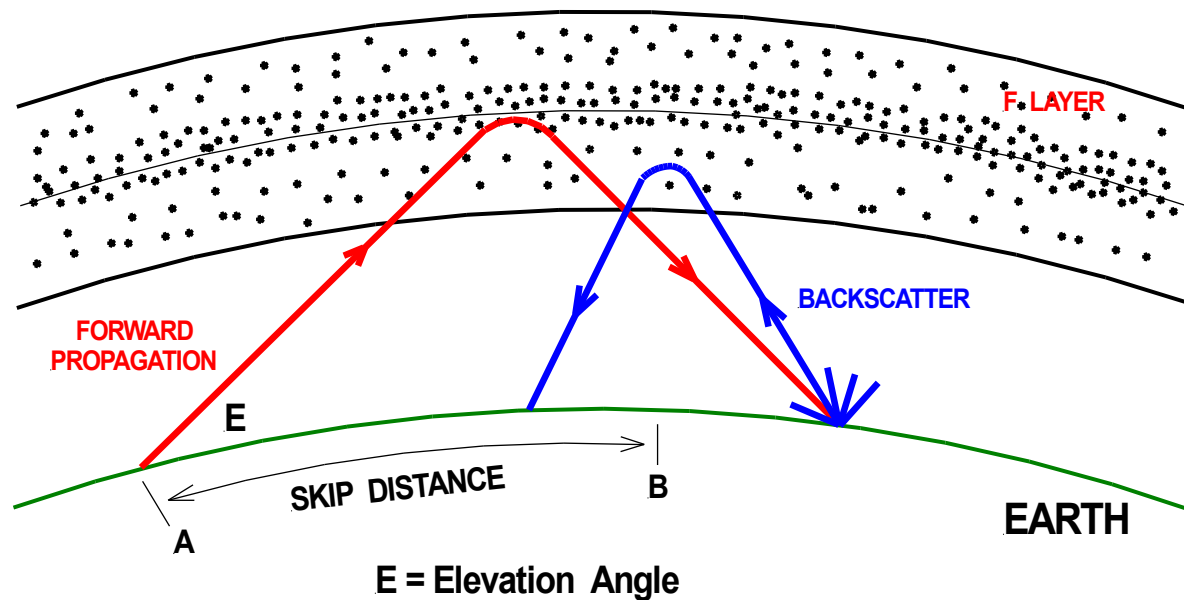


20 Meter Backscatter Test

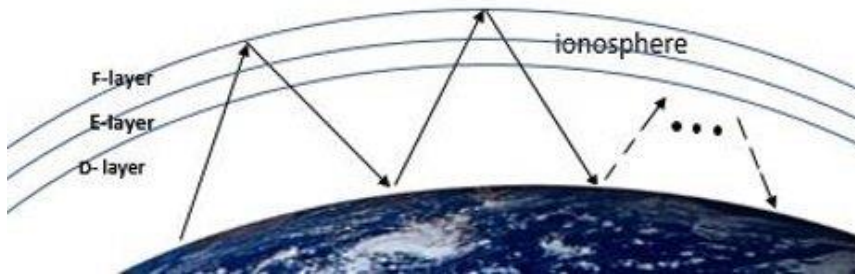


Ken Larson KJ6RZ

April 4, 2025

www.skywave-radio.org

Reflections From A Perfectly Smooth Surface

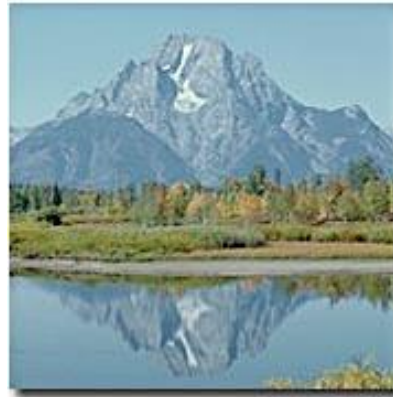


ResearchGate



- Our assumption of a smooth flat Earth is analogous in many ways to scenery perfectly reflecting from the surface of a very smooth lake
- In terms of reflection, the average depth of surface irregularities must be substantially less than the wavelength of the incident light, or radio wave, to be a perfectly smooth surface
- In some cases radio waves may perfectly reflect from a smooth flat Earth, for example from relatively quiet oceans
- However, this is usually not the situation

Ground Scattering of Radio Waves



Smooth lake surface

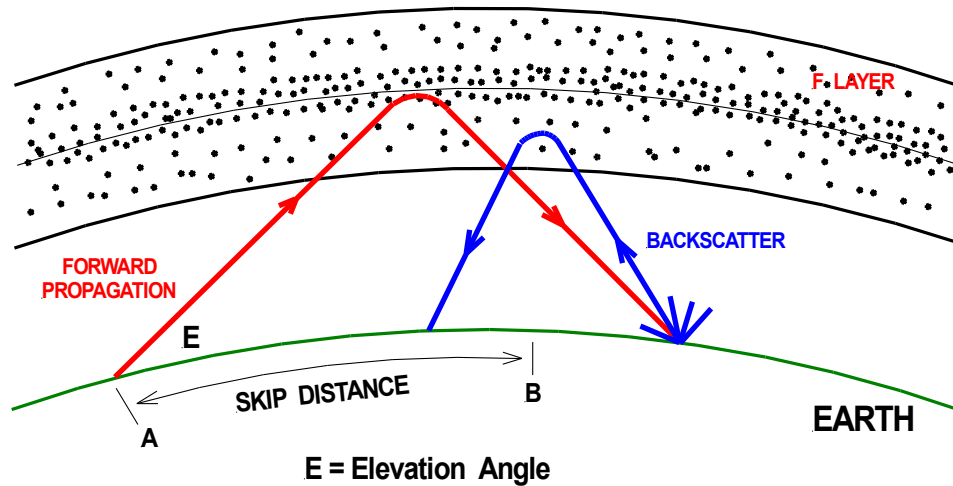


Rough surface

olympus-lifescience.com

- If the surface of a lake is not perfectly smooth, reflected light will be scattered in all directions producing a blurry image
- The same is true of radio waves
- Surface irregularities in mountainous terrain is considerably larger than the wavelength of incident radio waves scattering the radio waves in multiple directions
- Some of the scattered radio waves will be reflected in the desired propagation direction
- Radio waves scattered in other directions will be lost resulting in ground scatter attenuation

Backscatter



author

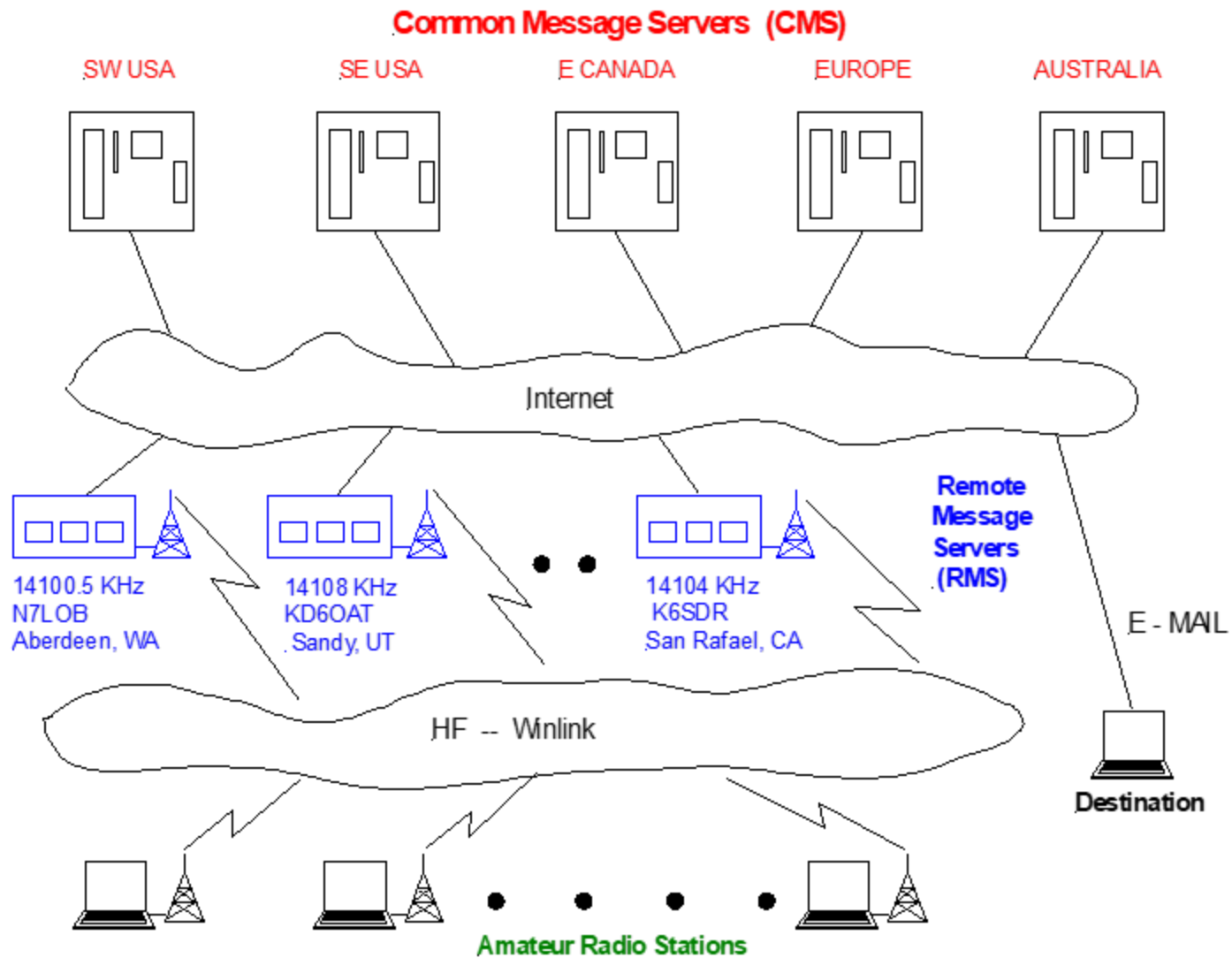
- Some of the scattered signals may travel back through the ionosphere toward the transmitting site
- This is known as backscatter (blue trace)
- It is not unusual for some of the backscattered signals to end up in the skip zone
- When this occurs, some of the stations in the skip zone may hear the transmitting station when normally they would not
- Backscatter is common on 20 meters during solar maximum

20 Meter Backscatter Test

Date:	3/30/25							
	Sun Rise	5:24	Sun Set	18:13	SFI	157		
					foF2	8-11 MHz	14:00 Local Time	foF2 10 MHz, hmF2 ~ 300 km
					X-Ray	C2.7		
					Kp	1.33		
					Proton	0.997		
					SSN	107		
Time	Frequency MHz	Call	Distance Miles	Contact Duration (sec)	Power Watts	Antenna	Comments	
1329	14.1025	KK6DA	34	96	200	Yellow	Back Scatter - Los Angeles, CA	
1332	14.1027	KN6BKT	48	46		Yellow	Back Scatter - San Gabriel, CA	
1334	14.1005	WB6TT	80	52		Yellow	Back Scatter - Corona, CA	
1335	14.1005	W6CTT	187	33		Yellow	Back Scatter - Clovis, CA	
1337	14.1084	N0CSM	213	88		Yellow	Back Scatter - Pahrump, NV	
1341	14.1085	K00000	252	111		Yellow	Back Scatter - North Las Vegas, NV	
1348	14.1085	KD7NHC	320	28		Yellow	Edge of skip zone - Wellington, NV (SE Carson City)	
1350	14.104	K6SDR	332	18		Yellow	San Rafael, CA	
1351	14.1055	KG6MDW	332	18		Yellow	Fairfield, CA (NE Berkeley, CA)	
1353	14.0985	KB6HOH	338	18		Yellow	Novato, CA (N San Rafael)	
1356	14.096	W7DEM	345	17		Yellow	Minden, NV (S Carson City)	
1357	14.1135	N0DAJ	348	16		Yellow	Wickenburg, AZ (NW Phoenix)	
1359	14.1125	W6LHR	349	16		Yellow	Lincoln, CA (NE Sacramento)	
1403	14.0949	KL7RI	368	18		Yellow	Reno, NV	
1405	14.1055	KJ7GSK	386	21		Yellow	Chandler, AZ. (SE Phoenix)	
1406	14.109	WB7BR	532	16		Yellow	Sierra Vista, AZ	
1407	14.105	W6FRI	542	17		Yellow	Arcata, CA	
1409	14.108	KD6OAT	585	16		Yellow	Sandy, UT	
1410	14.1035	W6HFP	595	18		Yellow	Heber City, UT	
1413	14.1034	NS7K	606	18		Yellow	Clearfield, UT (S Ogden, N Salt Lake City)	
1416	14.1015	KF0OIC	651	18		Yellow	Durango, CO	
1420	14.102	KG7AV	693	18		Yellow	Bend, OR	
1421	14.103	W7FLO	731	18		Yellow	Florence, OF	
1425	14.1067	KD7ZDO	793	22		Yellow	Oregon City, OR (S Portland)	
1427	14.1034	W7YAM	796	16		Yellow	McMinnville, OR (SW Portland)	
1429	14.111	W7OWO	798	25		Yellow	Dundee, OR. (SW Portland)	
1432	14.1005	WB0ECX	841	38		Yellow	Pueblo, CO	
1436	14.093	KD0SFY	845	18		Yellow	Colorado Springs, CO	
1437	14.086	XE2HS	864	19		Yellow	La Paz, MX	

- 20m backscatter test 13:29 thru 14:37 PDT March 30, 2025, Antenna: 20 meter inverted V with apex at 32 ft, VARA digital protocol used to connect to Winlink RMS stations (next slide)
- Contact duration is the time to connect to a RMS station, send a message, and disconnect
- For this test a contact consisted of a Connect followed by a Disconnect since the message field was empty, i.e. it did not contain any text
- A contact test duration greater than 40 seconds is considered a very poor connection unsuitable for sending text messages
- NC = No Connection, the station could not be contacted

Winlink Network



20 Meter Backscatter Data

Date:	3/30/25						
					SFI	157	
	Sun Rise	5:24	Sun Set	18:13	foF2	8-11 MHz	14:00 Local Time foF2 10 MHz, hmF2 ~ 300 km
					X-Ray	C2.7	
					Kp	1.33	
					Proton	0.997	
					SSN	107	
Time	Frequency MHz	Call	Distance Miles	Contact Duration (sec)	Power Watts	Antenna	Comments
1329	14.1025	KK6DA	34	96	200	Yellow	Back Scatter - Los Angeles, CA
1332	14.1027	KN6BKT	48	46		Yellow	Back Scatter - San Gabriel, CA
1334	14.1005	WB6TT	80	52		Yellow	Back Scatter - Corona, Ca
1335	14.1005	W6CTT	187	33		Yellow	Back Scatter - Clovis, CA
1337	14.1084	N0CSM	213	88		Yellow	Back Scatter - Pahrump, NV
1341	14.1085	KO0000	252	111		Yellow	Back Scatter - North Las Vegas, NV
1348	14.1085	KD7NHC	320	28		Yellow	Edge of skip zone - Wellington, NV (SE Carson City)
1350	14.104	K6SDR	332	18		Yellow	San Rafael, CA
1351	14.1055	KG6MDW	332	18		Yellow	Fairfield, CA (NE Berkeley, CA)
1353	14.0985	KB6HOH	338	18		Yellow	Novato, CA (N San Rafael)
1356	14.096	W7DEM	345	17		Yellow	Minden, NV (S Carson City)
1357	14.1135	N0DAJ	348	16		Yellow	Wickenburg, AZ (NW Phoenix)
1359	14.1125	W6LHR	349	16		Yellow	Lincoln, CA (NE Sacramento)
1403	14.0949	KL7RI	368	18		Yellow	Reno, NV
1405	14.1055	KJ7GSK	386	21		Yellow	Chandler, AZ. (SE Phoenix)
1406	14.109	WB7BR	532	16		Yellow	Sierra Vista, AZ
1407	14.105	W6FRI	542	17		Yellow	Arcatra, CA
1409	14.108	KD6OAT	585	16		Yellow	Sandy, UT
1410	14.1035	W6HFP	595	18		Yellow	Heber City, UT
1413	14.1034	NS7K	606	18		Yellow	Clearfield, UT (S Ogden, N Salt Lake City)
1416	14.1015	KF0OIC	651	18		Yellow	Durango, CO
1420	14.102	KG7AV	693	18		Yellow	Bend, OR
1421	14.103	W7FLO	731	18		Yellow	Florence, OF
1425	14.1067	KD7ZDO	793	22		Yellow	Oregon City, OR (S Portland)
1427	14.1034	W7YAM	796	16		Yellow	McMinnville, OR (SW Portland)
1429	14.111	W7OWO	798	25		Yellow	Dundee, OR. (SW Portland)
1432	14.1005	WB0ECX	841	38		Yellow	Pueblo, CO
1436	14.093	KD0SFY	845	18		Yellow	Colorado Springs, CO
1437	14.086	XE2HS	864	19		Yellow	La Paz, MX

- During this test the 20 meter skip zone was about 320 miles
- Beyond 320 miles contact test durations were excellent, usually less than 20 seconds
- Stations at distances less than 320 miles were in the skip zone

20 Meter Backscatter Test Results

Date:	3/30/25						
	Sun Rise	5:24	Sun Set	18:13	SFI	157	
					foF2	8-11 MHz	14:00 Local Time foF2 10 MHz, hmF2 ~ 300 km
					X-Ray	C2.7	
					Kp	1.33	
					Proton	0.997	
					SSN	107	
Time	Frequency MHZ	Call	Distance Miles	Contact Duration (sec)	Power Watts	Antenna	Comments
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1334	14.1005	WB6TT	80	52		Yellow	Back Scatter - Corona, Ca
1335	14.1005	W6CTT	187	33		Yellow	Back Scatter - Clovis, CA
1337	14.1084	N0CSM	213	88		Yellow	Back Scatter - Pahrump, NV
1341	14.1085	KO0OOO	252	111		Yellow	Back Scatter - North Las Vegas, NV
1348	14.1085	KD7NHC	320	28		Yellow	Edge of skip zone - Wellington, NV (SE Carson City)
1350	14.104	K6SDR	332	18		Yellow	San Rafael, CA
1351	14.1055	KG6MDW	332	18		Yellow	Fairfield, CA (NE Berkeley, CA)
1353	14.0985	KB6HOH	338	18		Yellow	Novato, CA (N San Rafael)
1356	14.096	W7DEM	345	17		Yellow	Minden, NV (S Carson City)
1357	14.1135	N0DAJ	348	16		Yellow	Wickenburg, AZ (NW Phoenix)
1359	14.1125	W6LHR	349	16		Yellow	Lincoln, CA (NE Sacramento)
1403	14.0949	KL7RI	368	18		Yellow	Reno, NV
1405	14.1055	KJ7GSK	386	21		Yellow	Chandler, AZ. (SE Phoenix)
1406	14.109	WB7BR	532	16		Yellow	Sierra Vista, AZ
1407	14.105	W6FRI	542	17		Yellow	Arcatra, CA
1409	14.108	KD6OAT	585	16		Yellow	Sandy, UT
1410	14.1035	W6HFP	595	18		Yellow	Heber City, UT
1413	14.1034	NS7K	606	18		Yellow	Clearfield, UT (S Ogden, N Salt Lake City)
1416	14.1015	KF0OIC	651	18		Yellow	Durango, CO
1420	14.102	KG7AV	693	18		Yellow	Bend, OR
1421	14.103	W7FLO	731	18		Yellow	Florence, OF
1425	14.1067	KD7ZDO	793	22		Yellow	Oregon City, OR (S Portland)
1427	14.1034	W7YAM	796	16		Yellow	McMinnville, OR (SW Portland)
1429	14.111	W7OWO	798	25		Yellow	Dundee, OR. (SW Portland)
1432	14.1005	WB0ECX	841	38		Yellow	Pueblo, CO
1436	14.093	KD0SFY	845	18		Yellow	Colorado Springs, CO
1437	14.086	XE2HS	864	19		Yellow	La Paz, MX

- Stations in the skip zone should not be heard at all (they are skipped over)
- Most RMS stations in the skip zone where not heard and thus did not appear in the chart
- However, 6 stations where heard due to backscatter
- Notice that the quality of the backscatter contacts were very poor with contact test durations generally much greater than 40 seconds