIDATES: Score < 4



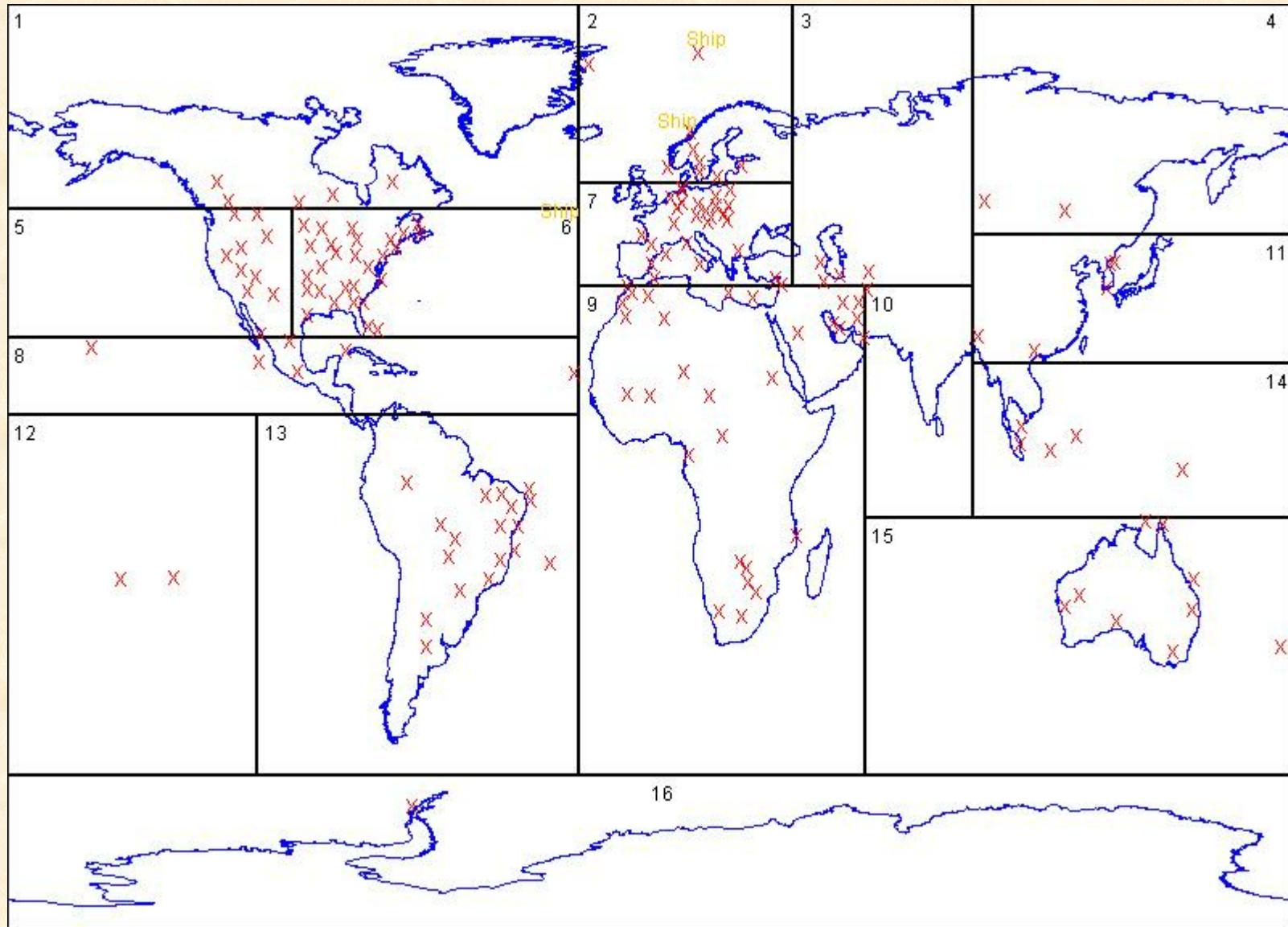
SUAN CANDIDATES: Score < 4, Raob Id's 37...74



SUAN CANDIDATES: Score @ 1, 0



SUAN CANDIDATES: Score @ 1, 0; Raob Id's 37...74



STATUS

- Current Operational Baseline of Collocations
- Climate (GUAN, GCOS, etc) Radiosonde Scores (Peter Thorne, HadleyCentre)
- Instrument used (WMO Pub-9, TTBB, EMC Dictionary)
- **Preliminary SUAN Candidates**
- Ships

Candidate Site Analysis

- “*Thorne*” Score ... < 4
- Acceptable Radiosonde Types
- Global Distribution
- Avoid Coasts
- Low Terrain (*456m ... 950mb*)
- Active

SUAN Candidate Sites

| | | | |
|------------|---|------|----------------|
| Green..... | Score 1 or 0 “and” Acceptable Raob Type | (24) | 23 Sea (3 Ice) |
| Yellow.... | Score 2 or 3 “and” Acceptable Raob Type | (11) | |
| Red..... | Score 4 or more “and/or” Unacceptable Raob Type | (8) | 20 Land |

Box 1: 71203 *, 71823, 71917, 70316 +, 70133, 71867 *

Box 2: 01004, 06011, 02185

Box 3: 40875, 28661

Box 4: 31736, 24343, 70414 +

Box 5: 74004

Box 6: 78073, 72230, 71600, 08508

Box 7: 08160, 16429, 12982

Box 8: 91176, 08594, 78897, 76692

Box 9: 60630, 64700, 67237, 68994

Box 10: 61967

Box 11: 41923, 47945, 47420

Box 12: 91948

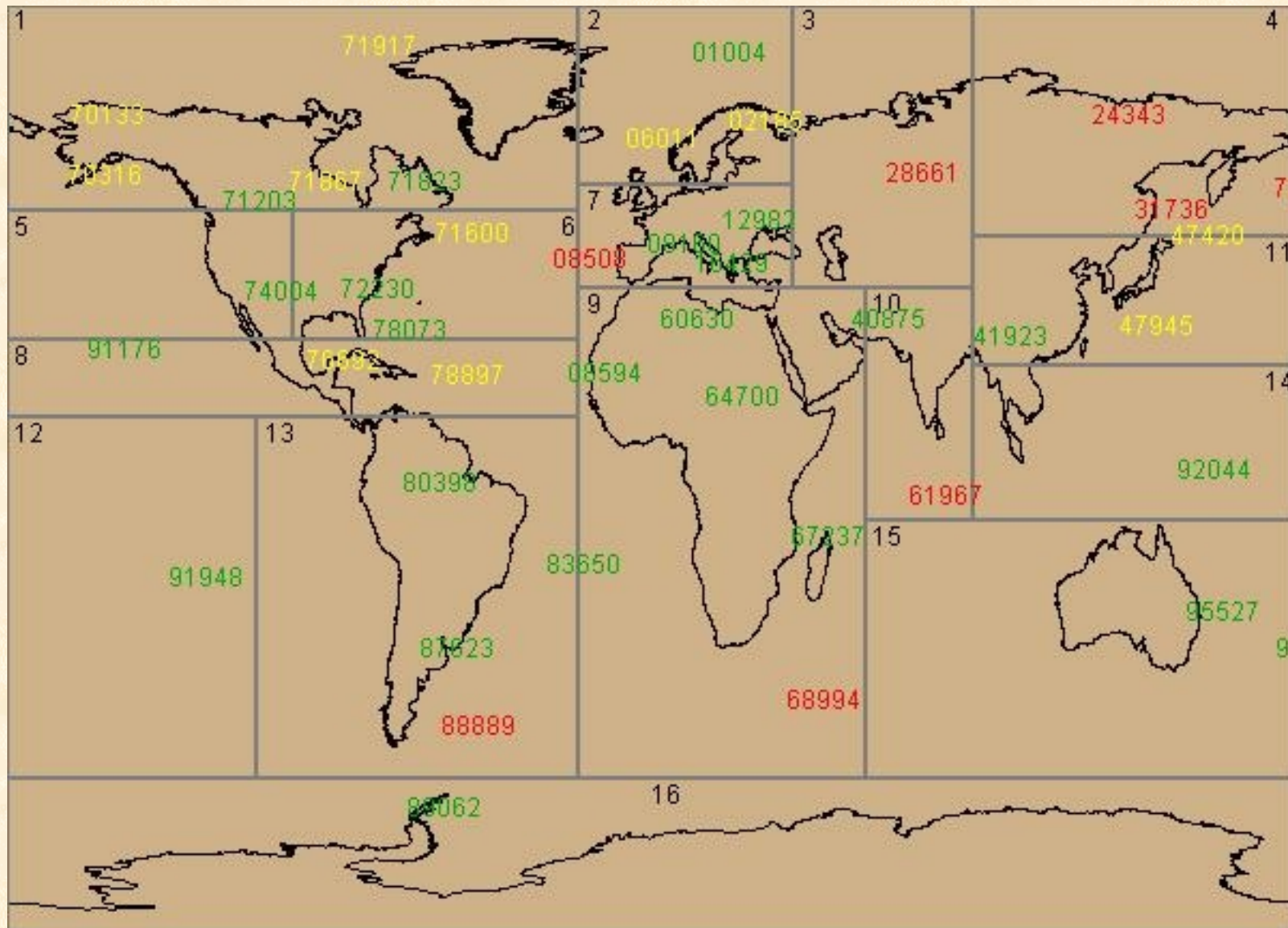
Box 13: 80398, 87623, 83650, 88889

Box 14: 92044

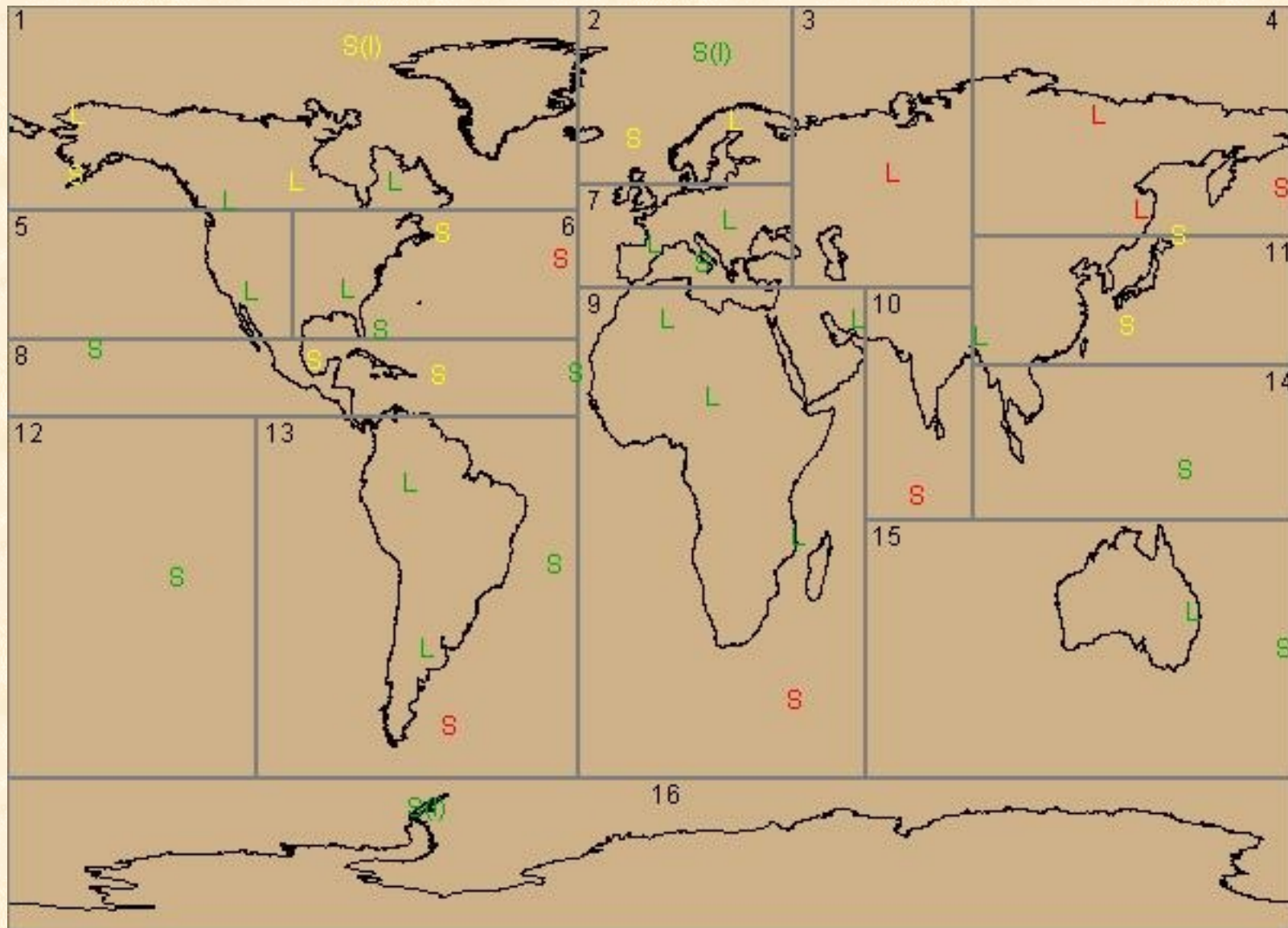
Box 15: 93112, 95527

Box 16: 89062

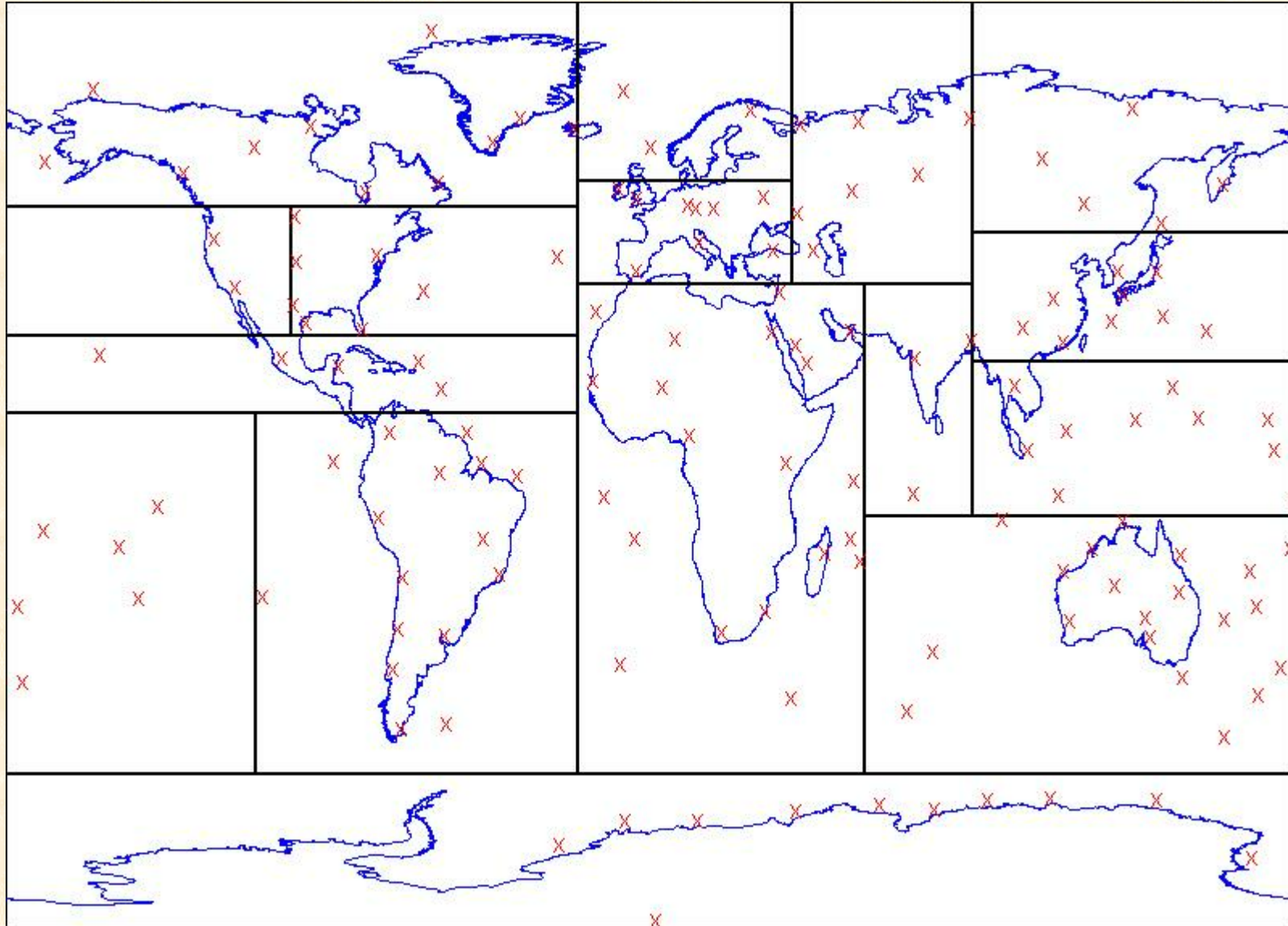
SUAN Candidates



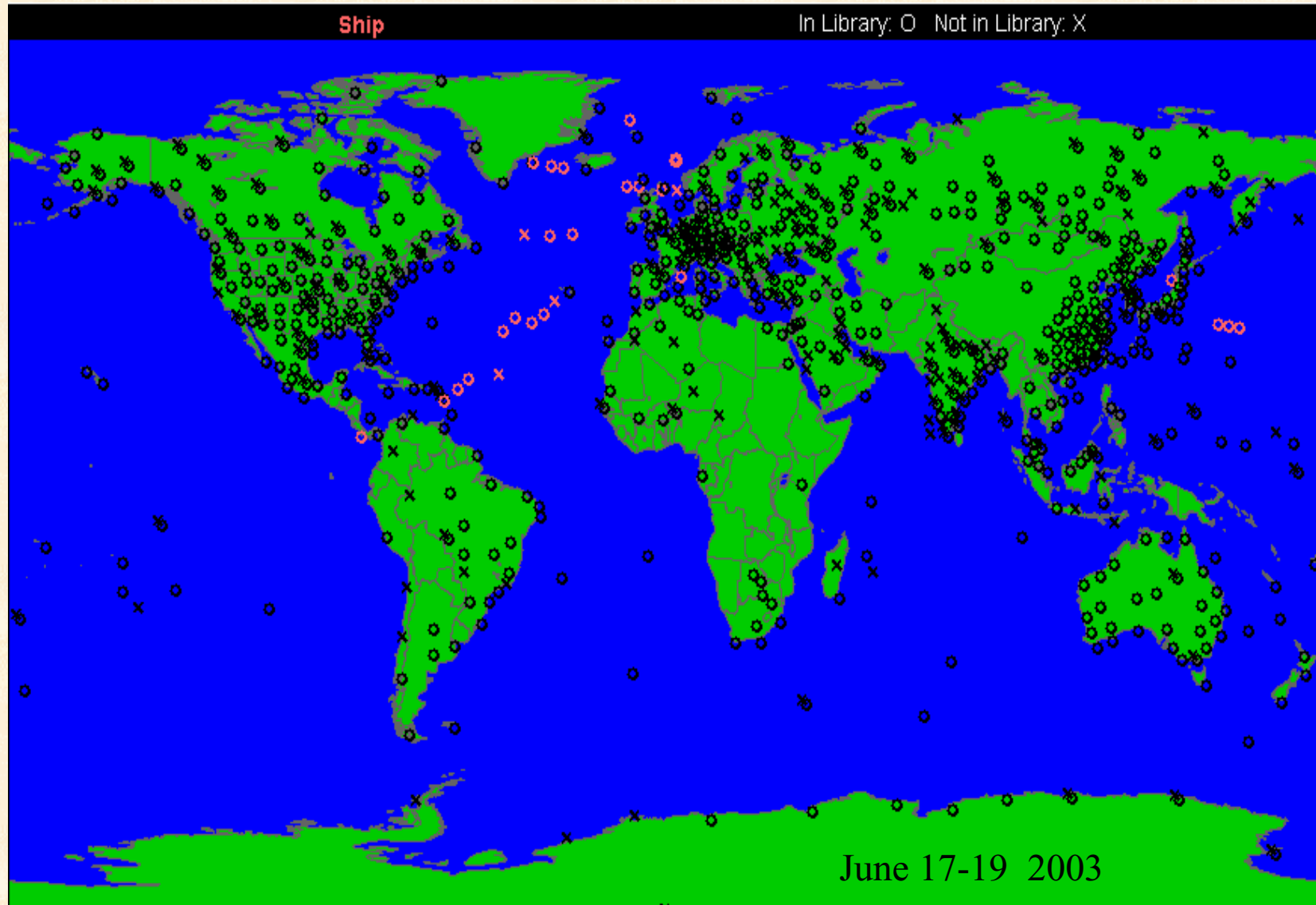
SUAN Candidates



the “Untouchables”: Score > 4



Global Radiosondes



Perspective 1

- **Question of tradeoffs:**

- What is (potential) impact of these sites ?

- *current Synoptic*

versus

- *proposed SUAN*

Perspective 1a

- In current *Synoptic* platform, Raobs impact on:
 - NWP is decreasing as satellite data impacts increase ...
(and 4d-var reduces need for synoptic data)
 - Climate is mitigated by (systematic) uncertainties in measurement ...
- In proposed *SUAN (5%)* platform, Raobs impact on:
 - NWP is enhanced thru “*super-obs*” at SUAN locations ... (that is, coincident NWP, Radiosonde and Satellite data)
 - Climate is enhanced thru ability to “better” compensate for Uncertainties in Satellite (measurement and product), Science and Radiosondes ... *Present, Past and Future !*

Perspective 1b

- **Conclusion:**
 - the benefits of **SUAN** are across the board
 - Satellite, Radiosonde, Science
 - Climate and NWP
 - Past, present and Future
- **SUAN represents a true “*Transfer Standard*”**
- **SUAN platform makes sense ...**
 - *it adds (much) more than it subtracts!*

Perspective 2

- **Polar Satellite Providers (ie NOAA) maintain and distribute global data (since 1979) ... *essentially free of charge***
- **Users have an inherent responsibility to provide ground truth data platforms ... *reimbursement to Providers***
- **The lack of such data (past, present and future) undermines (satellite and radiosonde) data impact**
- **SUAN is a program to “begin” providing such data ...**
- ***Operational means SUAN***

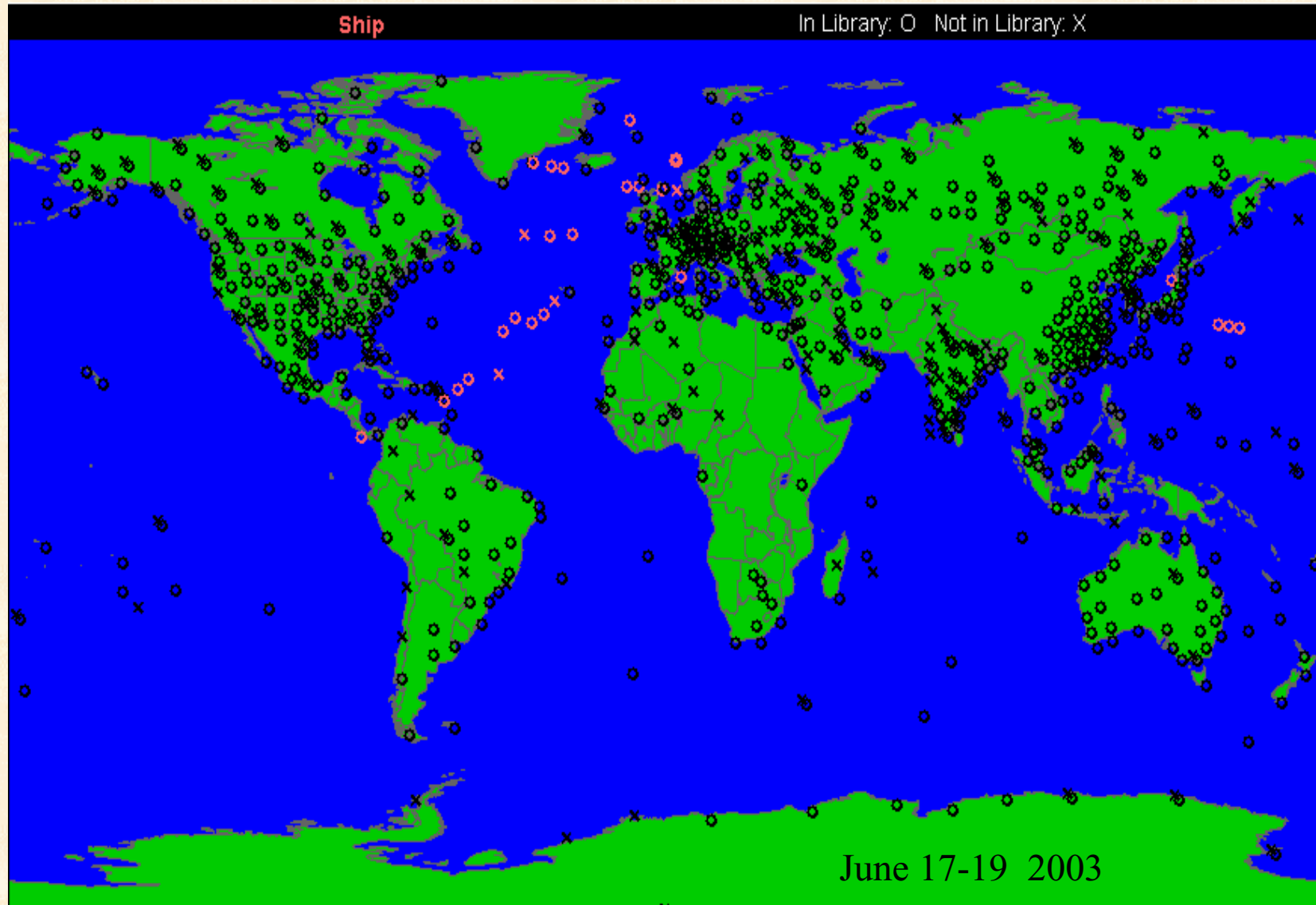
Follow-up

- Review (by NWP and Climate, etc) ...
- Site Analysis ... finalize the sites
(... *no additional launches ... !?*)
- NOAA, EUMETSAT, WMO ... ITSC roles
- Launch protocols; Schedules (land vs “*Ships*”), Reference Sonde(s), Training, Monitoring ... Resources !
- *Operational means SUAN !!!*

STATUS

- Current operational baseline of collocations
- Climate (GUAN, GCOS, etc) Radiosonde Scores (Peter Thorne, HadleyCentre)
- Instrument used (WMO Pub-9, TTBB, EMC Dictionary)
- Preliminary SUAN candidates
- **Ships**

Global Radiosondes



SHIPS (31 Active)

| SHIP STATIONS | | | | | | | | | | | | | | | | | | | | | |
|---------------|-----------------------------|----------|----|-----|-----|-----|----|----|----|-----|----|--------|----|-------|-------------|---------|------------|------|--------|--------|--|
| Station | StationName | Latitude | Hp | Hha | HHa | Upp | Up | Up | Up | CLI | GU | Geopot | Ra | Radia | GroundEquip | Frequen | RegularR | Alte | WindFg | Windfm | Remarks |
| CGDX | DES CROSELLIERS (CANADA) | | | | | | | X | | | N | AUTO | Y | V86 | MARWN | 401-406 | VRS80G | | GPS | MARW | ADDED 11/1997- LAST EDITED 01/11/1997 |
| DASAP | (GERMANY) | | | | | | | | | | | | | | | | | | | | |
| DBBH | FS METEOR (GERMANY) | | 6 | | | | | X | | | N | AUTO | Y | V86 | DIGICORA | 401-406 | VRS80G | | GPS | DIGICO | RESEARCH VESSEL,Operates in Atlantic,EUCOS |
| DBLK | POLARSTERN (GERMANY) | | 10 | | | | | X | | | N | AUTO | Y | V93 | DIGICORA | 401-406 | VRS80G | | GPS | DIGICO | RESEARCH VESSEL,Operates in Atlantic and N and S Polar regions ,EUCOS |
| EBUK | ESPERANZA DELMAR (SPAN) | | | | | | | X | | | N | AUTO | Y | V93 | DIGICORA | 401-406 | VRS80G | | GPS | DIGICO | new ship with same name as hospital ship,began operations Oct 2001 ,Canaries to Mauritania |
| EHOA | ESPERANZA DELMAR (SPAN) | | 6 | | | | | | | | N | AUTO | Y | V93 | DIGICORA | 401-406 | VRS80G | | GPS | DIGICO | Hospital ship, man. Launch, operated N. Atlantic, now ceased (see EBUQ) |
| ELML7 | HORN BAY (GERMANY) | | 10 | | | | | X | | | N | AUTO | Y | V93 | DIGICORA | 401-406 | VRS80G | | GPS | DIGICO | Container vessel,Operates in N Atlantic/Caribbean ,EUCOS- last updated 09/06/03 |
| FNOR | FORT ROYAL (FRANCE) | | 13 | | | | | X | | | N | AUTO | Y | | GEOLNK | 401-406 | GP SONDE G | | GPS | GEOLN | ASAP ,merchant vesselFRANCE-W-INDIES,EUCOS - LAST EDITED 09/06/2003 |
| FNOU | FORT FLEUR D'EP EE (FRANCE) | | 13 | | | | | X | | | N | AUTO | Y | | GEOLNK | 401-406 | GP SONDE G | | GPS | GEOLN | ASAP ,merchant ship FRANCE-W-INDIES,EUCOS - LAST EDITED 8/6/03 |

| | | | | | | | | | | | | | | | | | | | | | |
|-------|----------------------------|--|----|---|---|---|---|---|--|--|---|------|---|-----|----------|---------|----------|--|-------|--------|--|
| JNSR | MIRAI (JAPAN) | | 16 | | | | | X | | | N | AUTO | Y | | DIGICORA | 401-406 | VRS80G | | GPS | DIGICO | ASAP JAP ANESE RESEARCH SHIP ,operating area variable - LAST EDITED 08/6/03 |
| JPBN | KEIFUMARU (JAPAN) | | 8 | | | | | X | | | N | AUTO | Y | | DIGICORA | 401-406 | VRS80G | | GPS | DIGICO | ASAP JAP ANESE RESEARCH SHIP ,operates N. Pacific, irregular obs - LAST EDITED 08/6/03 |
| JCCX | CHOFUMARU (JAPAN) | | 6 | X | X | | | | | | N | AUTO | Y | V93 | DIGICORA | 404.5 | VRS80G | | GPS | DIGICO | ASAP JAP ANESE RESEARCH SHIP ,operates seas near Japan - LAST EDITED 08/6/03 |
| JDWX | KOFUMARU (JAPAN) | | 6 | X | X | | | | | | N | AUTO | Y | V93 | DIGICORA | 404.5 | VRS80G | | GPS | DIGICO | ASAP JAP ANESE RESEARCH SHIP ,operates seas near Japan - LAST EDITED 08/6/03 |
| JGQH | RYOFUMARU (JAPAN) | | 8 | X | X | | | | | | N | AUTO | Y | V93 | DIGICORA | 404.5 | VRS80G | | GPS | DIGICO | ASAP JAP ANESE RESEARCH SHIP ,operates N. Pacific - LAST EDITED 08/6/03 |
| JVB | SEIFUMARU (JAPAN) | | 6 | X | X | | | | | | N | AUTO | Y | V93 | DIGICORA | 401-406 | VRS80G | | GPS | DIGICO | ASAP JAP ANESE RESEARCH SHIP ,operates seas near Japan - LAST EDITED 08/6/03 |
| JDSS | HAKUHO MARU (JAPAN) | | - | | | | | X | | | N | AUTO | Y | V93 | DIGICORA | 401-406 | VRS80G | | GPS | DIGICO | ASAP JAP ANESE RESEARCH SHIP ,operating area variable - LAST EDITED 08/6/03 |
| LDWR | OWS MIKE (N 66 00N 02 00E) | | | X | X | X | X | | | | N | AUTO | Y | V86 | DIGICORA | 401-406 | VRS80L | | LORA | DIGICO | LAST EDITED 08/06/03 |
| OVYA2 | ARINA ARCTICA (DENMARK) | | 14 | | | | | | | | | AUTO | Y | | DIGICORA | | VRS90G/L | | GPS/L | DIGICO | Merchant ship,Container launch, Operates in N. Atlantic , EUCOS - Last edited 9/6/03 |
| OXTS2 | RENA ARCTICA (DENMARK) | | 9 | | | | | | | | | AUTO | Y | | DIGICORA | | VRS90G/L | | GPS/L | DIGICO | Merchant ship,Co ntainer launch, Operates in N. Atlantic , EUCOS - Last edited 9/6/03 |
| OXVH2 | NAJA ARTICA (DENMARK) | | | | | | | X | | | N | AUTO | Y | V86 | MARWN | 401-406 | VRS80G | | GPS? | MARW | CHANGED TO GP S? LAST EDITED 01/11/1997 |
| OXYH2 | NUKA ARTICA (DENMARK) | | 18 | X | X | X | X | | | | N | AUTO | Y | V86 | DIGICORA | | VRS90G | | GPS | MARW | Merchant ship,Container launch, Operates in N. Atlantic , EUCOS - Last edited 9/6/03 |

| | | | | | | | | | | | | | | | | | | | | | | |
|------|--------------------|--|--|--|--|--|--|---|--|--|---|------|---|--|---------|--|---------|--|-------|-------|------------------------|-------------|
| WTEC | RVDISCOVERER (USA) | | | | | | | X | | | N | AUTO | Y | | UNKNOWN | | UNKNOWN | | UNKNC | UNKNC | LAST EDITED 01/01/1996 | no obs 2003 |
| WTEV | ? | | | | | | | X | | | N | AUTO | Y | | UNKNOWN | | UNKNOWN | | UNKNC | UNKNC | LAST EDITED 01/01/1998 | no obs 2003 |
| XXBA | ? | | | | | | | X | | | N | AUTO | Y | | UNKNOWN | | UNKNOWN | | UNKNC | UNKNC | LAST EDITED 01/01/1998 | no obs 2003 |

NOAA RONALD H BROWN



The NOAA science vessel RHB provides radiosonde launch, insitu measurement, cloud observation and polar satellite direct receipt capabilities ... *an optimal platform for SUAN demonstration / support !*



At about \$250 per raob, twice per day, 250 days per year, estimated SUAN support is \$125K yearly; *very cost effective* at fraction of RHB and NOAA polar program budget ... \$250M

TOVS-1b and Radiosonde Collocation History (1979 - 2001)

(... trying to fix the past ...)

- Related Activity ... *pending “ESDIM” proposal*
- GTS Radiosondes ... NCAR
- Special Field Experiment Radiosondes:
 - ARM
 - JOSS (NCAR)
 - *Need More Sources*
- TOVS historical 1b-level data ... *overlap satellites!*
- *Multi-satellite observations ?*
- **Goals:**
 - Collocations, Directories ... *user friendly*
 - Operational ... *ATOVS and Beyond*

SUMMARY

- Need Continuous Global “**CALVAL**” Program for Polar Satellites
- **Radiosondes** and In-situ Measurements “**Can**” Provide Ground-truth (*but current data inadequate ...*)
- **Satellite Upper Air Network (SUAN)** ... Global Program to Launch Reference Radiosondes “*Coincident*” with Polar Satellite Overpass
- Support for **SUAN** growing:
 - International ATOVS Study Conference (Nov. 2003)*
 - NOAA Council on Long-Term Climate Monitoring (Jan., 2003)*
 - Workshop to Improve Usefulness of Radiosondes (March, 2003)*
- Work to finalize **SUAN** ... **SHIPS!** ... **NOAA RHB** ... **IPO!**
- Fixing the Past: “*TOVS-1b / Multi-satellite / Radiosonde*” Archive

